

INSTRUCTIONS

ABOUT IDOT PROPOSALS: All proposals are potential bidding proposals. Each proposal contains all certifications and affidavits, a proposal signature sheet and a proposal bid bond.

PREQUALIFICATION

Any contractor who desires to become pre-qualified to bid on work advertised by IDOT must submit the properly completed pre-qualification forms to the Bureau of Construction no later than 4:30 p.m. prevailing time twenty-one days prior to the letting of interest. This pre-qualification requirement applies to first time contractors, contractors renewing expired ratings, contractors maintaining continuous pre-qualification or contractors requesting revised ratings. To be eligible to bid, existing pre-qualification ratings must be effective through the date of letting.

WHO CAN BID ?

Bids will be accepted from only those companies that request and receive written Authorization to Bid from IDOT's Central Bureau of Construction. This does not apply to Small Business Set-Asides.

REQUESTS FOR AUTHORIZATION TO BID

Contractors wanting to bid on items included in a particular letting must submit the properly completed "Request for Authorization to Bid/or Not For Bid Status" (BDE 124) and the ORIGINAL "Affidavit of Availability" (BC 57) to the proper office no later than 4:30 p.m. prevailing time, three (3) days prior to the letting date. This does not apply to Small Business Set-Asides.

WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?: When a prospective prime bidder submits a "Request for Authorization to Bid/or Not For Bid Status"(BDE 124) he/she must indicate at that time which items are being requested For Bidding purposes. Only those items requested For Bidding will be analyzed. After the request has been analyzed, the bidder will be issued an **Authorization to Bid or Not for Bid Report**, approved by the Central Bureau of Construction that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Authorization to Bid or Not for Bid Report** will indicate the reason for denial.

ABOUT AUTHORIZATION TO BID: Firms that have not received an Authorization to Bid or Not For Bid Report within a reasonable time of complete and correct original document submittal should contact the department as to the status. Firms unsure as to authorization status should call the Prequalification Section of the Bureau of Construction at the number listed at the end of these instructions. These documents must be received three days before the letting date.

ADDENDA AND REVISIONS: It is the bidder's responsibility to determine which, if any, addenda or revisions pertain to any project they may be bidding. Failure to incorporate all relevant addenda or revisions may cause the bid to be declared unacceptable.

Each addendum or revision will be included with the Electronic Plans and Proposals. Addenda and revisions will also be placed on the Addendum/Revision Checklist and each subscription service subscriber will be notified by e-mail of each addendum and revision issued.

The Internet is the Department's primary way of doing business. The subscription server e-mails are an added courtesy the Department provides. It is suggested that bidders check IDOT's website at <http://www.dot.il.gov/desenv/deleft.html> before submitting final bid information.

IDOT IS NOT RESPONSIBLE FOR ANY E-MAIL FAILURES.

Addenda questions may be directed to the Plans and Contracts Office at (217)782-7806 or D&Econtracts@dot.il.gov

Technical questions about downloading these files may be directed to Tim Garman at (217)524-1642 or Timothy.Garman@illinois.gov.

BID SUBMITTAL GUIDELINES AND CHECKLIST

In an effort to eliminate confusion and standardize the bid submission process the Contracts Office has created the following guidelines and checklist for submitting bids.

This information has been compiled from questions received from contractors and from inconsistencies noted on submitted bids. If you have additional questions please refer to the contact information listed below.

ABOUT SUBMITTING BIDS: It is recommended that bidders deliver bid proposals in person to ensure they arrive at the proper location prior to the time specified for the receipt of bids. Any proposals received at the place of letting after the time specified will not be read.

STANDARD GUIDELINES FOR SUBMITTING BIDS

- All pages should be single sided.
- Use the Cover Page that is provided in the Bid Proposal (posted on the IDOT Web Site) as the first page of your submitted bid. This page has the Item number in the upper left-hand corner and lines provided for your company name and address in the upper right-hand corner.
- Do not use report covers, presentation folders or special bindings and do not staple multiple times on left side like a book. Use only 1 staple in the upper left hand corner. Make sure all elements of your bid are stapled together including the bid bond or guaranty check (if required).
- Do not include any certificates of eligibility, your authorization to bid, Addendum Letters or affidavit of availability.
- Do not include the Subcontractor Documentation with your bid (pages i – iii and pages a – g). This documentation is required only after you are awarded the contract.
- Use the envelope cover sheet (provided with the proposal) as the cover for the proposal envelope.
- Do not rely on overnight services to deliver your proposal prior to 10 AM on letting day. It will not be read if it is delivered after 10 AM.
- Do not submit your Substance Abuse Prevention Program (SAPP) with your bid. If you are awarded the contract this form is to be submitted to the district engineer at the pre-construction conference.

Use the following checklist to ensure completeness and the correct order in assembling your bid

Cover page followed by the Pay Items. If you are using special software or CBID to generate your schedule of prices, do not include the blank schedule of prices.

Page 4 (Item 9) – Check “YES” if you will use a subcontractor(s). Include the subcontractor(s) name, address and the dollar amount (if over \$25,000). If you will use subcontractor(s) but are uncertain who or the dollar amount; check “YES” but leave the lines blank.

After page 4, Insert your Cost Adjustments for Steel, Bituminous and Fuel (if applicable), and your State Board of Elections certificate of registration.

Page 10 (Paragraph J) – Check “YES” or “NO” whether your company has any business in Iran.

Page 10 (Paragraph K) – List the Union Local Name and number or certified training programs that you have in place. Do not include certificates with your bid. Keep the certificates in your office in case they are requested by IDOT.

Page 11 (Paragraph L) - Insert a copy of your State Board of Elections certificate of registration after page 4 of the bid proposal. Only include the page that has the date stamp on it. Do not include any other certificates or forms showing that you are an Illinois business.

Page 11 (Paragraph M) – Indicate if your company has hired a lobbyist in connection with the job for which you are submitting the bid proposal.

Page 12 (Paragraph C) – This is a work sheet to determine if a completed Form A is required. It is not part of the form and you do not need to make copies for each Form A that is filled out.

Pages 14-17 (Form A) – One Form A (4 pages) is required for each applicable person in your company. Copies of the Forms can be used and only need to be changed when the financial information changes. The certification signature and date must be original for each letting. Do not staple the forms together.

If you answered “NO” to all of the questions in Paragraph C (page 12), complete the first section (page 14) with your company information and then sign and date the Not Applicable statement on page 17.

Page 18 (Form B) - If you check “YES” to having other current or pending contracts it is acceptable to use the phrase, “See Affidavit of Availability on file”.

Page 20 (Workforce Projection) – Be sure to include the Duration of the Project. It is acceptable to use the phrase “Per Contract Specifications”.

Bid Bond – Submit your bid bond using the current Bid Bond Form provided in the proposal package. The Power of Attorney page should be stapled to the Bid Bond. If you are using an electronic bond, include your bid bond number on the form and attach the Proof of Insurance printed from the Surety 2000 Web Site.

Disadvantaged Business Utilization Plan and/or Good Faith Effort – The last item in your bid should be the DBE Utilization Plan (SBE 2026), DBE Participation Statement (SBE 2025) and supporting paperwork. If you have documentation for a Good Faith Effort, it should follow the SBE Forms.

The Bid Letting is now available in streaming Audio/Video from the IDOT Web Site. A link to the stream will be placed on the main page of the current letting on the day of the Letting. The stream will not begin until 10 AM. The actual reading of the bids does not begin until approximately 10:20 AM.

Following the Letting, the As-Read Tabulation of Bids will be posted by the end of the day. You will find the link on the main page of the current letting.

QUESTIONS: pre-letting up to execution of the contract

Contractor/Subcontractor pre-qualification -----217-782-3413
Small Business, Disadvantaged Business Enterprise (DBE) -----217-785-4611
Contracts, Bids, Letting process or Internet downloads-----217-785-0230
Estimates Unit -----217-785-3483

QUESTIONS: following contract execution

Including Subcontractor documentation, payments -----217-782-3413
Railroad Insurance -----217-785-0275

RETURN WITH BID

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Proposal Submitted By
Name
Address
City

Letting June 15, 2012

NOTICE TO PROSPECTIVE BIDDERS

This proposal can be used for bidding purposes by only those companies that request and receive written AUTHORIZATION TO BID from IDOT's Central Bureau of Construction. This does not apply to Small Business Set-Asides.

BIDDERS NEED NOT RETURN THE ENTIRE PROPOSAL

Notice to Bidders, Specifications, Proposal, Contract and Contract Bond



**Illinois Department
of Transportation**

Springfield, Illinois 62764

Contract No. 60P41
DUPAGE County
Section 2011-035-I
Route FAP 338
Project ACNHF-0338(044)
District 1 Construction Funds

PLEASE MARK THE APPROPRIATE BOX BELOW:

- A Bid Bond is included.
- A Cashier's Check or a Certified Check is included

Prepared by

Checked by

F

(Printed by authority of the State of Illinois)

Page intentionally left blank

RETURN WITH BID



PROPOSAL

TO THE DEPARTMENT OF TRANSPORTATION

1. Proposal of _____

Taxpayer Identification Number (Mandatory) _____

for the improvement identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60P41
DUPAGE County
Section 2011-035-I
Project ACNHF-0338(044)
Route FAP 338
District 1 Construction Funds**

Construction of a new pump station #47 near the existing pump station on IL 59 located south of N. Aurora Rd. in Naperville.

2. The undersigned bidder will furnish all labor, material and equipment to complete the above described project in a good and workmanlike manner as provided in the contract documents provided by the Department of Transportation. This proposal will become part of the contract and the terms and conditions contained in the contract documents shall govern performance and payments.

RETURN WITH BID

6. **COMBINATION BIDS.** The undersigned further agrees that if awarded the contract for the sections contained in the following combination, he/she will perform the work in accordance with the requirements of each individual proposal comprising the combination bid specified in the schedule below, and that the combination bid shall be prorated against each section in proportion to the bid submitted for the same. If an error is found to exist in the gross sum bid for one or more of the individual sections included in a combination, the combination bid shall be corrected as provided in the specifications.

When a combination bid is submitted, the schedule below must be completed in each proposal comprising the combination.

If alternate bids are submitted for one or more of the sections comprising the combination, a combination bid must be submitted for each alternate.

Schedule of Combination Bids

Combination No.	Sections Included in Combination	Combination Bid	
		Dollars	Cents

7. **SCHEDULE OF PRICES.** The undersigned bidder submits herewith, in accordance with the rules and instructions, a schedule of prices for the items of work for which bids are sought. The unit prices bid are in U.S. dollars and cents, and all extensions and summations have been made. The bidder understands that the quantities appearing in the bid schedule are approximate and are provided for the purpose of obtaining a gross sum for the comparison of bids. If there is an error in the extension of the unit prices, the unit prices shall govern. Payment to the contractor awarded the contract will be made only for actual quantities of work performed and accepted or materials furnished according to the contract. The scheduled quantities of work to be done and materials to be furnished may be increased, decreased or omitted as provided elsewhere in the contract.

8. **AUTHORITY TO DO BUSINESS IN ILLINOIS.** Section 20-43 of the Illinois Procurement Code (30 ILCS 500/20-43) provides that a person (other than an individual acting as a sole proprietor) must be a legal entity authorized to do business in the State of Illinois prior to submitting the bid.

9. **The services of a subcontractor will or may be used.**

Check box Yes
 Check box No

For known subcontractors with subcontracts with an annual value of more than \$25,000, the contract shall include their name, address, and the dollar allocation for each subcontractor.

10. **EXECUTION OF CONTRACT:** The Department of Transportation will, in accordance with the rules governing Department procurements, execute the contract and shall be the sole entity having the authority to accept performance and make payments under the contract. Execution of the contract by the Chief Procurement Officer or the State Purchasing Officer is for approval of the procurement process and execution of the contract by the Department. Neither the Chief Procurement Officer nor the State Purchasing Officer shall be responsible for administration of the contract or determinations respecting performance or payment there under except as otherwise permitted in the Illinois Procurement Code.

ILLINOIS DEPARTMENT OF TRANSPORTATION
 SCHEDULE OF PRICES
 CONTRACT
 NUMBER - 60P41

State Job # - C-91-538-11

County Name - DUPAGE -

Code - 43 - -

District - 1 - -

Section Number - 2011-035-I

Project Number
 ACNHF-0338/044/

Route
 FAP 338

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X0301028	PUMP STA SCADA EQUIP	L SUM	1.000				
X0322121	SHEET WAT PRF MEM SYS	SQ YD	600.000				
X0322719	TEMP DRAINAGE CONNECT	EACH	1.000				
X0323002	TEMP ELECT SERV CONN	EACH	1.000				
X0324455	DRILL/SET SOLD P SOIL	CU FT	22,830.000				
X0325405	FILL EX STORM SEWERS	CU YD	67.000				
X0326694	PLUG EX STORM SEWERS	CU YD	0.500				
X0327394	HEAT VENTILATION WORK	L SUM	1.000				
X0335700	P.S. GENERAL WORK	L SUM	1.000				
X0783300	P.S. ELECTRICAL WORK	L SUM	1.000				
X0783500	P.S. MECHANICAL WORK	L SUM	1.000				
X2020502	BRACED EXCAVATION	CU YD	2,730.000				
X4402302	CURB REMOVAL PART	FOOT	170.000				
X5051100	BRIDGE CRANE	L SUM	1.000				
X6028050	TEMPORARY MANHOLE	EACH	5.000				

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Section Number - 2011-035-I

Project Number
 ACNHF-0338/044/

Route
 FAP 338

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
X6640308	CH LK GATES SPL	EACH	3.000				
X6640570	CH LK FENCE 8 SPL	FOOT	143.000				
X6640585	CH LK FENC ATT STR SP	FOOT	105.000				
X7010216	TRAF CONT & PROT SPL	L SUM	1.000				
Z0004522	HMA DRIVEWAY PAVT 6	SQ YD	356.000				
Z0007118	UNTREATED TIMBER LAG	SQ FT	4,881.000				
Z0007601	BLDG REMOV NO 1	L SUM	1.000				
Z0013798	CONSTRUCTION LAYOUT	L SUM	1.000				
Z0026402	FUR SOLDIER PILES HP	FOOT	828.000				
Z0026404	FUR SOLDIER PILES WS	FOOT	3,041.000				
Z0030240	IMP ATTN TEMP NRD TL2	EACH	1.000				
Z0030850	TEMP INFO SIGNING	SQ FT	50.000				
Z0046304	P UNDR FOR STRUCT 4	FOOT	495.000				
Z0048665	RR PROT LIABILITY INS	L SUM	1.000				
20200100	EARTH EXCAVATION	CU YD	701.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
20800150	TRENCH BACKFILL	CU YD	989.000				
21101605	TOPSOIL F & P 2	SQ YD	1,253.000				
25000210	SEEDING CL 2A	ACRE	0.260				
25100115	MULCH METHOD 2	ACRE	0.260				
28000250	TEMP EROS CONTR SEED	POUND	26.000				
28000400	PERIMETER EROS BAR	FOOT	1,104.000				
28000510	INLET FILTERS	EACH	5.000				
30300108	AGG SUBGRADE IMPR 8	SQ YD	943.000				
42300400	PCC DRIVEWAY PAVT 8	SQ YD	943.000				
44000200	DRIVE PAVEMENT REM	SQ YD	704.000				
44000500	COMB CURB GUTTER REM	FOOT	60.000				
44201359	CL C PATCH T4 10	SQ YD	27.000				
48100500	AGGREGATE SHLDS A 6	SQ YD	622.000				
50200100	STRUCTURE EXCAVATION	CU YD	416.000				
50300225	CONC STRUCT	CU YD	900.000				

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District - 1 - -

Section Number - 2011-035-I

Project Number
 ACNHF-0338/044/

Route
 FAP 338

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
50300285	FORM LINER TEX SURF	SQ FT	4,263.000				
50300300	PROTECTIVE COAT	SQ YD	611.000				
50500505	STUD SHEAR CONNECTORS	EACH	1,548.000				
50800205	REINF BARS, EPOXY CTD	POUND	96,760.000				
50800515	BAR SPLICERS	EACH	12.000				
50901750	PARAPET RAILING	FOOT	344.000				
5422C030	P CUL CL C 2 30 TEMP	FOOT	38.000				
5422C036	P CUL CL C 2 36 TEMP	FOOT	12.000				
5422C048	P CUL CL C 2 48 TEMP	FOOT	109.000				
550A0190	STORM SEW CL A 1 48	FOOT	40.000				
550A0450	STORM SEW CL A 2 36	FOOT	499.000				
550A0470	STORM SEW CL A 2 42	FOOT	16.000				
550A0480	STORM SEW CL A 2 48	FOOT	516.000				
550B0380	STORM SEW CL B 2 18	FOOT	7.000				
550B0430	STORM SEW CL B 2 30	FOOT	24.000				

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Project Number
 ACNHF-0338/044/

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
550B0450	STORM SEW CL B 2 36	FOOT	29.000				
55100500	STORM SEWER REM 12	FOOT	10.000				
55100900	STORM SEWER REM 18	FOOT	10.000				
55101400	STORM SEWER REM 30	FOOT	566.000				
55101600	STORM SEWER REM 36	FOOT	647.000				
55201600	STORM SEWERS JKD 48	FOOT	110.000				
59100100	GEOCOMPOSITE WALL DR	SQ YD	543.000				
59300100	CONTR LOW-STRENG MATL	CU YD	129.000				
60221100	MAN TA 5 DIA T1F CL	EACH	5.000				
60223800	MAN TA 6 DIA T1F CL	EACH	1.000				
60224445	MAN TA 7 DIA T1F OL	EACH	5.000				
60224446	MAN TA 7 DIA T1F CL	EACH	2.000				
60500040	REMOV MANHOLES	EACH	8.000				
60500105	FILL MANHOLES	EACH	1.000				
60604400	COMB CC&G TB6.18	FOOT	60.000				

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Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
67000400	ENGR FIELD OFFICE A	CAL MO	20.000				
67100100	MOBILIZATION	L SUM	1.000				
70103815	TR CONT SURVEILLANCE	CAL DA	400.000				
70400100	TEMP CONC BARRIER	FOOT	750.000				
70400200	REL TEMP CONC BARRIER	FOOT	600.000				
78200530	BAR WALL MKR TYPE C	EACH	80.000				
80400200	ELECT UTIL SERV CONN	L SUM	1.000				

CONTRACT NUMBER

60P41

THIS IS THE TOTAL BID

\$ _____

NOTES:

- 1. Each PAY ITEM should have a UNIT PRICE and a TOTAL PRICE.**
- 2. The UNIT PRICE shall govern if no TOTAL PRICE is shown or if there is a discrepancy between the product of the UNIT PRICE multiplied by the QUANTITY.**
- 3. If a UNIT PRICE is omitted, the TOTAL PRICE will be divided by the QUANTITY in order to establish a UNIT PRICE.**
- 4. A bid may be declared UNACCEPTABLE if neither a unit price nor a total price is shown.**

RETURN WITH BID

STATE REQUIRED ETHICAL STANDARDS GOVERNING CONTRACT PROCUREMENT: ASSURANCES, CERTIFICATIONS AND DISCLOSURES

I. GENERAL

A. Article 50 of the Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

B. In order to comply with the provisions of Article 50 and to carry out the duty established therein, all bidders are to adhere to ethical standards established for the procurement process, and to make such assurances, disclosures and certifications required by law. Except as otherwise required in subsection III, paragraphs J-M, by execution of the Proposal Signature Sheet, the bidder indicates that each of the mandated assurances have been read and understood, that each certification is made and understood, and that each disclosure requirement has been understood and completed.

C. In addition to all other remedies provided by law, failure to comply with any assurance, failure to make any disclosure or the making of a false certification shall be grounds for the chief procurement officer to void the contract, or subcontract, and may result in the suspension or debarment of the bidder or subcontractor.

II. ASSURANCES

The assurances hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder.

A. Conflicts of Interest

1. The Illinois Procurement Code provides in pertinent part:

Section 50-13. Conflicts of Interest.

(a) Prohibition. It is unlawful for any person holding an elective office in this State, holding a seat in the General Assembly, or appointed to or employed in any of the offices or agencies of state government and who receives compensation for such employment in excess of 60% of the salary of the Governor of the State of Illinois, or who is an officer or employee of the Capital Development Board or the Illinois Toll Highway Authority, or who is the spouse or minor child of any such person to have or acquire any contract, or any direct pecuniary interest in any contract therein, whether for stationery, printing, paper, or any services, materials, or supplies, that will be wholly or partially satisfied by the payment of funds appropriated by the General Assembly of the State of Illinois or in any contract of the Capital Development Board or the Illinois Toll Highway authority.

(b) Interests. It is unlawful for any firm, partnership, association or corporation, in which any person listed in subsection (a) is entitled to receive (i) more than 7 1/2% of the total distributable income or (ii) an amount in excess of the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(c) Combined interests. It is unlawful for any firm, partnership, association, or corporation, in which any person listed in subsection (a) together with his or her spouse or minor children is entitled to receive (i) more than 15%, in the aggregate, of the total distributable income or (ii) an amount in excess of 2 times the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(d) Securities. Nothing in this Section invalidates the provisions of any bond or other security previously offered or to be offered for sale or sold by or for the State of Illinois.

(e) Prior interests. This Section does not affect the validity of any contract made between the State and an officer or employee of the State or member of the General Assembly, his or her spouse, minor child or any combination of those persons if that contract was in existence before his or her election or employment as an officer, member, or employee. The contract is voidable, however, if it cannot be completed within 365 days after the officer, member, or employee takes office or is employed.

The current salary of the Governor is \$177,412.00. Sixty percent of the salary is \$106,447.20.

RETURN WITH BID

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-13, or that an effective exemption has been issued by the Board of Ethics to any individual subject to the Section 50-13 prohibitions pursuant to the provisions of Section 50-20 of the Code and Executive Order Number 3 (1998). Information concerning the exemption process is available from the Department upon request.

B. Negotiations

1. The Illinois Procurement Code provides in pertinent part:

Section 50-15. Negotiations.

(a) It is unlawful for any person employed in or on a continual contractual relationship with any of the offices or agencies of State government to participate in contract negotiations on behalf of that office or agency with any firm, partnership, association, or corporation with whom that person has a contract for future employment or is negotiating concerning possible future employment.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-15, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

C. Inducements

1. The Illinois Procurement Code provides:

Section 50-25. Inducement. Any person who offers or pays any money or other valuable thing to any person to induce him or her not to bid for a State contract or as recompense for not having bid on a State contract is guilty of a Class 4 felony. Any person who accepts any money or other valuable thing for not bidding for a State contract or who withholds a bid in consideration of the promise for the payment of money or other valuable thing is guilty of a Class 4 felony.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-25, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

D. Revolving Door Prohibition

1. The Illinois Procurement Code provides:

Section 50-30. Revolving door prohibition. Chief procurement officers, State purchasing officers, procurement compliance monitors, their designees whose principal duties are directly related to State procurement, and executive officers confirmed by the Senate are expressly prohibited for a period of 2 years after terminating an affected position from engaging in any procurement activity relating to the State agency most recently employing them in an affected position for a period of at least 6 months. The prohibition includes, but is not limited to: lobbying the procurement process; specifying; bidding; proposing bid, proposal, or contract documents; on their own behalf or on behalf of any firm, partnership, association, or corporation. This Section applies only to persons who terminate an affected position on or after January 15, 1999.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-30, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

E. Reporting Anticompetitive Practices

1. The Illinois Procurement Code provides:

Section 50-40. Reporting anticompetitive practices. When, for any reason, any vendor, bidder, contractor, chief procurement officer, State purchasing officer, designee, elected official, or State employee suspects collusion or other anticompetitive practice among any bidders, offerors, contractors, proposers, or employees of the State, a notice of the relevant facts shall be transmitted to the Attorney General and the chief procurement officer.

2. The bidder assures the Department that it has not failed to report any relevant facts concerning the practices addressed in Section 50-40 which may involve the contract for which the bid is submitted.

F. Confidentiality

1. The Illinois Procurement Code provides:

Section 50-45. Confidentiality. Any chief procurement officer, State purchasing officer, designee, or executive officer who willfully uses or allows the use of specifications, competitive bid documents, proprietary competitive information, proposals, contracts, or selection information to compromise the fairness or integrity of the procurement, bidding, or contract process shall be subject to immediate dismissal, regardless of the Personnel code, any contract, or any collective bargaining agreement, and may in addition be subject to criminal prosecution.

2. The bidder assures the Department that it has no knowledge of any fact relevant to the practices addressed in Section 50-45 which may involve the contract for which the bid is submitted.

RETURN WITH BID

G. Insider Information

1. The Illinois Procurement Act provides:

Section 50-50. Insider information. It is unlawful for any current or former elected or appointed State official or State employee to knowingly use confidential information available only by virtue of that office or employment for actual or anticipated gain for themselves or another person.

2. The bidder assures the Department that it has no knowledge of any facts relevant to the practices addressed in Section 50-50 which may involve the contract for which the bid is submitted.

III. CERTIFICATIONS

The certifications hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. Section 50-2 of the Illinois Procurement Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible chief procurement officer whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

A. Bribery

1. The Illinois Procurement Code provides:

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 1961.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

2. The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

B. Felons

1. The Illinois Procurement Code provides:

Section 50-10. Felons. Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

1. Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any of the certifications required by this Section are false.

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C. Debt Delinquency

1. The Illinois Procurement Code provides:

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Procurement Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the chief procurement officer may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

D. Prohibited Bidders, Contractors and Subcontractors

1. The Illinois Procurement Code provides:

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

E. Section 42 of the Environmental Protection Act

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-12 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Procurement Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the chief procurement officer may declare the contract void if this certification is false.

F. Educational Loan

1. Section 3 of the Educational Loan Default Act provides:

§ 3. No State agency shall contract with an individual for goods or services if that individual is in default, as defined in Section 2 of this Act, on an educational loan. Any contract used by any State agency shall include a statement certifying that the individual is not in default on an educational loan as provided in this Section.

2. The bidder, if an individual as opposed to a corporation, partnership or other form of business organization, certifies that the bidder is not in default on an educational loan as provided in Section 3 of the Act.

G. Bid-Rigging/Bid Rotating

1. Section 33E-11 of the Criminal Code of 1961 provides:

§ 33E-11. (a) Every bid submitted to and public contract executed pursuant to such bid by the State or a unit of local government shall contain a certification by the prime contractor that the prime contractor is not barred from contracting with any unit of State or local government as a result of a violation of either Section 33E-3 or 33E-4 of this Article. The State and units of local government shall provide the appropriate forms for such certification.

- (b) A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

A violation of Section 33E-3 would be represented by a conviction of the crime of bid-rigging which, in addition to Class 3 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be barred for 5 years from the date of conviction from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

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A violation of Section 33E-4 would be represented by a conviction of the crime of bid-rotating which, in addition to Class 2 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be permanently barred from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

2. The bidder certifies that it is not barred from contracting with the Department by reason of a violation of either Section 33E-3 or Section 33E-4.

H. International Anti-Boycott

1. Section 5 of the International Anti-Boycott Certification Act provides:

§ 5. State contracts. Every contract entered into by the State of Illinois for the manufacture, furnishing, or purchasing of supplies, material, or equipment or for the furnishing of work, labor, or services, in an amount exceeding the threshold for small purchases according to the purchasing laws of this State or \$10,000.00, whichever is less, shall contain certification, as a material condition of the contract, by which the contractor agrees that neither the contractor nor any substantially-owned affiliated company is participating or shall participate in an international boycott in violation of the provisions of the U.S. Export Administration Act of 1979 or the regulations of the U.S. Department of Commerce promulgated under that Act.

2. The bidder makes the certification set forth in Section 5 of the Act.

I. Drug Free Workplace

1. The Illinois "Drug Free Workplace Act" applies to this contract and it is necessary to comply with the provisions of the "Act" if the contractor is a corporation, partnership, or other entity (including a sole proprietorship) which has 25 or more employees.

2. The bidder certifies that if awarded a contract in excess of \$5,000 it will provide a drug free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance, including cannabis, is prohibited in the contractor's workplace; specifying the actions that will be taken against employees for violations of such prohibition; and notifying the employee that, as a condition of employment on such contract, the employee shall abide by the terms of the statement, and notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction.

(b) Establishing a drug free awareness program to inform employees about the dangers of drug abuse in the workplace; the contractor's policy of maintaining a drug free workplace; any available drug counseling, rehabilitation, and employee assistance programs; and the penalties that may be imposed upon employees for drug violations.

(c) Providing a copy of the statement required by subparagraph (1) to each employee engaged in the performance of the contract and to post the statement in a prominent place in the workplace.

(d) Notifying the Department within ten (10) days after receiving notice from an employee or otherwise receiving actual notice of the conviction of an employee for a violation of any criminal drug statute occurring in the workplace.

(e) Imposing or requiring, within 30 days after receiving notice from an employee of a conviction or actual notice of such a conviction, an appropriate personnel action, up to and including termination, or the satisfactory participation in a drug abuse assistance or rehabilitation program approved by a federal, state or local health, law enforcement or other appropriate agency.

(f) Assisting employees in selecting a course of action in the event drug counseling, treatment, and rehabilitation is required and indicating that a trained referral team is in place.

(g) Making a good faith effort to continue to maintain a drug free workplace through implementation of the actions and efforts stated in this certification.

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J. Disclosure of Business Operations in Iran

Section 50-36 of the Illinois Procurement Code, 30ILCS 500/50-36 provides that each bid, offer, or proposal submitted for a State contract shall include a disclosure of whether or not the Company acting as the bidder, offeror, or proposing entity, or any of its corporate parents or subsidiaries, within the 24 months before submission of the bid, offer, or proposal had business operations that involved contracts with or provision of supplies or services to the Government of Iran, companies in which the Government of Iran has any direct or indirect equity share, consortiums or projects commissioned by the Government of Iran, or companies involved in consortiums or projects commissioned by the Government of Iran and either of the following conditions apply:

- (1) More than 10% of the Company's revenues produced in or assets located in Iran involve oil-related activities or mineral-extraction activities; less than 75% of the Company's revenues produced in or assets located in Iran involve contracts with or provision of oil-related or mineral-extraction products or services to the Government of Iran or a project or consortium created exclusively by that government; and the Company has failed to take substantial action.
- (2) The Company has, on or after August 5, 1996, made an investment of \$20 million or more, or any combination of investments of at least \$10 million each that in the aggregate equals or exceeds \$20 million in any 12-month period, which directly or significantly contributes to the enhancement of Iran's ability to develop petroleum resources of Iran.

The terms "Business operations", "Company", "Mineral-extraction activities", "Oil-related activities", "Petroleum resources", and "Substantial action" are all defined in the Code.

Failure to make the disclosure required by the Code shall cause the bid, offer or proposal to be considered not responsive. The disclosure will be considered when evaluating the bid, offer, or proposal or awarding the contract. The name of each Company disclosed as doing business or having done business in Iran will be provided to the State Comptroller.

Check the appropriate statement:

Company has no business operations in Iran to disclose.

Company has business operations in Iran as disclosed the attached document.

K. Apprenticeship and Training Certification (Does not apply to federal aid projects)

In accordance with the provisions of Section 30-22 (6) of the Illinois Procurement Code, the bidder certifies that it is a participant, either as an individual or as part of a group program, in the approved apprenticeship and training programs applicable to each type of work or craft that the bidder will perform with its own forces. The bidder further certifies for work that will be performed by subcontract that each of its subcontractors submitted for approval either (a) is, at the time of such bid, participating in an approved, applicable apprenticeship and training program; or (b) will, prior to commencement of performance of work pursuant to this contract, begin participation in an approved apprenticeship and training program applicable to the work of the subcontract. The Department, at any time before or after award, may require the production of a copy of each applicable Certificate of Registration issued by the United States Department of Labor evidencing such participation by the contractor and any or all of its subcontractors. Applicable apprenticeship and training programs are those that have been approved and registered with the United States Department of Labor. The bidder shall list in the space below, the official name of the program sponsor holding the Certificate of Registration for all of the types of work or crafts in which the bidder is a participant and that will be performed with the bidder's forces. Types of work or craft work that will be subcontracted shall be included and listed as subcontract work. The list shall also indicate any type of work or craft job category that does not have an applicable apprenticeship or training program. **The bidder is responsible for making a complete report and shall make certain that each type of work or craft job category that will be utilized on the project as reported on the Construction Employee Workforce Projection (Form BC-1256) and returned with the bid is accounted for and listed.**

NA-FEDERAL

The requirements of this certification and disclosure are a material part of the contract, and the contractor shall require this certification provision to be included in all approved subcontracts. In order to fulfill this requirement, it shall not be necessary that an applicable program sponsor be currently taking or that it will take applications for apprenticeship, training or employment during the performance of the work of this contract.

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L. Political Contributions and Registration with the State Board of Elections

Sections 20-160 and 50-37 of the Illinois Procurement Code regulate political contributions from business entities and any affiliated entities or affiliated persons bidding on or contracting with the state. Generally under Section 50-37, any business entity, and any affiliated entity or affiliated person of the business entity, whose current year contracts with all state agencies exceed an awarded value of \$50,000, are prohibited from making any contributions to any political committees established to promote the candidacy of the officeholder responsible for the awarding of the contracts or any other declared candidate for that office for the duration of the term of office of the incumbent officeholder or a period 2 years after the termination of the contract, whichever is longer. Any business entity and affiliated entities or affiliated persons whose state contracts in the current year do not exceed an awarded value of \$50,000, but whose aggregate pending bids and proposals on state contracts exceed \$50,000, either alone or in combination with contracts not exceeding \$50,000, are prohibited from making any political contributions to any political committee established to promote the candidacy of the officeholder responsible for awarding the pending contract during the period beginning on the date the invitation for bids or request for proposals is issued and ending on the day after the date of award or selection if the entity was not awarded or selected. Section 20-160 requires certification of registration of affected business entities in accordance with procedures found in Section 9-35 of The Election Code.

By submission of a bid, the contractor business entity acknowledges and agrees that it has read and understands Sections 20-160 and 50-37 of the Illinois Procurement Code, and that it makes the following certification:

The undersigned business entity certifies that it has registered as a business with the State Board of Elections and acknowledges a continuing duty to update the registration in accordance with the above referenced statutes. A copy of the certificate of registration shall be submitted with the bid. The bidder is cautioned that the Department will not award a contract without submission of the certificate of registration.

These requirements and compliance with the above referenced statutory sections are a material part of the contract, and any breach thereof shall be cause to void the contract under Section 50-60 of the Illinois Procurement Code. This provision does not apply to Federal-aid contracts.

M. Lobbyist Disclosure

Section 50-38 of the Illinois Procurement Code requires that any bidder or offeror on a State contract that hires a person required to register under the Lobbyist Registration Act to assist in obtaining a contract shall:

- (i) Disclose all costs, fees, compensation, reimbursements, and other remunerations paid or to be paid to the lobbyist related to the contract,
- (ii) Not bill or otherwise cause the State of Illinois to pay for any of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration, and
- (iii) Sign a verification certifying that none of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration were billed to the State.

This information, along with all supporting documents, shall be filed with the agency awarding the contract and with the Secretary of State. The chief procurement officer shall post this information, together with the contract award notice, in the online Procurement Bulletin.

Pursuant to Subsection (c) of this Section, no person or entity shall retain a person or entity to attempt to influence the outcome of a procurement decision made under the Procurement Code for compensation contingent in whole or in part upon the decision or procurement. Any person who violates this subsection is guilty of a business offense and shall be fined not more than \$10,000.

Bidder acknowledges that it is required to disclose the hiring of any person required to register pursuant to the Illinois Lobbyist Registration Act (25 ILCS 170) in connection with this contract.

Bidder has not hired any person required to register pursuant to the Illinois Lobbyist Registration Act in connection with this contract.

Or

Bidder has hired the following persons required to register pursuant to the Illinois Lobbyist Registration Act in connection with the contract:

Name and address of person: _____
All costs, fees, compensation, reimbursements and other remuneration paid to said person: _____

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IV. DISCLOSURES

- A. The disclosures hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. The bidder further certifies that the Department has received the disclosure forms for each bid.

The chief procurement officer may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Procurement Code. Furthermore, the chief procurement officer may void the contract and the surety providing the performance bond shall be responsible for completion of the contract.

B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Illinois Procurement Code provides that all bids of more than \$25,000 shall be accompanied by disclosure of the financial interests of the bidder. This disclosed information for the successful bidder, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the contract. Furthermore, pursuant to Section 5-5, the Procurement Policy Board may review a proposal, bid, or contract and issue a recommendation to void a contract or reject a proposal or bid based on any violation of the Procurement Code or the existence of a conflict of interest as provided in subsections (b) and (d) of Section 50-35.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the bidding entity or its parent entity, whichever is less, unless the contractor or bidder is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.

The current annual salary of the Governor is \$177,412.00.

In addition, all disclosures shall indicate any other current or pending contracts, proposals, leases, or other ongoing procurement relationships the bidding entity has with any other unit of state government and shall clearly identify the unit and the contract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. A separate Disclosure Form A must be submitted with the bid for each individual meeting the above requirements. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies and a total ownership certification. **The forms must be included with each bid.**

C. Disclosure Form Instructions

Form A Instructions for Financial Information & Potential Conflicts of Interest

If the bidder is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a bidder is not subject to Federal 10K reporting, the bidder must determine if any individuals are required by law to complete a financial disclosure form. To do this, the bidder should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the NOT APPLICABLE STATEMENT on Form A must be signed and dated by a person that is authorized to execute contracts for the bidding company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES ___ NO ___
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than 60% of the annual salary of the Governor? YES ___ NO ___
3. Does anyone in your organization receive more than 60% of the annual salary of the Governor of the bidding entity's or parent entity's distributive income? YES ___ NO ___
4. Does anyone in your organization receive greater than 5% of the bidding entity's or parent entity's total distributive income, but which is less than 60% of the annual salary of the Governor? YES ___ NO ___

(Note: Only one set of forms needs to be completed per person per bid even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The bidder must determine each individual in the bidding entity or the bidding entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The bidder is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the NOT APPLICABLE STATEMENT of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

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Form B: Instructions for Identifying Other Contracts & Procurement Related Information

Disclosure Form B must be completed for each bid submitted by the bidding entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the bidder to ignore Form B. Form B must be completed, checked, and dated or the bidder may be considered nonresponsive and the bid will not be accepted.*

The Bidder shall identify, by checking Yes or No on Form B, whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the bidder only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the bidder must do one of the following:

Option I: If the bidder did not submit an Affidavit of Availability to obtain authorization to bid, the bidder must list all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Do not include IDOT contracts. Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included. Bidders who submit Affidavits of Availability are suggested to use Option II.

Option II: If the bidder is required and has submitted an Affidavit of Availability in order to obtain authorization to bid, the bidder may write or type "See Affidavit of Availability" which indicates that the Affidavit of Availability is incorporated by reference and includes all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. For any contracts that are not covered by the Affidavit of Availability, the bidder must identify them on Form B or on an attached sheet(s). These might be such things as leases.

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ILLINOIS DEPARTMENT OF TRANSPORTATION

Form A Financial Information & Potential Conflicts of Interest Disclosure

Contractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Code (30 ILCS 500). Vendors desiring to enter into a contract with the State of Illinois must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form. This information shall become part of the publicly available contract file. This Form A must be completed for bids in excess of \$25,000, and for all open-ended contracts. A publicly traded company may submit a 10K disclosure (or equivalent if applicable) in satisfaction of the requirements set forth in Form A. See Disclosure Form Instructions.

The current annual salary of the Governor is \$177,412.00.

DISCLOSURE OF FINANCIAL INFORMATION

- 1. Disclosure of Financial Information. The individual named below has an interest in the BIDDER (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than 60% of the annual salary of the Governor. (Make copies of this form as necessary and attach a separate Disclosure Form A for each individual meeting these requirements)

FOR INDIVIDUAL (type or print information) NAME: ADDRESS Type of ownership/distributable income share: stock sole proprietorship Partnership other: (explain on separate sheet): % or \$ value of ownership/distributable income share:

- 2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes ___ No ___

If your answer is yes, please answer each of the following questions.

- 1. Are you currently an officer or employee of either the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___
2. Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor provide the name the State agency for which you are employed and your annual salary.

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- 3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor? Yes ___ No ___

- 4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15% in aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor? Yes ___ No ___

(b) State employment of spouse, father, mother, son, or daughter, including contractual employment for services in the previous 2 years.

Yes ___ No ___

If your answer is yes, please answer each of the following questions.

- 1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___

- 2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, provide the name of the spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. _____

- 3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess 100% of the annual salary of the Governor? Yes ___ No ___

- 4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or any minor children entitled to receive (i) more than 15% in the aggregate of the total distributable income from your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor? Yes ___ No ___

(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years.

Yes ___ No ___

(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter.

Yes ___ No ___

(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United State of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years.

Yes ___ No ___

(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter.

Yes ___ No ___

(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government.

Yes ___ No ___

RETURN WITH BID

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

3. Communication Disclosure.

Disclose the name and address of each lobbyist and other agent of the bidder or offeror who is not identified in Section 2 of this form, who is has communicated, is communicating, or may communicate with any State officer or employee concerning the bid or offer. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the process and throughout the term of the contract. If no person is identified, enter "None" on the line below:

Name and address of person(s): _____

RETURN WITH BID

4. Debarment Disclosure. For each of the persons identified under Sections 2 and 3 of this form, disclose whether any of the following has occurred within the previous 10 years: debarment from contracting with any governmental entity; professional licensure discipline; bankruptcies; adverse civil judgments and administrative findings; and criminal felony convictions. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the procurement process and term of the contract. If no person is identified, enter "None" on the line below:

Name of person(s): _____

Nature of disclosure: _____

APPLICABLE STATEMENT

This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.

Completed by: _____
Signature of Individual or Authorized Representative Date

NOT APPLICABLE STATEMENT

Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.

This Disclosure Form A is submitted on behalf of the CONTRACTOR listed on the previous page.

Signature of Authorized Representative Date

The bidder has a continuing obligation to supplement these disclosures under Sec. 50-35 of the Procurement Code.

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form B Other Contracts & Financial Related Information Disclosure

Contractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Act (30 ILCS 500). This information shall become part of the publicly available contract file. This Form B must be completed for bids in excess of \$25,000, and for all open-ended contracts.

DISCLOSURE OF OTHER CONTRACTS AND PROCUREMENT RELATED INFORMATION

1. Identifying Other Contracts & Procurement Related Information. The BIDDER shall identify whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes ___ No ___

If "No" is checked, the bidder only needs to complete the signature box on the bottom of this page.

2. If "Yes" is checked. Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

THE FOLLOWING STATEMENT MUST BE CHECKED

Signature of Authorized Representative, Date

OWNERSHIP CERTIFICATION

Please certify that the following statement is true if the individuals for all submitted Form A disclosures do not total 100% of ownership.

Any remaining ownership interest is held by individuals receiving less than \$106,447.20 of the bidding entity's or parent entity's distributive income or holding less than a 5% ownership interest.

Yes No N/A (Form A disclosure(s) established 100% ownership)

RETURN WITH BID

SPECIAL NOTICE TO CONTRACTORS

The following requirements of the Illinois Department of Human Rights' Rules and Regulations are applicable to bidders on all construction contracts advertised by the Illinois Department of Transportation:

CONSTRUCTION EMPLOYEE UTILIZATION PROJECTION

- (a) All bidders on construction contracts shall complete and submit, along with and as part of their bids, a Bidder's Employee Utilization Form (Form BC-1256) setting forth a projection and breakdown of the total workforce intended to be hired and/or allocated to such contract work by the bidder including a projection of minority and female employee utilization in all job classifications on the contract project.
- (b) The Department of Transportation shall review the Employee Utilization Form, and workforce projections contained therein, of the contract awardee to determine if such projections reflect an underutilization of minority persons and/or women in any job classification in accordance with the Equal Employment Opportunity Clause and Section 7.2 of the Illinois Department of Human Rights' Rules and Regulations for Public Contracts adopted as amended on September 17, 1980. If it is determined that the contract awardee's projections reflect an underutilization of minority persons and/or women in any job classification, it shall be advised in writing of the manner in which it is underutilizing and such awardee shall be considered to be in breach of the contract unless, prior to commencement of work on the contract project, it submits revised satisfactory projections or an acceptable written affirmative action plan to correct such underutilization including a specific timetable geared to the completion stages of the contract.
- (c) The Department of Transportation shall provide to the Department of Human Rights a copy of the contract awardee's Employee Utilization Form, a copy of any required written affirmative action plan, and any written correspondence related thereto. The Department of Human Rights may review and revise any action taken by the Department of Transportation with respect to these requirements.

RETURN WITH BID

**Contract No. 60P41
DUPAGE County
Section 2011-035-I
Project ACNHF-0338(044)
Route FAP 338
District 1 Construction Funds**

PART II. WORKFORCE PROJECTION - continued

- B. Included in "Total Employees" under Table A is the total number of **new hires** that would be employed in the event the undersigned bidder is awarded this contract.

The undersigned bidder projects that: (number) _____ new hires would be recruited from the area in which the contract project is located; and/or (number) _____ new hires would be recruited from the area in which the bidder's principal office or base of operation is located.

- C. Included in "Total Employees" under Table A is a projection of numbers of persons to be employed directly by the undersigned bidder as well as a projection of numbers of persons to be employed by subcontractors.

The undersigned bidder estimates that (number) _____ persons will be directly employed by the prime contractor and that (number) _____ persons will be employed by subcontractors.

PART III. AFFIRMATIVE ACTION PLAN

- A. The undersigned bidder understands and agrees that in the event the foregoing minority and female employee utilization projection included under **PART II** is determined to be an underutilization of minority persons or women in any job category, and in the event that the undersigned bidder is awarded this contract, he/she will, prior to commencement of work, develop and submit a written Affirmative Action Plan including a specific timetable (geared to the completion stages of the contract) whereby deficiencies in minority and/or female employee utilization are corrected. Such Affirmative Action Plan will be subject to approval by the contracting agency and the **Department of Human Rights**.
- B. The undersigned bidder understands and agrees that the minority and female employee utilization projection submitted herein, and the goals and timetable included under an Affirmative Action Plan if required, are deemed to be part of the contract specifications.

Company _____ Telephone Number _____

Address _____

NOTICE REGARDING SIGNATURE

The Bidder's signature on the Proposal Signature Sheet will constitute the signing of this form. The following signature block needs to be completed only if revisions are required.

Signature: _____ Title: _____ Date: _____

- Instructions: All tables must include subcontractor personnel in addition to prime contractor personnel.
- Table A - Include both the number of employees that would be hired to perform the contract work and the total number currently employed (Table B) that will be allocated to contract work, and include all apprentices and on-the-job trainees. The "Total Employees" column should include all employees including all minorities, apprentices and on-the-job trainees to be employed on the contract work.
 - Table B - Include all employees currently employed that will be allocated to the contract work including any apprentices and on-the-job trainees currently employed.
 - Table C - Indicate the racial breakdown of the total apprentices and on-the-job trainees shown in Table A.

RETURN WITH BID

ADDITIONAL FEDERAL REQUIREMENTS

In addition to the Required Contract Provisions for Federal-Aid Construction Contracts (FHWA 1273), all bidders make the following certifications.

- A. By the execution of this proposal, the signing bidder certifies that the bidding entity has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action, in restraint of free competitive bidding in connection with the submitted bid. This statement made by the undersigned bidder is true and correct under penalty of perjury under the laws of the United States.
- B. CERTIFICATION, EQUAL EMPLOYMENT OPPORTUNITY:
1. Have you participated in any previous contracts or subcontracts subject to the equal opportunity clause. YES _____ NO _____
 2. If answer to #1 is yes, have you filed with the Joint Reporting Committee, the Director of OFCC, any Federal agency, or the former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements of those organizations? YES _____ NO _____

RETURN WITH BID

**Contract No. 60P41
DUPAGE County
Section 2011-035-I
Project ACNHF-0338(044)
Route FAP 338
District 1 Construction Funds**

PROPOSAL SIGNATURE SHEET

The undersigned bidder hereby makes and submits this bid on the subject Proposal, thereby assuring the Department that all requirements of the Invitation for Bids and rules of the Department have been met, that there is no misunderstanding of the requirements of paragraph 3 of this Proposal, and that the contract will be executed in accordance with the rules of the Department if an award is made on this bid.

(IF AN INDIVIDUAL) Firm Name _____
Signature of Owner _____
Business Address _____

(IF A CO-PARTNERSHIP) Firm Name _____
By _____
Business Address _____
Name and Address of All Members of the Firm: _____

(IF A CORPORATION) Corporate Name _____
By _____
Signature of Authorized Representative _____
Typed or printed name and title of Authorized Representative _____
Attest _____
Signature _____
(IF A JOINT VENTURE, USE THIS SECTION FOR THE MANAGING PARTY AND THE SECOND PARTY SHOULD SIGN BELOW) Business Address _____

(IF A JOINT VENTURE) Corporate Name _____
By _____
Signature of Authorized Representative _____
Typed or printed name and title of Authorized Representative _____
Attest _____
Signature _____
Business Address _____

If more than two parties are in the joint venture, please attach an additional signature sheet.



Item No. _____

Letting Date _____

KNOW ALL MEN BY THESE PRESENTS, That We _____

as PRINCIPAL, and _____

_____ as SURETY, are held jointly, severally and firmly bound unto the STATE OF ILLINOIS in the penal sum of 5 percent of the total bid price, or for the amount specified in the bid proposal under "Proposal Guaranty" in effect on the date of the Invitation for Bids, whichever is the lesser sum, well and truly to be paid unto said STATE OF ILLINOIS, for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH, that whereas, the PRINCIPAL has submitted a bid proposal to the STATE OF ILLINOIS, acting through the Department of Transportation, for the improvement designated by the Transportation Bulletin Item Number and Letting Date indicated above.

NOW, THEREFORE, if the Department shall accept the bid proposal of the PRINCIPAL; and if the PRINCIPAL shall, within the time and as specified in the bidding and contract documents, submit a DBE Utilization Plan that is accepted and approved by the Department; and if, after award by the Department, the PRINCIPAL shall enter into a contract in accordance with the terms of the bidding and contract documents including evidence of the required insurance coverages and providing such bond as specified with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof; or if, in the event of the failure of the PRINCIPAL to make the required DBE submission or to enter into such contract and to give the specified bond, the PRINCIPAL pays to the Department the difference not to exceed the penalty hereof between the amount specified in the bid proposal and such larger amount for which the Department may contract with another party to perform the work covered by said bid proposal, then this obligation shall be null and void, otherwise, it shall remain in full force and effect.

IN THE EVENT the Department determines the PRINCIPAL has failed to comply with any requirement as set forth in the preceding paragraph, then Surety shall pay the penal sum to the Department within fifteen (15) days of written demand therefor. If Surety does not make full payment within such period of time, the Department may bring an action to collect the amount owed. Surety is liable to the Department for all its expenses, including attorney's fees, incurred in any litigation in which it prevails either in whole or in part.

In TESTIMONY WHEREOF, the said PRINCIPAL and the said SURETY have caused this instrument to be signed by

their respective officers this _____ day of _____ A.D., _____.

PRINCIPAL

SURETY

(Company Name)

(Company Name)

By _____
(Signature & Title)

By: _____
(Signature of Attorney-in-Fact)

Notary Certification for Principal and Surety

STATE OF ILLINOIS,
County of _____

I, _____, a Notary Public in and for said County, do hereby certify that

_____ and _____
(Insert names of individuals signing on behalf of PRINCIPAL & SURETY)

who are each personally known to me to be the same persons whose names are subscribed to the foregoing instrument on behalf of PRINCIPAL and SURETY, appeared before me this day in person and acknowledged respectively, that they signed and delivered said instrument as their free and voluntary act for the uses and purposes therein set forth.

Given under my hand and notarial seal this _____ day of _____ A.D. _____

My commission expires _____

Notary Public

In lieu of completing the above section of the Proposal Bid Form, the Principal may file an Electronic Bid Bond. By signing the proposal and marking the check box next to the Signature and Title line below, the Principal is ensuring the identified electronic bid bond has been executed and the Principal and Surety are firmly bound unto the State of Illinois under the conditions of the bid bond as shown above.

Electronic Bid Bond ID#

Company / Bidder Name



Signature and Title

(1) Policy

It is public policy that disadvantageded businesses as defined in 49 CFR Part 26 and the Special Provision shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part with Federal or State funds. Consequently the requirements of 49 CFR Part 26 apply to this contract.

(2) Obligation

The contractor agrees to ensure that disadvantageded businesses as defined in 49 CFR Part 26 and the Special Provision have the maximum opportunity to participate in the performance of contracts or subcontracts financed in whole or in part with Federal or State funds. The contractor shall take all necessary and reasonable steps in accordance with 49 CFR Part 26 and the Special Provision to ensure that said businesses have the maximum opportunity to compete for and perform under this contract. The contractor shall not discriminate on the basis of race, color, national origin or sex in the award and performance of contracts.

(3) Project and Bid Identification

Complete the following information concerning the project and bid:

Route _____	Total Bid _____
Section _____	Contract DBE Goal _____ (Percent) (Dollar Amount)
Project _____	
County _____	
Letting Date _____	
Contract No. _____	
Letting Item No. _____	

(4) Assurance

I, acting in my capacity as an officer of the undersigned bidder (or bidders if a joint venture), hereby assure the Department that on this project my company : (check one)

- Meets or exceeds contract award goals and has provided documented participation as follows:
Disadvantaged Business Participation _____ percent
- Attached are the signed participation statements, forms SBE 2025, required by the Special Provision evidencing availability and use of each business participating in this plan and assuring that each business will perform a commercially useful function in the work of the contract.
- Failed to meet contract award goals and has included good faith effort documentation to meet the goals and that my company has provided participation as follows:
Disadvantaged Business Participation _____ percent

The contract goals should be accordingly modified or waived. Attached is all information required by the Special Provision in support of this request including good faith effort. Also attached are the signed participation statements, forms SBE 2025, required by the Special Provision evidencing availability and use of each business participating in this plan and assuring that each business will perform a commercially useful function in the work of the contract.

Company

By _____

Title _____

Date _____

The "as read" Low Bidder is required to comply with the Special Provision.

Submit only one utilization plan for each project. The utilization plan shall be submitted in accordance with the special provision.

Bureau of Small Business Enterprises **Local Let Projects**
2300 South Dirksen Parkway Submit forms to the
Springfield, Illinois 62764 Local Agency

The Department of Transportation is requesting disclosure of information that is necessary to accomplish the purpose as outlined under State and Federal law. Disclosure of this information is **REQUIRED**. Failure to provide any information will result in the contract not being awarded. This form has been approved by the State Forms Manager Center.



**Illinois Department
of Transportation**

DBE Participation Statement

Subcontractor Registration _____

Letting _____

Participation Statement

Item No. _____

(1) Instructions

Contract _____

This form must be completed for each disadvantaged business participating in the Utilization Plan. This form shall be submitted in accordance with the special provision and will be attached to the Utilization Plan form.. If additional space is needed complete an additional form for the firm.

(2) Work

Pay Item No.	Description	Quantity	Unit Price	Total
Total				

(3) Partial Payment Items

For any of the above items which are partial pay items, specifically describe the work and subcontract dollar amount:

(4) Commitment

The undersigned certify that the information included herein is true and correct, and that the DBE firm listed below has agreed to perform a commercially useful function in the work of the contract item(s) listed above and to execute a contract with the prime contractor. The undersigned further understand that no changes to this statement may be made without prior approval from the Department's Bureau of Small Business Enterprises and that complete and accurate information regarding actual work performed on this project and the payment therefore must be provided to the Department.

Signature for Prime Contractor

Signature for DBE Firm

Title _____

Title _____

Date _____

Date _____

Contact _____

Contact Person _____

Phone _____

Phone _____

Firm Name _____

Firm Name _____

Address _____

Address _____

City/State/Zip _____

City/State/Zip _____

E _____

WC _____

The Department of Transportation is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under the state and federal law. Disclosure of this information is **REQUIRED**. Failure to provide any information will result in the contract not being awarded. This form has been approved by the State Forms Management Center.

PROPOSAL ENVELOPE



PROPOSALS

for construction work advertised for bids by the
Illinois Department of Transportation

Item No.	Item No.	Item No.

Submitted By:

Name:
Address:
Phone No.

Bidders should use an IDOT proposal envelope or affix this form to the front of a 10" x 13" envelope for the submittal of bids. If proposals are mailed, they should be enclosed in a second or outer envelope addressed to:

Engineer of Design and Environment - Room 326
Illinois Department of Transportation
2300 South Dirksen Parkway
Springfield, Illinois 62764

NOTICE

Individual bids, including Bid Bond and/or supplemental information if required, should be securely stapled.

CONTRACTOR OFFICE COPY OF CONTRACT SPECIFICATIONS

NOTICE

None of the following material needs to be returned with the bid package unless the special provisions require documentation and/or other information to be submitted.

**Contract No. 60P41
DUPAGE County
Section 2011-035-I
Project ACNHF-0338(044)
Route FAP 338
District 1 Construction Funds**



Illinois Department of Transportation

SUBCONTRACTOR DOCUMENTATION

Public Acts 96-0795 and 96-0920, enacted substantial changes to the provisions of the Illinois Procurement Code (30 ILCS 500). Among the changes are provisions affecting subcontractors. The Contractor awarded this contract will be required as a material condition of the contract to implement and enforce the contract requirements applicable to subcontractors approved in accordance with article 108.01 of the Standard Specifications for Road and Bridge Construction.

If the Contractor seeks approval of subcontractors to perform a portion of the work, and approval is granted by the Department, the Contractor shall provide a copy of the subcontract to the Chief Procurement Officer within 20 calendar days after execution of the subcontract.

The subcontract shall contain the certifications required to be made by subcontractors pursuant to Article 50 of the Illinois Procurement Code. This Notice to Bidders includes a document incorporating all required subcontractor certifications and disclosures for use by the Contractor in compliance with this mandate. The document is entitled State Required Ethical Standards Governing Subcontractors.

RETURN WITH SUBCONTRACT

STATE ETHICAL STANDARDS GOVERNING SUBCONTRACTORS

Article 50 of the Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

The certifications hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed should the Department approve the subcontractor. The chief procurement officer may terminate or void the subcontract approval if it is later determined that the bidder or subcontractor rendered a false or erroneous certification.

Section 50-2 of the Illinois Procurement Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible chief procurement officer whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

A. Bribery

1. The Illinois Procurement Code provides:

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract to which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 1961.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

2. The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

B. Felons

1. The Illinois Procurement Code provides:

Section 50-10. Felons. Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

2. Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any of the certifications required by this Section are false.

RETURN WITH SUBCONTRACT

C. Debt Delinquency

1. The Illinois Procurement Code provides:

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Procurement Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the chief procurement officer may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

D. Prohibited Bidders, Contractors and Subcontractors

1. The Illinois Procurement Code provides:

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction.. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

E. Section 42 of the Environmental Protection Act

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-12 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Procurement Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the chief procurement officer may declare the contract void if this certification is false.

The undersigned, on behalf of the subcontracting company, has read and understands the above certifications and makes the certifications as required by law.

Name of Subcontracting Company

Authorized Officer

Date

RETURN WITH SUBCONTRACT
SUBCONTRACTOR DISCLOSURES

I. DISCLOSURES

- A. The disclosures hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed. The subcontractor further certifies that the Department has received the disclosure forms for each subcontract.

The chief procurement officer may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Procurement Code. Furthermore, the chief procurement officer may void the contract or subcontract.

B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Illinois Procurement Code provides that all subcontracts with a total value of \$25,000 or more, from subcontractors identified in Section 20-120 of the Illinois Procurement Code, shall be accompanied by disclosure of the financial interests of the subcontractor. This disclosed information for the subcontractor, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the Prime Contractor's contract. Furthermore, pursuant to this Section, the Procurement Policy Board may recommend to allow or void a contract or subcontract based on a potential conflict of interest.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the subcontracting entity or its parent entity, whichever is less, unless the subcontractor is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.

The current annual salary of the Governor is \$177,412.00.

In addition, all disclosures shall indicate any other current or pending contracts, subcontracts, proposals, leases, or other ongoing procurement relationships the subcontracting entity has with any other unit of state government and shall clearly identify the unit and the contract, subcontract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. A separate Disclosure Form A must be submitted with the bid for each individual meeting the above requirements. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies and a total ownership certification. **The forms must be included with each bid.**

C. Disclosure Form Instructions

Form A Instructions for Financial Information & Potential Conflicts of Interest

If the subcontractor is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 200 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a subcontractor is not subject to Federal 10K reporting, the subcontractor must determine if any individuals are required by law to complete a financial disclosure form. To do this, the subcontractor should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the NOT APPLICABLE STATEMENT on the second page of Form A must be signed and dated by a person that is authorized to execute contracts for the subcontracting company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES ___ NO ___
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than 60% of the annual salary of the Governor? YES ___ NO ___
3. Does anyone in your organization receive more than 60% of the annual salary of the Governor of the subcontracting entity's or parent entity's distributive income? YES ___ NO ___

(Note: Distributive income is, for these purposes, any type of distribution of profits. An annual salary is not distributive income.)

4. Does anyone in your organization receive greater than 5% of the subcontracting entity's or parent entity's total distributive income, but which is less than 60% of the annual salary of the Governor? YES ___ NO ___

(Note: Only one set of forms needs to be completed per person per subcontract even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The subcontractor must determine each individual in the subcontracting entity or the subcontracting entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The subcontractor is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the NOT APPLICABLE STATEMENT on page 2 of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

RETURN WITH SUBCONTRACT

Form B: Instructions for Identifying Other Contracts & Procurement Related Information

Disclosure Form B must be completed for each subcontract submitted by the subcontracting entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the subcontractor to ignore Form B. Form B must be completed, checked, and dated or the subcontract will not be approved.*

The Subcontractor shall identify, by checking Yes or No on Form B, whether it has any pending contracts, subcontracts, leases, bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the subcontractor only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the subcontractor must list all non-IDOT State of Illinois agency pending contracts, subcontracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts or subcontracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included.

**ILLINOIS DEPARTMENT
OF TRANSPORTATION**

**Form A
Subcontractor: Financial
Information & Potential Conflicts
of Interest Disclosure**

Subcontractor Name		
Legal Address		
City, State, Zip		
Telephone Number	Email Address	Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Code (30 ILCS 500). Subcontractors desiring to enter into a subcontract of a State of Illinois contract must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form. This information shall become part of the publicly available contract file. This Form A must be completed for subcontracts with a total value of \$25,000 or more, from subcontractors identified in Section 20-120 of the Illinois Procurement Code, and for all open-ended contracts. **A publicly traded company may submit a 10K disclosure (or equivalent if applicable) in satisfaction of the requirements set forth in Form A. See Disclosure Form Instructions.**

The current annual salary of the Governor is \$177,412.00.

DISCLOSURE OF FINANCIAL INFORMATION

1. Disclosure of Financial Information. The individual named below has an interest in the SUBCONTRACTOR (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than 60% of the annual salary of the Governor. **(Make copies of this form as necessary and attach a separate Disclosure Form A for each individual meeting these requirements)**

FOR INDIVIDUAL (type or print information)	
NAME:	_____
ADDRESS	_____
Type of ownership/distributable income share:	
stock _____ sole proprietorship _____ Partnership _____ other: (explain on separate sheet):	
% or \$ value of ownership/distributable income share:	_____

2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes ___ No ___

If your answer is yes, please answer each of the following questions.

- Are you currently an officer or employee of either the Capitol Development Board or the Illinois State Toll Highway Authority? Yes ___ No ___
- Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, provide the name the State agency for which you are employed and your annual salary. _____

RETURN WITH SUBCONTRACT

3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor?
Yes ___ No ___

4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor?
Yes ___ No ___

(b) State employment of spouse, father, mother, son, or daughter, including contractual employment services in the previous 2 years.

Yes ___ No ___

If your answer is yes, please answer each of the following questions.

1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois State Toll Highway Authority?
Yes ___ No ___

2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, provide the name of your spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. _____

3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 100% of the annual salary of the Governor?
Yes ___ No ___

4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds 60% of the annual salary of the Governor, are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of two times the salary of the Governor?
Yes ___ No ___

(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years.
Yes ___ No ___

(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter.
Yes ___ No ___

(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United States of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years.
Yes ___ No ___

(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter.
Yes ___ No ___

(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government.
Yes ___ No ___

RETURN WITH SUBCONTRACT

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes ___ No ___

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes ___ No ___

3 Communication Disclosure.

Disclose the name and address of each lobbyist and other agent of the bidder or offeror who is not identified in Section 2 of this form, who is has communicated, is communicating, or may communicate with any State officer or employee concerning the bid or offer. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the process and throughout the term of the contract. If no person is identified, enter "None" on the line below:

Name and address of person(s): _____

RETURN WITH SUBCONTRACT

4. Debarment Disclosure. For each of the persons identified under Sections 2 and 3 of this form, disclose whether any of the following has occurred within the previous 10 years: debarment from contracting with any governmental entity; professional licensure discipline; bankruptcies; adverse civil judgments and administrative findings; and criminal felony convictions. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the procurement process and term of the contract. If no person is identified, enter "None" on the line below:

Name of person(s): _____

Nature of disclosure: _____

APPLICABLE STATEMENT

This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.

Completed by: _____ Date _____
Signature of Individual or Authorized Officer

NOT APPLICABLE STATEMENT

Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.

This Disclosure Form A is submitted on behalf of the SUBCONTRACTOR listed on the previous page.

_____ Date _____
Signature of Authorized Officer

RETURN WITH SUBCONTRACT

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form B
Subcontractor: Other Contracts & Financial Related Information Disclosure

Form with fields: Subcontractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Act (30 ILCS 500). This information shall become part of the publicly available contract file. This Form B must be completed for subcontracts with a total value of \$25,000 or more, from subcontractors identified in Section 20-120 of the Illinois Procurement Code, and for all open-ended contracts.

DISCLOSURE OF OTHER CONTRACTS, SUBCONTRACTS, AND PROCUREMENT RELATED INFORMATION

1. Identifying Other Contracts & Procurement Related Information. The SUBCONTRACTOR shall identify whether it has any pending contracts, subcontracts, including leases, bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes ___ No ___

If "No" is checked, the subcontractor only needs to complete the signature box on the bottom of this page.

2. If "Yes" is checked. Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

THE FOLLOWING STATEMENT MUST BE CHECKED

Signature box with fields for Signature of Authorized Officer and Date

OWNERSHIP CERTIFICATION

Please certify that the following statement is true if the individuals for all submitted Form A disclosures do not total 100% of ownership

Any remaining ownership interest is held by individuals receiving less than \$106,447.20 of the bidding entity's or parent entity's distributive income or holding less than a 5% ownership interest.

Yes No N/A (Form A disclosure(s) established 100% ownership)



NOTICE TO BIDDERS

- 1. TIME AND PLACE OF OPENING BIDS.** Sealed proposals for the improvement described herein will be received by the Department of Transportation at the Harry R. Hanley Building, 2300 South Dirksen Parkway, in Springfield, Illinois until 10:00 o'clock a.m., June 15, 2012. All bids will be gathered, sorted, publicly opened and read in the auditorium at the Department of Transportation's Harry R. Hanley Building shortly after the 10:00 a.m. cut off time.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60P41
DUPAGE County
Section 2011-035-I
Project ACNHF-0338(044)
Route FAP 338
District 1 Construction Funds**

Construction of a new pump station #47 near the existing pump station on IL 59 located south of N. Aurora Rd. in Naperville.

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Ann L. Schneider,
Secretary

INDEX
FOR
SUPPLEMENTAL SPECIFICATIONS
AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2012

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS, frequently used RECURRING SPECIAL PROVISIONS, and LOCAL ROADS AND STREETS RECURRING SPECIAL PROVISIONS.

SUPPLEMENTAL SPECIFICATIONS

Std. Spec. Sec.

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No Supplemental Specifications this year.

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2 X Subletting of Contracts (Federal-Aid Contracts) (Eff. 1-1-88) (Rev. 5-1-93)	4
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8 Haul Road Stream Crossings, Other Temporary Stream Crossings, and In-Stream Work Pads (Eff. 1-2-92) (Rev. 1-1-98)	27
9 Construction Layout Stakes Except for Bridges (Eff. 1-1-99) (Rev. 1-1-07)	28
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11 Use of Geotextile Fabric for Railroad Crossing (Eff. 1-1-95) (Rev. 1-1-07)	34
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14 Pavement and Shoulder Resurfacing (Eff. 2-1-00) (Rev. 1-1-09)	42
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16 Patching with Hot-Mix Asphalt Overlay Removal (Eff. 10-1-95) (Rev. 1-1-07)	45
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29 Portland Cement Concrete Inlay or Overlay for Pavements (Eff. 11-1-08) (Rev. 1-1-12)	65
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STATE OF ILLINOIS
SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2012 (hereinafter referred to as the Standard Specifications); the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways" in effect on the date of invitation for bids; the "Manual of Test Procedures for Materials" in effect on the date of invitation for bids; and the "Supplemental Specifications and Recurring Special Provisions" indicated on the Check Sheet included herein which apply to and govern the construction of FAP 338 (IL Route 59), Project ACNHF-0338(044), Section 2011-035-I, in DuPage County, Contract 60P41 and in case of conflict with any part of parts of said specifications, the said Special Provisions shall take precedence and shall govern.

FAP 338 (IL Route 59)
Aurora Ave./New York St. to Ferry Ave.
Project ACNHF-0338(044)
Section 2011-035-I
DuPage County
Contract 60P41

LOCATION OF IMPROVEMENT

IL Route 59, from approximately 830 feet south of New York Street/Aurora Avenue to approximately 320 feet south of Ferry Road within the corporate limits of the cities of Naperville and Aurora in DuPage County, Illinois. The improvement covers a distance of 18,100 feet (3.43 miles) along IL Route 59.

DESCRIPTION OF IMPROVEMENT

The improvement consists of the replacement of Pump Station 47, including but not limited to, concrete work, reinforcement bars, glass block and masonry work, doors and frame, roofing, sheet metal work, and site work, and a retaining wall and driveway, as specified herein and shown on the plans. In addition, the pump station shall include mechanical work consisting of pumps including motors, fabricated metal, bowls, and impellers and heating and ventilating equipment, piping for pump and recirculation system and electrical distribution, control, instrumentation, intrusion and fire alarm, lighting, equipment, conduit and wiring, electrical service connection and Supervisory Control and Data Acquisition (SCADA) System.

STAGING AND SEQUENCE OF CONSTRUCTION

Construction Staging: The Contractor shall be responsible for and include all work for implementing and staging construction in a manner that permits the continuous pumping capabilities throughout the contract period.

Suggested Construction Sequencing is provided in the Contract Documents, however, the Contractor is responsible for staging in order to provide the District One Electrical Maintenance Contractor vehicular access, pedestrian access and parking adjacent to the existing pump station until such time as it can be decommissioned. The Contractor shall confine his construction operations within the limits of work indicated on the Drawings.

COMPLETION DATE PLUS WORKING DAYS

Revise Article 108.05 (b) of the Standard Specifications as follows:

"When a completion date plus working days is specified, the Contractor shall complete all contract items and safely open all roadways to traffic by 11:59 PM on, March 30, 2014 except as specified herein.

The Contractor will be allowed to complete all clean-up work and punch list items within 5 working days after the completion date for opening the roadway to traffic. Under extenuating circumstances the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic, may be completed within the working days allowed for cleanup work and punch list items. Temporary lane closures for this work may be allowed at the discretion of the Engineer.

Article 108.09 or the Special Provision for "Failure to Complete the Work on Time", if included in this contract, shall apply to both the completion date and the number of working days.

PRE-BID SITE INSPECTION OF PUMP STATION

The new Pump Station No. 47 site will be open for Contractor's inspection on _____, between _____ and _____ local time. A representative of the State will be on hand during this stated time period. In the event the date or time is not suitable, an alternative inspection date and time can be arranged with _____ of IDOT's Bureau of Electrical Operations, Maintenance Division, at _____.

COORDINATION WITH ADJACENT AND/OR OVERLAPPING CONTRACTS

This contract overlaps with other concurrent and future contracts as listed below. The Contractor shall cooperate with the other contractors in the phasing and performance of his work so as not to delay, interrupt or hinder the progress or completion of work being performed by the other contractors.

No additional compensation will be allowed this Contractor for compliance with the above requirements, nor for any delays or inconvenience resulting from the activities of the other contractors.

1. Contract 60P43 – Tree Removal, IL-59 from New York St./Aurora Ave. to Ferry Rd.

2. Contract 60R30 – Roadway Reconstruction, IL-59 from New York St./Aurora Ave. to North Aurora Rd.
3. Contract 60P42 – Retaining Wall Construction, IL-59

PROGRESS SCHEDULE

Time is of the essence in this Contract. It may be necessary for the Contractor to work longer hours, use additional crews, and work during weekends in order to complete the work within the required time limit. The Contractor shall submit a Critical Path Method (CPM) Progress Schedule for the Engineer's approval before the work can be started.

In the event the Contractor falls more than three (3) days behind the approved progress schedule, the Contractor shall work seven (7) days a week at extended hours in order to meet the specified Completion Date.

The Contractor will not be allowed any extra compensation for working longer hours or using extra shifts; and working on weekends or during holidays; working during winter months, etc., to meet the specified Completion Date.

STATUS OF UTILITIES TO BE ADJUSTED

Effective: January 30, 1987

Revised: July 1, 1994

Utility companies involved in this project have provided the following estimated dates:

Name Of Utility	Type	Location	Estimated Dates for Start and Completion of Relocation or Adjustments
AT&T	Telephone	STA 3960+76 86 LT to 3964+07 92 LT	To be determined
City of Naperville	Electric	STA 3961+99 88 LT to 3963+07 95 LT STA 3957+83 76 LT to 3958+58 98 LT	To be determined
Com Ed	Aerial Electric	STA 3963+09 99 LT to 3963+28 84 RT	To be determined
KDL, Inc.	Fiber optic	STA 3958+00 57 LT to 3963+03 41 LT	To be determined

The above represents the best information available to the Department and is included for the convenience of the bidder. The applicable portions of Articles 105.07 and 107.31 of the Standard Specifications shall apply.

EXISTING UTILITIES

The Contractor shall familiarize himself with the locations of all utilities and structures that may be found in the vicinity of the construction. The Contractor shall conduct his operations to avoid damage to the above-mentioned utilities and structures. Should any damage occur due to the Contractor's negligence, repairs shall be made by the Contractor at his expense in a manner acceptable to the Engineer.

The Contractor shall notify all utility owners of his construction schedule and shall coordinate constructions operations with utility owners so that relocation of utility lines and structures may proceed in an orderly manner. Notification shall be in writing, with copies transmitted to the Engineer.

TRAFFIC CONTROL PLAN

Effective: September 30, 1985

Revised: January 1, 2007

Traffic Control shall be according to the applicable sections of the Standard Specifications, the Supplemental Specifications, the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", any special details and Highway Standards contained in the plans, and the Special Provisions contained herein.

Special attention is called to Article 107.09 of the Standard Specifications and the following Highway Standards, Details, Quality Standard for Work Zone Traffic Control Devices, Recurring Special Provisions and Special Provisions contained herein, relating to traffic control.

The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

STANDARDS:

	701101	Off-Road Operations, Multilane, 15' to 24" from Pavement Edge
Edge	701106	Off-Road Operations, Multilane, more than 15' from Pavement
	701427	Lane Closure, Multilane, Moving Operation for Speeds < 40 MPH
Median	701601	Urban Lane Closure, Multilane, 1W or 2W with Nontraversable
	701901	Traffic Control Devices
	704001	Temporary Concrete Barrier

DETAILS:

Driveways	TC10	Traffic Control & Protection for Side Roads, Intersections &
	TC18	Signing for Flagging Operations at Work Zone Openings
	TC22	Arterial Road Information Sign

SPECIAL PROVISIONS:

Traffic Control Plan
Temporary Information Signing

BDE SPECIAL PROVISIONS:

Flagger at Side Roads and Entrances
Traffic Control Surveillance

TRAFFIC CONTROL AND PROTECTION (ARTERIALS)

Effective: February 1, 1996

Revised: March 1, 2011

Specific traffic control plan details and Special Provisions have been prepared for this contract. This work shall include all labor, materials, transportation, handling and incidental work necessary to furnish, install, maintain and remove all traffic control devices required as indicated in the plans and as approved by the Engineer.

When traffic is to be directed over a detour route, the Contractor shall furnish, erect, maintain and remove all applicable traffic control devices along the detour route according to the details shown in the plans.

Method of Measurement: All traffic control (except Traffic Control and Protection (Expressways)) and temporary pavement markings) indicated on the traffic control plan details and specified in the Special Provisions will be measured for payment on a lump sum basis.

Basis of Payment: All traffic control and protection will be paid for at the contract lump sum price for TRAFFIC CONTROL AND PROTECTION (SPECIAL).

Temporary pavement markings will be paid for separately unless shown on a Standard.

TEMPORARY INFORMATION SIGNING

Effective: November 13, 1996

Revised: January 2, 2007

Description. This work shall consist of furnishing, installing, maintaining, relocating for various states of construction and eventually removing temporary informational signs. Included in this item may be ground mount signs, skid mount signs, truss mount signs, bridge mount signs, and overlay sign panels which cover portions of existing signs.

Materials. Materials shall be according to the following Articles of Section 1000 - Materials:

	<u>Item</u>	<u>Article/Section</u>
a.)	Sign Base (Notes 1 & 2)	1090
b.)	Sign Face (Note 3)	1091
c.)	Sign Legends	1092
d.)	Sign Supports	1093
e.)	Overlay Panels (Note 4)	1090.02

- Note 1. The Contractor may use 5/8 inch (16 mm) instead of 3/4 inch (19 mm) thick plywood.
- Note 2. Type A sheeting can be used on the plywood base.
- Note 3. All sign faces shall be Type A except all orange signs shall meet the requirements of Article 1106.01.
- Note 4. The overlay panels shall be 0.08 inch (2 mm) thick.

GENERAL CONSTRUCTION REQUIREMENTS

Installation. The sign sizes and legend sizes shall be verified by the Contractor prior to fabrication.

Signs which are placed along the roadway and/or within the construction zone shall be installed according to the requirements of Article 701.14 and Article 720.04. The signs shall be 7 ft (2.1 m) above the near edge of the pavement and shall be a minimum of 2 ft (600 mm) beyond the edge of the paved shoulder. A minimum of two (2) posts shall be used.

The attachment of temporary signs to existing sign structures or sign panels shall be approved by the Engineer. Any damage to the existing signs due to the Contractor's operations shall be repaired or signs replaced, as determined by the Engineer, at the Contractor's expense.

Signs which are placed on overhead bridge structures shall be fastened to the handrail with stainless steel bands. These signs shall rest on the concrete parapet where possible. The Contractor shall furnish mounting details for approval by the Engineer.

Method of Measurement. This work shall be measured for payment in square feet (square meters) edge to edge (horizontally and vertically).

All hardware, posts or skids, supports, bases for ground mounted signs, connections, which are required for mounting these signs will be included as part of this pay item.

Basis of Payment. This work shall be paid for at the contract unit price per square foot (square meter) for TEMPORARY INFORMATION SIGNING.

DISPOSAL OF SURPLUS MATERIAL

The Contractor is prohibited from burning any material within or adjacent to the project limits.

All excess or waste material shall be either hauled away from the project site by the Contractor or deposited at locations provided by him, or disposed of within the right-of-way in a manner other than burning, subject to the approval of the Engineer.

No extra compensation will be allowed by the Contractor for any expense incurred by complying with the requirements of this Special Provision.

BUILDING REMOVAL - CASE IV (NO ASBESTOS) (SPECIAL)

BUILDING REMOVAL: This work shall consist of the removal and disposal of the existing pump station building, together with all foundations, retaining walls, and piers, to a finished grade at or below elevation 691.0, and also all incidental and collateral work necessary to complete the removal of the building(s) in a manner approved by the Engineer. The basement slab shall be cored with no fewer than three holes of 4 in diameter, and the remaining foundation shall be filled with a controlled low-strength flowable mixture.

The building is identified as follows:

<u>Bldg. No.</u>	<u>Parcel No.</u>	<u>Location</u>	<u>Description</u>
1	1-HJ0061PE	SW Quadrant, BNSF RR & IL-59	Existing Pump Sta. 47

Discontinuance of Utilities: The Contractor shall arrange for the discontinuance of all utility services and the removal of the metering devices that serve the building(s) according to the respective requirements and regulations of the City, County, or utility companies involved. The Contractor shall disconnect and seal, in an approved manner, all service outlets that serve any building(s) he/she is to remove.

Demolition shall not commence, nor shall the existing pump station be decommissioned until written authorization has been obtained from the Engineer to proceed. The pumps, generator, SCADA panel and all other items identified by the Engineer to be salvaged shall be removed from the building and delivered to a location determined by the Engineer. All remaining items shall be removed and properly disposed.

Basis of Payment: This work will be paid for at the contract lump sum unit price for BUILDING REMOVAL NO. 1, which price shall be payment in full for complete removal of the buildings and structures, including any necessary backfilling material as specified herein. The lump sum unit price(s) for this work shall represent the cost of demolition. Any salvage value shall be reflected in the contract unit price for this item.

The remaining foundation to be filled with a controlled low-strength flowable mixture shall be measured separately and paid for by cubic yard for CONTROLLED LOW-STRENGTH MATERIAL.

Notifications: The "Demolition/Renovation Notice" form, which can be obtained from the IEPA office, shall be completed and submitted to the address listed below at least ten days prior to commencement of any demolition activity.

Asbestos Demolition/Renovation Coordinator
Illinois Environmental Protection Agency
Division of Air Pollution Control
P. O. Box 19276
Springfield, Illinois 62794-9276
(217)785-1743

Notices shall be updated if there is a change in the starting date or the amount of asbestos changes by more than 20 percent.

Submittals:

A. All submittals and notices shall be made to the Engineer except where otherwise specified herein.

B. Prior to starting work, the Contractor shall submit proof of written notification and compliance with the "Notifications" paragraph.

RAILROAD PROTECTIVE LIABILITY INSURANCE (5 AND 10) (BDE)

Revised: January 1, 2006

Description. Railroad Protective Liability and Property Damage Liability Insurance shall be carried according to Article 107.11 of the Standard Specifications, except the limits shall be a minimum of \$5,000,000 combined single limit per occurrence for bodily injury liability and property damage liability with an aggregate limit of \$10,000,000 over the life of the policy. A separate policy is required for each railroad unless otherwise noted.

NAMED INSURED & ADDRESS	NUMBER & SPEED OF PASSENGER TRAINS	NUMBER & SPEED OF FREIGHT TRAINS
<p>BNSF over IL 59 in Naperville</p> <p>BNSF Railway Company Jones Lang LaSalle 3017 Lou Menk Drive Suite 100 Fort Worth, TX 76131-2800</p>	<p>134 trains/day@70mph (METRA & AMTRAK)</p>	<p>52trains/day @30mph</p>
<p>DOT/AAR No.: 079551E RR Division: Chicago</p>	<p>RR Mile Post: 30.6 RR Sub-Division: First</p>	
<p>FOR FREIGHT/PASSENGER INFO CONTACT: French Thompson 579-5092</p>		<p>PHONE: 773-</p>
<p>FOR INSURANCE INFORMATION CONTACT: 8519</p>	<p><u>Rosa Martinez</u></p>	<p>PHONE: <u>214-303-</u></p>

Approval of Insurance. The original and one certified copy of each required policy shall be submitted to the following address for approval:

Illinois Department of Transportation
 Bureau of Design and Environment
 2300 South Dirksen Parkway, Room 326
 Springfield, Illinois 62764

The Contractor will be advised when the Department has received approval of the insurance from the railroad(s). Before any work begins on railroad right-of-way, the Contractor shall submit to the Engineer evidence that the required insurance has been approved by the railroad(s). The Contractor shall also provide the Engineer with the expiration date of each required policy.

Basis of Payment. Providing Railroad Protective Liability and Property Damage Liability Insurance will be paid for at the contract unit price per Lump Sum for RAILROAD PROTECTIVE LIABILITY INSURANCE.

80157

LAW DEPARTMENT APPROVED

OVERPASS EXHIBIT "C-1"

**Agreement
Between
BNSF RAILWAY COMPANY
and the
CONTRACTOR**

BNSF RAILWAY COMPANY
Attention: Manager Public Projects

Railway File: _____
Agency Project: _____

Gentlemen:

The undersigned (hereinafter called, the "Contractor"), has entered into a contract (the "Contract") dated _____, 200_, **[***Drafter's Note: Insert the date of the contract between the Agency and the Contractor here **]** with _____ **[**Drafter's Note: insert the name of the Agency here**]** for the performance of certain work in connection with the following project:

_____. Performance of such work will necessarily require contractor to enter BNSF RAILWAY COMPANY ("Railway") right of way and property ("Railway Property"). The Contract provides that no work will be commenced within Railway Property until the Contractor employed in connection with said work for _____ **[insert Agency name here]** (i) executes and delivers to Railway an Agreement in the form hereof, and (ii) provides insurance of the coverage and limits specified in such Agreement and Section 3 herein. If this Agreement is executed by a party who is not the Owner, General Partner, President or Vice President of Contractor, Contractor must furnish evidence to Railway certifying that the signatory is empowered to execute this Agreement on behalf of Contractor.

Accordingly, in consideration of Railway granting permission to Contractor to enter upon Railway Property and as an inducement for such entry, Contractor, effective on the date of the Contract, has agreed and does hereby agree with Railway as follows:

Section 1. RELEASE OF LIABILITY AND INDEMNITY

Contractor hereby waives, releases, indemnifies, defends and holds harmless Railway for all judgments, awards, claims, demands, and expenses (including attorneys' fees), for injury or death to all persons, including Railway's and Contractor's officers and employees, and for loss and damage to property belonging to any person, arising in any manner from Contractor's or any of Contractor's subcontractors' acts or omissions or any work performed on or about Railway's property or right-of-way. **THE LIABILITY ASSUMED BY CONTRACTOR WILL NOT BE AFFECTED BY THE FACT, IF IT IS A FACT, THAT THE DESTRUCTION, DAMAGE, DEATH, OR INJURY WAS OCCASIONED BY OR CONTRIBUTED TO BY THE NEGLIGENCE OF RAILWAY, ITS AGENTS, SERVANTS, EMPLOYEES OR OTHERWISE, EXCEPT TO THE EXTENT THAT SUCH CLAIMS ARE PROXIMATELY CAUSED BY THE INTENTIONAL MISCONDUCT OR GROSS NEGLIGENCE OF RAILWAY.**

THE INDEMNIFICATION OBLIGATION ASSUMED BY CONTRACTOR INCLUDES ANY CLAIMS, SUITS OR JUDGMENTS BROUGHT AGAINST RAILWAY UNDER THE FEDERAL EMPLOYEE'S LIABILITY ACT, INCLUDING CLAIMS FOR STRICT LIABILITY UNDER THE SAFETY APPLIANCE ACT OR THE BOILER INSPECTION ACT, WHENEVER SO CLAIMED.

Contractor further agrees, at its expense, in the name and on behalf of Railway, that it will adjust and settle all claims made against Railway, and will, at Railway's discretion, appear and defend any suits or actions of law or in equity brought against Railway on any claim or cause of action arising or growing out of or in any manner connected with any liability assumed by Contractor under this Agreement for which Railway is liable or is alleged to be liable. Railway will give notice to Contractor, in writing, of the receipt or dependency of such claims and thereupon Contractor must proceed to adjust and handle to a conclusion such claims, and in the event of a suit being brought against Railway, Railway may forward summons and complaint or other process in connection therewith to Contractor, and Contractor, at Railway's discretion, must defend, adjust, or settle such suits and protect, indemnify, and save harmless Railway from and against all damages, judgments, decrees, attorney's fees, costs, and expenses growing out of or resulting from or incident to any such claims or suits.

It is mutually understood and agreed that the assumption of liabilities and indemnification provided for in this Agreement survive any termination of this Agreement.

Section 2. TERM

This Agreement is effective from the date of the Contract until (i) the completion of the project set forth herein, and (ii) full and complete payment to Railway of any and all sums or other amounts owing and due hereunder.

Section 3. INSURANCE

Contractor must, at its sole cost and expense, procure and maintain during the life of this Agreement the following insurance coverage:

A. Commercial General Liability insurance. This insurance must contain broad form contractual liability with a combined single limit of a minimum of \$5,000,000 each occurrence and an aggregate limit of at least \$10,000,000. Coverage must be purchased on a post 1998 ISO occurrence form or equivalent and include coverage for, but not limit to the following:

- ◆ Bodily Injury and Property Damage
- ◆ Personal Injury and Advertising Injury
- ◆ Fire legal liability
- ◆ Products and completed operations

This policy must also contain the following endorsements, which must be indicated on the certificate of insurance:

- ◆ It is agreed that any workers' compensation exclusion does not apply to **Railroad** payments related to the Federal Employers Liability Act or a **Railroad Wage Continuation Program** or similar programs and any payments made are deemed not to be either payments made or obligations assumed under any Workers Compensation, disability benefits, or unemployment compensation law or similar law.
- ◆ The definition of insured contract must be amended to remove any exclusion or other limitation for any work being done within 50 feet of railroad property.
- ◆ Any exclusions related to the explosion, collapse and underground hazards must be removed.

No other endorsements limiting coverage as respects obligations under this Agreement may be included on the policy.

B. Business Automobile Insurance. This insurance must contain a combined single limit of at least \$1,000,000 per occurrence, and include coverage for, but not limited to the following:

- ◆ Bodily injury and property damage
- ◆ Any and all vehicles owned, used or hired

- C. Workers Compensation and Employers Liability insurance including coverage for, but not limited to:
- ◆ _____'s statutory liability under the worker's compensation laws of the state(s) in which the work is to be performed. If optional under State law, the insurance must cover all employees anyway.
 - ◆ Employers' Liability (Part B) with limits of at least \$500,000 each accident, \$500,000 by disease policy limit, \$500,000 by disease each employee.
- D. Railroad Protective Liability insurance naming only the **Railroad** as the Insured with coverage of at least \$5,000,000 per occurrence and \$10,000,000 in the aggregate. The policy Must be issued on a standard ISO form CG 00 35 10 93 and include the following:
- ◆ Endorsed to include the Pollution Exclusion Amendment (ISO form CG 28 31 10 93)
 - ◆ Endorsed to include the Limited Seepage and Pollution Endorsement.
 - ◆ Endorsed to remove any exclusion for punitive damages.
 - ◆ No other endorsements restricting coverage may be added.
 - ◆ The original policy must be provided to the **Railroad** prior to performing any work or services under this Agreement

Other Requirements:

All policies (applying to coverage listed above) must not contain an exclusion for punitive damages and certificates of insurance must reflect that no exclusion exists.

Contractor agrees to waive its right of recovery against **Railroad** for all claims and suits against **Railroad**. In addition, its insurers, through the terms of the policy or policy endorsement, waive their right of subrogation against **Railroad** for all claims and suits. The certificate of insurance must reflect the waiver of subrogation endorsement. Contractor further waives its right of recovery, and its insurers also waive their right of subrogation against **Railroad** for loss of its owned or leased property or property under contractor's care, custody or control.

Contractor's insurance policies through policy endorsement, must include wording which states that the policy is primary and non-contributing with respect to any insurance carried by **Railroad**. The certificate of insurance must reflect that the above wording is included in evidenced policies.

All policy(ies) required above (excluding Workers Compensation and if applicable, Railroad Protective) must include a severability of interest endorsement and **Railroad** must be named as an additional insured with respect to work performed under this agreement. Severability of interest and naming **Railroad** as additional insured must be indicated on the certificate of insurance.

Contractor is not allowed to self-insure without the prior written consent of **Railroad**. If granted by **Railroad**, any deductible, self-insured retention or other financial responsibility for claims must be covered directly by contractor in lieu of insurance. Any and all **Railroad** liabilities that would otherwise, in accordance with the provisions of this **Agreement**, be covered by contractor's insurance will be covered as if contractor elected not to include a deductible, self-insured retention or other financial responsibility for claims.

Prior to commencing the Work, contractor must furnish to **Railroad** an acceptable certificate(s) of insurance including an original signature of the authorized representative evidencing the required coverage, endorsements, and amendments and referencing the contract audit/folder number if available. The policy(ies) must contain a provision that obligates the insurance company(ies) issuing such policy(ies) to notify **Railroad** in writing at least 30 days prior to any cancellation, non-renewal, substitution or material alteration. This cancellation provision must be indicated on the certificate of insurance. Upon request from **Railroad**, a certified duplicate original of any required policy must be furnished. Contractor should send the certificate(s) to the following address:

BNSF RISK MANAGEMENT
2500 Lou Menk Drive AOB-1
Fort Worth, TX 76131-2828
Fax: 817-352-7207

Any insurance policy must be written by a reputable insurance company acceptable to **Railroad** or with a current Best's Guide Rating of A- and Class VII or better, and authorized to do business in the state(s) in which the service is to be provide.

Contractor represents that this **Agreement** has been thoroughly reviewed by contractor's insurance agent(s)/broker(s), who have been instructed by contractor to procure the insurance coverage required by this **Agreement**. Allocated Loss Expense must be in addition to all policy limits for coverages referenced above.

Not more frequently than once every five years, **Railroad** may reasonably modify the required insurance coverage to reflect then-current risk management practices in the railroad industry and underwriting practices in the insurance industry.

If any portion of the operation is to be subcontracted by contractor, contractor must require that the subcontractor provide and maintain the insurance coverages set forth herein, naming **Railroad** as an additional insured, and requiring that the subcontractor release, defend and indemnify **Railroad** to the same extent and under the same terms and conditions as contractor is required to release, defend and indemnify **Railroad** herein.

Failure to provide evidence as required by this section will entitle, but not require, **Railroad** to terminate this **Agreement** immediately. Acceptance of a certificate that does not comply with this section will not operate as a waiver of contractor's obligations hereunder.

The fact that insurance (including, without limitation, self-insurance) is obtained by contractor will not be deemed to release or diminish the liability of contractor including, without limitation, liability under the indemnity provisions of this **Agreement**. Damages recoverable by **Railroad** will not be limited by the amount of the required insurance coverage.

For purposes of this section, **Railroad** means "Burlington Northern Santa Fe Corporation", "BNSF RAILWAY COMPANY" and the subsidiaries, successors, assigns and affiliates of each.

Section 4. EXHIBIT "C" CONTRACTOR REQUIREMENTS

The Contractor must observe and comply with the provisions, obligations, requirements and limitations contained in the Contract and the Contractor Requirements set forth on Exhibit "C" attached to the Contract and this Agreement, including, but not be limited to, payment of all costs incurred for any damages to Railway roadbed, tracks, and/or appurtenances thereto, resulting from use, occupancy, or presence of its employees, representatives, or agents or subcontractors on or about the construction site.

Section 5. TRAIN DELAY

Contractor is responsible for and hereby indemnifies and holds harmless Railway (including its affiliated railway companies, and its tenants) for, from and against all damages arising from any unscheduled delay to a freight or passenger train which affects Railway's ability to fully utilize its equipment and to meet customer service and contract obligations. Contractor will be billed, as further provided below, for the economic losses arising from loss of use of equipment, contractual loss of incentive pay and bonuses and contractual penalties resulting from train delays, whether caused by Contractor, or subcontractors, or by the Railway performing work under this Agreement. Railway agrees that it will not perform any act to unnecessarily cause train delay.

For loss of use of equipment, Contractor will be billed the current freight train hour rate per train as determined from Railway's records. Any disruption to train traffic may cause delays to multiple trains at the same time for the same period.

Additionally, the parties acknowledge that passenger, U.S. mail trains and certain other grain, intermodal, coal and freight trains operate under incentive/penalty contracts between Railway and its customer(s). Under these arrangements, if Railway does not meet its contract service commitments, Railway may suffer loss of performance or incentive pay and/or be subject to penalty payments. Contractor is responsible for any train performance and incentive penalties or other contractual economic losses actually incurred by Railway which are attributable to a train delay caused by Contractor or its subcontractors.

The contractual relationship between Railway and its customers is proprietary and confidential. In the event of a train delay covered by this Agreement, Railway will share information relevant to any train delay to the extent consistent with Railway confidentiality obligations. Damages for train delay for certain trains may be as high as \$50,000.00 per incident.

Contractor and its subcontractors must give Railway's representative (_____) _____ weeks advance notice of the times and dates for proposed work windows. Railway and Contractor will establish mutually agreeable work windows for the project. Railway has the right at any time to revise or change the work windows due to train operations or service obligations. Railway will not be responsible for any additional costs or expenses resulting from a change in work windows. Additional costs or expenses resulting from a change in work windows shall be accounted for in Contractor's expenses for the project.

Contractor and subcontractors must plan, schedule, coordinate and conduct all Contractor's work so as to not cause any delays to any trains.

Kindly acknowledge receipt of this letter by signing and returning to the Railway two original copies of this letter, which, upon execution by Railway, will constitute an Agreement between us.

(Contractor)

BNSF Railway Company

By: _____
Printed Name: _____
Title: _____

By: _____
Name: _____
Manager Public Projects

Contact Person: _____
Address _____

Accepted and effective this ____ day of 20__.

City: _____ State: ___ Zip: ___
Fax: _____
Phone: _____
E-mail: _____

PROTECTION OF EXISTING DRAINAGE FACILITIES DURING CONSTRUCTION

Unless otherwise noted in the contract plans, the existing drainage facilities shall remain in use during the period of construction.

Locations of existing drainage structures and sewers as shown on the contract plans are approximate. Prior to commencement of work, the Contractor, at his own expense, shall determine the exact location of existing structures that are within the proposed construction site.

All drainage structures are to be kept free from any debris resulting from construction operations. All work and materials necessary to prevent accumulation of debris in the drainage structures will be considered as incidental to the contract. Any accumulation of debris in the drainage structure resulting from construction operations shall be removed at the Contractor's own expense, and no extra compensation will be allowed.

Existing frames and grates are to remain unless otherwise noted in the contract plans or as directed by the Engineer. Frames and grates that are missing or damaged prior to construction shall be replaced. The type of replacement frame or grate shall be determined by the Engineer, and replacement and payment for same shall be in accordance with Section 604 and Article 104.02 respectively, of the Standard Specifications unless otherwise noted in the plans or Special Provisions.

The Contractor shall take the necessary precautions when working near or above existing sewers and culverts in order to protect these pipes during construction from any damage resulting from his operations. All work and materials necessary to repair or replace existing pipes damaged because of noncompliance with this provision shall be as directed by the Engineer in accordance with Section 542 or 550 of the Standard Specifications and at the Contractor's own expense, and no extra compensation will be allowed.

During construction, if the Contractor encounters or otherwise becomes aware of any sewers, culverts, or underdrains within the right-of-way other than those shown on the plans, he shall so inform the Engineer who shall direct the work necessary to maintain the facilities in service and to protect them from damage during construction. Complying with this requirement shall be considered incidental to the various pay items involved.

DRAINAGE AND INLET PROTECTION UNDER TRAFFIC (DISTRICT 1)

Effective: April 1, 2011

Revised: April 2, 2011

Add the following to Article 603.02 of the Standard Specifications:

- “(i) Temporary Hot-Mix Asphalt (HMA) Ramp (Note 1) 1030
- “(j) Temporary Rubber Ramps (Note 2)

Note 1. The HMA shall have maximum aggregate size of 3/8 in. (95 mm).

Note 2. The rubber material shall be according to the following.

Property	Test Method	Requirement
Durometer Hardness, Shore A	ASTM D 2240	75 ±15
Tensile Strength, psi (kPa)	ASTM D 412	300 (2000) min
Elongation, percent	ASTM D 412	90 min
Specific Gravity	ASTM D 792	1.0 - 1.3
Brittleness, °F (°C)	ASTM D 746	-40 (-40)°

Revise Article 603.07 of the Standard Specifications to read:

“603.07 Protection Under Traffic. After the casting has been adjusted and the Class PP concrete has been placed, the work shall be protected by a barricade and two lights according to Article 701.17(e)(3)b.

When castings are under traffic before the final surfacing operation has been started, properly sized temporary ramps shall be placed around the drainage and/or utility castings according to the following methods.

- (a) Temporary Asphalt Ramps. Temporary hot-mix asphalt ramps shall be placed around the casting, flush with its surface and decreasing to a featheredge in a distance of 2 ft (600 mm) around the entire surface of the casting.
- (b) Temporary Rubber Ramps. Temporary rubber ramps shall only be used on roadways with permanent posted speeds of 40 mph or less and when the height of the casting to be protected meets the proper sizing requirements for the rubber ramps as shown below.

Dimension	Requirement
Inside Opening	Outside dimensions of casting + 1 in. (25 mm)
Thickness at inside edge	Height of casting ± 1/4 in. (6 mm)
Thickness at outside edge	1/4 in. (6 mm) max.
Width, measured from inside opening to outside edge	8 1/2 in. (215 mm) min

Placement shall be according to the manufacturer’s specifications.

Temporary ramps for castings shall remain in place until surfacing operations are undertaken within the immediate area of the structure. Prior to placing the surface course, the temporary ramp shall be removed. Excess material shall be disposed of according to Article 202.03.”

PLUG EXISTING STORM SEWERS

Description. The work shall consist of plugging abandoned storm sewers at the locations shown on the plans and as directed by the Engineer. The plug shall be constructed of cement bricks and mortar, a poured concrete plug, or other means approved by the Engineer.

Method of Measurement. This work will be measured for payment for each section of capped and filled storm sewer pipe.

Basis of Payment. This work will be paid for at the contract unit price per cubic yard for PLUG EXISTING STORM SEWERS.

FILL EXISTING STORM SEWERS

Description. The work shall consist of filling abandoned storm sewers at the locations shown on the plans and as directed by the engineer. All storm sewer pipes to be abandoned in place shall be completely filled with Controlled Low Strength Material (CLSM), per section 1019 of the standard specification. The ends of the storm sewer pipe shall be sealed with cement bricks and mortar, a poured concrete plug, or other means approved by the Engineer. Work shall be coordinated with FILLING MANHOLES when possible.

Method of Measurement. This work will be measured for payment in place and the volume computed in cubic yards.

Basis of Payment. This work will be paid for at the contract unit price per cubic yard for FILL EXISTING STORM SEWERS. This price shall include all costs for providing and injecting CLSM, capping and all other labor, equipment, and materials necessary to abandon and fill the pipe in accordance with the Specifications.

TEMPORARY MANHOLE

Description. This work shall consist of the installation of manholes of the type and size specified, at the locations shown in the plans, in accordance with applicable portions of the Standard Specifications. These manholes shall subsequently be removed as shown on the plans and directed by the Engineer, and no separate payment for removal of these manholes shall be made.

Basis of Payment. This work will be paid for at the contract unit price each for TEMPORARY MANHOLE.

TEMPORARY DRAINAGE CONNECTION

Description. This work shall consist of the installation of manholes of the type and size specified, at the locations shown in the plans, in accordance with applicable portions of the Standard Specifications. These manholes shall subsequently be removed, and no separate payment for removal of these manholes shall be made.

Basis of Payment. This work will be paid for at the contract unit price each for TEMPORARY DRAINAGE CONNECTION.

STORM SEWERS JACKED IN PLACE, 48”

Description. This work shall conform to Article 552 of the Standard Specifications except as herein modified:

General. Metal liner is required. A steel casing of 66 in. diameter shall be installed and the strength and thickness shall be in accordance with BNSF Railroad requirements. Voids between the liner and the pipe shall be filled with grout mixture. Sand shall not be allowed.

Basis of Payment. This work will be paid for at the contract unit price per foot of STORM SEWERS JACKED IN PLACE, 48”. This price shall include all costs for the excavation, work pits, receiving pits, sheeting, bracing, backfilling, caps, plugs, grout, spacers, lubricants, drilling fluids, auguring and disposal of the augured material, steel casing pipe, and all other labor, equipment, and materials necessary to install the work as specified.

CURB REMOVAL (PARTIAL)

Description. This work shall consist of the removal of the existing curb in order to create a level pad for moveable barrier wall and temporary impact attenuators at the location(s), and in accordance with the notes and details shown in the Plans.

Basis of Payment. This work will be paid for at the contract unit price per foot for CURB REMOVAL (PARTIAL). This price shall include any backfill or grading operations necessary to provide a level surface after removal.

CHAIN LINK FENCE, ATTACHED TO STRUCTURE, SPECIAL

Description. This work shall consist of fabricating, delivering and erecting a chain link fence, attached to a newly constructed retaining wall at the location shown in the contract plans.

Work shall be performed in accordance with Section 664 of the Standard Specifications and the Fence and Gate details provided in the Plans.

Materials. Materials shall meet the requirements of Section 1006.27 of the Standard Specifications, except as modified in the plans.

Method of Measurement. Chain Link Fence, Attached To Structure, Special shall be measured for payment along the top of the fence from center to center of end posts excluding the length occupied by gates, installed and accepted..

Basis of Payment. This work will be paid for at the contract unit price per foot for CHAIN LINK FENCE, ATTACHED TO STRUCTURE, SPECIAL.

CHAIN LINK FENCE, 8' (SPECIAL)

Description. This work shall consist of fabricating, delivering and erecting a Chain Link Fence, 8' at the location shown in the contract plans.

Work shall be performed in accordance with Section 664 of the Standard Specifications and the Fence and Gate details provided in the Plans.

Materials. Materials shall meet the requirements of Section 1006.27 of the Standard Specifications, except as modified in the plans.

Method of Measurement. Chain Link Fence, 8' (Special) will be measured for payment along the top of the fence from center to center of end posts excluding the length occupied by gates, installed and accepted..

Basis of Payment. This work will be paid for at the contract unit price per foot for CHAIN LINK FENCE, 8' (SPECIAL).

CHAIN LINK GATES, (SPECIAL)

Description: This work shall consist of constructing a chain link cantilever slide gate of the type and size specified. Work shall be in accordance with the details shown on the plans and the applicable portions of Section 664 of the Standard Specifications.

Adjusting. Adjust hardware for smooth operation and lubricate all moving parts. The dimension between the bottom of the fabric and the ground shall be 3" nominal and may vary from 2" minimum to 4" maximum over the paved driveway surface.

Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

Basis of Payment. This work will be paid for at the contract unit price per each for CHAIN LINK GATES, (SPECIAL).

HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"

Description. This work shall consist of the placement of HMA at the locations and thickness specified on the plans, and according to applicable portions of the Standard Specifications.

Construction Requirements. This work shall be performed according to Article 406.06 of the Standard Specifications.

Basis of Payment. This work will be paid for at the contract unit price per square yard for HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6"

FINE AGGREGATE FOR HOT- MIX ASPHALT (HMA) (D-1)

Effective: May 1, 2007

Revised: January 1, 2012

“(a) Description. Fine aggregate for HMA shall consist of sand, stone sand, chats, slag sand, or steel slag sand. For gradation FA 22, uncrushed material will not be permitted.”

Revise Article 1003.03 (c) of the Standard Specifications to read:

“(c) Gradation. The fine aggregate gradation for all HMA shall be FA1, FA 2, FA 20, FA 21 or FA 22. When Reclaimed Asphalt Pavement (RAP) is incorporated in the HMA design, the use of FA 21 Gradation will not be permitted.

RECLAIMED ASPHALT PAVEMENT AND SHINGLES (D-1)

Effective: January 1, 2012

Revise Section 1031 of the Standard Specifications to read:

“SECTION 1031. RECLAIMED ASPHALT PAVEMENT AND SHINGLES

1031.01 Description. RAP is reclaimed asphalt pavement resulting from cold milling and crushing of an existing hot-mix asphalt (HMA) pavement. RAP will be considered processed FRAP after completion of both crushing and screening to size. The Contractor shall supply written documentation that the RAP originated from routes or airfields under federal, state, or local agency jurisdiction.

RAS is reclaimed asphalt shingles resulting from the processing and grinding of either preconsumer or post consumer shingles.

RAS shall be a clean and uniform material with a maximum of 0.5 percent unacceptable materials, as defined in Bureau of Materials and Physical Research Policy (BMPR) Memorandum *Reclaimed Asphalt Shingle (RAS) Sources*, by weight of RAS. All RAS used shall come from a BMPR approved processing facility.

RAS shall meet either Type 1 or Type 2 requirements as specified herein.

- (a) Type 1. Type 1 RAS shall be processed, preconsumer asphalt shingles salvaged from the manufacture of residential asphalt roofing shingles.
- (b) Type 2. Type 2 RAS shall be processed post-consumer shingles only, salvaged from residential, or four unit or less dwellings not subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP).

1031.02 Stockpiles. The Contractor shall construct individual, sealed RAP or RAS stockpiles meeting one of the following definitions. No additional RAP or RAS shall be added to the pile after the pile has been sealed. Stockpiles shall be sufficiently separated to prevent intermingling at the base. All stockpiles (including unprocessed RAP and Processed FRAP) shall be identified by signs indicating the type as listed below (i.e. “crushed natural aggregate, ACBF and steel slag, crystalline structure or Type 2 RAS”, etc...).

- (a) Fractionated RAP (FRAP). FRAP shall consist of RAP from Class I, Superpave (High ESAL), HMA (High ESAL), or equivalent mixtures. The coarse aggregate in FRAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. All FRAP shall be processed prior to testing and sized into fractions with the separation occurring on or between the #4 (4.75mm) and ½ in. (12.5mm) sieves. Agglomerations shall be minimized such that 100 percent of the RAP in the coarse fraction shall pass the maximum sieve size specified for the mix the RAP will be used in.
- (b) Restricted FRAP (B quality) stockpiles shall consist of RAP from Class I, Superpave (High ESAL), or HMA (High ESAL). If approved by the Engineer, the aggregate from a maximum 3.0 inch single combined pass of surface/binder milling will be classified as B quality. All millings from this application will be processed into FRAP as described previously.
- (c) Conglomerate. Conglomerate RAP stockpiles shall consist of RAP from Class I, Superpave (High ESAL), HMA (High ESAL), or equivalent mixtures. The coarse aggregate in this RAP shall be crushed aggregate and may represent more than one aggregate type and/or quality but shall be at least C quality. This RAP may have an inconsistent gradation and/or asphalt binder content prior to processing. All conglomerate RAP shall be processed (FRAP) prior to testing. Conglomerate RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (d) Conglomerate "D" Quality (DQ). Conglomerate DQ RAP stockpiles shall consist of RAP from HMA shoulders, bituminous stabilized subbases or Superpave (Low ESAL)/HMA (Low ESAL) IL-19.0L binder mixture. The coarse aggregate in this RAP may be crushed or processed (FRAP DQ) but shall be at least D quality. This RAP may have an inconsistent gradation and/or asphalt binder content. Conglomerate DQ RAP stockpiles shall not contain steel slag or other expansive material as determined by the Department.
- (e) Non-Quality. RAP stockpiles that do not meet the requirements of the stockpile categories listed above shall be classified as "Non-Quality".

RAP/FRAP containing contaminants, such as earth, brick, sand, concrete, sheet asphalt, bituminous surface treatment (i.e. chip seal), pavement fabric, joint sealants, plant cleanout etc., will be unacceptable unless the contaminants are removed to the satisfaction of the Engineer. Sheet asphalt shall be stockpiled separately.

Type 1 and Type 2 RAS shall be stockpiled separately and shall not be intermingled. Each stockpile shall be signed indicating what type of RAS is present. However, a RAS source may submit a written request to the Department for approval to blend mechanically a specified ratio of type 1 RAS with type 2 RAS. The source will not be permitted to change the ratio of the blend without the Department prior written approval.

The Engineer's written approval will be required, to mechanically blend RAS with any fine aggregate produced under the AGCS, up to an equal weight of RAS, to improve workability. The fine aggregate shall be "B Quality" or better from an approved Aggregate Gradation Control System source. The fine aggregate shall be one that is approved for use in the HMA mixture and shall be accounted for in the mix design and during HMA production.

Records identifying the shingle processing facility supplying the RAS, RAS type and lot number shall be maintained by project contract number and kept for a minimum of 3 years.

1031.03 Testing. When used in HMA, the RAS/RAP/FRAP shall be sampled and tested either during processing or after stockpiling.

(a) RAS shall be sampled and tested as follows:

During stockpiling, washed extraction, and testing for unacceptable materials shall be run at the minimum frequency of one sample per 200 tons (180 metric tons) for the first 1000 tons (900 metric tons) and one sample per 1000 ton (900 metric ton) thereafter. A minimum of five tests are required for stockpiles less than 1000 ton (900 metric ton). Once a ≤ 1000 ton, five-test stockpile has been established it shall be sealed. Additional incoming RAS shall be stockpiled in a separate working pile as designated in the Quality Control plan and only added to the sealed stockpile when the test results of the working pile are complete and are found to meet the tolerances specified herein for the original sealed RAS stockpile.

All of the test results, with the exception of percent unacceptable materials, shall be compiled and averaged for asphalt binder content, and gradation. Individual test results, when compared to the averages, will be accepted if within the tolerances listed below.

Parameter	RAS
No. 8 (2.36 mm)	$\pm 5 \%$
No. 16 (1.18 mm)	$\pm 5 \%$
No. 30 (600 μm)	$\pm 4\%$
No. 200 (75 μm)	$\pm 2.0 \%$
Asphalt Binder Content	$\pm 1.5 \%$

(b)RAP/FRAP shall be sampled and tested as follows:

For testing during stockpiling, washed extraction samples shall be run at the minimum frequency of one sample per 500 tons (450 metric tons) for the first 2000 tons (1800 metric tons) and one sample per 2000 tons (1800 metric tons) thereafter. A minimum of five tests shall be required for stockpiles less than 4000 tons (3600 metric tons).

For testing after stockpiling, the Contractor shall submit a plan for approval to the District proposing a satisfactory method of sampling and testing the RAP/FRAP pile either in-situ or by restockpiling. The sampling plan shall meet the minimum frequency required above and detail the procedure used to obtain representative samples throughout the pile for testing.

All of the RAP/FRAP extraction results shall be compiled and averaged for asphalt binder content and gradation and, when applicable (for slag) G_{mm} . Individual extraction test results, when compared to the averages, will be accepted if within the tolerances listed below.

Parameter	RAP or FRAP	Conglomerate "D" Quality RAP
1 in. (25 mm)		± 5 %
1/2 in. (12.5 mm)	± 8 %	± 15 %
No. 4 (4.75 mm)	± 6 %	± 13 %
No. 8 (2.36 mm)	± 5 %	
No. 16 (1.18 mm)		± 15 %
No. 30 (600 μm)	± 5 %	
No. 200 (75 μm)	± 2.0 %	± 4.0 %
Asphalt Binder	± 0.4 % ^{1/}	± 0.5 %
G _{mm}	± 0.03 ^{2/}	

1/ The tolerance for FRAP shall be ± 0.3 %

2/ for slag and steel slag

Before extraction, each field sample whether, RAS, RAP or FRAP, shall be split to obtain two samples of test sample size. One of the two test samples from the final split shall be labeled and stored for Department use. The Contractor shall extract the other test sample according to Department procedure. The Engineer reserves the right to test any sample (split or Department-taken) to verify Contractor test results.

If more than 20 percent of the individual sieves are out of the gradation tolerances, or if more than 20 percent of the asphalt binder content test results fall outside the appropriate tolerances, the RAS, RAP or FRAP shall not be used in HMA unless the RAS, RAP or FRAP representing the failing tests is removed from the stockpile. All test data and acceptance ranges shall be sent to the District for evaluation.

With the approval of the Engineer, when testing for RAP or FRAP, the ignition oven may be substituted for extractions according to the Illinois Test Procedure, "Calibration of the Ignition Oven for the Purpose of Characterizing Reclaimed Asphalt Pavement (RAP)".

1031.04 Quality Designation of Aggregate in RAP/FRAP.

(a) The aggregate quality of the RAP, Fractionated RAP, Restricted FRAP, Conglomerate, and conglomerate "D" quality stockpiles shall be set by the lowest quality of coarse aggregate in the stockpile and are designated as follows:

- (1) RAP from Class I, Superpave (High ESAL)/HMA (High ESAL), or HMA (Low ESAL) IL-9.5L surface mixtures are designated as containing Class B quality coarse aggregate.
- (2) RAP from Superpave (Low ESAL)/HMA (Low ESAL) IL-19.0L binder mixture is designated as Class D quality coarse aggregate.
- (3) RAP from Class I, Superpave (High ESAL), or HMA (High ESAL) binder mixtures, bituminous base course mixtures, and bituminous base course widening mixtures are designated as containing Class C quality coarse aggregate.

(4) RAP from bituminous stabilized subbase and BAM shoulders are designated as containing Class D quality coarse aggregate.

(b) The aggregate quality of FRAP shall be determined as follows.

(1) If the Engineer has documentation of the quality of the FRAP aggregate, the Contractor shall use the assigned quality provided by the Engineer. If the quality is not known, the quality shall be determined according to note (2) herein:

(2) Fractionated RAP stockpiles containing plus #4 (4.75 mm) sieve coarse aggregate shall have a maximum tonnage of 5000 tons (4500 metric tons). The Contractor shall obtain a representative sample witnessed by the Engineer. The sample shall be a minimum of 50 lb (25 kg). The sample shall be extracted according to Illinois Modified AASHTO T 164 by a consultant prequalified by the Department for the specified testing. The consultant shall submit the test results along with the recovered aggregate to the District Office. The cost for this testing shall be paid by the Contractor. The District will forward the sample to the BMPR Aggregate Lab for MicroDeval Testing, according to Illinois Modified AASHTO T 327. A maximum loss of 15.0 percent will be applied for all HMA applications. The fine aggregate portion of the fractionated RAP shall not be used in any HMA mixtures that require a minimum of "B" quality aggregate or better, until the coarse aggregate fraction has been determined to be acceptable thru a MicroDeval Testing.

1031.05 Use of RAS, RAP or FRAP in HMA. The use of RAS, RAP or FRAP shall be a Contractor's option when constructing HMA in all contracts.

The use of RAS shall be as follows:

Type 1 or Type 2 RAS may be used alone or in conjunction with, Fractionated Reclaimed Asphalt Pavement (FRAP) or Reclaimed Asphalt Pavement (RAP), in all HMA mixtures up to a maximum of 5.0 percent by weight of total mix.

Reclaimed asphalt shingles (RAS) meeting Type 1 or Type 2 requirements will be permitted in all HMA mixtures for overlay applications. RAS will also be permitted in all Low ESAL full depth pavement and ALL other Mixtures (Stabilized Subbase and shoulder HMA). RAS shall not be used in full depth HMA High ESAL main line pavement.

The use of RAP/FRAP shall be as follows:

(a) Coarse Aggregate Size (after extraction), The coarse aggregate in all RAP or FRAP shall be equal to or less than the maximum size requirement for the HMA mixture to be produced.

(b) Steel Slag Stockpiles. RAP stockpiles containing steel slag or other expansive material, as determined by the Department, shall be homogeneous and will be approved for use in HMA (High ESAL and Low ESAL) surface mixtures only.

(c) Use in HMA Surface Mixtures (High and Low ESAL). RAP/FRAP and Restricted FRAP stockpiles for use in HMA surface mixtures (High and Low ESAL) shall in which the coarse aggregate is Class B quality or better. RAP/FRAP shall be considered equivalent to Limestone for frictional considerations unless produced/screened to minus 3/8 inch.

- (d) Use in HMA Binder Mixtures (High and Low ESAL), HMA Base Course, and HMA Base Course Widening. RAP/FRAP stockpiles for use in HMA binder mixtures (High and Low ESAL), HMA base course, and HMA base course widening shall be FRAP, in which the coarse aggregate is Class C quality or better.
- (e) Use in Shoulders and Subbase. RAP/FRAP stockpiles for use in HMA shoulders and stabilized subbase (HMA) shall RAP, Restricted FRAP, Conglomerate, or Conglomerate DQ.

When the Contractor chooses the RAP option, the percentage of virgin asphalt binder replaced by the asphalt binder from the RAP shall not exceed the percentages indicated in the table below for a given N Design:

Max Asphalt Binder Replacement RAP Only
 Table 1

HMA Mixtures ^{1/, 3/}	Maximum % Asphalt Binder replacement (ABR)		
Ndesign	Binder/Leveling Binder	Surface	Polymer Modified
30L	25	15	10
50	25	15	10
70	15	10	10
90	10	10	10
105	10	10	10

- 1/ For HMA "All Other" (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.
- 2/ When the asphalt binder replacement exceeds 15 percent, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement would require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28).

When the Contractor chooses either the RAS or FRAP option, the percent binder replacement shall not exceed the amounts indicated in the tables below for a given N Design.

Max Asphalt Binder Replacement RAS or FRAP
 Table 2

HMA Mixtures ^{1/, 2/}	Level 1 - Maximum % ABR		
Ndesign	Binder/Leveling Binder	Surface	Polymer ^{3/, 4/} Modified
30L	35	30	15
50	30	25	15
70	30	20	15
90	20	15	15
105	20	15	15

1/ For HMA “All Other” (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.

2/ When the asphalt binder replacement exceeds 15 percent for all mixes, except for SMA and IL-4.75, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement will require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28).

3/ For SMA, when the FRAP option is used, the maximum ABR is 15 percent. When the RAS option is used, the maximum ABR is 20 percent. When the asphalt binder replacement in SMA exceeds 10 percent, the high and low virgin asphalt binder grade shall each be reduced by one grade (i.e. 15 percent asphalt binder replacement would require a virgin asphalt binder grade of PG76-22 to be reduced to a PG70-28).

4/ For IL 4.75 mix, when the FRAP option is used, the maximum ABR is 15 percent. When the RAS option is used, the maximum ABR is 20 percent. When the RAS option is used, a maximum of 5 percent RAS by weight of the mix, shall be permitted. When the ABR in the IL-4.75 exceeds 15 percent, the high and low virgin asphalt binder grade shall each be reduced by one grade (i.e. 16 percent asphalt binder replacement would require a virgin asphalt binder grade of PG76-22 to be reduced to a PG70-28).

When the Contractor chooses the RAS with FRAP combination, the percent asphalt binder replacement shall split equally between the RAS and the FRAP, and the total replacement shall not exceed the amounts indicated in the tables below for a given N Design.

Max Asphalt Binder Replacement RAS and FRAP Combination
 Table 3

HMA Mixtures ^{1/, 2/}	Level 2 - Maximum % ABR		
	Binder/Leveling Binder	Surface	Polymer Modified ^{3/, 4/}
30L	40	40	20
50	40	30	20
70	40	30	20
90	40	30	20
105	40	30	20

1/ For HMA “All Other” (shoulder and stabilized subbase) N-30, the percent asphalt binder replacement shall not exceed 50% of the total asphalt binder in the mixture.

2/ When the binder replacement exceeds 15 percent for all mixes, except for SMA and IL-4.75, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent binder replacement will require a virgin asphalt binder grade of PG64-22 to be reduced to a PG58-28).

3/ For SMA, 20 percent ABR from RAS maybe combined with a maximum of 10 percent ABR from FRAP. When the asphalt binder replacement in SMA exceeds 10 percent, the high and low virgin asphalt binder grade shall each be reduced by one grade (i.e. 15 percent asphalt binder replacement would require a virgin asphalt binder grade of PG76-22 to be reduced to a PG70-28).

4/ For IL 4.75, a 20 percent ABR from RAS maybe combined with a maximum of 20 percent ABR from FRAP. When the asphalt binder replacement in the IL-4.75 exceeds 15 percent, the high and low virgin asphalt binder grade shall each be reduced by one grade (i.e. 16 percent asphalt binder replacement would require a virgin asphalt binder grade of PG76-22 to be reduced to a PG70-28).

1031.06 HMA Mix Designs. All HMA mixtures will be required to be tested, prior to submittal for Department verification, according to Illinois Modified AASHTO T324 (Hamburg Wheel) and shall meet the following requirements:

Asphalt Binder Grade	# Repetitions	Max Rut Depth (mm)
PG76-XX	20,000	12.5
PG70-XX	20,000	12.5
PG64-XX	10,000	12.5
PG58-XX	10,000	12.5

Note: For SMA Designs (N-80) the maximum rut depth is 6.0 mm at 20,000 repetitions.
 For IL 4.75 mm Designs (N-50) the maximum rut depth is 9.0 mm at 15,000 repetitions.

1031.07 HMA Production. All HMA mixtures shall be sampled within the first 500 tons on the first day of production or during start up, with a split reserved for the Department. The mix sample shall be tested according to Illinois Modified AASHTO T324 and shall meet the requirements specified herein. The production of such mixture, shall not exceed 1,500 tons or one days production, which ever comes first, until the testing is completed and the mixture is found to be in conformance. The requirement to cease mix production may be waived if the plant produced mixture is demonstrated prior to start of mix production for the contract.

To remove or reduce agglomerated material, a scalping screen, gator, crushing unit, or comparable sizing device approved by the Engineer shall be used in the RAS, RAP and FRAP feed system to remove or reduce oversized material. If material passing the sizing device adversely affects the mix production or quality of the mix, the sizing device shall be set at a size specified by the Engineer.

If the RAS, RAP and FRAP control tolerances or QC/QA test results require corrective action, the Contractor shall cease production of the mixture containing RAs, RAP or FRAP and either switch to the virgin aggregate design or submit a new RAS, RAP or FRAP design.

HMA plants utilizing RAS, RAP and FRAP shall be capable of automatically recording and printing the following information.

(a) Dryer Drum Plants.

- (1) Date, month, year, and time to the nearest minute for each print.
- (2) HMA mix number assigned by the Department.
- (3) Accumulated weight of dry aggregate (combined or individual) in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton).
- (4) Accumulated dry weight of RAS, RAP and FRAP in tons (metric tons) to the nearest 0.1 ton (0.1 metric ton).
- (5) Accumulated mineral filler in revolutions, tons (metric tons), etc. to the nearest 0.1 unit.
- (6) Accumulated asphalt binder in gallons (liters), tons (metric tons), etc. to the nearest 0.1 unit.
- (7) Residual asphalt binder in the RAS, RAP and FRAP material as a percent of the total mix to the nearest 0.1 percent.
- (8) When producing mixtures with FRAP and/or RAS, a positive dust control system shall be utilized.
- (9) Accumulated mixture tonnage.
- (10) Dust removed (accumulated to the nearest 0.1ton)
- (11) Aggregate RAS, RAP and FRAP moisture compensators in percent as set on the control panel. (Required when accumulated or individual aggregate and RAS, RAP FRAP are printed in wet condition.)

(b) Batch Plants.

- (1) Date, month, year, and time to the nearest minute for each print.
- (2) HMA mix number assigned by the Department.
- (3) Individual virgin aggregate hot bin batch weights to the nearest pound (kilogram).
- (4) Mineral filler weight to the nearest pound (kilogram).

- (5) RAS, RAP and FRAP weight to the nearest pound (kilogram).
- (6) Virgin asphalt binder weight to the nearest pound (kilogram).
- (7) Residual asphalt binder in the RAS, RAP and FRAP material as a percent of the total mix to the nearest 0.1 percent.

The printouts shall be maintained in a file at the plant for a minimum of one year or as directed by the Engineer and shall be made available upon request. The printing system will be inspected by the Engineer prior to production and verified at the beginning of each construction season thereafter.

1031.08 RAP in Aggregate Surface Course and Aggregate Shoulders. The use of RAP or FRAP in aggregate surface course and aggregate shoulders shall be as follows.

- (a) Stockpiles and Testing. RAP stockpiles may be any of those listed in Article 1031.02, except "Non-Quality" and "FRAP". The testing requirements of Article 1031.03 shall not apply.
- (b) Gradation. One hundred percent of the RAP material shall pass the 1 1/2 in. (37.5mm) sieve. The RAP material shall be reasonably well graded from coarse to fine. RAP material that is gap-graded, FRAP, or single sized will not be accepted for use as Aggregate Surface Course and Aggregate Shoulders."

AGGREGATE SUBGRADE IMPROVEMENT, 8"

This work shall be done in accordance with the applicable portions of Section 207 of the Standard Specifications. The material shall conform with Article 1004.04 of the Standard

Specifications except as follows:

Crushed Stone, Crushed Blast Furnace Slag, and Crushed Concrete will be permitted. Steel slag and other expansive materials as determined through testing by the Department will not be permitted.

<u>Sieve Size Percent</u>	<u>Passing</u>
150 mm (6 inches)	97+3
100 mm (4 inches)	90+10
50 mm (2 inches)	45+25
75 µm (#200)	5+5

The Aggregate subgrade shall be placed in one lift consisting of 8 inches. Reclaimed Asphalt Pavement (RAP) meeting Article 1004.07 of the Standard Specifications and having 100% passing the 37.5 mm (1 1/2 inches) sieve and well-graded down through fines may shall be used as capping aggregate. RAP shall not contain steel slag or other expansive material. The results of the Department's tests on the RAP material will be the determining factor for consideration as expansive.

A vibratory roller meeting the requirements of Article 1101.01 of the Standard Specifications shall be used to roll each lift of material to obtain the desired keying or interlock and necessary compaction. The Engineer will verify that adequate keying has been obtained.

Method of Measurement.

(a) Contract Quantities. Contract quantities shall be in accordance with Article 202.07.

(b) Measured Quantities. Aggregate subgrade will be measured in place and the area computed in square yards).

Basis of Payment. This work will be paid for at the contract unit price per square yard for AGGREGATE SUBGRADE IMPROVEMENT, 8", which price shall include the capping aggregate.

HOT MIX ASPHALT - MIXTURE DESIGN VERIFICATION AND PRODUCTION (BMPR)

Effective: January 1, 2012

Description. This special provision states the requirements for Hamburg Wheel and Tensile Strength testing for High ESAL, IL-4.75, and SMA hot mix asphalt (HMA) mixes during mix design verification and production. This special provision also states the plant requirements for hydrated lime addition systems used in the production of High ESAL, IL-4.75, and SMA mixes.

When the options of Warm Mix Asphalt, Reclaimed Asphalt Shingles, or Reclaimed Asphalt Pavement are used by the Contractor, the Hamburg Wheel and tensile strength requirements in this special provision will be superseded by the special provisions for Warm Mix Asphalt, Reclaimed Asphalt Shingles, or Reclaimed Asphalt Pavement as applicable.

In addition to the requirements in the December 1, 2011 HMA Special Provisions for Pay for Performance Using Percent Within Limits, a Hamburg Wheel test and tensile strength test will be conducted during mix design on mixtures used for Pay For Performance projects.

Mix Design Testing. Add the following to Article 1030.04 of the Standard Specifications:

"(d) Verification Testing. High ESAL, IL-4.75, and SMA mix designs submitted for verification will be tested to ensure that the resulting mix designs will pass the required criteria for the Hamburg Wheel Test (IL mod AASHTO T-324) and the Tensile Strength Test (IL mod AASHTO T-283). The Department will perform a verification test on gyratory specimens compacted by the Contractor. If the mix fails the Department's verification test, the Contractor shall make necessary changes to the mix and provide passing Hamburg Wheel and Tensile Strength test results from a private lab. The Department will verify the passing results.

All new and renewal mix designs shall meet the following requirements for verification testing.

(1) Hamburg Wheel Test criteria. The maximum allowable rut depth shall be 0.5 in. (12.5 mm). The minimum number of wheel passes at the 0.5 in. (12.5 mm) rut depth criteria shall be based on the high temperature binder grade of the mix as specified in the plans for the mix design.

PG Grade	Number of Passes
PG 64-xx (or lower)	10,000
PG 70-xx	15,000
PG 76-xx (or higher)	20,000

(2) Tensile Strength Criteria. The minimum allowable conditioned tensile strength shall be 415 kPa (60 psi) for non-polymer modified performance graded (PG) asphalt binder and 550 kPa (80 psi) for polymer modified PG asphalt binder. The maximum allowable unconditioned tensile strength shall be 1380 kPa (200 psi).”

Production Testing. Add the following to Article 1030.06 of the Standard Specifications:

“(c) Hamburg Wheel Test. A Hamburg Wheel test will be conducted on each High ESAL, IL-4.75, and SMA mix produced that has been verified by the Hamburg Wheel process.

The Contractor shall obtain a sample during the startup for each mix and compact gyratory specimens to the air void percentage as specified in IL-modified AASHTO T-324 to be provided to the Department for testing. The Department may conduct additional Hamburg Wheel Tests on production material as determined by the Engineer.”

System for Hydrated Lime Addition. Revise the last sentence of the third paragraph of Article 1030.04(c) of the Standard Specifications to read:

“The method of application shall be according to Article 1102.01(a)(10).”

Revise the first three sentences of the second paragraph of Article 1102.01(a)(10) of the Standard Specifications to read:

“When hydrated lime is used as the anti-strip additive, a separate bin or tank and feeder system shall be provided to store and accurately proportion the lime onto the aggregate either as a slurry, as dry lime applied to damp aggregates, or as dry lime injected onto the hot aggregates prior to adding the liquid asphalt cement. If the hydrated lime is added either as a slurry or as dry lime on damp aggregates, the lime and aggregates shall be mixed by a power driven pugmill to provide a uniform coating of the lime prior to entering the dryer. If dry hydrated lime is added to the hot dry aggregates in a drum plant, the lime will be added in such a manner that the lime will not become entrained into the air stream of the dryer and that thorough dry mixing will occur prior to the injection point of the liquid asphalt. When a batch plant is used, the hydrated lime shall be added to the mixture in the weigh hopper or as approved by the Engineer.”

Basis of Payment. Revise the seventh paragraph of Article 406.14 of the Standard Specifications to read:

“For mixes designed and verified under the Hamburg Wheel criteria, the cost of furnishing and introducing anti-stripping additives in the HMA will not be paid for separately, but shall be considered as included in the contract unit price of the HMA item involved.

If an anti-stripping additive is required for any other HMA mix, the cost of the additive will be paid for according to Article 109.04. The cost incurred in introducing the additive into the HMA will not be paid for separately, but shall be considered as included in the contract unit price of the HMA item involved.

No additional compensation will be awarded to the Contractor because of reduced production rates associated with the addition of the anti-stripping additive.”

ARCHITECTURAL FINISH FOR RETAINING WALLS

This work consists of providing an architectural finish on retaining walls in accordance with the details shown in the plans and the Special Provisions.

Forms shall be constructed so that the completed concrete structures conform to the shape, lines and dimensions of the members as shown on the plans. Forms shall be properly braced or tied together to maintain position and shape. Forms shall be made sufficiently tight to prevent leakage of mortar.

Formliners shall be used to obtain the architectural finish on the retaining walls. Formwork shall have the strength and stability to ensure finished concrete dimensions within the tolerances specified herein. The quality of the formwork shall be maintained throughout the entire project. ACI 117 “Specifications for concrete Construction and Materials and Commentary” shall be followed for variations in dimensions for the wall sections with an architectural finish.

The Contractor shall submit proposed construction procedures for the architectural finish on the outside face of retaining walls. The Contractor's method of obtaining the surface texture specified on the plans shall be subject to approval by the Engineer.

Upon approval of the construction procedures by the Engineer, the Contractor shall pour a 30 foot (9 m) long test section of retaining wall at a location directed by the Engineer. After removal of the formwork, the Engineer will examine the test section of the wall and instruct the Contractor if the architectural finish is acceptable or if future wall sections need further modifications. If necessary, the Contractor shall pour additional test sections of wall at locations designated by the Engineer until a wall section meets with the Engineer's approval. The architectural finish of all subsequently installed wall sections shall match the approved test section. All deviations from the approved architectural finish shall be repaired by the Contractor at no additional cost to the Department.

The Contractor shall notify the Engineer at least 40 hours prior to placing concrete. Concrete shall not be placed until the Engineer has inspected the formwork and the placement of reinforcing bars for compliance with the plans.

Method of Measurement. Architectural finish will be measured in place and the area computed in square feet (square meters). The dimensions used to compute the area of architectural finish will be the dimensions indicated on the plans or directed by the Engineer which outline plane area. Measurement will not be made on the actual surface area of architectural finish.

Basis of Payment. This work will be paid for at the contract unit price per square foot (square meter) for FORM LINER TEXTURED SURFACE

EPOXY COATING ON REINFORCEMENT (D-1)

Effective: January 1, 2007

Revised: July 20, 2010

For work outside the limits of bridge approach pavement, all references in the Highway Standards and Standard Specifications for reinforcement, dowel bars and tie bars in pavement, shoulders, curb, gutter, combination curb and gutter and median, and chair supports for CRC pavement, shall be epoxy coated, unless noted on the plan.

BRACED EXCAVATION

Description. This work shall include the installation of a bracing system, excavation, and backfilling to the elevation of the proposed grade according to Section 502 and the following. The bracing system shall be designed and installed to prevent the movement of soil, structures, pavements and/or utilities adjacent to the excavated area.

Construction Requirements. The bracing system shall support excavations by the use of sheeting, timber or plates. The Contractor shall submit design calculations and shop drawings prepared and sealed by an Illinois Licensed Structural Engineer for the bracing system. Shop drawings shall show all necessary details for the construction of the bracing system. The design calculations and shop drawings shall be submitted to the Engineer for review and approval.

The District One Electrical Maintenance Contractor shall be provided with uninterrupted access to the existing pump station, which shall include vehicular access to the north side of the building. The bracing system shall be designed for a minimum AASHTO H15 vehicle.

This work shall not proceed without the approval and authorization of the Engineer. However, in any event, the Contractor shall be fully responsible for the safety, stability and adequacy of the bracing system and shall be solely responsible and liable for all damages resulting from his construction operations or from failure or inadequacy of the bracing system.

In the event the bracing system protecting the existing embankment fails or is otherwise inadequate, in the judgment of the Engineer, the Contractor shall, at his own expense, take all necessary steps to restore the embankments to a safe operating condition to the satisfaction of the Engineer.

Bracing members shall be installed as soon as an excavation level is reached to permit their installation. Bracing members shall be completely removed after the excavation is backfilled.

Care shall be taken to not damage the temporary pipe culvert installed during Stage 1.

Method of Measurement. This work shall be measured in cubic yards (cubic meters) according to the requirements for structure excavation as specified in Section 502.12 of the Standard Specifications.

Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for BRACED EXCAVATION. Payment for BRACED EXCAVATION will be limited to those locations shown on the plans. All sheeting and bracing members associated with braced excavation will not be measured for payment but shall be included in the cost for BRACED EXCAVATION. Backfilling to proposed grade lines shall not be measured for payment but shall be included in the cost for BRACED EXCAVATION.

No separate payment will be made for structure excavation where BRACED EXCAVATION is shown.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01 01 00 – SUMMARY OF WORK GENERAL:

1.1 GENERAL WORK

- A. The requirement of Division 1, General Requirements, shall apply to all Pump Station General Work.
- B. The Pump Station General Work shall include, but not be limited to, the following:
 - 1. Providing the District One Electrical Maintenance Contractor uninterrupted access to the existing pump station. Access shall include vehicular access to the building, sufficient parking space for a service truck and keys as required to enter the site.
 - 2. All grout as indicated on the Drawings and as specified in Section 03 60 00, Grout.
 - 3. All unit masonry work consisting of glass block work and faced brickwork as indicated on the Drawings and as specified in Section 04 10 00, Unit Masonry.
 - 4. All miscellaneous metal work as indicated on the Drawings and as specified in Division 5, Metals.
 - 5. All carpentry work as indicated on the Drawings and as specified in Section 06 10 00, Rough Carpentry.
 - 6. All roofing work as indicated on the Drawings and as specified in Section 07 41 13, Preformed Metal Standing Seam Roofing.
 - 7. All sheet metal work as indicated on the Drawings and as specified in Section 07 62 00, Sheet Metal Flashing and Trim.
 - 8. All sealant work as indicated on the Drawings and as specified in Section 07 92 00, Joint Sealers.
 - 9. All board insulation work as indicated on the Drawings and as specified in Section 07 20 00, Board Insulation.
 - 10. All doors and hardware as indicated on the Drawings and as specified in Division 8, Doors and Windows.
 - 11. All painting as indicated on the Drawings and as specified in Section 09 91 00, Painting.
 - 12. The station identification plate, shop desk, bulletin board, staff gauges, first aid kit, fire extinguishers, electric clock and trash can as indicated on the Drawings and as specified in Section 10 00 00, Specialties.
 - 13. Fiberglass ladder and railing as specified in Section 06 60 00, Fiberglass Reinforced Plastic.

1.2 MECHANICAL WORK

- A. The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all Pump Station Mechanical Work described herein.

- B. The Pump Station Mechanical Work shall include, but not be limited to, furnishing and installing the following items as indicated on the Project Drawings and in the Special Provisions:
1. New submersible pumps installed complete and operational, including all appurtenances.
 2. New pump discharge and suction piping, fittings, wall castings, and appurtenances.
 3. New recirculation line; including all piping, fittings, wall castings, flow meter, and appurtenances.
 4. New valves and appurtenances as indicated; including but not limited to, knife gates valves installed on the pump discharge and suction piping, check valves installed on the pump discharge piping, air/vacuum valves installed on the pump discharge piping, a gate valve installed on the recirculation line, and any valves required for installation on ancillary piping. Manual or electric motor actuators for valves shall also be included.
 5. New slide gates; including frames, guides, wall thimbles, electric motor operators, and appurtenances.
 6. All required pipe and equipment support systems, hangers, and appurtenances; required for the installation of all piping, pumps, valves, and other mechanical items.
 7. New metal bar rack, including appurtenant items.
 8. Any miscellaneous mechanical items that are ancillary to the Work described above.

1.3 HEATING AND VENTILATION

- A. The requirement of Division 1, General Requirements, shall apply to all Heating and Ventilation Work.
- B. The Heating and Ventilation Work shall include, but not be limited to, the following:
1. New ventilation system including, but not limited to, exhaust fans, supply fans, duct work, unit heaters, louvers, dampers, actuators, controls, control wiring and all associated appurtenances.

1.4 ELECTRICAL

- A. The requirements of Division 1, General Requirements, shall apply to all Pump Station Electrical Work.

- B. The Pump Station Electrical Work shall include, but not be limited to, the following:
1. Disconnection and removal of existing electric service, including all metering.
 2. Installation and connection of a new electric service including all metering in accordance with Naperville Electric Requirements.
 3. New motor control center.
 4. Installation of new disconnect switches and motor starters.
 5. Removal of existing disconnect switches and motor starters.
 6. New control and SCADA panels.
 7. New lighting fixtures, lighting panel board, lighting transformer and wiring devices.
 8. New power, lighting, control and signal wires and cables.
 9. New conduit and raceway system.
 10. New float type level sensing control system.
 11. New combustible gas detectors, fire detection system and intrusion alarm system.
 12. Branch wiring and conduit for main pumps, low flow pumps, unit heaters, slide gate actuator, recirculation slide gate valve, ventilation system, SCADA panel and other electrical equipment as shown on the Drawings.
 13. Testing of electrical equipment.

1.5 INSTRUMENT AND CONTROL

- A. The requirement of Division 1, General Requirements, shall apply to all Pump Station SCADA Equipment work.
- B. The Pump Station SCADA Equipment work shall include, but not be limited to, the following:
1. The SCADA (Supervisory Control and Data Acquisition) system shall be provided to function as the "Master Control Station" for the Pump Station facility.
 2. The SCADA will be a PLC based system with an operator interface mounted on the SCADA panel for control, monitoring and system configuration. The following equipment and instrumentation, as a minimum, will be monitored/controlled:
 - a. Motor Control Center
 - b. Automatic Transfer Switch
 - c. Pump Motor Controllers and Protection Devices
 - d. Pump Alternation Devices
 - e. Level Sensing Systems
 - f. Pavement Float Switches
 - g. Influent Sluice Gate
 - h. Recirculation Pipe Valve
 - i. Discharge Chamber Sluice Gate
 - j. Gas Detectors
 - k. Fire Alarm System
 - l. Intrusion System
 - m. AEGIS System

- n. Flow Monitoring System
 - o. Control Panel 47
3. The Operator Interface shall consist of a graphical interface which provides a view of the pumping station. Several "screens" shall be designed in order to display the features of the facility.
 4. In addition the screens that shall be developed for the pump station Operator Interface, screens shall be developed for the District 1 and Maintenance Facility Station PCs based monitoring interface. The screens shall be similar to the graphics currently displayed for the other pump stations.
 5. The Contractor shall provide all programming and configuration of equipment and software including development of graphic displays and reports. Displays and Report development shall be coordinated with existing Department standards.

1.6 SUBMITTALS

- A. Except as specified elsewhere herein, materials and equipment shall be in conformance with the requirements of Section 106 of the Standard Specifications.
- B. Materials and equipment shall be the products of established and reputable manufacturers and shall be suitable for the service required. Unless otherwise specifically indicated, all materials and equipment shall be new. The Contractor is obligated to conduct his own search into the timely availability of the specified equipment and materials to ensure that they are in strict conformance with the contract documents and that delivery schedules are compatible with project time constraints. Materials or equipment items which are similar or identical shall be the product of the same manufacturer. The cost of submittals, certifications, any required samples, and similar costs shall not be separately paid for but shall be included in the pay item bid price for the respective material or work.
- C. All equipment, products, and materials incorporated in the work shall be submitted for approval.
- D. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, requirements specified herein shall apply for each indicated type of submittal. Procedures concerning items such as a listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.
- E. WORK RELATED SUBMITTALS
 1. Substitution or "Or Equal" Items include material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.

2. Shop Drawings include technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.
3. Product Data include standard printed information on manufactured products and systems that has not been specially prepared for this project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
4. Samples include both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing. Mock-ups are special forms of samples, which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.
5. Miscellaneous Submittals are work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

F. SCHEDULING

1. A preliminary schedule of shop drawings and sample submittals shall be submitted for approval, in duplicate.
 2. Prior to final payment, the original and one copy of all bonds, warranties, guarantees, and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period shall be delivered to the OWNER.
 3. Within 60 days of the contract award, the Contractor shall submit, for approval, complete manufacturer's product data (for standard products and components) and detailed shop drawings (for fabricated equipment). Submittals need not include all project equipment and materials in one submittal; however, the submittals for the equipment and materials for each individual pay item shall be complete in every respect. Partial submittals may be returned without review. The Contractor may request, in writing, permission to make a partial submittal; the Engineer will evaluate the circumstances of the request and may accept to review such partial submittal. However, no additional compensation or extension of time will be allowed for extra costs or delays incurred due to partial or late submittals.
- G. Each submittal shall be accompanied by a transmittal containing the following information:
1. Contractor's Name
 2. Supplier's Name

3. Manufacturer's Name
4. Date of submittal and dates of previous submittals containing the same material
5. Project Route/Name
6. Section
7. Submittal and transmittal number
8. Contract identification
9. Identification of equipment and material with equipment identification numbers, motor numbers, and Specification section number
10. Variations from Contract Documents and any limitations which may impact the Work.
11. Drawing sheet and detail number as appropriate.

Multi-part submittal forms will be provided by the Department to the Contractor to facilitate the submittal and review process. The Contractor shall complete all submittal information on the form and shall sign the submittal as indicated

H. Exceptions, Deviations, and Substitutions

1. In general, exceptions to and deviations from the requirements of the Contract Documents will not be allowed. It is the CONTRACTOR's responsibility to note any deviations from Contract requirements at the time of submittal and to make any requests for deviations in writing. In general, substitutions must demonstrate that the proposed substitution is superior to the equipment or material required by the Contract Documents. No exceptions, deviations, or substitutions will be permitted without approval.
2. Data for items to be submitted for review, as substitution shall be collected into one submittal for each item of material or equipment.
3. Request shall be submitted with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, substitution submittal request shall be included in Submittal schedule and submitted as scheduled.

I. Shop Drawings

1. Shop drawing information shall be newly prepared and submitted with graphic information at accurate scale. The name of manufacturer or supplier (firm name) shall be indicated. Dimensions shall be shown and clearly noted which are based on field measurement; materials and products that are included in the Work shall be identified; revision shall be identified. Compliance with standards and notation of coordination requirements with other work shall be indicated. Variations from Contract Documents or previous submittals shall be highlighted, encircled or otherwise indicated.
2. The following information shall be included on each drawing or page:
 - a. Submittal date and revision dates.
 - b. Project name, division number and descriptions.

- c. Detailed specifications section number and page number.
 - d. Identification of equipment, product or material.
 - e. Name of CONTRACTOR and Subcontractor.
 - f. Name of Supplier and Manufacturer.
 - g. Relation to adjacent structure or material.
 - h. Field dimensions, clearly identified.
 - i. Standards or Industry Specification references.
 - j. Identification of deviations from the Contract Documents.
 - k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
 - l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
3. An 8-inch by 3-inch blank space shall be provided for CONTRACTOR and ENGINEER stamps.
 4. Three blue line or black line prints or two reverse sepia reproducible and 1 blue or black line print shall be submitted. One reproducible or one print will be returned.
 5. Materials, products or systems shall not be installed until copy of applicable product data showing only approved information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site. Five additional copies shall be marked with the date of approval and forwarded to the ENGINEER for use in field and for OWNER'S records.

J. Product Data

1. Required product data shall be collected into a single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, copies shall be marked to clearly show such information is not applicable.
2. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, data shall be submitted as a Shop Drawing and not as product data.
3. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal shall be final when returned by ENGINEER marked "Approved".
4. Four submittal copies, in addition to the number the Contractor requires returned, including those required for RECORD DRAWINGS, shall be submitted to the Engineer.
5. Materials, products or systems shall not be installed until copy of applicable product data showing only approval information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site, available for reference by ENGINEER and others.

K. Samples

1. Where possible, samples shall be physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, multiple units (not less than 3 units) shall be submitted showing approximate limits of variations.
2. A full set of optional samples shall be provided where ENGINEER's selection required. Samples shall be prepared to match ENGINEER's selection where so indicated.
3. Each sample shall include generic description, source or product name and manufacturer, limitations, and compliance with standards.
4. Samples for ENGINEER's visual review and final check of coordination of these characteristics with other related elements of work shall be of general generic kind, color, pattern, and texture.
5. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.

A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.

Three sets of samples shall be submitted in final submittal, one set will be returned.

6. The returned final set of samples shall be maintained at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.
Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.

- L. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Requirements for sample submittal shall be complied with to greatest extent possible. Transmittal forms shall be processed to provide record of activity.

M. Miscellaneous Submittals

1. Inspection and Test Reports
 - a. Each inspection and test report shall be classified as either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Inspection and test reports shall be processed accordingly.

2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds

- a. Refer to Specification sections and section Guarantees and Warranties of this Division for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
- b. In addition to copies desired for CONTRACTOR's use, 2 executed copies shall be furnished. Two additional copies shall be provided where required for maintenance data.

3. Certifications

- a. Refer to Specification sections for specific requirements on submittal of certifications. Seven copies shall be submitted. Certifications are submitted for review of conformance with specified requirements and information. Submittal shall be final when returned by ENGINEER marked "Approved".
- b. Where certifications are specified, the information submitted for approval shall incorporate certification information. When a certification can be made prior to manufacture, the certification shall be included with initial submittal information. When certification is possible only after manufacture, the initial submittal information shall include a statement of intent to furnish the certification after equipment approval and manufacture. Certifications involving inspections and/or tests shall be complete with all test data presented in a neat, descriptive format, with all test data, applicable dates, times, and persons responsible.

4. Tools

- a) Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units shall be submitted.
- b) Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.
- c) For each type of equipment provided under this CONTRACT, a complete set of all special tools shall be furnished including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be of high grade, smooth forged alloy tool steel. Grease guns shall be of the lever type.
- d) One or more neat and substantial steel wall cases or cabinets shall be furnished and erected with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

N. Contractor's Stamp

1. Prior to submittal, the Contractor shall review the submittal material and shall affix his stamp of approval, with comments as applicable, signed by a responsible representative, to each appropriate submittal item. In the case of Subcontractor's submittals, both the Sub-contractor and the General Contractor shall review and stamp the submittal. Submittals which are not approved or approved-as-noted by the Contractor shall not be submitted to the Engineer.

The Contractor shall not give an approved-as-noted status to submittals having incompleteness or major corrective notations as this will only delay the ultimate approval process.

2. The receipt of submittal information from the Contractor will be construed as the Contractor's assurance that he has reviewed the submittal information and attests to the submittal's accuracy and conformance to the requirements of the contract documents. Submitted information shall be complete and in sufficient detail to demonstrate compliance with all requirement of the contract documents, including fitting in the space provided and meeting all salient features of the specifications.
- O. Submittal information must be particularly detailed in every respect. Product data shall present information to demonstrate the complete nature of the product, including dimensions, wiring diagrams, operating information, and the like. Shop drawings shall be extremely detailed and shall include all appropriate dimensions, fabrication details, component bill of material, information relative to mounting, detailed wiring, finish, and the like. Wiring diagrams shall include both schematic and point-to point representations, complete with references to circuiting as indicated on the Contract Drawings as well as terminal points of component devices.
 - P. Unless required elsewhere, submittals shall be distributed to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.
 - Q. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.
 - R. Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.
 - S. When submittals are marked "Approved as Noted" or "Approved Subject to Corrections Marked", Work covered by submittal may proceed provided it complies with both ENGINEER's notations or corrections on submittal and with Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.
 - T. When submittals are marked "Examined and Returned for Correction or disapproved", Work covered by submittal shall not proceed. Work covered by submittal shall not be used at Project site or elsewhere where Work is in progress. The submittal shall be revised or a new submittal shall be prepared in accordance with ENGINEER's notations in accordance with Re-submittal Preparation procedures specified in this section. The submittal shall be resubmitted without delay and repeated if necessary to obtain different action marking.

- U. Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.
- V. Coordination
 - 1. Preparation and processing of submittals shall be coordinated with performance of the work, other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
 - 2. Submission of different units of interrelated work shall be coordinated so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.
- W. Unless otherwise indicated, guarantees as specified herein shall be included with the submittal information of all applicable equipment and materials. Incompleteness, inaccuracy, or lack of coordination shall be grounds for rejection. The Contractor shall clearly understand no equipment or material shall be installed prior to approval and that any equipment or material installed prior to approval is subject to removal from the right-of-way solely at the Contractor's expense.
- X. Re-submittal Preparation
 - 1. Re-submittal Preparation shall comply with the requirements described in subsection 1.6, Submittal, of this section. In addition, it shall be identified on the transmittal form that the submittal is a resubmission.
 - 2. Any corrections or changes in submittals required by ENGINEER's notations shall be made on returned submittal.
 - 3. On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, all notations or questions indicated by ENGINEER on ENGINEER's transmittal form shall be answered or acknowledged in writing. Each response shall be identified by question or notation number established by ENGINEER. If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.
- Y. Variations or revisions from previously reviewed submittal, other than those called for by ENGINEER, shall be identified on transmittal form.

1.7 GUARANTEES AND WARRANTIES

- A. All equipment shall be furnished complete with the manufacturer's standard trade guarantee or warranty, applicable to the Illinois Department of Transportation, from the date of final acceptance. Such guarantee shall accompany submittal shop drawings and product data.

- B. Prior to final payment, the original and one copy of all bonds, warranties, guarantees, and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period shall be delivered to the OWNER.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Four copies of an Operation and Maintenance Manual shall be furnished to the ENGINEER for all equipment and associated control systems furnished and installed.
- B. Prior to the Work Reaching 50 Percent Completion, one copy of the manual shall be submitted to the ENGINEER for approval with all specified material. The approval copies shall be submitted with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the two-copy submittal, the remaining 3 copies of the manual shall be furnished to the ENGINEER. Space shall be provided in the manual for additional material. Any missing material for the manual shall be submitted prior to requesting certification of substantial completion.
- C. Each copy of the manual shall consist of the following and shall be prepared and arranged as follows:
 - 1. A section of an equipment data summary (see sample form at end of section) for each item of equipment.
 - 2. A section of an equipment preventive maintenance data summary (see sample form at end of section) for each item of equipment.
 - 3. A section of the equipment manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.
 - 4. List of electrical relay settings and control and alarm contact settings.
 - 5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. All valves in same piping systems shall be grouped together in the schedule. A sample of the valve numbering system shall be obtained from the ENGINEER.
 7. All O&M Manual material shall be on 8-1/2 inch by 11 inch commercially printed or typed forms or an acceptable alternative format.
- D. Each manual shall be organized into sections paralleling the equipment specifications. Each section shall be identified using heavy section dividers with reinforced holes and numbered plastic index tabs. The data shall be compiled in high-quality heavy-weight, hard cover binders with piano style metal hinges or in an alternate approved format. Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders. The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled. All loose data shall be punched for binding. Composition and printing shall be arranged so that punching does not obliterate any data. The project title, and manual title, as furnished and approved by the ENGINEER shall be printed on the cover and binding edge of each manual.
- E. All operating and maintenance material that comes bound by the equipment manufacturer shall be left in its original bound state. The appropriate sections of the CONTRACTOR's O&M manual shall be cross-referenced to the manufacturers' bound manuals.

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

STORMWATER PUMP STATION NO. 47

Operation and Maintenance Manual

Equipment Data Summary

Equipment Name:

Specification Reference:

Manufacturer

Name:

Address:

Telephone:

Number Supplied:

Location/Service:

Model No:

Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative

Name:

Address:

Telephone:

NOTES:

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

STORMWATER PUMP STATION NO. 47

Operation and Maintenance Manual

Preventive Maintenance Summary

Equipment Name: Location: O&M Manual Reference

Manufacturer:

 Name:

 Address:

 Telephone:

 Model No:

 Serial No:

Maintenance Task

Lubricant/Part

D W M Q SA A

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-annual A-Annual

1.9 RECORD DRAWINGS

- F. One record copy of all Contract Documents, reference documents and all technical documents submitted in good order shall be kept and maintained at the site. On bond media, and using drafting symbols and standards consistent with the original documents, Contract Drawings shall be annotated in red to show all changes made during the construction period. Annotated drawings are to be made available to ENGINEER for reference at all times.

- G. At completion of the CONTRACT and before final payment is made, three (3) sets of clearly legible 11"x17" bond media Contract Drawings reflecting all changes made during construction shall be delivered to the Resident Engineer. The drawings shall each be stamped "RECORD DRAWING", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's representative. In addition, one (1) CD containing electronic version of these documents in PDF format shall be provided. Refer to individual sections for addition requirements.

- H. The Record Drawings must be submitted and must be acceptable to the Engineer prior to final acceptance.

END OF SECTION 01 01 00

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01 01 10 – MEASUREMENT AND PAYMENT

Part 1 – Description :

- A. The Pump Station General Work shall include, but not be limited to, the following: The work under this Contract for the rehabilitation of Pump Station 47 shall include all labor, materials, tools, equipment and incidentals and for performing all work required for the complete rehabilitation for a complete operational facility, as included in all Contract Documents and shall be as measured and paid for as described herein.
1. EARTH EXCAVATION shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications
 2. TRENCH BACKFILL shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications.
 3. TOPSOIL FURNISH AND PLACE, 2" shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
 4. SEEDING, CLASS 2A shall be paid for at the Contract unit price per acre in accordance with the Standard Specifications.
 5. MULCH METHOD 2 shall be paid for at the Contract unit price per acre in accordance with the Standard Specifications.
 6. TEMPORARY EROSION CONTROL SEEDING shall be paid for at the Contract Unit price per pound as in accordance with the Standard Specifications.
 7. PERIMETER EROSION BARRIER shall be paid at the Contract unit price per lineal foot in accordance with the Standard Specifications.
 8. INLET FILTERS shall be paid for at the contract unit price per each in accordance with the Standard Specifications.
 9. PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 8 INCH shall be paid for at the contract unit price per square yard in accordance with the Standard Specifications.
 10. DRIVEWAY PAVEMENT REMOVAL shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
 11. COMBINATION CURB AND GUTTER REMOVAL shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
 12. CLASS C PATCHES, TYPE IV, 10" shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.

13. AGGREGATE SHOULDERS. TYPE A, 6" shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
14. STRUCTURE EXCAVATION shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications.
15. CONCRETE STRUCTURES shall be paid for at the Contract unit price per cubic yard as specified in Section 03 30 00, Cast-In-Place Concrete.
16. FORM LINER TEXTURED SURFACE shall be paid for at the Contract unit price per square foot in accordance with the Standard Specifications.
17. PROTECTIVE COAT shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
18. STUD SHEAR CONNECTORS shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
19. REINFORCEMENT BARS, EPOXY COATED shall be paid for at the Contract unit price per pound as specified in Section 03 30 00, Cast-In-Place Concrete.
20. BAR SPLICERS shall be paid for at the Contract unit price per each
21. PARAPET RAILING shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
22. PIPE CULVERTS, CLASS C, TYPE 2, 30" (TEMPORARY) shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
23. PIPE CULVERTS, CLASS C, TYPE 2, 36" (TEMPORARY) shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
24. PIPE CULVERTS, CLASS C, TYPE 2, 48" (TEMPORARY) shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
25. STORM SEWERS, CLASS A, TYPE 1, 48" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
26. STORM SEWERS, CLASS A, TYPE 2, 36" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
27. STORM SEWERS, CLASS A, TYPE 2, 42" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
28. STORM SEWERS, CLASS A, TYPE 2, 48" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
29. STORM SEWERS, CLASS B, TYPE 2, 18" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.

30. STORM SEWERS, CLASS B, TYPE 2, 30" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
31. STORM SEWERS, CLASS B, TYPE 2, 36" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
32. STORM SEWERS REMOVAL 12" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
33. STORM SEWERS REMOVAL 18" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
34. STORM SEWERS REMOVAL 30" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
35. STORM SEWERS REMOVAL 36" shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
36. STORM SEWERS JACKED IN PLACE, 48" shall be paid for at the Contract unit price per lineal foot in accordance with the Special Provisions.
37. GEOCOMPOSITE WALL DRAIN shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
38. CONTROLLED LOW STRENGTH MATERIAL shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications.
39. MANHOLES, TYPE A, 5'- DIAMETER, TYPE 1 FRAME, CLOSED LID shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
40. MANHOLES, TYPE A, 6'- DIAMETER, TYPE 1 FRAME, CLOSED LID shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
41. MANHOLES, TYPE A, 7'- DIAMETER, TYPE 1 FRAME, OPEN LID shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
42. MANHOLES, TYPE A, 7'- DIAMETER, TYPE 1 FRAME, CLOSED LID shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
43. REMOVING MANHOLES shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
44. FILLING MANHOLES shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.

45. COMBINATION CURB AND GUTTER, TYPE B-6.18 shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
46. ENGINEER'S FIELD OFFICE, TYPE A shall be paid for at the Contract unit price per calendar month and shall be in accordance with the requirements of the Standard Specifications.
47. MOBILIZATION shall be paid for at the Contract lump sum price in accordance with the Standard Specifications.
48. TRAFFIC CONTROL SURVEILLANCE shall be paid for at the Contract unit price per calendar day in accordance with the Standard Specifications.
49. TEMPORARY CONCRETE BARRIER shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
50. RELOCATE TEMPORARY CONCRETE BARRIER shall be paid for at the Contract unit price per lineal foot in accordance with the Standard Specifications.
51. BARRIER WALL MARKERS, TYPE C shall be paid for at the Contract unit price per each in accordance with the Standard Specification.
52. PUMP STATION SCADA EQUIPMENT shall be paid for at the contract lump sum price as specified in the applicable requirements of the special provisions and Division 1, General Requirements and all requirements under Division 40, SCADA System.
53. SHEET WATERPROOFING MEMBRANE SYSTEM shall be paid for at the contract unit price per square yard as specified in Section 07 13 26, SELF-ADHERING SHEET WATERPROOFING.
54. TEMPORARY DRAINAGE CONNECTION shall be paid for at the Contract unit price per each in accordance with the Special Provisions.
55. TEMPORARY ELECTRICAL SERVICE CONNECTION shall consist of charges by ComEd for the temporary electrical service, if any, to be paid to the utility by the Contractor. For bidding purposes, this item shall be estimated at \$50,000.00. The Contractor will be reimbursed the exact amount of the charges by the utility, plus any allowable administrative costs as permitted in Standard Specification Article 109.05.
56. DRILLING AND SETTING SOLDIER PILES (IN SOIL) shall be paid for at the Contract unit price per cubic foot in accordance with the Special Provisions.
57. FILL EXISTING STORM SEWERS shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications.

58. PUMP STATION GENERAL WORK shall include all work which is not listed as a specific pay item but which is required for compliance with the specifications and for a complete operational facility and shall be paid for at the Contract lump sum price as specified in the Special Provisions; Division 1, General Requirements; and the applicable requirements under the following: Division 2, Existing Conditions; Division 3, Concrete; Division 4, Masonry; Division 5, Metals; Division 6, Wood, Plastics, and Composites; Division 7, Thermal and Moisture Protection; Division 8, Openings; Division 9, Finishes; and Division 10, Specialties.
59. HEATING AND VENTILATION WORK shall be paid for at the Contract lump sum price as specified in the applicable requirements of the Special Provisions and all requirements under Division 1, General Requirements and Division 23, HEATING AND VENTILATING AND AIR CONDITIONING.
60. PUMP STATION ELECTRICAL WORK shall be paid for at the Contract lump sum price as specified in the applicable requirements of the Special Provisions and Division 1, General Requirements and all requirements under Division 26, Electrical.
61. PUMP STATION MECHANICAL WORK shall be paid for at the Contract lump sum price as specified in the applicable requirements of the Special Provisions; Division 1, General Requirements; and all requirements under Section 05 50 20, Metal Bar Rack; Section 33 40 10, Interior Pipe and Appurtenances; Section 33 40 30, Pipe Specialties; 43 01 50 General Mechanical Provisions; Section 43 20 10, Valves and Appurtenances; Section 43 20 20 Hydraulic Gates; Section 43 21 39, Submersible Pumps; and Section 43 21 43, Sump Pumps.
62. BRACED EXCAVATION shall be paid for at the Contract unit price per cubic yard in accordance with the Standard Specifications.
63. CURB REMOVAL (PARTIAL) shall be paid for at the Contract unit price per lineal foot in accordance with the Special Provisions.
64. TEMPORARY MANHOLE shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
65. CHAIN LINK GATES (SPECIAL) shall be paid for at the Contract unit price per each as specified in the applicable requirements of the Special Provisions.
66. CHAIN LINK FENCE, 8' (SPECIAL) shall be paid for at the Contract unit price per lineal foot as specified in the applicable requirements of the Special Provisions.
67. CHAIN LINK FENCE, ATTACHED TO STRUCTURE, SPECIAL shall be paid for at the Contract unit price per lineal foot as specified in the applicable requirements of the Special Provisions.
68. TRAFFIC CONTROL AND PROTECTION (SPECIAL) shall be paid for at the Contract lump sum price in accordance with the Special Provisions.

69. ELECTRICAL UTILITY SERVICE CONNECTION shall consist of charges by the Naperville Electric for the electrical service connection, to be paid to the utility by the Contractor. This Item shall not include charges for electric power usage. For bidding purposes, this item shall be estimated at \$255,000.00. The Contractor will be reimbursed for the exact amount of the charges by the utility, plus any allowable administrative costs as permitted in Standard Specification Article 109.05.
70. AGGREGATE SUBGRADE IMPROVEMENT 8" shall be paid for at the Contract unit price per square yard in accordance with the Special Provisions.
71. HOT-MIX ASPHALT DRIVEWAY PAVEMENT, 6" shall be paid for at the Contract unit price per square yard in accordance with the Standard Specifications.
72. UNTREATED TIMBER LAGGING shall be paid for at the Contract unit price per square foot in accordance with the Special Provisions.
73. BUILDING REMOVAL NO. 1 shall be paid for at the Contract unit price per lump sum as specified in the applicable requirements of the Special Provisions and all requirements under Section 02 41 00, Demolition.
74. FURNISHING SOLDIER PILES (HP SECTION) shall be paid for at the Contract unit price per lineal foot in accordance with the Special Provisions.
75. FURNISHING SOLDIER PILES (W SECTION) shall be paid for at the Contract unit price per lineal foot in accordance with the Special Provisions.
76. IMPACT ATTENUATOR, TEMPORARY (NON-REDIRECTIVE), TEST LEVEL 2 shall be paid for at the Contract unit price per each in accordance with the Standard Specifications.
77. TEMPORARY INFORMATION SIGNING shall be paid for at the Contract unit price per square foot and shall be in accordance with the Special Provisions.
78. PLUG EXISTING STORM SEWERS shall be paid for at the Contract unit price per each in accordance with the Special Provisions.
79. PIPE UNDERDRAINS FOR STRUCTURES, 4" shall be paid for at the Contract unit price per lineal foot in accordance with the Special Provisions.
80. RAILROAD PROTECTIVE LIABILITY INSURANCE shall be for at the Contract lump sum price in accordance with the Special Provisions.
81. BRIDGE CRANE shall be paid for at the Contract lump sum unit price as specified in Section 41 22 13, Bridge Crane.

END OF SECTION 01 01 10

DIVISION 2 - SITE WORK

SECTION 02 41 00 - DEMOLITION

PART 2 - GENERAL

2.1 DESCRIPTION

- A. The extent and location of the Demolition works shall be as specified herein. The work includes the requirements for the removal, and satisfactory disposal of all materials except materials approved by the Engineer to be reused in the work.

2.2 JOB CONDITIONS

- A. The Contractor represents that it has visited the site to become familiar with the quantity and character of all materials to be demolished. The Contractor agrees that the premises were made available prior to deadline for submission of Bids for whatever inspection and tests the Contractor deemed appropriate. The Contractor assumes full responsibility for the proper disposal of all demolition materials.
- B. The Pump Station shall not be decommissioned until the following criteria have been met:
 - 1. The new Pump Station has been placed in service, and written Notice of Acceptance for the proposed Pump Station has been provided to the Contractor,
 - 2. IDOT has identified items to be salvaged,
 - 3. Written permission to decommission the existing Pump Station has been permission has been provided to the Contractor.

2.3 RELATED SECTIONS

- A. Section 01 01 00 – Summary of Work.
- B. Section 01 01 10 – Measurement and Payment

2.4 SUBMITTAL

- A. Submit under provisions of Section 01 01 01 – Summary of Work.

2.5 BASIS OF PAYMENT

- A. Scope of work shall be as shown and specified in the prospective divisions and include, but not limited to, the following major items:

1. Removal and disposal of the existing Pump Station and removal of the portion of the building foundation above El. 691.00.
 2. The remainder of the foundation shall be backfilled with Controlled Low-Strength Material in accordance with Standard Specification 593.
- B. Payment
1. Generator, SCADA PLC, and all other items identified by the Engineer to be salvaged shall be removed from the building and delivered to a location determined by the Engineer. All remaining items shall be removed and properly disposed. This work is included in the pay item, BUILDING REMOVAL NO 1.
 2. The work specified under this Section and as required for the removal and disposal of the existing bituminous pavement shall be paid at the contract unit price per square yard for the Item, DRIVEWAY PAVEMENT REMOVAL.
 3. The work specified under this Section and as required for the backfilling of the below grade portion of the building to remain shall be measured and paid at the contract unit price per cubic yard for the Item, CONTROLLED LOW-STRENGTH MATERIAL.

PART 3 - PRODUCTS:

- A. CONTROLLED LOW-STRENGTH MATERIAL shall conform to the Standard Specification 1019.

PART 4 - EXECUTION:

4.1 DEMOLITION

- A. Demolition work to be included under the Item, BUILDING REMOVAL NO. 1 shall include, but not be limited to, the following:
 1. Pump Station building removal in its entirety.
- B. Pump Station building removal in its entirety.
 1. Pump Station foundation removal to an elevation of 691.00 or below.
 2. Abandoned electrical control box and pole.

4.2 DISPOSAL

- A. General: All materials, except those indicated to be salvaged upon their demolition, shall become the property of the Contractor and shall be removed and promptly disposed of in a lawful manner away from the site.
- B. Cleanup: After removal of designated areas of structure, clean and grade the area. There shall be no debris, rubble, or litter left at the site from any of the demolition operations, and the site shall be clean. Contractor shall coordinate with overall requirements for final site requirements.

END OF SECTION 02 41 00

DIVISION 3 - CONCRETE

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 5 - GENERAL:

5.1 DESCRIPTION

- A. The work shall include requirements for all Cast-In-Place Concrete, as shown and specified herein. The work shall also include requirements for Concrete Form work for structural concrete, Concrete Reinforcement and Concrete Accessories.
- B. Unless otherwise indicated, concrete material and work shall be in conformance with the requirements of the Standard Specifications for Road and Bridge Construction, adopted January 1, 2012, a publication of the Illinois Department of Transportation. Refer to Division 1 for additional requirements.

5.2 SUBMITTALS

- A. Submit under provisions of Section 01 01 00 – SUMMARY OF WORK and Standard Specifications.

5.3 QUALITY ASSURANCE

- A. Under provisions of Standard Specifications.

5.4 BASIS OF PAYMENT

- A. Measurement
 - 1. The work specified for concrete shall be measured as specified in Article 503.21 of the Standard Specifications.
 - 2. Concrete reinforcement shall be measured for payment as specified in Article 508.07 of the Standard Specifications.
- B. Payment
 - 1. The work specified under this Section excluding concrete reinforcements shall be paid for at the contract unit price per cubic yard for CONCRETE STRUCTURES, which price shall be considered as payment in full for this Item.
 - 2. The work specified under this Section for concrete reinforcements shall be paid for at the contract unit price per pound for REINFORCEMENT BARS, EPOXY COATED, which price shall be considered as payment in full for this item.

PART 6 - PRODUCTS

6.1 CONCRETE FORM WORK

- A. Forms shall be of wood or metal, as required, and supplied in sufficient quantities so that work can be properly accomplished.
- B. Forms shall be constructed to slopes, lines and dimensions shown, plumb, straight and sufficiently tight to prevent leakage and so braced that no distortion or settling can take place during or after placing of concrete.
- C. Forms shall conform to the requirements of Section 503 "Concrete Structures" of the Standard Specifications.

6.2 CONCRETE REINFORCING

A. General

- 1. All concrete reinforcement bars, fabric and strand shall meet the requirements of Article 1006.10 of the Standard Specifications.
- 2. All steel reinforcement bars shall be deformed bars conforming to the requirements of AASHTO M-31, M-42 or M-53 Grade 60 ksi, and the applicable portions of the Standard Specifications. Epoxy coated bars shall conform to the requirement of AASHTO M284. Submit one sample of 12 inch long steel reinforcement bars and one sample each reinforcement accessories. Materials shall meet the requirements of Section 508 and Section 1006 of the Standard Specifications.
- 3. Reinforcing bars shown to be welded on Drawings shall be Designation ASTM A706, Grade 60.
- 4. Minimum clearances for reinforcement bars shall be as shown on the Plans. Where clearances are not shown on the Plans, the minimum clearances shall be as specified in ACI-318 (Building Code Requirements for Reinforced Concrete).

6.3 CONCRETE

A. General

- 1. Unless otherwise indicated, all regular concrete shall be Class SI with 14 days Compressive Strength of 3,500 psi Section 1020 of the Standard Specifications. Fly ash shall be stored at the concrete mixing plant separately from the cement. Fly ash and cement shall not be intermixed prior to being added to the concrete mix.
- 2. Unless otherwise indicated, all cement shall be Portland Cement type I or II.

3. The coarse aggregate gradations for all regular concrete (Class SI) shall be CA7 or CA 11.
4. Concrete Proportions: Concrete proportions shall be selected to provide the required strength and durability and to provide work ability and consistency so that the concrete can be worked into forms and around reinforcement without segregation or excessive bleeding.

Establish concrete proportions including the water-cementitious material ratio on the basis of field experience or trial mixtures with the materials to be used in accordance with ACI 318.

5. The concrete mix design slumps shall be within the following limits:
Concrete Placement (Class SI)

Normal 2 in. to 4 in.
Pumped 4 in. to 6 in.

B. Fiber Reinforcement Concrete

1. Fiber Reinforcement Manufacturers:
 - a. W.R. Grace & Co.
 - b. Fibermesh Co.
 - c. Euclid Chemical Co.
2. Dosage Rate: 1-1/2 lbs/cu yd min.
3. Use in strict accordance with manufacturer's written recommendation and ASTM C94.

6.4 WATERSTOP

- A. Virgin polyvinyl chloride (PVC) waterstop conforming to CRD C572, with hog rings or grommets at 12 to 18 in. oc.
- B. Construction Joints: Dumbbell or serrated type, 6 in. wide by 3/8 in. thick, at center.
- C. Provide prefabricated tees, crosses, and other configurations as required.
- D. Gasket Type Waterstop: 1" by 3/4" Waterstop-Rx by American Colloid Co. or SikaSwell S-Sealant by Sika Corp.

6.5 MECHANICAL SPLICER

- A. Develop minimum 125% of yield capacity of bars spliced in tension when tested as assembly in accordance with ASTM A370 and ASTM A615.

PART 7 - EXECUTION:

7.1 FORM

A. FORM INSTALLATION

1. Form surfaces shall be smooth and free from any imperfections which would cause objectionable roughness on the finished surface of the concrete.
2. All forms for concrete shall be tied with rods or patented ties where the concrete is to be exposed. Ties within the forms shall be constructed so as to permit their removal in accordance with the requirements of Section 503.06 of the Standard Specifications. Ties which are left in place within water containing structures shall be provided with swaged washers or other suitable devices to prevent seepage or moisture along the ties. Use lugs, cones, washers or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.
3. All necessary inserts in form work such as rods, bolts, anchorages, fillets, and other devices shall be installed as required.
4. Forms shall not be treated with material that will adhere to or discolor the concrete.
5. All sheeting, bracing and timbering shall be placed entirely outside of the neat lines of the structure, except that flanges or projections of steel shapes may extend into the concrete a distance not exceeding 2 inches. All sheeting shall be closely fitted to the excavation and no timber shall be left within the finished lines of the structure. The bracing shall be so arranged that no stress will be placed on any part of the sub-structure concrete until the concrete has developed sufficient strength to support safely the load thereon.
6. For all exposed concrete edges a 3/4 inch chamfer strip shall be provided.

B. FORM REMOVAL

1. Forms shall be removed in such manner and at such a time as to insure the complete safety of the structure. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support safely their weight and load thereon. The results of suitable control tests shall be used as evidence that the concrete has attained the required strength.
2. Removal of forms shall conform to Section 503.06 of the Standard Specifications.

7.2 CONCRETE REINFORCING

A. REINFORCING INSTALLATION

1. Placing and fastening of reinforcement shall be as per Article 508 of Standard Specifications.
2. The Contractor shall furnish to the Engineer complete bar bending details, bar lists, weights and detail drawings for the fabricating and placing of all reinforcement to be furnished under this contract. Such lists and drawings shall be prepared in accordance with the American Concrete Institute ACI 315, SP66 (Details and Detailing of Concrete Reinforcement), except as otherwise shown on the plans or ordered by the Engineer.
3. Bar bending details, bar lists, weights and detail drawings furnished by the Contractor will be examined by the Engineer and it shall be understood by the Contractor that a responsible amount of time will be necessary for their examination before they can be approved or returned for correction. No reinforcement shall be fabricated until the bar bending details and detail drawings have been approved by the Engineer. The Contractor shall furnish to the Engineer, without extra charge therefore, copies of the approved bar bending details, bar lists and detail drawings in such number as the Engineer may require.
4. Mechanical connections shall develop at least 125 percent of the Specified Yield Strength of the bar in tension.

7.3 CAST-IN-PLACE CONCRETE

A. Placing Concrete

1. Concrete placement and consolidation shall comply with provisions of Section 503 of the Standard Specifications.
2. Once concreting is started it shall be carried on as a continuous operation until the placing of the section between construction joints is completed. Sections containing "cold joints" will not be accepted and shall be removed and replaced at the Contractor's expense.
3. Concreting in freezing weather shall comply with the provisions of Section 1020 of the Standard Specifications.
4. Old concrete surfaces that will be in contact with the new concrete shall be coated with an epoxy bonding agent, Sika Chemical Co. Sikadur Ili-Mod (Sikastix 370), or approved equal. Application shall be in strict conformity with the manufacturer's recommendations, with particular attention given to temperature requirements. Applicable provisions of Article 503.09 (a) (2) of the Standard Specifications shall be followed. This work will not be paid for separately, but shall be incidental to the contract unit price for Class SI Concrete, and no additional compensation will be allowed.

5. The concrete surface for Wet Well and Discharge Chamber bottom shall be screeded and wood floated.
6. All interior and exterior surfaces that will be exposed to view after completion of the work shall be given a normal finish in accordance with Section 503.16(a) of the Standard Specifications.
7. All top slab surfaces exposed to the weather shall be finished to a true and even surface with floats and trowels. The final troweling shall be done with a steel trowel, leaving a smooth even surface. After the water sheen has disappeared, the surface shall be given a final finish by brushing with a whitewash brush. The brush shall be drawn across the slab with adjacent strokes slightly overlapping, producing a uniform, slightly roughened surface with parallel brush marks. All edges shall be rounded with an edging tool.
8. Concrete floor slab of building shall have a smooth steel troweled finish and all edges of finished surfaces shall be rounded or leveled with edging tools. The pumping station floor slab shall be treated with an approved floor hardener and sealer.
9. All concrete shall be cured for a minimum of 7 days in accordance with Section 1020.13, "Curing and Protection" of Portland Cement Concrete.

END OF SECTION 03 30 33

DIVISION 3 – CONCRETE

SECTION 03 41 13 – PRESTRESSED HOLLOWCORE PLANK

PART 8 - GENERAL

8.1 DESCRIPTION

- A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the precast hollowcore plank as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
1. Hollowcore plank.
 2. Grouting between units.

8.2 RELATED WORK

8.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute (PCI) Plant Certification Program prior to the start of production. Manufacturer shall be certified in category C3.
1. The manufacturer shall, at his expense, meet the following requirements:
 - a. The basis of inspection shall be the Prestressed Concrete Institute's "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products", MNL-116, and the criteria for acceptance shall be the same as the Plant Certification Program.
- B. Erector Qualifications: PCI Qualified and regularly engaged for at least three years in the erection of precast structural concrete similar to the requirements of this project. Retain a registered structural engineer to certify that erection is in accordance with design requirements.
- C. Welder Qualifications: In accordance with AWS D1.1.
- D. Testing: In general compliance with applicable provisions of Prestressed Concrete Institute MNL-116, "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products".
- E. Requirements of Regulatory Agencies: All local codes plus the following specifications, standards and codes are a part of these specifications:
1. ACI 318 – Building Code Requirements for Reinforced Concrete;
 2. AWS D1.1 – Structural Welding Code-Steel;
 3. AWS D1.4 – Structural Welding Code-Reinforcing Steel;
 4. ASTM Specifications – As referred to in Part 2-Products, of this Specification.

8.4 SUBMITTALS AND DESIGN

A. Shop Drawings:

1. Erection Drawings

- a. Plans locating and defining all hollowcore planks furnished by the manufacturer, with all major openings shown.
- b. Sections and details showing connections, weld plates, edge conditions and support conditions of the hollowcore plank units.
- c. All dead, live and other applicable loads used in the design.
- d. Fire rating.
- e. Estimated Camber:

2. Production Drawings

- a. Plan view of each hollowcore slab unit type.
- b. Sections and details to indicate quantities, location and type of reinforcing steel and prestressing strands.
- c. Lifting and erection inserts.
- d. Dimensions and finishes.
- e. Prestress for strand and concrete strength.
- f. Camber.

B. Approvals:

1. Submit five copies of erection drawings and calculations for approval prior to fabrication. Fabrication not to proceed prior to receipt of approved drawings and calculations.

C. Product Design Criteria:

1. Loadings for design

- a. Initial handling and erection stresses.
- b. All dead and live loads as specified herein.(DL = 20 psf, LL = 50 psf)
- c. All other loads specified for hollowcore plank where applicable. Reference Mechanical supply and exhaust fans in the construction documents.

2. Design steel plank support headers when such headers are determined necessary by the manufacturer's engineer.

3. Design calculations shall be performed by an engineer, registered in the state that the project is located in, and experienced in precast prestressed concrete design. Design calculations to be submitted for approval upon request.

4. Design shall be in accordance with ACI 318 and applicable codes.

D. Permissible Design Deviations:

1. Design deviations will be permitted only after the Architect/Engineer's written approval of the manufacturer's proposed design supported by complete design calculations and drawings.
2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.

E. Test Reports: Test reports on concrete and other materials shall be submitted upon request.

8.5 SAFETY

- A. The Contractor shall provide and maintain all safety barricades, rebar caps and opening covers required for plank in accordance with current industry safety standards.

8.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling:

1. Hollowcore plank shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, or both, and with approved lifting devices. Lifting inserts shall have a minimum safety factor of 4. Exterior lifting hardware shall have a minimum safety factor of 5.
2. Transportation, site handling and erection shall be performed with acceptable equipment and methods and by qualified personnel.

B. Storage:

1. Store all units off ground on firm, level surfaces with dunnage placed at bearing points.
2. Place stored units so that identification marks are discernible.
3. Separate stacked units by dunnage across full width of each plank.

8.7 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 9 - PRODUCTS

9.1 MATERIALS

A. Portland Cement

1. ASTM C150 – Type I or III.

B. Admixtures

1. Air Entraining Admixtures, ASTM C260, Water Reducing, Retarding, Accelerating, High-Range Water Reducing Admixtures: ASTM C494.

C. Aggregates

1. ASTM C33 or C330.

D. Water

1. Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

E. Reinforcing Steel

1. Bars:
 - a. Deformed Billet Steel: ASTM A615.
 - b. Deformed Low Alloy Steel: ASTM A706.
2. Wire:
 - a. Cold Drawn Steel: ASTM A82.

F. Prestressing Strand:

1. Uncoated, 7-Wire, Low Lax strand: ASTM A416 (including supplement) – Grade 270K.

G. Structural Steel Plates and Shapes: ASTM A36.

H. Grout:

1. Grout shall be a mixture of not less than one part Portland cement to three parts fine sand, and the consistency shall be such that joints can be completely filled but without seepage over adjacent surfaces. The grout shall achieve a minimum 28-day compressive strength of 2,000 psi. Any grout that seeps from the joint shall be completely removed before it hardens.

I. Bearing Strips: Hardboard.

9.2 CONCRETE MIXES

- A. 28-day compressive strength: Minimum of 5,000 p.s.i.
- B. Release strength: Minimum of 3,000 p.s.i.
- C. Use of calcium chloride, or admixtures containing chlorides is not permitted.

9.3 MANUFACTURE

- A. Hollowcore plank shall be machine cast in 48-inch widths as manufactured by High Concrete Group LLC or equivalent.(Additional sizes as indicated on Drawings)
- B. Manufacturing procedures and tolerances shall be in general compliance with PCI MNL-116.
- C. Openings: Manufacturer shall provide for rectangular openings 12 inches or larger on all sides and as clearly shown on the architectural and structural drawings. They shall be located by the trade requiring them and then field cut. Round and small openings (less than 12 inches) shall be drilled or cut by the respective trades after grouting. Openings requiring cutting of prestressing strand shall be approved by the precast plank manufacturer before drilling or cutting.
- D. Finishes: Bottom surface shall be flat and uniform as resulting from an extrusion process, without major chips, spalls and imperfections. Top surface shall be machine formed.
- E. Patching: Will be acceptable providing the structural adequacy of the hollow core unit is not impaired.

9.4 TOPPING COAT

- A. Topping coat shall be in accordance with IDOT Standard Specification Section 503.
- B. Concrete shall be Class S-1.

PART 10 - EXECUTION

10.1 ERECTION

- A. Site Access: Erection access suitable for cranes and trucks to move unassisted from public roads to all crane working areas as required by erector, or otherwise indicated herein, will be provided and maintained by the general contractor.
- B. Preparation: The general contractor shall be responsible for:
 - 1. Providing true, level, bearing surfaces on all field-placed bearing walls and other field-placed supporting members. Masonry wall bearing surfaces shall be bond beams with properly filled concrete of adequate strength.
 - 2. All pipes, stacks, conduits and other such items shall be stubbed off at a level lower than the bearing plane until after the plank are set. Masonry, concrete or steel shall not be installed above plank-bearing surface until after the plank is in place and grout reaches adequate strength.
- C. Installation: Installation of hollowcore plank shall be performed by the manufacturer or a competent erector. Members shall be lifted with slings at points determined by the manufacturer.

Bearing strips shall be set where required. Grout keys shall be filled. Openings shall be field cut only after grout has reached adequate strength, unless authorized by the manufacturer's engineer. The general contractor is to provide temporary shoring or bracing of framing to accept hollowcore plank prior to plank being set.

- D. Snow Removal: Snow removal and winter heat will be provided by the general contractor.
- E. Alignment: Members shall be properly aligned. Variations between adjacent members shall be reasonably leveled out by jacking, bolting or any other feasible method as recommended by the manufacturer.

10.2 FIELD WELDING

- A. Field welding is to be done by qualified welders using equipment and materials compatible to the base material.

10.3 ATTACHMENTS AND OPENINGS

- A. Attachments: Subject to approval of the Architect/Engineer, hollowcore plank units may be drilled or "shot" provided no contact is made with the prestressing steel. Should spalling occur, it shall be repaired by the trade doing the drilling, shooting or cutting. Holes shall be drilled by the general contractor.
- B. Openings: Any unframed opening shall be drilled or cut by the respective trades without making contact with prestressing strand.

10.4 WEEP HOLES

- A. Quarter-inch holes shall be drilled into the bottom of each core at each end of hollowcore plank to allow drainage of accumulated moisture. Holes shall be drilled and patched by the general contractor.

10.5 CLEAN UP

- A. Remove rubbish and debris resulting from hollowcore plank work from premises upon completion.

END OF SECTION 03 41 13

DIVISION 3 - CONCRETE

SECTION 03 60 00 - GROUT

PART 1 - GENERAL:

1.1 SECTION INCLUDES

- A. Grout for equipment bases.
- B. Grout for pipe and conduit penetrations.
- C. Grout for anchor bolts.
- D. Grout for slide gate frame.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 05 05 23 – Bolts, Anchor Bolts, Concrete Anchors, and Concrete Inserts.
- C. Section 33 40 10 – Interior Pipe and Appurtenances.

1.3 REFERENCES

- A. ASTM C109 - Compressive Strength of Hydraulic Cement Mortars (using 2" or 50 mm. Cube Specimens).
- B. ASTM C150 - Portland Cement.
- C. ASTM C191 - Time of Setting of Hydraulic Cement by Vicat Needle.
- D. ASTM C827 - Early Volume Change of Cementitious Mixtures.
- E. CRD-C-588 - Specifications for Non-Shrink Grout.
- F. CRD-C-619 - Specification for Grout Fluidifier.
- G. CRD-C-621 - Specification for Non-Shrink Grout.

1.4 SUBMITTALS

- A. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.
- B. Submit manufacturer's installation instructions under provisions of Division 1.

1.5 TESTS

- A. Testing of grout will be performed under provisions of Division 1.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Grout materials from manufacturers shall be delivered in unopened containers.
- B. Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperatures to a minimum of 50°F prior to, during and 48 hours after completion of the Work.
- B. If manufacturer's requirements are more stringent, such requirements shall govern.

1.8 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS:

2.1 MATERIALS

- A. Each required material shall have one manufacturer throughout the use of that material on the Work.

2.2 MANUFACTURERS - NON-SHRINK, NON-METALLIC, 100% SOLID, HIGH STRENGTH EPOXY GROUT

- A. Sikadur 42, Grout-Pak by Sika Chemical Company.
- B. Five Star Epoxy Grout by U.S. Grout Corporation.
- C. Substitutions: Under provisions of Division 1.

2.3 MATERIALS- NON-SHRINK, NON-METALLIC, CEMENTITIOUS GROUT

- A. Pre-mixed, non-staining, cementitious grout requiring only the addition of water at the job site; conforming to the following:
 - 1. Non-shrink: No shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with CRD-C-621.
 - 2. Compressive Strength: A minimum 28-day compressive strength of 7,000 psi when tested in accordance with ASTM C109.
 - 3. Setting Time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C191.

4. Composition: Shall not contain metallic, particles, chlorides or expansive cement.

2.4 MANUFACTURERS - NON-SHRINK, NON-METALLIC, CEMENTITIOUS GROUT

- A. Sika Grout 212 by Sika Chemical Company.
- B. Masterflow 928 by Master Builders Company.
- C. Sealtight 588 grout by W. R. Meadows, Inc.
- D. Substitutions: Under provisions of Division 1.

2.5 MATERIALS - CEMENT-SAND GROUT

- A. Use 1 part cement to 3 parts sand. Keep the water cement ratio below 0.45 and achieve a minimum 28-day compressive strength of 4,000 psi.
- B. Cement: ASTM C150, Type 2.
- C. Sand: ASTM C33.
- D. Water: Clean, fresh, potable water free from injurious amounts of vegetable matter and mineral salts.

PART 3 - EXECUTION:

3.1 INSPECTION

- A. Examine site for unsatisfactory conditions or deficiencies that have been corrected under which grout is to be installed and notify Engineer in writing.

3.2 INSTALLATION

- A. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until Engineer provides clarification.
- B. Drypacking for vertical grouting behind vertical base plates.
- C. Manufacturers of proprietary products shall make available upon 72 hours' notification the services of a qualified, full-time employee to aid in assuring proper use of the product under job conditions.
- D. Placing grout shall conform to temperature and weather limitations in Section 3A.
- E. Equipment Bases
 1. After shimming all equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout.

Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with grout. Use non-metallic cementitious grout unless another type of grout is recommended by equipment manufacturer.

2. Non-shrink, non-metallic epoxy grout may be used with Engineer's specific review.

3.3 SCHEDULE

- A. Non-Shrink, Non-Metallic Cementitious Grout: anchor bolts, equipment bases, pipe supports, pipe and conduit penetration, slide gate frame, and pipe thrust support structures.
- B. Cement-Sand Grout: Pipe and conduit penetrations for non-water containing structure, and repair of exposed concrete.

END OF SECTION 03 60 00

DIVISION 4 - MASONRY SYSTEM

SECTION 04 10 00 - UNIT MASONRY

PART 11 - GENERAL

11.1 DESCRIPTION

- A. The scope of work under this Division shall include the furnishing and installing of all masonry units, bond beams, grout and mortar, reinforcing steel, wall ties, flashing, and appurtenant work required to complete the masonry walls and partitions as shown on the Drawings and as specified herein. Refer to Division 1 for additional requirements.
- B. The Contractor shall be responsible for ascertaining the extent of work by other trades which require coordination with this work and shall be responsible for the coordination thereof.
- C. This work shall include the setting and incorporating into the masonry of all bolts, anchors, inserts, nailers, metal attachments, etc. as indicated on the Drawings, as specified herein, as furnished by others, and as located by others.
- D. This work shall include the building in of all door and window frames, vents, louvers, conduits, pipes, etc. as shown on the Drawings and as furnished by and set by others.

11.2 RELATED WORK

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 05 10 00 - Structural Steel.
- C. Section 05 50 00 - Metal Fabrications.
- D. Section 05 05 23 - Bolts, Anchor Bolts, Concrete Anchors, And Concrete Inserts
- E. Section 06 10 00 – Carpentry.
- F. Section 07 41 13 – Metal Roof Panels.
- G. Section 07 62 00 - Sheet Metal Flashing and Trim.
- H. Section 07 92 00 - Joint Sealers.
- I. Section 07 20 00 - Board Insulation.
- J. Section 08 13 19 – Stainless Steel Doors and Frames.
- K. Section 08 71 00 - Door Hardware.

- L. Section 09 10 00 - Painting
- M. Section 10 00 00 – Specialties.
- N. Divisions 11, 12, 13 & 15.

11.3 REFERENCE STANDARDS

- A. This work is subject to the requirements of the applicable portions of the following standards:
 - 1. General:
 - a. ACI 530: Building Code Requirements for Concrete Masonry Structures.
 - b. ACI 530.1: Specifications for Masonry Structures.
 - c. IBC 2006: International Building Code.
 - 2. Mortar:
 - a. ASTM C5: Quicklime for Structural Purposes.
 - b. ASTM C144: Aggregate for Masonry Mortar.
 - c. ASTM C150: Portland Cement.
 - d. ASTM C207: Hydrated Lime for Masonry Purposes.
 - e. ASTM C270: Mortar for Unit Masonry.
 - f. ASTM C404: Aggregates for Masonry Grout.
 - g. ASTM C476: Grout for Masonry.
 - h. ASTM C780: Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - i. ASTM C1019: Method of Sampling and Testing Grout.
 - 3. Unit Masonry:
 - a. ASTM A123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. ASTM A525: Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
 - c. ASTM B370: Copper Sheet and Strip for Building Construction.
 - d. ASTM C90: Hollow Load Bearing Concrete Masonry Units.
 - e. ASTM C216: Facing Brick (Solid Masonry Units Made From Clay or Shale).

11.4 SUBMITTALS

- A. Samples of glass block, brick and block per the type, size, color and texture shall be submitted. As a minimum, samples shall include 3 blocks of the following:

1. Glass Block.
 2. Glazed single face block.
 3. Glazed double face block.
 4. Brick unit.
 5. Concrete masonry unit.
- B. Material submittals shall include manufacturer's certification of compliance for the type and grade of masonry units supplied.
- C. Include design mix, indicate proportion or property method used, required environmental conditions, and admixture limitations.
- D. Submit test reports on mortar indicating conformance with ASTM C270.
- E. Submit test reports on grout indicating conformance with ASTM C476 and C1019.
- F. Submit manufacturer's certificate indicating that products meet or exceed specified requirements.

11.5 DELIVERY AND STORAGE

- A. Deliver cements and lime to the site in unopened containers. Use one manufacturer's product for each type of material throughout the work. Do not use material that has, in the opinion of the Engineer, become unstable for good construction.
- B. Store cementitious materials off the ground and completely cover with a wind safe waterproof covering.
- C. Take special precautions during transit and storage of masonry units to protect them from staining or discoloration from any cause whatsoever and replace permanently discolored units, whether set in place or not. Stains which cannot be removed with clean water and fiber brushes shall be considered defects and pieces so stained shall not be used.
- D. Stack masonry units on platforms and cover, or store in other approved manner that will protect them from contact with soil and from weather exposure.

11.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperatures to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

11.7 MIX TESTS

- A. Testing of Mortar Mix: In accordance with ASTM C780.

- B. Test mortar mix for compressive strength, slump, consistency, mortar aggregate ratio, water content, air content and splitting tensile strength.
- C. Testing of Grout Mix: In accordance with ASTM C1019.

11.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on the Drawings.

11.9 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 12 - PRODUCTS

12.1 BRICK UNITS

- A. Manufacturers:
 - 1. Belden.
 - 2. Darlington, A General Shale Company.
 - 3. Hanley Brick, A Glen-Gery Brick Company.
 - 4. Substitutions: Approved equal.
- A. Brick masonry units shall be face brick in accordance with ASTM C216, Type FBS, Grade SW (severe weathering/exposure), zero efflorescence.
- B. Brick masonry units shall be nominal standard size of 4"x2 2/3"x8". Provide special solid brick units for corners, lintels, headers, bases and other special conditions as required.
- C. Color shall be as selected by Owner from manufacturers standard products. Contractor shall submit the sample brick for Engineer's approval. Do not start Work until Engineer/Owner has accepted sample. The Owner or Engineer's brick chosen shall be provided by the Contractor at no additional cost to Owner.

12.2 CONCRETE BLOCK (STANDARD AND GLAZED TYPE CMU)

- A. Manufacturers: Each type of masonry unit shall have a single source of supply through completion of the Work. Substitutions will not be allowed without written approval of the Engineer.

- B. Glazed concrete masonry units shall be subject to requirements, provide factory glazed concrete masonry units from one of the followings or approved equal.
 - 1. The Spectra Group, Spectra glazed II CMU.
 - 2. Trenwyth, Astra-glazed CMU.
- C. Hollow normal weight concrete block units shall conform to ASTM C 90.
- D. Solid normal weight concrete block units shall conform to ASTM C 90.
- E. Provide special units for 90 degree corners, bond beams, lintels, jambs, bullnose, wall base (cove-type), and other special conditions as required.
- F. Glazed face block color shall be as follows (based on Trenwyth Astra-glazed CMU):
 - 1. Base: As selected by Owner from manufacturers standard products.
 - 2. Walls: As selected by Owner from manufacturers standard products.
 - 3. Contractor shall submit the sample block for Engineer's approval. Do not start Work until Engineer/Owner has accepted sample. The Owner or Engineer's block chosen shall be provided by the Contractor at no additional cost to Owner.
- G. Glazed face block shall be provided in (1) single glazed face and (2) double glazed face units at locations indicated on drawings.

12.3 GLASS BLOCK

- A. Manufacturer - Subject to compliance with requirements, provide glass block of one of the following, or an approved equal:
 - 1. Pittsburgh Corning Corp.: Vistabrick Type, Saint-Gobain
- B. The glass block shall be solid, transparent blocks with smooth outer faces made by fusing together two solid slabs of clear, colorless glass with manufacturer's standard coating factory-applied on edge surfaces. Size shall be 3 inch thick by 7-3/4 inch square actual size.
- C. Accessories: Panel reinforcing shall be formed of two parallel wires with cross wires at regular intervals. Expansion strips shall be dense glass fiber matting 3/8" thick x 3" wide. Asphalt emulsion shall be water based.
- D. Aluminum angles, plates and tube sections are to be provided with an anodic R1-A1 finish. Interior and exterior color to be selected by Engineer.

2.4 MORTAR

A. Materials:

1. Portland Cement: ASTM C150, Type I, as selected by Owner from manufacturers standard products.
2. Masonry Cement: Not permitted for use.
3. Mortar Aggregate: ASTM C144, standard masonry type. Grading and color suitable for type of masonry, one source for entire project.
4. Hydrated Lime: ASTM C207. Type S
5. Quicklime: ASTM C5, non-hydraulic type.
6. Grout Aggregate: ASTM C404
7. Grout Fine Aggregate: Sand, 50 percent by volume.
8. Water: Clean and potable.

B. Pre-Mix Mortar:

1. Ready mix mortar may be used on this project per the following mortar type listed below:
 - a. Ready Mixed Mortar for all load bearing and non-loading bearing walls and partitions: ASTM C1142, Type RS with an average compressive strength of 1800 psi at 28 day strength.

C. Mortar Mixes:

1. Mortar for Load, Non-Load Bearing Walls and Partitions, and Reinforced Masonry: Mortar shall be Type S and shall conform to ASTM C 270, with a minimum compressive strength of 1800 psi utilizing the Proportion Method.
2. Pointing Mortar: Mortar shall be Type N and shall conform to ASTM C270, using the Property Method.
3. The mortar shall have proportions of 1 part Portland cement, 1/2 part hydrated lime and 4 parts sand by volume. A measuring box shall be used to attain the specified mix. Sand shall be measured in a loose, damp condition.
4. Mortar shall be freshly prepared and uniformly mixed and shall be of spreadable, workable consistency.
5. The mortar shall be re-tempered with water as required to maintain high plasticity. Re-tempering on mortar boards shall be done only by adding water within a basin formed with the mortar and the mortar worked into the water. Any mortar which has stiffened or which is unused after one and one-half hours from the initial mixing shall not be used.
6. The mortar ingredients shall be mixed in a batch mixer for not less than three minutes.
7. The use of fire clay, rock dust, dirt and other deleterious materials is prohibited.

2.5 GROUT

- A. Grout shall conform to ASTM C476 and shall have a minimum strength of 3,000 psi at 28 days.
- B. Grout shall have proportions of 1 part Portland cement 0.10 parts hydrated lime and 3 parts sand by volume.
- C. Bond Beams: Lintels: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.
- D. Engineered Masonry: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.6 CEMENT

- A. Cement shall be Type 1 Portland cement conforming to ASTM C150. Plastic cement shall not be used.

2.7 LIME

- A. Hydrated lime shall conform to ASTM C207.

2.8 AGGREGATES

- A. All aggregate for mortar and grout shall be sharp, clean, and well graded and free of injurious amounts of dust, lumps, shale, alkali, surface coatings and organic matter.
- B. Aggregate for mortar shall conform to ASTM C144.
- C. Aggregate for grout shall conform to ASTM C404 Size No. 2.

2.9 WATER

- A. Water shall be free of deleterious quantities of acids, alkalis and organic materials and shall come from a domestic supply.

2.10 REINFORCING STEEL

- A. Steel reinforcement bars shall conform to the requirements of ASTM A706 Grade 60 Ksi, deformed and epoxy coated reinforcement bars, and the applicable requirements of Illinois Standard Specifications for Road and Bridge Construction.
- B. Reinforcement shall be clean and free from loose rust, scale, dirt, and any coatings that reduce bond.
- C. Mechanical splice anchors for reinforcing bars: submit product data and information for review.

2.11 HORIZONTAL JOINT REINFORCEMENT AND METAL ACCESSORIES

- A. Wire for joint reinforcement shall be truss type, with moisture drip, hot dip galvanized after fabrication, cold-drawn steel and shall conform to ASTM A82 and ASTM A153, Class B2. As a minimum, longitudinal wires shall be 3/16" side rods with gage cross ties.
- B. Manufacturer - Subject to compliance with requirements, provide horizontal joint reinforcement of one of the following, or an approved equal:
 - 1. A. A. Wire Products Co.
 - 2. "Dur-O-Wall" by Dayton Superior
 - 3. Blok-Lok, A Hohmann and Bernard Company
- C. Horizontal Joint Reinforcement and Metal Accessories shall be as follows:
 - 1. The width of the horizontal reinforcing shall be 2 inches less than the actual thickness of the wall or partition in which it is to be placed. Splicing of horizontal reinforcing, including corner and partition reinforcing, shall be done by providing a 8-inch overlapping of side rods.
 - 2. Corners shall be reinforced with Blok-Trus Corner-Lok, standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R. Intersection between walls and partitions shall be reinforced horizontally with Blok-Trus Partition-Lok, standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R, or equal, spaced at 16-inch centers vertically, in the same course as the wall reinforcing.
 - 3. Solid and hollow interior or exterior masonry walls shall be reinforced horizontally with Blok-Trus AA600, (AA610) Standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R or equal, spaced at 16-inch centers vertically.

2.12 FLASHING

- A. Rubberized asphalt sheet flashing with metal drip edge.
- B. Sheet Flashing:
 - 1. "Perm-A-Barrier VP" as manufactured by W. R. Grace & Co.
 - 2. "Dur-O-Barrier" as manufactured by Dayton Superior.
 - 3. A self-sealing, self-healing, fully adhered composite flexible, self-adhesive, cold applied sheet consisting of a minimum of 32 mils of rubberized asphalt bonded to an 8 mil high density cross laminated polyethylene film.
 - 4. Metal drip edge shall be 26 gauge 304 stainless steel sheet. Drip edge shall be minimum 2 ½ inches wide with 5/8 inch 135 degree drip and minimum ¼ inch hem along outside edge.
 - 5. Accessories: Primer, conditioner, adhesive, and mastic compatible with the sheet flashing as recommended by the sheet flashing manufacturer.

2.13 ACCESSORIES

- A. Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials per the following:

1. Cleaners for red and light colored brick not subject to metallic staining with mortar not subject to bleaching.
 - a. Sure Klean No. 600 Detergent; ProSoCo. Inc.
 - b. Approved equal.
 2. Cleaners for brick subject to metallic staining:
 - a. Sure Klean Vana Trol; ProSoCo. Inc.
 - b. 202V Vana-Stop; Diedrich Technologies, Inc.
 - c. Approved equal.
 3. Cleaners for glazed concrete masonry units
 - a. Cleaning solution as recommended by glazed block manufacturer. Submit cleaning solution and manufacturer's instructions and recommends for review.
- B. Cavity Drainage Material: 1 inch thick, free draining mesh; made from polyethylene, polypropelene, or other polymer strands and shaped to avoid being clogged by mortar droppings per the following:
1. Mortar Break; Advanced Building Products, Inc.
 2. Mortar Net; Mortar Net U.S.A. Ltd.
- C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 inch steel wire, hot-dip galvanized after fabrication.

2.14 DOVETAIL ANCHOR SLOTS AND ANCHORS

- A. 20 gauge galvanized dovetail foam filled anchor slots compatible with anchors.
- B. 16 gauge by 1 in. galvanized corrugated, dovetailed metal anchor straps.
- C. Zinc coated in accordance with ASTM A153, Class B2.

2.15 WEEPHOLE MATERIAL

- A. 1/4 in. dia. plastic or rubber tube.
- B. Cotton sash cord.

2.16 LIMESTONE SILL

- A. Furnish Indiana (oolitic) limestone complying with ASTM C568, Category II (medium density), and as follows.

- B. Minimum Compressive Strength: 4,000 psi (ASTM C170) and maximum absorption of 7.5% (ASTM C97).

PART 3 - EXECUTION

3.1 GENERAL

- A. Masonry work shall not be started when the horizontal and vertical alignment of the foundation is out of plumb or line.
- B. Masonry The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed before starting the masonry.
- C. All masonry shall be laid true, level and plumb in accordance with the Drawings.
- D. Proper masonry units shall be used to provide for all windows, doors, vents, bond beams, lintels, etc. as shown on the Drawings or otherwise required to provide a minimum of unit cutting.
- E. Where masonry unit cutting is necessary, all cuts shall be neat and true and made by a masonry saw. Openings for other trades shall be neatly patched.
- F. Unless otherwise indicated, the masonry units shall be laid in a running bond pattern. All bond patterns and special details shown on the drawings shall be accurately and uniformly executed.
- G. All masonry units shall be sound, free of cracks or other defects that would interfere with the proper placing of the unit or impair the strength of construction.
- H. The starting joint on foundations shall be laid with full mortar coverage on the bed joints, except that area where the grout occurs shall be free from mortar, so that the grout will be in contact with the foundation. The starter coarse shall be laid out dry to determine the extent to which they must be cut, or joint sizes varied, to accomplish accurate horizontal coursing.
- I. Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled joints. Unless otherwise indicated, both horizontal and vertical masonry joints shall be 3/8-inch nominal thickness.
- J. Unless otherwise indicated, all face joints shall be tooled to provide a concave joint. Tooling shall be done when the mortar is partially set and still sufficiently plastic to bond. The tooling shall be done in a matter to provide strength and weather resistance. Unless otherwise indicated all concrete block joints shall be tooled. Where tooled joints are not possible, the joints shall be troweled flush.
- K. Care shall be taken to prevent visible mortar and grout stains on all sides that will be exposed to view. In general, the walls shall be kept continually clean. Grout run over shall be cleaned immediately.

- L. All surfaces, including sills, ledges, finished concrete, etc., shall be protected from mortar droppings or other damage during construction.
- M. Horizontal reinforcing shall be laid on the webs of bond beam units.
- N. Wire reinforcement shall be completely embedded in mortar or grout. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire.
- O. Install horizontal joint reinforcement 16 inches o.c. Place joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening. Place joint reinforcement continuous in first joint below top of walls.
- P. As a minimum, wire reinforcement shall be lapped 8 inches at splices and shall contain at least one cross wire of each piece of reinforcement in the lap distance.
- Q. Reinforcement shall be in place before grouting starts. The grouting space shall be free from mortar droppings. All grout shall be puddled or vibrated in place.
- R. Grouting at beams over openings shall be done in one continuous operation.
- S. All cells containing reinforcement, anchor bolts, inserts, etc. shall be grouted solidly. Spaces around metal door frames and other built-in items shall be filled solidly with grout.
- T. Beams and other structural members shall be anchored to the wall with anchor bolts or their equivalent. Anchors shall be fully, solidly embedded in place. Embedment shall not be less than 2/3 of wall thickness unless otherwise noted. Bearing pads shall be furnished below beams to prevent spalling of the masonry, if required.
- U. Masonry shall not be erected when the ambient temperature is below 0 degrees C (32 degrees F) with a rising temperature, or below 4 degrees C (40 degrees F) with a falling temperature, or when there is a probability of such a condition existing within 48 hours, unless special provisions are made for heating the materials and protecting the work from freezing. Protection shall consist of heating and maintaining the temperature of the masonry materials at not less than 4 degrees C (40 degrees F) but not more than 71 degrees C (160 degrees F), and maintaining an air temperature above 4 degrees C (40 degrees F) on both sides of the masonry for not less than 72 hours. Work will not be permitted with or on frozen materials. Masonry work which has frozen before the mortar has set shall be removed and replaced. No brick or other units having a film of frost on their surfaces shall be laid in the walls.
- V. One section of the walls shall not be carried up in advance of the others, unless specifically approved. Heights of masonry shall be checked with an instrument at each floor, and at sills and heads of openings, to maintain the level of the walls. Partitions shall extend from the floor to the bottom of the floor or roof construction above, unless otherwise indicated.

Walls and partitions shall be structurally bonded or anchored to each other and to concrete walls, beams and columns. Non load-bearing partitions and interior walls shall be securely anchored to the construction above and in a manner that provides lateral stability.

- W. Unfinished work shall be stepped back for jointing with new work; toothing will not be permitted, except where specified. All loose mortar shall be removed and the exposed jointing thoroughly wetted for not less than 12 hours before laying new work.
- X. Surfaces of masonry not being worked on shall be properly protected at all times during the construction operation. When rain or snow is imminent and the work is discontinued, the tops of exposed masonry walls and similar surfaces shall be covered with a strong waterproof membrane, well secured in place.
- Y. Concrete masonry units shall be cut and fit for placement of monorail and support beam. Coordinate with other sections of work to provide correct size, shape, and location.

3.2 CAVITY WALL CONSTRUCTION

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep.
- B. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier sheet/adhesive.

3.3 CONCRETE MASONRY UNITS

- A. All concrete masonry units shall be true, plumb and built to the thickness and bond pattern indicated. Special units shall be furnished and used where indicated and as specified. Cutting of units shall be avoided insofar as possible. Cutting at the site shall be done with a power-driven carborundum saw. Units shall not be wetted prior to use.
- B. The first course of concrete masonry units shall be laid in a full bed of mortar for the full width of the unit. Bed joints of a concrete masonry unit shall be formed by applying the mortar to the entire top surfaces of the inner and outer face shells, and the head joints shall be formed by applying the mortar for a width of about 1 inch to the ends of the adjoining units laid previously. Mortar for joints shall be smooth, not furrowed, and of such thickness that it will be forced out of the joints as the units are being placed in position. Where anchors, bolts, reinforcing and ties occur within the cells of the units, such cells shall be filled with mortar or grout as the work progresses. Concrete brick shall be used for topping out walls under sloping slabs, distributing concentrated loads, backing brick headers, and elsewhere as indicated.
- C. Concrete masonry lintels shall be installed over openings where steel or precast concrete lintels are not scheduled. Place reinforcing bars 1 inch from bottom web. Use single piece reinforcing bars only; do not splice reinforcing bars. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position. Place and consolidate grout fill without displacing reinforcing. Grout minimum 2 courses solid (16 inches high) or higher as shown on Contract Drawings. Allow masonry lintels to attain specified strength before removing temporary supports. Refer to the following bond beam lintel schedule below:

1. Openings up to 42 inches wide: Place two (2) No. 5 bars 1 inch from bottom web.
2. Openings from 42 inches up to 78 inches wide: Place two (2) No. 5 bars 1 inch from bottom web.
3. Openings over 78 inches wide: Reinforce openings as detailed.

D. Grouted Components (general)

1. Reinforce bond beam (where required and as indicated on drawings) with two (2) No. 5 bars, placed continuous bottom reinforcement.
2. Reinforce other grouted components as shown and indicated on Contract Drawings.
3. Lap splices minimum 40 bar diameters.
4. Support and secure reinforcing bars from displacement. Maintain position within $\frac{1}{2}$ inch of dimensioned position.
5. Place and consolidate grout fill without displacing reinforcing.
6. At bearing locations, fill masonry cores with grout for a minimum 16 inches either side of opening.

E. Control Joints:

1. Do not continue horizontal joint reinforcement through control joints.
2. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
3. Size control joint in accordance with Section 7E for sealant performance.

4. Built-In Work

- a. As work progresses, build in steel frames at door openings, anchor bolts, embed bearing plates, lintels and other items furnished by other Sections.
- b. Build in items plumb and level.
- c. Bed anchors of steel frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- d. Do not build in organic materials subject to deterioration.

F. Tolerances

1. Maximum variation from unit to adjacent unit: $\frac{1}{32}$ inch.

2. Maximum variation from plane of wall: 1/4 inch in 10 feet, and 1/2 inch in 20 feet or more.
3. Maximum variation from plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
4. Maximum variation from level coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
5. Maximum variation of joint thickness: 1/8 inch in 3 feet.
6. Maximum variation from cross sectional thickness of walls: 1/4 inch.

G. Cutting and Fitting

1. Cut and fit for chases, pipes, conduit, sleeves and other components. Coordinate with other Sections of work to provide correct size, shape, and location.
2. Obtain Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 GLASS BLOCK

- A. Glass block including reinforcing, expansion strips, coatings, anchors and sealants shall be installed in accordance with the manufacturer's recommendations.
- B. Clean glass units of substances that may impair bond with mortar or sealant. Coat sill under units with asphalt emulsion as a bond breaker, and allow to dry. Set panel anchors in mortar bed directly over coating. Provide full mortar joints. Furrowing not permitted. Remove excess mortar. Maintain uniform joint width of 3/8 inch.
- C. Place panel reinforcement at every second horizontal joint in full mortar bed and at first course above and below openings within the glass unit panel. Discontinue reinforcement at expansion strips.

3.5 FLASHING

- A. Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing.
- B. Install in accordance with manufacturer's recommendations to provide continuous flashing system.
- C. Provide end dam at each end of flashing to funnel flow out of wall.
- D. Turn up sheet flashing a minimum of 8 inches and fully adhere to substrate.
- E. Fully adhere sheet flashing to top of metal drip edge and cut off sheet flashing 1/2 inch back from exterior face.

- F. In cold or wet weather when flashing will not fully adhere to substrate, provide termination bar mechanically anchored to substrate at top of flashing to secure flashing in place.

3.6 CLEAN-UP

- A. All surplus material and debris shall be removed from the job site when the masonry work is completed. Any items defaced from the masonry work shall be cleaned.
- B. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units where intended. Provide new units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- C. After mortar is thoroughly set and cured, remove large mortar particles by hand with wooden paddles and non-metallic scrape holes or chisels.
- D. Use bucket and brush hand cleaning method as described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale, except use detergent type masonry cleaner.

END OF SECTION 04 10 00

DIVISION 5 - METALS

SECTION 05 05 23 - BOLTS, ANCHOR BOLTS, CONCRETE ANCHORS, AND CONCRETE INSERTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and installing all bolts, anchors and inserts, anchor bolts, expansion anchors and concrete inserts for:
 - 1. Piping.
 - 2. Hangers and brackets.
 - 3. Equipment. Electrical, plumbing and HVAC work.
 - 4. Pump base.
 - 5. Miscellaneous fasteners.

1.2 RELATED SECTIONS

- A. Section 04 10 00 - Unit Masonry.
- B. Section 05 50 00 - Metal Fabrication.
- C. Section 33 40 10 – Interior Pipe and Appurtenances.

1.3 REFERENCES

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
- B. ACI 349 - Appendix B - Code Requirements for Nuclear Safety Related Concrete Structures.
- C. AISC - American Institute of Steel Construction, Structural Steel Detailing.
- D. ANSI B1.1 - Screw Threads, Coarse Thread Series.
- E. ANSI B18.2 - Square and Hex Bolts and Nuts.
- F. ASTM A36 - Structural Steel.
- G. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- H. ASTM A193 - Alloy-Steel & Stainless Steel Bolting Materials for High-Temperature Service.
- I. ASTM A194 - Carbon & Alloy Steel Nuts for Bolts for High Pressure & High Temp. Service.

- J. ASTM A242 - High Strength Low-Alloy Structural Steel.
- K. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- L. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum tensile Strength.
- M. ASTM A354 - Quenched & Tempered Alloy Steel Bolts, Studs & Other Externally Threaded Fasteners.
- N. ASTM A563 - Carbon and Alloy Steel Nuts.
- O. ASTM A588 - High Strength Low-Alloy Structural Steel With 50 KSI Minimum Yield Point.
- P. ASTM B98 - Copper Silicon Alloy Rods, Bars, and Shapes.
- Q. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

1.4 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. Representative samples of bolts, anchors and inserts as may be requested by the Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of Contractor.
- B. Shop Drawings: Submit for approval the following:
 - 1. Setting drawings and templates for location and installation of anchorage devices.
 - 2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.
- C. Contractor shall submit calculations stamped by a professional engineer.

1.5 QUALITY ASSURANCE

- A. Bolts, anchor bolts, expansion anchors and concrete inserts shall conform to applicable Section 01 01 00 – SUMMARY OF WORK, METALS, of the Standard Specifications.

1.6 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. All bolts, studs and nuts shall have American National form right-hand machine cut threads which shall be in conformity with the current ANSI B1.1, "Screw Threads", Coarse Thread Series, Class 2 Fit, unless otherwise specified.
- B. Bolt heads and nuts shall be semi-finished and shall be in conformity with ANSI B18.2, "Wrench-head Bolts and Nuts and Wrench Openings", Heavy Series, unless otherwise specified. Nut dimensions shall conform to ANSI Standard B18.2.2 for heavy hex nuts.
- C. Allowable tensile design stress for threaded fasteners shall not be greater than 0.33 times minimum tensile strength of threaded fastener on tensile stress area.
- D. Concrete Fasteners: When the size, length and load carrying capacity of concrete fasteners is not Specified or shown on the Drawings, provide the size, length and capacity required to satisfy all of the following. Concrete fasteners include anchor bolts, expansion anchors, or concrete inserts:
 - 1. Working load shall be a minimum of the design load times a safety factor of four, and shall be based on a concrete compressive strength not exceeding 3000 psi.
 - 2. Shall satisfy all requirements and recommendations of ACI 349, Appendix B.
 - 3. Shall satisfy all minimum recommendations and requirements of Manufacturer.
 - 4. Allowances for vibration are not included in the safety factor specified above.
- E. Determine design loads as follows:
 - 1. For equipment anchors, use the design load recommended by the manufacturer and approved by the Engineer.
 - 2. For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides. Load shall be increased where required to allow for thrust and temperature induced forces.
- F. Anchors and inserts shall be located and sized so as not to impair the integrity of the supporting structure.

2.2 MATERIALS

- A. Bolts and Anchor Bolts:
 - 1. Galvanized Steel Bolts and Nuts:

- a. Steel anchor bolts, studs, nuts and washers for interior installation shall be in conformity with the current ASTM Designation: A307 "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength", Grade B, A36 or approved equal. All steel bolts, studs, nuts and washers shall be hot-dip galvanized in conformance with Class C of ASTM A153. Nuts shall conform to requirements of ASTM A563, heavy hex style.
2. Stainless Steel Bolts and Nuts:
 - a. In buried, outdoor, high humidity or submerged locations, provide stainless steel bolts, nuts and washers. Stainless steel bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) 75 KSI Min. Tensile Strength), Class 1 and ASTM A194, Grade 8 (AISI 304), AISI 316 or approved equal.
 - b. For high strength applications, stainless steel bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) (Tensile Strength 100/125 KSI, Class 2 and ASTM A194, Grade 8 Strained Hardened (AISI 304) or approved equal.
 3. Bronze Bolts and Nuts:
 - a. Where shown on Drawings or specified under other Sections, bronze anchor bolts, flange bolts, studs, and nuts shall be in conformity with the current ASTM Designation B98, "Copper-Silicon Alloy Rods, Bars, and Shapes." made of Alloy B12, Hard. Bolts, studs, and nuts machined from bar stock shall be made of Alloy A7, Hard.
 4. Other types, if shown on drawings or specified under other Sections.

2.3 CONCRETE ANCHORS

A. Wedge Anchors:

1. Manufacturers:
 - a. Power-Stud by Powers Fasteners (Rawl).
 - b. Kwik Bolt II by Hilti Corp.
 - c. Liebig Wedge Anchor by Liebig.
 - d. Ankr-Tite Wedge Anchor by Ankr-Tite Fastening Systems.
 - e. Wedge-All by Simpson Strong-Tie Co., Inc.
2. Usage: In concrete:
 - a. 316 stainless steel.
 - b. Do not use when submerged or subjected to dynamic loads.

B. Expansion Anchors:

1. Manufacturers:

- a. Power-Bolt by Powers Fasteners (Rawl).
- b. HSL Heavy Duty Sleeve Anchor by Hilti Corp.
- c. Liebig Anchor by Liebig.

2. Usage: In concrete:

- a. 316 stainless steel.
- b. Do not use when submerged, in overhead applications, or subjected to dynamic loads.

C. Sleeve Anchors:

1. Manufacturers:

- a. Lok/Bolt by Powers Fasteners (Rawl).
- b. HLC Sleeve Anchor by Hilti Corp.
- c. Sleeve Anchors by Ankr-Tite Fastening Systems.
- d. Sleeve-All Anchor by Simpson Strong-Tie Co., Inc.

2. Usage: In masonry:

- a. 316 stainless steel.

D. Undercut Anchors:

1. Manufacturers:

- a. Maxi-Bolt by Drillco Devices Ltd.
- b. HDA Undercut Anchor by Hilti Corp.
- c. Liebig Ultraplus by Liebig.

2. Usage: In concrete, overhead applications, and for dynamic loads:

- a. 316 stainless steel.
- b. Do not use when submerged.

E. Adhesive Anchors:

1. Manufacturers:

- a. HIT RE 500 Epoxy Adhesive Anchor by Hilti Corp.
- b. AC100 Plus or Power-Fast + by Powers Fasteners (Rawl).
- c. Inject-Tite Two-Part Epoxy by Ankr-Tite Fastening Systems.
- d. ET, SET or ETF Epoxy Adhesive System by Simpson Strong-Tie Co., Inc.

2. Epoxy adhesive with 316 stainless steel stud assembly.

3. Usage:

- a. In concrete, submerged.
- b. In masonry, provide tube screen inserts.
- c. Do not use in overhead applications.

PART 3 - EXECUTION:

3.1 INSPECTION

- A. Examine conditions under which bolts, anchors, or inserts are to be installed, and notify Engineer in writing of unsatisfactory conditions existing.
- B. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to Engineer.

3.2 INSTALLATION OF EXPANSION ANCHORS AND UNDERCUT ANCHORS

- A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- B. Torque anchor as specified by manufacturer recommendation. Do not cut reinforcing bars.
- C. Provide embedded items for placement in concrete form work and assure that embedded items are protected from damage and are not filled in with concrete.
- D. Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller.
- E. Expansion anchors shall not be used for larger pipe or supporting vibrating equipment unless otherwise shown or approved by the Engineer.
- F. Unless otherwise shown, anchor design shall be in accordance with ACI 349, Appendix B and approved by Engineer, and in no case shall be less than:
 - 1. Embedment depth in concrete: 8 diameters.
 - 2. Anchor spacing on centers: 10 diameters.
 - 3. Distance to edge of concrete: 1.5 embedment.
 - 4. Distance to edge of concrete where anchor is loaded in direction of edge: 2.5 embedment.
- G. Undercut Anchors shall be installed in accordance with manufacturer's instructions.

3.3 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

END OF SECTION 05 05 23

DIVISION 5 - METALS

SECTION 05 10 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Traveling bridge crane beams.

1.2 RELATED WORK

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 09 91 00 - Painting.
- C. Section 41 22 23 – Hoist Equipment.

1.3 REFERENCES

All reference standards shall be from the latest edition.

- A. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. ASTM A36 - Structural Steel.
- C. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- E. ASTM A 992 – Structural Steel Shapes
- F. AWS A2.0 - Standard Welding Symbols.
- G. AWS D1.1 - Structural Welding Code.
- H. SSPC - Steel Structures Painting Council.

1.4 DESIGN REQUIREMENTS

- A. Where final design of members and connections for any portion of the structure is not indicated, perform final design of such members and connections in accordance with AISC Specification and as Specified herein, at no additional cost.
- B. Members and connections shall be designed by a structural engineer registered in the State of Illinois.

- C. Unless otherwise indicated, design connections in accordance with American Institute of Steel Construction "Manual of Steel Construction, Latest Edition".

1.5 SUBMITTALS

A. Shop Drawings

1. Indicate profiles, sizes, and locations of structural members, attachments and fasteners.
2. Indicate welded connections with AWS A2.0 welding symbols.
3. Indicate net weld lengths and size.
4. Review of shop drawings in no way affects the Contractor's responsibility for carrying out the Work to Contract Drawings and specifications.
5. Shop drawings shall be approved prior to fabrication.

- B. Manufacturer's Mill Certificate: Submit under provisions of Division 1 certifying that products meet or exceed specified requirements.

- C. Welders' Certificates: Submit under provisions of Division 1 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months in the position in which they will be carrying out the welding.

- D. Substitutions of sections or modifications of details and the reasons for these changes shall be submitted by letter with shop drawings for review by the Engineer. Changes in related portions of the Work shall be coordinated by the Contractor.

1.6 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.7 BASIS OF PAYMENT

- A. The work specified under this Section and as required shall be paid for at the Contract lump sum price for BRIDGE CRANE, which price shall be payment in full for all labor, materials, tools, equipment and incidentals required to complete this Item.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: ASTM A36 or A 992.
- B. Bolts, Nuts, and Washers: ASTM A325.
- C. Welding Materials: AWS D1.1; type required for materials being welded.

D. Materials shall meet the requirements of the Standard Specifications, Section 505.

2.2 FABRICATION

- A. Fabricate all members as indicated on Drawings and as outlined in AISC.
- B. Perform welding in accordance with AWS D1.1.
- C. Fabricating tolerances for finished parts shall comply with AISC Code of Standard Practice.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.
- B. Hot-dip galvanized conforming to ASTM A123 and AHDGA Specifications.
- C. Galvanizing repair paint: High zinc-dust content paint complying with MIL-P-21035.

2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Testing and analysis of components will be performed under provisions of Division 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 ERECTION

- A. Erect structural steel in compliance with AISC Code of Standard Practice and Specification.
- B. Do not field cut or alter structural members without approval of Engineer.

3.3 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 1.

END OF SECTION 05 10 00

DIVISION 5 - METALS

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide miscellaneous metal work shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
 - 1. Lintels.
 - 2. Metal frames.
 - 3. Attic access hatch.
 - 4. Miscellaneous items.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 04 10 00 - Unit Masonry.
- C. Section 05 05 23 - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts.
- D. Section 09 91 00 - Painting.

1.3 REFERENCES

All reference standards shall be the latest edition.

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A276, Type 316L - Stainless Steel.
- F. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K. ASTM A992 – Structural Steel Shapes.

- L. AWS A2.0 - Standard Welding Symbols.
- M. AWS D1.1 - Structural Welding Code.
- N. AISI - Standard for Stainless Steel.
- O. SSPC - Steel Structures Painting Council.
- P. ANSI A14.3: Safety requirements for fixed ladders.
- Q. Specifications for Aluminum Structures, The Aluminum Association.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- B. Submit Product Data.
- C. Shop drawings shall be approved prior to fabrication.
- D. Indicate all revisions on resubmissions.

1.5 QUALITY ASSURANCE

- A. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society (AWS).
- B. Conform to AISC and AA standards.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings and in accordance with manufacturers' recommendations.

1.7 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, and roughness.
- B. Comply with following standards, as pertinent.

1. Steel plates and shapes: ASTM A36 or A992.
2. Square or rectangular tubing: ASTM A500, Grade B.
3. Round tubing or pipe: ASTM A53, Type E or S, Grade B.
4. Stainless Steel:
 - a. Exterior and submerged uses: AISI, Type 316.
 - b. Interior uses: AISI, Type 304 or Type 316.
5. Aluminum shapes and plates: Alloy 6061-T6 or 6063-T6.
6. Floor Plate: Stainless steel grate.
7. Connection Bolts:
 - a. For steel members: ASTM A325.
 - b. For aluminum members: Stainless steel.
8. Cast-in-place Anchor Bolts:
 - a. 1/2 in. min dia.
 - b. Nonsubmerged: ASTM A307, galvanized.
 - c. Submerged: Stainless steel.
9. Malleable Iron: ASTM A47.
 - a. Cast Iron: ASTM A48, Class 35B.
 - b. Ductile Iron: ASTM A536, Grade 65-45-12.
 - c. Cast Aluminum: ASTM B26.

2.2 FABRICATION

- A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
- B. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
- C. Fabricate with accurate angles and surfaces which are true to the required lines and levels, with projecting corners clipped, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.
- D. Weld shop connections and bolt or weld field connections.
- E. Use AISC standard 2-angle web connections or single plate framing connections capable of supporting min of 50% of total uniform load capacity of member.
- F. Connections shall consist of min two 3/4 in. dia bolts or welds developing min of 10,000 lbs capacity.

G. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item. Conform to Section 9A.

1. Do not coat ferrous metal surfaces embedded in concrete.
2. Coating of cast iron or ductile iron floor access hatches and pressure relief valves not required.
3. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer.
4. Change color of second coat to distinguish it from the first.
5. Coat aluminum surfaces in contact with concrete with bituminous coating.
6. Under no circumstances shall aluminum contact dissimilar metal.

H. Galvanizing - Galvanize after fabrication.

1. Galvanize by hot-dip process conforming to ASTM A123 and AHDGA specifications.

2.3 FINISHES

A. Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.

B. Shop prime structural steel members except members to be galvanized. Do not prime surfaces that will be field welded, contact surface for friction bolts, welded studs, deformed bar anchors and steel encased in concrete.

C. Zinc used for hot-dip galvanizing coating shall conform to the Standard Specifications for Slab Zinc (Spelter) ASTM Designation B6 and shall be at least equal to the grade designated as "Prime Western". Thickness of coatings shall conform to ASTM Specifications A123, A153, and A385, as applicable for items coated.

D. Quality of galvanizing shall be rigidly controlled and it shall be understood that any defects as mentioned below shall be just grounds for rejection.

E. Galvanized steel shall have no bare spots unless small and suitable for patching, pimples showing excessive contamination, flux, ash inclusions, or blisters.

F. Where cutting existing galvanized metal work or attaching to existing galvanized metal work, such as by welding, the connection or bore edges shall be cold galvanized.

G. Structural and miscellaneous metal Work shall be galvanized when located on the exterior and on the interior where so indicated and/or specified.

H. Prime paint items in accordance with finish coat requirements.

I. Repair all damage to field-primed surfaces.

2.4 LINTELS

- A. Provide steel lintels over openings in masonry walls as noted and wherever reinforced masonry or concrete lintels are not provided.
- B. Fabricate lintels from structural steel shapes as detailed, selected for straightness of section, with minimum of 8 in bearing each side of opening.
- C. Openings 4 ft and less in width without lintel scheduled shall have double steel angle lintels or reinforced masonry lintels. Total width of horizontal legs shall be 1 in. less than nominal thickness of wall. Weld angles together. Masonry lintels shall conform to requirements of Section 4A.
- D. Hot-dip galvanize after fabrication.

2.5 METAL FRAMES

- A. Provide door, hatch, grille, louver, and other frames fabricated from structural shapes or plates.
- B. Select sections for trueness of web and flange. Straighten members so finished frames are uniform, square, and true throughout length and depth of assembled units.
- C. Miter or cope and join members with continuous welds.
- D. Provide temporary spreader bars to prevent springing frames out of shape prior to and during erection.

2.6 SAFETY GRATE

- A. Where noted on Drawings provide retractable safety grate across access hatch openings.
- B. Metal Grating Type:
 - 1. Halliday Retro-Grate.
 - 2. Aluminum construction with safety orange powder coat.
 - 3. Spring loaded lifting handle.
 - 4. Stainless steel hold open arm with aluminum latch.
 - 5. Stainless steel hardware throughout.
 - 6. Load rated at 300 psf.

2.7 ATTIC ACCESS HATCHES

- A. Prefabricated Single Leaf Access Door Type K:
 - 1. Manufacturers: Bilco Type K.
 - 2. Provide access hatches with integral curbs where noted.
 - 3. Door leaf shall be 1/4" aluminum plate with neatly welded 3 in. beaded flange.

4. Extruded aluminum frame.
5. ¼" aluminum diamond plate cover.
6. Torsion/cam operating mechanism
7. Standard slam lock
8. Automatic hold open arm with red vinyl grip.
9. 1/8" x 1" steel anchor strap
10. Continuous neoprene cushion.
11. Steel Cast hinges
12. Lock strike
13. Factory finish on aluminum surfaces shall be mill finish with Thnemec coating applied to surfaces in contact with concrete. (See section 09 91 00)
14. Manufacturer shall warranty in writing against defects in material and workmanship for 5 yrs.

2.8 MISCELLANEOUS ITEMS

- A. Fabricate miscellaneous framing, supports, and items of structural shapes, plates, bars, and tubing of sizes and arrangements indicated and as required.

2.9 ALUMINUM FLOOR ACCESS DOOR

- B. The angle frame floor access door shall be Model APS150 as manufactured by U.S.F. Fabrication, Inc. with the size being specified on the plans.
- C. Cover: 3/16-inch (4.8mm) aluminum diamond plate cover reinforced for 150 psf (733 kg/m²) live load. Equipped with cast aluminum flush lifting handle and 316 stainless steel hold-open arm with red vinyl grip that automatically keeps the cover in its open/upright position.
- D. Frame: Extruded aluminum with integral anchor flange and door seat on all four sides.
- E. Hardware: 316 stainless steel hinges and tamper resistant bolts/lock nuts.
- F. Security: Aluminum staple protrudes through cover for user supplied padlock.

- G. Finish: Aluminum cover and frame have mill finish which is protected during shipping and installation by an attached adhesive-backed vinyl material with bituminous Tnemec coating applied to surfaces in contact with concrete. (See section 09 91 00)
- H. Warranty: Manufacturer shall guarantee against defects in materials and workmanship for a period of ten years.

PART 3 - EXECUTION:

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Preparation
 - 1. Clean and strip primed steel items to bare metal where site welding is required.
 - 2. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1.
- D. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- E. Perform cutting, drilling and fitting required for installation of metal fabrications. Set the work accurately. Provide temporary bracing and anchors in formwork for items to be built into masonry or concrete. Field weld joints not shop welded because of size limitations. Grind welds smooth and touch-up shop paint coat. Do not weld, cut or abrade surfaces that have been galvanized.
- F. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- G. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- H. Protect aluminum in contact with dissimilar material with asphalt paint to provide 2 mil dry thickness. Paint miscellaneous metal work which is to be in contact with but not fully embedded in concrete or masonry with a heavy coat of asphalt paint. Coating shall not extend onto surfaces which will be exposed.

- I. Install hatches and manufactured items in accordance with manufacturer's instruction.
- J. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- K. Touch up damaged galvanizing with cold galvanizing compound as produced by Rust-Oleum Corp. or ZRC Chemical Company, Quincy, Mass.

END OF SECTION 05 50 00

DIVISION 5 - METALS

SECTION 05 50 20 – METAL BAR RACK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall provide all labor, materials, equipment, and services required to furnish, install, and place in satisfactory operation the metal bar rack and all appurtenances as shown on the Plans, as specified herein or as required for a complete installation.
- B. The Contractor shall provide a rake for use with the metal bar rack and any accessories required for wall mounting the rake at a location within the pump station as directed by the Engineer or Owner.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Section 05 05 23: Bolts, Anchor Bolts, Concrete Anchors, Concrete Inserts
- C. Section 05 50 00: Metal Fabrications
- D. Section 09 91 00: Painting

1.3 REFERENCES

- A. Aluminum products shall conform to the latest editions of the following:
 - 1. ASTM B26 – Standard Specification for Aluminum-Alloy Sand Castings.
 - 2. ASTM B108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings.
 - 3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM B308 – Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
7. Aluminum Association, Inc. – AA SAS-30, “Specifications for Aluminum Structures.”

1.4 QUALITY CONTROL

- A. The bar rack and appurtenances shall be furnished by an established and reputable fabricator with five (5) years of experience with similar type fabrications.

1.5 SUBMITTALS

- A. The Contractor shall prepare and submit for approval the drawings and details of the bar rack and miscellaneous appurtenances that demonstrates the following items:
 1. Product data and detailed assembly drawings with dimensions and anchors.
 2. Certified drawings indicating materials of construction, including the material thickness of all structural components.
 3. Mill certificates and signed statements from fabricators certifying alloys from which work is fabricated with delivery of material and equipment.
 4. Coatings or other protection against corrosion.
 5. Design load calculations.
- B. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.6 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials

1. Bar rack shall be of aluminum alloy construction unless otherwise noted. The bar rack shall be fabricated into a single unit. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit.
2. Nuts, bolts, fasteners, and other appurtenant items shall be type 304 stainless steel.

B. Design and Performance

1. Width of clear opening between bars: 1-1/2"
2. Bar size: 3/8" width x 3" depth
3. Channel width: 5'-0"
4. Channel bottom to operating floor height: 9'-0"
5. Angle of installation (from horizontal): 60 degrees

C. The bar rack shall be anchored directly to the concrete channel, spanning the full width and depth of the channel.

D. Reinforce the bar rack to meet all anticipated loads, including the maximum head differential possible in the channel.

E. Rake

1. The rake head and teeth shall be constructed of 1/8" thick type 304 stainless steel plate with tooth penetration of at least 2 inches. Rake teeth shall mesh with bar spacing of rack with an 18" wide head. Provide aluminum or fiberglass handle of a length equal to the inclined length of rack plus 4.5 feet. Handles shall be telescoping and collapse to approximately one half the fully extended handle length.
2. Provide clips and any required accessories for hanging the rake on the wall.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The frame of metal structures shall be installed true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing shall be left in place as long as may be necessary for safety.
- B. Install suitable hangers on the wall, where directed, for supporting bar rack rake.

3.2 PAINTING

- A. Field painting shall be in accordance with the requirements specified under Section 09 91 00, Painting.
- B. All aluminum, stainless steel, and other metal surfaces in contact with dissimilar metals shall be painted to prevent contact between dissimilar metals. Aluminum in contact with concrete shall be coated to prevent direct metal contact to concrete.

END OF SECTION 05 50 20

DIVISION 6 - CARPENTRY

SECTION 06 61 00 - ROUGH CARPENTRY

PART 13 - GENERAL:

13.1 SECTION INCLUDES

- A. Roof Rafters and Plates
- B. Wood nailers.
- C. Blocking at roof system.
- D. Other miscellaneous wood blocking as required or as noted.
- E. Shoring and temporary protection.

13.2 RELATED SECTIONS

- A. Section 07 41 13 – Preformed Metal Standing Seam Roofing.

13.3 REFERENCES

- A. ASTM A525 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-dip Process.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. Federal Specifications (FS):
 - 1. FF-B-575C - Bolts, Hexagon and Square.
 - 2. FF-N-105B - Nails, Brads, Staples, and Spikes.
 - 3. FF-N-836D - Nut, Square, Hexagon, Cap, Slotted, Castle. Knurled, Welding, and Single Ball Seat.
 - 4. FF-S-111D - Screw, Wood.

13.4 QUALITY ASSURANCE

- A. Grading Rules:
 - 1. Lumber Grading Rules and wood species shall conform with Voluntary Product Standard PS20. Grading rules of the following associations shall also apply to materials produced under their supervision.
 - a. Northeastern Lumber Manufacturers Association, Inc. (NELMA).
 - b. Southern Pine Inspection Bureau (SPIB).

- c. West Coast Lumber Inspection Bureau (WCLIB).
- d. Western Wood Products Association ((WWPA).
- e. Redwood Inspection Service (RIS).

B. Grade Marks: Identify all lumber by official grade mark.

- 1. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacture.
 - a. S-Dry: Maximum 19 percent moisture content.
 - b. MC-5 or KD: Maximum 15 percent moisture content.
 - c. Dense.

13.5 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Rough Carpentry: Submit certification that lumber and connection material conforms to specified minimum grade.

13.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1 and in accordance with the manufacturer's instructions.

13.7 BASIS OF PAYMENT

- A. Payment for work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 14 - MATERIALS

14.1 BLOCKING, NAILING, ETC.

- A. Shall be construction grade douglas fir, hem-fir, or No.1 common southern pine.

14.2 FASTENERS FOR WOOD NAILERS FOR ROOFING,

- A. Shall be not less than 4.76 mm (3/16-inch) diameter stainless steel, zinc coated steel, or equivalent zinc-coated wire anchors, spaced 24 inches on center.

14.3 PRESSURE TREATMENT OF WOOD

- A. Shall comply with applicable requirements of AWPA C1, C2, and C9. Preservative shall be CA-B (Copper Azole Type B) minimum retention of 0.25. After treatment, kiln-dry lumber to maximum moisture content of 19%.

2.4 BLOCKING, NAILERS AND OTHER ITEMS,

- A. Whether or not covered by other materials, shall be pressure treated.

2.5 WOOD FRAMING MEMBERS & DIMENSIONAL LUMBER IN CONNECTION WITH ROOFING AND FLASHING

- A. Shall be pressure treated.

2.6 LUMBER FOR TEMPORARY PROTECTION

- A. Shall be southern yellow pine and an exterior type, Grade C, plugged fir plywood.

2.7 ANCHORS, CONNECTORS, AND FASTENINGS, NOT INDICATED OR SPECIFIED OTHERWISE,

- A. Shall be of the type, size, and spacing necessary to suit the conditions encountered and as recommended by the National Lumber Manufacturer's Association. Sizes, types, and spacing of nails, screws, or bolts for installation of manufactured building materials, shall be as recommended by the product manufacturer unless indicated or specified otherwise; bolts, nuts, washers, and all other rough hardware embedded in, or in contact with, exterior walls of masonry shall be zinc-coated, except as specified otherwise. Rough hardware shall be formed and punched before coating.

PART 3 - EXECUTION

3.1 MEMBERS

- A. Shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Provide blocking where indicated and as necessary to secure the work.

3.2 ALL FIELD-CUT EDGES AND SURFACES OF TREATED LUMBER

- A. Shall be liberally coated with a concentrated solution of preservative.

3.3 DELIVERY AND STORAGE

- A. Protect lumber against dampness before and after delivery. Store under cover in a well-ventilated area and where not exposed to extreme changes in temperature or humidity until used.

END OF SECTION 06 10 00

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

SECTION 06 60 00 - FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Design, fabrication and Furnishing all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) products as specified herein.
 - 1. Handrails.
 - 2. Ladder.
 - 3. Stairs.

1.2 QUALITY ASSURANCE

- A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.
- B. Substitution of any component or modification of system shall be made only when approved by the Engineer.
- C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- E. Provide a written certification that the products have been installed in accordance with the requirements under this Section.
- F. The installing contractor shall be approved by the FRP manufacturer.

1.3 DESIGN CRITERIA

- B. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

1.4 SUBMITTALS

- A. Shop drawings of all FRP structural members, handrails, plate, ladders, stairs and appurtenances shall be submitted to the Engineer for review.
- B. Manufacturer's catalog data showing:
 - 1. Dimensions, spacings, and construction.
 - 2. Materials of construction.

3. Chemical resistance table.

C. Detailed shop drawings showing:

1. Dimensions.
2. Sectional assembly.
3. Location and identification mark.
4. Size and type of supporting frames required.

1.5 SHIPPING AND STORAGE INSTRUCTIONS

- A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting and installation.
- B. Items shall be covered and protected from exposure to sun or ultra violet light during storage.
- C. All materials and equipment necessary for the fabrication and installation of the plate, handrails, and structural shapes shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun.
- D. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.
- E. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

1.6 BASIS OF PAYMENT

- A. Specialties shall be paid for as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for work described herein.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials used in the manufacture of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.
- B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.
 1. Resins shall be VINYL ESTER resin for ladders and other members that may be submerged in the wet well or discharge chamber and in continuous contact with water.

2. Resins for members for exterior or dry service shall be either polyester or vinyl ester resin.
- C. After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.
 - D. All exposed surfaces shall be smooth and true to form.
 - E. FRP Manufacturers:
 1. Strongwell-Chatfield Division, Chatfield, MN.
 2. Composite Structures International, Inc.
 3. Bedford Plastics, Inc.
 4. Augusta Fiberglass.
 5. Ultra, Inc.
 6. Or approved alternative manufacturer.

2.2 HANDRAIL / Guardrail

- A. All handrail / guardrail systems shall be compliant to OSHA 1910.23
- B. All posts, and rails are to be FRP structural shapes manufactured by the pultrusion process. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the Contract Documents.
- C. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
- D. Resins shall be a fire-retardant isophthalic polyester resin with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.
- E. Posts, top and mid rails are to be 2"x2"x0.25" wall square tube and kickplate is to be ½" x 4" with two reinforcing ribs. The bases of the posts are to be reinforced to a height of 10" using a high strength epoxy compound.
- F. The handrail post/rail connection is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or splices. The mid rail is to be installed through the post at a prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into a machined, u-shaped pocket formed into top of the post such that the rail is located at the center of the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 5'-0".
- G. All rails, posts, and kick plates are to be integrally pigmented yellow.
- H. All fasteners and rivets shall be SAE 304 stainless steel, conforming to ASTM A593 304 Condition A.

2.3 LADDER

- A. Ladder rails shall be 2"x2"x0.25" square tube. Ladder rungs shall be 1" diameter with non-skid surface.
- B. Ladder support brackets are to be installed at a maximum of 4'-0" on center. All hardware is to be 316 Stainless steel.
- C. Ladders are to be integrally pigmented yellow.
- D. Where noted on Drawings provide Bilco LadderUP model LU-3 retractable safety post extension at top of ladder.

2.4 STAIR

- A. Construct stairs and platforms of frp channel stringers and framing members with a fire retardant isophthalic polyester resin to support uniform live load of 100 psf or a moving concentrated load of 1000 lbs, whichever produces the greatest stress.
- B. Exposed ends of stringers with plates, continuously welded to main member.
- C. Grating and Treads.
 - 1. Provide shop-fabricated grating and accessories such as frames, support angles, and fasteners.
 - 2. Grating and treads shall be of integrally pigmented frp.
 - 3. Treads and exposed edges of grating platforms shall have 1 1/2" deep molded or pultruded frp with non-skid abrasive grit surface and wide nosings.
 - 4. Provide fastening devices to firmly anchor grating and treads to supports.
 - a. Min of 4 per panel.
 - b. Saddle clip type.
 - c. "G" clip type.
 - d. Clamp type.
 - e. Min 1/2 in. bolts or self tapping screws.
 - f. 316 stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

- B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSPECTION AND TESTING

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.
- C. Members and components shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

3.3 INSTALLATION, GENERAL

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
- B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.
- C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.
- D. At all unsupported cutouts, install hold downs at uncut bearing bars beyond cutout area and install support bars from hold down to hold down. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products
- E. Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION 06 60 00

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 07 92 00 – Joint Sealers

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Modified bituminous sheet waterproofing.
 - 2. Protection Course.
 - 3. Insulation.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 12-by-12-inch square of insulation.
 - 3. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is approved by the waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials, protection course, through one source from a single manufacturer.
- C. Mockups: Before beginning installation, install waterproofing to 100 sq. ft. of to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality.
 - 1. If Architect determines mockups do not comply with requirements, reapply waterproofing and reinstall until mockups are approved.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
 - 2. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 2. Warranty Period: Five years from date of Substantial Completion.
 3. Warranty includes removing and reinstalling protection board.

1.8 BASIS OF PAYMENT

- A. The work specified under this Section shall be paid for at the contract unit price per square yard for SHEET WATERPROOFING MEMBRANE SYSTEM, which price shall be considered as payment in full for this item.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Not less than 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; VM 75.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - c. CETCO Building Materials Group; Envirosheet.
 - d. Grace, W. R. & Co.; Bituthene 4000.
 - e. Henry Company; Blueskin WP 200.
 - f. Meadows, W. R., Inc.; SealTight Mel-Rol.
 - g. Nervastral, Inc.; BITU-MEM.
 - h. Pecora Corporation; Duramem 700-SM.
 - i. Polyguard Products; Polyguard 650.
 - j. Progress Unlimited, Inc.; Plastiwrap 60.
 - k. Tamko Roofing Products, Inc.; TW-60.
 3. Physical Properties:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.

- c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
- d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
- e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
- f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
- g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
- h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 - 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
 - 2. Detail Strips: 62.5-mil thick, felt-reinforced self-adhesive strip, 9 inches wide, with release film on adhesive side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch centers.
- I. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced one side with plastic film, nominal thickness 1/4 inch, with compressive strength of not less than 8 psi per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

J. Insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, and sound; and ready to receive adhesive-coated HDPE sheet.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch for modified bituminous deck paving waterproofing.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.

- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

3.4 PROTECTION AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed Modified Bituminous Sheet Waterproofing, Protection Course and Insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
SECTION 07 20 00 - BOARD INSULATION

PART 4 - GENERAL

4.1 SECTION INCLUDES

- A. Cavity Wall: 2" thick board insulation for cavity wall.
- B. Foundation Wall: 2" thick board insulation for foundation wall to 4'-6" below grade.

4.2 RELATED SECTION

- A. Division 03 30 00 – Cast-in Place Concrete.
- B. Section 04 10 00 - Unit Masonry System.

4.3 REFERENCES

- A. ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions.
- B. ASTM C591 – UnFaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- C. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM C1621 - Compressive Properties of Rigid CellularPlastics.
- E. ASTM D1622 - Apparent Density of Rigid Cellular Plastics.
- F. ASTM D2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- G. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

1.4 SYSTEM DESCRIPTION

- A. Materials of this Section shall provide a continuous thermal barrier at building enclosure elements.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1, Section 01 01 00, Summary of Work.
- B. Product Data: Provide data on product characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Division 1 and in accordance with the manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.8 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for PUMP STATION GENERAL WORK.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. The Apache Products Company: Polyisocyanurate Insulation
- B. Celotex Corporation
- C. Johns Manville Corporation
- D. Substitutions: Under provisions of Division 1.

2.2 INSULATION MATERIALS

- A. Polyisocyanurate Insulation: ASTM C591 rigid, cellular type, conforming to the following:
 - 1. Thermal Resistance: R-value of 6 per inch.
 - 2. Compressive Strength: 20 psi minimum per ASTM D1621.
 - 3. Water Absorption: In accordance with ASTM C2842, less than 1.5 percent by volume maximum.

4. Board Edges: Square
5. Board Thickness: 2" min. thickness for walls and foundations. Foundation walls to 4'-6" below grade minimum for frost protection.
6. Board Density: (2.0 lbs/cu. ft.)

2.3 ADHESIVE MATERIALS

- A. Adhesive: Type recommended by insulation manufacturer for application.

2.4 ACCESSORIES

- A. A 1/2" or 5/8" fiber board for protection of rigid insulation surfaces.
- B. Nails or Staples: Steel wire; galvanized; type and size to suit application.
- C. Insulation Fasteners: Impale clip type of galvanized steel; of type to be mechanically fastened to surface to receive rigid insulation; length to suit insulation thickness; capable of securely and rigidly fastening insulation in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.
- B. Verify substrate surface is flat, free of honeycomb, fins, irregularities and materials that may impede adhesive bond.
- C. Verify insulation boards are unbroken, free of damage.

3.2 INSTALLATION – MASONRY CAVITY WALLS AND FOUNDATION WALLS

- A. Secure impale fasteners to substrate at a frequency of 6 per insulation board.
- B. Adhere a 6 inch wide strip of polyethylene sheet over control and expansion joint with double beads of adhesive each side of joints. Tape seal joints between sheets. Extend sheet full height of joint.
- C. Apply adhesive in three continuous beads per board length to full bed 1/8 inch thick on substrate. Daub adhesive tight to protrusions to ensure continuity of vapor and air barrier.
- D. Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent boards and no protrusions. Place impale fastener locking discs.

- E. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.
- F. In masonry cavity walls, coordinate placement of rigid insulation boards with installation of masonry wire reinforcing, brick ties, flashing and other masonry and insulation accessories, and in accordance with manufacturer's instructions.
- G. Cut and fit insulation tight to cavity wall protrusions and interruptions to the insulation plane.

3.3 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Division 1.
- B. Do not permit work to be damaged prior to covering insulation.

END OF SECTION 07 20 00

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 41 13 - PREFORMED METAL STANDING SEAM ROOFING

PART 5 - GENERAL

1.1 SECTION INCLUDES

- A. This section covers the pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
- B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

- 1. Section 07 62 00 - Flashing and Sheet Metal

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Process
 - 2. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process
 - 3. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate
 - 4. ASTM B370 Standard Specification for Copper Sheet and Strip for Building Construction
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - 1. SMACNA Architectural Sheet Metal Manual, 1993 edition
- C. American Iron and Steel Institute (AISI)
 - 1. AISI Cold Formed Steel Design Manual
- D. Aluminum Association
 - 1. Aluminum Design Manual
- E. Metal Construction Association
 - 1. Preformed metal Wall Guidelines

1.4 QUALITY ASSURANCE

- A. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.

- B. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.5 SUBSTITUTIONS

- A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution or equal.

1.6 SYSTEM DESCRIPTION

- A. Material to comply with:
 - 1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.7 ROOF SYSTEM PERFORMANCE TESTING

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
- B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.
- C. Panels to meet:
 - 1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
 - 2. UL 2218 - Impact Resistance rated.

1.8 WARRANTIES

- A. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
- B. Exposed Panels Finish - deterioration includes the following:
 - 1. Color fading more than 5 hunter units when tested according to ASTM D 2244
 - 2. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214
 - 3. Cracking, checking, peeling or failure of a paint to adhere to a bare metal.
- C. Warranty Period: 40 Years from the date of substantial completion

- D. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

1.9 SUBMITTALS

- A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
- B. Provide finish samples of all colors specified.
- C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels or metal soffit panels, details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
- D. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved:
 - 1. Roof panels and attachments
 - 2. Metal trusses, bracings and supports
 - 3. Roof-mounted items including snow guards and items mounted on roof curbs.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.
- B. Deliver components, sheets, metal roof panels and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
- C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.
- D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting or other surface damage.
- E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.11 PROJECT CONDITIONS

- A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.12 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoining work to provide a leakproof, secure and noncorrosive installation.

1.13 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 PANEL DESIGN

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.
- B. Roof panels shall be Snap On Standing Seam in 12" widths with 1" high seams.
 - 1. Curving Option: Roof panels may be "field-curved/radiused" with the Factory-Supplied Curving Machine to achieve the proper installation of these panels on the radiused/curved roofs on this project
- C. Panels to be produced Smooth - Factory Standard.
- D. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.

2.2 MATERIALS AND FINISHES

- A. Preformed roofing panels shall be fabricated of .032 Aluminum
- B. Color shall be *Standard Manufacturer Finish

- C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
- D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
- E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
- F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
- G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.
- H. Substrate shall be $\frac{3}{4}$ " Pressure Treated Plywood
- I. Roofing Underlayment
 - 1. On all surfaces to be covered with roofing material, furnish and install a 40 mil "Peel & Stick membrane", required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
 - a. W.R Grace "Ice & water Shield"
 - b. Cetco Strongseal
 - c. Carlisle CCW WIP 300HT
 - d. Interwrap Titanium PSU
 - e. MFM Corp "Wind & Water Shield"
 - f. Polyguard Deck Guard HT or Polyglas HT
 - g. Tamko TW Tile and Metal Underlayment
 - 2. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6", and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
 - 3. Ice and Water Shield shall lap all hips and ridges at least 12" to form double thickness and shall be lapped 6" over the metal of any valley or built-in gutters and shall be installed as required by the Standing Seam Panel Manufacturer to attain the desired 40 Year Weathertightness Warranty.

J. Sealants

1. Exterior grade silicone sealant recommended by roofing manufacturer

2.3 FABRICATION

- A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
- B. Fabricate components of the system in factory, ready for field assembly.
- C. Fabricate components and assemble units to comply with fire performance requirements specified.
- D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
- B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

- A. Secure units to supports
- B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

- A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
- B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
- C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

- A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION 07 41 13

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 6 - GENERAL

6.1 SECTION INCLUDES

- A. Sill, lintel, base, through wall and cap flashings.
- B. Counter flashing.
- C. Fascias.
- D. Scuppers, downspouts, and accessories.

6.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 04 10 00 – Unit Masonry.
- C. Section 05 50 00 - Metal Fabrications.
- D. Section 06 10 00 – Rough Carpentry.
- E. Section 07 41 13 – Preformed Metal Standing Seam Roofing.
- F. Section 07 92 00 - Joint Sealers.
- G. Section 43 01 50 - General Mechanical Provisions.

6.3 REFERENCES

- A. AISI (American Iron and Steel Institute) - Stainless Steel Uses in Architecture.
- B. ASTM A167 - Stainless and Heat-Resisting Chromium- Nickel Steel Plate.
- C. ASTM B32 - Solder Metal.
- D. FS O-F-506 - Flux, Soldering, Paste and Liquid.
- E. FS QQ-S-571 - Solder, Tin Alloy.

- F. NAAMM - Metal Finishes Handbook.
- G. NRCA (National Roofing Contractors Association) - Roofing Manual.
- H. SMACNA - Architectural Sheet Metal Manual.
- I. ASTM A240 - Heat-resisting, Chromium & Chromium-Nickel Stainless Steel Plate, Sheet, and Strip.

6.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Provide manufacturer's or fabricator's detail drawings showing:
 - 1. Scuppers and downspouts
 - 2. Flashing and counterflashing
 - 3. All associated accessories
- C. The drawings and manufacturer's product data shall indicate type of material(s) used, material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.
- D. Samples: Submit two samples 300 mm (12") long of each type of downspouts, flashing, and accessories illustrating typical material, and finish.

6.5 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years minimum experience.

6.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stainless Steel Flashing Trim: Through wall, base, lintel, sill; Brake formed to required profiles.
- B. Scuppers and downspouts: Stainless Steel- brake formed to required profiles.
- C. Substitutions: Under provisions of Division 1.

2.2 SHEET MATERIALS

- A. Stainless Steel: ASTM A240, type 304, 20 gauge, architectural grade alloy, finish to be 2B.

2.3 ACCESSORIES AND COMPONENTS

- A. Fastener: Same material and finish as flashing metal with soft neoprene washers at exposed fasteners.
- B. Underlayment: 6 mil polyethylene.
- C. Slip Sheet: Rosin sized building paper.
- D. Sealant: Type specified in Section 07 92 00.
- E. Solder: ASTM B32; 50/50 type.
- F. Flux: FS O-F-506.
- G. Downspout: Stainless Steel. Fabricate to 3" x 4" rectangular profile.
- H. Splash Pads: Precast concrete type: minimum 3000psi at 28 days, with minimum 5 percent air entrainment.

2.4 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects. Form scupper and downspout sections to sizes as shown on drawings. Downspout shall be rectangular 3"x4" profile.
- B. Fabricate cleats, hold-down clips, and starter strips of same material as sheet, minimum 50 mm (2 inches) wide, interlockable with sheet.

- C. Form pieces in longest practical lengths.
- D. Hem exposed edges on underside 13 mm (1/2 inch); miter and seam corners.
- E. Form material with flat lock seam.
- F. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
- G. Fabricate corners from one piece with minimum 406 mm (16 inch) long legs; solder for rigidity, seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward 6.3 mm (1/4 inch) and hemmed 45 o to form drip.
- I. Fabricate flashing to allow toe to extend 50 mm (2 inches) over roofing. Return and brake edges.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, pipes, or vents through roof are solidly set and nailing strips located.
- B. Verify roofing termination and base flashing are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Field measure site conditions prior to fabricating work.

3.3 INSTALLATION

- A. Secure flashing in place using concealed fasteners. Use exposed fasteners only in locations approved by Engineer.
- B. Lap, Cleat and seal all joints.
- C. Fit flashing tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- E. Seal metal joints watertight.
- F. Secure scuppers and downspouts in place using concealed fasteners where applicable.

G. Set concrete splash pads under downspouts.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 1.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 07 62 00

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07 92 00 - JOINT SEALERS

PART 7 - GENERAL

7.1 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and backing.

7.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 04 10 00 - Unit Masonry System.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Sealants used in conjunction with metal flashings.
- D. Section 08 11 16 - Aluminum Doors and Frames.
- E. Section 08 51 13 – Aluminum Windows.
- F. Section 08 71 00 – Door Hardware.
- G. Section 08 81 00 – Glass and Glazing.
- H. Divisions 5, 10 through 16.

7.3 REFERENCES

- A. ASTM C804 – Use of Solvent-Release Type Sealants.
- B. ASTM C920 - Elastomeric Joint Sealants.
- C. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- D. ASTM D1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
- E. FS HH-F-341 _ Fillers, Expansion Joint: Bituminous

- F. FS TT-S-00227 – Sealing Compound: Elastomeric Type, Multi-Component.
- G. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.
- H. SWRI (Sealing, Waterproofing, and Restoration Institute) - Sealant and Caulking Guide Specification.

7.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples 102 mm x 13 mm (4 x 1/2 inches) in size illustrating color for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

7.5 QUALITY ASSURANCE

- A. Perform work in accordance with SWRI requirements for materials and installation.

7.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.

7.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install solvent curing sealants in enclosed building spaces without providing adequate ventilation.
- B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

7.8 COORDINATION

- A. Coordinate work under provisions of Division 1.
- B. Coordinate the work with all sections referencing this section.

7.9 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 8 - PRODUCTS

8.1 SEALANTS

Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25 (100/50), Use NT, M, G, A, O; single component, moisture curing, low modulus type; colors to be selected by Engineer from manufacturer's standard color selection (see schedule below); product: Spectrem 1 manufactured by Tremco. Color Schedule:

- 1. Exterior wall joints: match mortar joint color.
- 2. Sheet metal coping: match sheet metal color
- 3. Exterior doors: match stainless steel color.
- 4. Exterior louvers, etc: match louver, equipment color(s)
- 5. Other surfaces: match substrate color as approved by Engineer

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Bituminous and Fiber Joint Filler: ASTM D1751 or FS HH-F-341.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with ASTM C804 for solvent release sealants.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.4 CLEANING AND REPAIRING

- A. Clean work under provisions of Division 1.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Division 1.
- B. Protect sealants until cured.

END OF SECTION 07 92 00

DIVISION 8 - DOORS AND WINDOWS

SECTION 08 13 19 – STAINLESS STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Stainless steel doors.
- B. Stainless steel frames.
- C. Steel window frames.

1.2 RELATED SECTION

- A. Section 04 10 00 - Unit Masonry.
- B. Section 05 50 00 - Metal Fabrications.
- C. Section 08 71 00 - Door Hardware.
- D. Section 08 81 00 – Glass and Glazing.

1.3 REFERENCES

- A. ANSI A250.6 – Hardware Reinforcing on Standard Steel Doors and Frames.
- B. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
- C. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames
- D. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- E. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Course Round Wire, Carbon Steel.
- F. ASTM A1008 – Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability Solution Hardened, and Bake Hardened.
- G. ANSI/ASTM A568 – Standard Specification for Steel Sheet, Carbon, and High Strength Low Alloy Hot Rolled and Cold Rolled Sheet Steel.
- H. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hip Dip Process.
- I. DHI A115.1G – Door Hardware Institute, Installation Guide for Doors and Hardware.

- J. SDI 117 – Steel Door Institute, Manufacturing Tolerances for Steel Doors and Frames.
- K. SDI 22 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: In addition to requirements below, provide a schedule of doors and frames using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.
 - 3. Frame details for each frame type, including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Details of glazing frames and stops showing glazing and glazing requirements.
 - 8. Fire-resistance ratings.
- C. Manufacturer's Installation Instructions: Indicate special installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

1.6 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A250.8 unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.7 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Deliver doors and frames cardboard wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory finished doors and frames.

- C. Inspect doors and frames on delivery for damage and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Engineer. Remove and replace damaged items that cannot be repaired as directed.
- D. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum ¼ inch spaces between stacked doors to permit air circulation.

1.8 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ceco Door Products.
- B. Steelcraft.
- C. Curries Company
- D. Substitutions: Under provisions of Division 1.

2.2 MATERIALS

- A. Stainless Steel: ASTM A240, Type 304.
- B. Door Core:
 - 1. Stiffened: Continuous vertical formed stainless steel sections, 0.026 in. (0.6 mm) minimum thickness, spaced with interior webs not more than 6 in. (152 mm) apart, which upon assembly, span the full thickness of the interior of the door. Voids between stiffeners shall be filled with fiberglass or mineral rock-wool batt-type material.

2.3 DOORS AND FRAMES

- A. Doors: Level 2 Heavy Duty 1-3/4 inches thick, seamless construction (i.e.: Level II, Model 2).
- B. Doors and Frames: Face sheet construction. (Level II, Model 2) Heavy Duty 0.053 inch minimum wall thickness for both door and frame construction.

- C. Frames: shall be full profile weld type; provide minimum of three anchors per jamb suitable for adjoining wall construction. Provide anchors of not less than 0.042 inch in thickness or 0.167 inch diameter wire. Frames over 7'-6" shall be provided with an additional anchor per jamb
- D. Frames: Base anchors shall be provided with minimum thickness of 0.042 inches.
- E. All frames shall be fully prepared for all mortise template hardware and reinforced only for surface mounted hardware. Drilling and/or tapping shall be completed by others.
- F. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.
- G. Fire rated door assemblies: Materials and construction shall comply with NFPA 80 requirements.

2.4 ACCESSORIES, SUPPORTS AND ANCHORS

- A. Wall anchors in masonry construction: 0.177 inch diameter, steel wire complying with ASTM A510 may be used in place of steel sheet.
- B. Inserts, Bolts and Fasteners: Manufacturer's standard units.
- C. Exterior Top Caps: Stainless steel flush channel.
- D. Frame Thermal Breaks: Rigid polyvinylchloride extrusion.

2.5 FABRICATION

- A. Fabricate doors and frames to comply with ANSI/SDI 250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project Site.
- B. Stainless Steel Doors: 1.6 mm (16 gauge) thick stainless steel door faces.
- C. Flush Design: Non-fire rated.
 - 1. Flush Design: Butt seam door construction, longitudinal edges fully welded with no visible edge seam.
 - 2. Top and Bottom Channels: Inverted, recessed, welded steel channels.
 - 3. Astragals: Stainless steel Z shaped astragals for double doors.
 - 4. Exterior Door: Flush stainless steel top caps.
 - 5. Fabricate with stainless steel hardware reinforcement plates welded in place
 - 6. Core: Stiffened.
- D. Stainless Steel Frames:

1. Stainless Steel Frames: 2.0 mm (14 gauge) thick stainless steel, welded type construction, mitred corners.
2. Factory assemble and weld stainless steel frames.
3. Stainless Steel Mullions for Double Doors: Removable type.
4. Fabricate with stainless steel hardware reinforcement plates welded in place.
5. Reinforce frames wider than 1200 mm (48 inches) with roll formed stainless steel channels fitted tightly into frame head, flush with top.

E. Tolerances: Comply with SDI 117.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Hardware Preparation:

1. Prepare doors and frames to receive mortised and concealed hardware according to door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
2. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

H. Frame Construction:

1. Fabricate frames, including transom, sidelight frame, etc. to shape or configuration shown.
2. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
3. Provide temporary spreader bars.

I. Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface applied hardware may be done at project site.

J. Locate hardware as indicated on Shop Drawings, or, if not indicated, according to ANSI A250.8.

K. Fabricate frames with 4 inch head member or as indicated.

2.6 FINISH

A. Standard Stainless Steel Finish: #2B Mill Finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that opening dimensions and tolerances are acceptable.

3.2 INSTALLATION

- A. General: Install doors, frames, glazing and hardware in accordance with Shop Drawings, manufacturer's instructions, and as specified.
- B. Placing Frames:
 - 1. Comply with provisions in ANSI/SDI A250.1 unless otherwise indicated.
 - 2. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set.
 - 3. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 4. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 - 5. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
- C. Door Installation:
 - 1. Comply with ANSI A250.8 unless otherwise indicated.
 - 2. Fit hollow metal doors accurately in frames within tolerances specified in ANSI A250.8.
 - 3. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Hardware: Install hardware using templates provided. Refer to Section 8D for hardware installation requirements.

3.3 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING AND CLEANING

- A. Adjust work under provisions of Division 1.
- B. Adjust door for smooth and balanced door movement.
- C. Protection Removal: Immediately before final inspection, remove protective material or wrappings from doors and frames where applicable.
- D. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.5 SCHEDULE

- A. See Drawings and refer to Shop Drawings.

END OF SECTION 08 13 19

DIVISION 8 - DOORS AND WINDOWS

SECTION 08 71 00 - DOOR HARDWARE

PART 9 - GENERAL

9.1 SECTION INCLUDES

- A. Hardware for aluminum and steel doors.
- B. Fire rated hardware for fire-rated doors.
- C. Thresholds.
- D. Weatherstripping.

9.2 RELATED SECTIONS

- A. Section 04 10 00 - Unit Masonry.
- B. Section 05 50 00 - Metal Fabrications.
- C. Section 08 11 16 - Aluminum Doors and Frames.
- D. Section 08 51 13 – Aluminum Windows.

9.3 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. BHMA - Builders' Hardware Manufacturers Association.
- C. DHI - Door and Hardware Institute.
- D. NAAMM - National Association of Architectural Metal Manufacturers.
- E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
- F. UL 305 - Panic Hardware.

9.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate locations and mounting heights of each type of hardware.
- C. Submit manufacturer's parts lists, templates.

- D. Product Data: Provide data on specified hardware.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

9.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of installed cylinders and their master key code.

9.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

9.7 QUALITY ASSURANCE

- A. Perform work in accordance with the following requirements:
 - 1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. NFPA 101.

1.8 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with 5 years documented experience.
- C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC), as certified by the Door and Hardware Institute to assist in the work of this section.

1.9 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements applicable to fire rated doors and frames.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1.
- B. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

- C. Deliver keys to Owner by security shipment direct from hardware supplier.
- D. Protect hardware from theft by cataloging and storing in secure area.

1.11 COORDINATION

- A. Coordinate work with other directly affected Sections involving manufacturer or fabrication of internal reinforcement for door hardware.

1.12 WARRANTY

- A. Provide five year warranty under provisions of Division 1.
- B. Warranty: Include coverage of door closures.

1.13 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide special wrenches and tools applicable to each different or special hardware component.
- C. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.14 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Exit Devices (Rim Type): Corbin Russwin, Adams Rite, Von Duprin.
- B. Exit Devices (Vertical Rod Type): Corbin Russwin, Adams Rite, Von Duprin.
- C. Mortise Lockset: Corbin Russwin, Schlage, and Yale.
- D. Mortise Latchset: Corbin Russwin, Schlage, and Yale.
- E. Dummy Trim: Corbin Russwin, Schlage and Yale.
- F. Hinges: Hager, Stanley, and Lawrence.
- G. Closers: Corbin Russwin, LCN, and Norton.

- H. Flush Bolts: Corbin Russwin, Hager, Rockwood, Baldwin, Ives.
- I. Weatherstripping: National Guard Products, Hager, Penko, Reese Enterprises.
- J. Thresholds: National Guard Products, Hager, Pemko, Reese Enterprises.
- K. Astragals: National Guard Products, Reese Enterprises, Pemko.
- L. Door Sweeps: National Guard Products, Pemko.
- M. Kick plates: National Guard Products, Hiawatha, Ives, Brookline, Rockwood.
- N. Wall stops: Ives, Rockwood.
- O. IDOT Standard Surface Mounted Outside Deadbolt: American Lock
- P. Substitutions: Under provisions of Division 1.

2.2 KEYING

- A. Supply 5 keys for each lock.
- B. Keys shall match Owner's keying system.
- C. Serial numbers shall be stamped or engraved on all keys.

2.3 FINISHES

- A. Finishes: Identified in schedule at end of section.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of NAAMM.
- B. Use templates provided by hardware item manufacturer.
- C. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.3 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 1.

- B. Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
- C. Provide two copies of certification to Engineer.

3.4 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Division 1.
- B. Do not permit adjacent work to damage hardware or finish.

3.5 SCHEDULE

- A. General: Provide fire-rated hardware to match B-label door and frame as required to provide a fully operational fire-rated door assembly. Refer to drawings for designated door.
- B. Exit Devices: Rim Type-Single Leaf Door) Heavy Duty, visible parts US 32D finish, nonferrous internal parts, surface mounted rim type with $\frac{3}{4}$ " throw on latch bolt. Keyed access with trim lever handle mounted on exterior side of door leaf.
 - 1. Corbin Russwin Model ED5200
 - 2. Adams Rite Model 8300
 - 3. Von Duprin Model CRE
- C. Exit Devices: (Vertical Rod Type-Active Leaf Door of Double Doors) Heavy Duty, visible parts US 32D finish, nonferrous internal parts, surface mounted vertical rods with two point latching on active leaf. Keyed access with trim lever handle mounted on exterior side of active door leaf. Corbin Russwin ED 5400 Series.
 - 1. Corbin Russwin Model No. ED5400
 - 2. Adams Rite Model 8100
 - 3. Von Duprin Model CRE
- D. Mortise Lockset (Entrance Type): Wrought bronze, visible parts US32D finish, non-ferrous internal parts, with minimum $\frac{3}{4}$ " throw on latch bolt, 1" throw on deadbolt. Cylinder shall be as specified by Owner. Latch bolt by grip either side. Dead bolt by key outside or by thumbturn lever inside, inside grip simultaneously retracts latchbolt and deadbolt
 - 1. Corbin Russwin Model ML2048 x LSM
 - 2. Schlage Model L9453x03
 - 3. Yale Model 8847 CRE
- E. Dummy Trim Lockset x Lever Action: (No lever on inside face) Heavy Duty, visible parts US 32D finish, nonferrous internal parts, surface mounted rim type with $\frac{3}{4}$ " throw on latch bolt. Keyed access with trim lever handle mounted on exterior side of door leaf.

1. Corbin Russwin Model LSM
2. Schlage Model L9176x03
3. Yale Model CRE

F. Hinges: Stainless steel, heavy weight, five knuckle, four ball bearing with non-rising pin, button tip and ring, non-removable stainless steel pin on exterior doors, US32D finish. (All doors to open 180 degrees)

1. Door size to 8'-0" x 4'-0" 2 pr. 4.5" x 4.5".
 - a. Hager Model BB1199.
 - b. Stanley Model FBB 191
 - c. Lawrence Model BB4101

G. Closers: Heavy duty parallel arms with adjustable closing speed, with hold-open for outswinging exterior doors. US32D finish. (All doors to open 180 degrees)

1. Corbin Russwin Model DC6000 Series (DC6210 A2 M72)
2. LCN Model 4010/4110 Smoothe Series
3. Norton Model 7500 Series

H. Flush Bolts: US32D (satin stainless steel finish), full mortised extension flush bolts with dust proof strike, located at inactive leaf of all pairs of doors. Corbin Russwin Model 2849 with No. 70-1/2M Strike.

1. Corbin Russwin Model 2849 W/ No. 70-1/2M Strike
2. Hager Model 282D x 26D
3. Rockwood Model 555 x 26D
4. Baldwin Model 0600 x 26D
5. Ives Model FB458 X 26D

I. Weatherstripping: Head and jamb gasket, aluminum with clear anodized aluminum finish and neoprene insert.

1. National Guard Products Model 110 NA
2. Hager Model 412S x AL
3. Pemko Model 332 CR
4. Reese Enterprises Model DS 69C

J. Thresholds: Heavy Duty, clear anodized aluminum finish, with chemically treated stainless steel screws, set in full bed of sealant. 5" x 12". Thermally broken.

1. National Guard Products Model 8425 x AL
2. Hager Model 412S x AL
3. Pemko Model 252 x 3AFG x AL
4. Reese Enterprises Model S282A x AL

- K. Astragals: Full height, clear anodized aluminum, surface mounted, meeting stile gasketing with silicone seal.
1. Doors with one active leaf:
 - a. National Guard Products Model 109NA
 - b. Reese Enterprises Model 93C
 - c. Pemko Model 375CR
- L. Door Sweep: Nylon brush gasketing, clear aluminum finish.
1. National Guard Products Model 600A
 2. Pemko Model 18137CNB
- M. Kick Plate: Ives Model 8400 10"x34" US32D x 16GA, or equal selected from manufacturers listed below.
1. National Guard Products
 2. Hiawatha
 3. Ives
 4. Brookline
 5. Rockwood

Exit Doors are not Pad Lockable.

3.6 HARDWARE SCHEDULE PER DOOR

A. Door Hardware Req'd

1. D1(exterior door) Exit Device (rim type) with keyed access and lever trim exterior side, hinges, weatherstripping, door sweep, closer, IDOT Std. Deadbolt, threshold, kick plate.
2. D2(exterior double door) Exit Device (vertical rod type) on active leaf with keyed access and lever trim exterior side, dummy trim inactive leaf, hinges, weatherstripping, door sweep each door, two closers, threshold, flush bolts on inactive leaf, astragal on active leaf, IDOT Std. Deadbolt, kick plates on each door leaf.

END OF SECTION 08 71 00

DIVISION 8 - DOORS AND WINDOWS

SECTION 08 81 00 - GLASS AND GLAZING

PART 10 - GENERAL

10.1 SECTION INCLUDES

- A. Glass and glazing for steel window assemblies.

10.2 RELATED SECTION

- A. Section 08 13 19 – Stainless Steel Doors and Frames.

10.3 REFERENCES

- A. ANSI Z97.1 – Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. ASTM D1667 – Standard Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- C. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
- D. ASTM D2287 – Standard Specifications for Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
- E. ASTM E84 – Surface Burning Characteristics of Building Materials.
- F. FS DD-G-451 – Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors, and Other Uses).
- G. FS DD-G-1403 – Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened & Fully Tempered).
- H. FGMA – Glazing Manual. Glazing Sealing Systems Manual.

10.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: In addition to requirements below, provide a schedule glazing size and type for each frame using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each window.
 - 2. Details of glazing frames and stops showing glazing and glazing requirements.

C. Manufacturer's Data: Glass:

1. Manufacturer's specifications and installation instructions for each type of glass required.
2. Include test data substantiating that glass complies with specified requirements.

D. Manufacturer's Data: Glazing Materials:

1. Manufacturer's specifications and installation instructions for each type of glazing sealant and compound, gasket and associated miscellaneous material. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with project specifications and is suitable for the applications shown.

E. Samples: Glass:

1. Submit 3, samples of each type of glass specified.
2. Insulating glass samples need not be hermetically sealed, but edge construction shall be included.

- A. Manufacturer's Installation Instructions: Indicate special installation instructions.
- B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

10.5 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

10.6 QUALITY ASSURANCE

Conform to Flat Glass Marketing Association (FGMA) Glazing Manual for glazing installation methods.

- A. Provide ten year manufacturer's warranty under provisions of Division 1.

10.7 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Deliver glass and glazing to window manufacturer in accordance with each manufacturer's instructions. Protect in cardboard wrapped containers, crated, or other manufacturer's protection method to provide protection during transit and job storage. Provide additional protection to prevent damage to glass and glazing.
- C. Remove and replace damaged items that cannot be repaired as directed.

10.8 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 11 - PRODUCTS

11.1 MANUFACTURERS

- A. PPG Industries, Inc.
- B. Libby-Owens-Ford Co. (A Pilkington Glass Company)
- C. AFG Industries. (AGC Flat Glass North America)
- D. Substitutions: Under provisions of Division 1.

11.2 GLASS MATERIALS

- A. Type G1: ¼" thick, clear, fully tempered, safety glass.

11.3 GLAZING SEALANTS/COMPOUNDS

- A. Preformed Butyl Rubber Glazing Sealant.
 - 1. Tape or ribbon (coiled on release paper) of polymerized butyl, of mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent based with minimum of 95% solids, with thread of fabric reinforcement, tack-free within 24 hours, paintable, non-staining.
 - 2. Provide combination tape and encased continuous rubber shim, of approximately 50 durometer hardness.
 - 3. Any caulking or window sealants which come in contact with the insulating glass sealants are to be compressible.

11.4 GLAZING GASKETS

- A. Provide glazing gaskets recommended by manufacturer.
- B. Miscellaneous Glazing Materials
 - 1. Settling Blocks: Neoprene, 70-90 durometer hardness with proven compatibility with sealants used.

2. Spacers: Neoprene 40-50 durometer hardness, with proven compatibility with sealants used.
3. Compressible Filler Rod: Closed cell or waterproof jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 510 psi compression strength for 25% deflection.
4. Cleaners, Primers, and Sealants: Type recommended by sealant or gasket manufacturer.

PART 12 - EXECUTION

12.1 EXAMINATION

- A. Verify that opening dimensions and tolerances are acceptable.
- B. Examine the framing and glazing surfaces, backing, and removable stop design, and the conditions under which the glazing will be installed on the doors.
- C. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer, and in accordance with specifications.

12.2 JOB REQUIREMENTS AND INSTALLATION

- A. General: Install glass and glazing in accordance with Shop Drawings, manufacturer's instructions, and as specified.
- B. Coordinate installation of glass and framing with window manufacturer.
- C. Provide watertight and airtight installation of each piece of glass. Each installation shall withstand normal temperature changes, wind loading, impact loading for doors, without failure of any kind including loss or breakage of glass, failure of sealants, or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- D. Protect glass at all times during handling, installation and operation of the building.
- E. Glazing dimensions shown provide for a minimum bite on the glass: minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. Be responsible for correct glass size for each opening, within tolerance for the dimensions established.

- F. Comply with combined recommendations of glass manufacturer, manufacturer of sealants, manufacturer of windows and other materials used in glazing except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise. Installation shall meet or exceed window manufacturer's requirements.
- G. Inspect each piece of glass immediately before installation, and eliminate all which have observable edge damage or face imperfections.

12.3 GLAZING

- A. Prepare and clean framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Comply with ANSI Standard Z97.1-2004 Safety Glazing Code.
- C. Install setting blocks of proper size at quarter points. Set blocks in thin course of the heelbead compound.
- D. Glazing shall be set with equal bearing for entire width.
- E. Provide minimum 1/8 inch bite of spacers on glass and use thickness equal to sealant width. Where sealant tape is used instead, use thickness slightly less than final compressed tape thickness.
- F. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channels at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass and complying with manufacturer's recommendations.
- G. Do not attempt to cut, seam, nip or abrade glass which is chemically strengthened, tempered, or heat strengthened.
- H. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- I. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel to eliminate dirt and moisture products.
- J. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation, and eliminate stains and discolorations.
- K. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that the gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or proven adhesive, including embedment of gasket tail in cured heel bead.

12.4 CURE, PROTECTION, ADJUSTING AND CLEANING

- A. Adjust work under provisions of Division 1.
- B. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- C. Protect glass from breakage or damage during installation of window assembly. Do not apply markers to any type of glass surface.
- D. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- E. Wash and polish glass on both sides not more than four days prior to acceptance of the work. Comply with glass manufacturer's recommendations. Washing shall be done in accordance with manufacturer's instructions.

12.5 SCHEDULE

- A. See Drawings and refer to Shop Drawings.

END OF THIS SECTION

DIVISION 9 – FINISHES

SECTION 09 29 00 - GYPSUM BOARD

PART 13 - GENERAL

RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

13.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.

13.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

13.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

13.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

13.6 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

PART 14 - PRODUCTS

14.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

14.2 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. American Gypsum.
 2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company.
 6. PABCO Gypsum.
 7. Temple-Inland.
 8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch (15.9 mm).
 2. Long Edges: Tapered.

14.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - b. Expansion (control) joint.

14.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

14.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 15 - EXECUTION

15.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

15.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

15.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Ceiling surfaces unless otherwise indicated.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

15.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840.
- C. Interior Trim: Install in the following locations:
 1. LC-Bead: Use at exposed panel edges.

15.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

15.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

END OF SECTION 092900

DIVISION 9 - PAINTING

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item of work includes the furnishing, preparation and application of painting and related items to complete the work indicated on drawings and described in these specifications.
- B. All work under this Section shall be subject to the applicable provisions of Section 100 of the Standard Specifications. Refer to Division 1 for additional requirements.
- C. Terms used in this Section shall be as defined in ANSI/ASTM DIG.

1.2 REFERENCE STANDARDS

- A. The work shall be in conformance with the applicable standards/regulations of:
 - 1. Society of Protective Coatings.
 - 2. National Fire Protection Association (NFPA.
 - 3. American National Standards Institute (ANSI.
 - 4. Occupational Safety and Health Act (OSHA.
 - 5. SSPC SP10 "Near White Metal Blast Cleaning", Society of Protective Coatings.
 - 6. Military Specification MIL-L-81352A.
 - 7. Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction.
- A. The term "finishes" as used herein means all painting and coating systems materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- B. Consult the specifications for work and materials of other trades to determine the provisions regarding their finishing. Surfaces left unfinished by the requirements of other specifications shall be painted or finished as part of this work. Work requiring finish and not specified shall be finished same as specified for similar work. Finishing specified hereinafter shall be in addition to shop and prime coats specified in other sections.
- C. The work under this section shall be done by a firm with not less than 5 years of experience in commercial painting and finishing. Documentation of this experience shall be included together with the product data submitted for approval.

1.3 QUALITY ASSURANCE

- A. Painting shall conform to applicable Section 1008, PAINT MATERIALS and MIXED PAINTS, of the IDOT Standard Specifications.
- B. The types of paint products to be used in the work shall be identified by the manufacturer's name and number.
- C. The products of manufacturers other than those herein named, which are approved equal to the products specified, may be substituted, except that, all paints applied to a surface shall be products of one manufacturer. Data showing equivalent performance of each paint product to be submitted for review at least 30 calendar days before the painting is to begin, and no painting shall proceed until the substituted products have been accepted.
- D. All paints and painting materials shall be delivered to the work in the original and unopened containers plainly marked with the name, brand, shelf life, and analysis of the product, and the name of the manufacturer.

1.4 DELIVERY AND STORAGE OF MATERIALS

- A. Deliver materials in original containers with seals unbroken and labels intact. Do not deliver or store on the site materials other than those approved for use. Empty containers shall have labels canceled.
- B. Store materials outside the building. Keep storage place neat and clean and correct all damage thereto or to its surroundings.
- C. Materials shall not be mixed or applied in any room having finished floor installed without providing adequate protection. Only materials used during the course of one day may be kept within the building. Remove oily rags and waste from building every night and take every precaution to avoid danger of fire.

1.5 SUBMITTALS

- A. Submit product data under provisions of Section 1A.

1.6 SHOP DRAWINGS: SUBMIT THE FOLLOWING FOR APPROVAL:

- A. Copies of manufacturer's technical information, including paint label analysis and application instructions, certification of coating, primer and finish coat for the material and service for each coating system proposed for use.
- B. Copies of Contractor's proposed surface preparation and work area protection procedures in each area of the work.
- C. List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

- D. Copies of manufacturer's complete color charts for each coating system.

1.7 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tnemec Co., Inc.
- B. Substitutions: Under provisions of Division 1.

2.2 COLORS

- A. Unless otherwise indicated, colors will be selected by the Engineer during the submitted review process.
- B. Complete color charts shall be submitted of proposed paint manufacturers to the Engineer for final paint color selections.
- C. Unless otherwise indicated, all surfaces without a final finish color shall be painted. In general, colors will be differentiated as follows:
 - 1. Ceiling.
 - 2. Grade floor.
 - 3. Lower level floors.
 - 4. Lower level concrete walls.
 - 5. Interior metal trim.
 - 6. Exterior metal trim (excluding louvers, stainless steel, and aluminum framing).
 - 7. Exterior piping and appurtenances (such as sluiceway stands and operators).
 - 8. Natural or anodized aluminum surfaces shall not be painted. Surfaces and equipment which are provided with a factory final finish shall not be painted.
 - 9. Stainless steel surfaces shall not be painted unless noted otherwise.
 - 10. Exterior concrete walls of building.
 - 11. Interior concrete walls of building (including masonry surfaces that are not glazed block surfaces).
 - 12. Safety items as necessary (bollards, hoist beams/trolley, etc.).

D. Notes:

- 1. Wall and floor at wet well shall not be painted.
- 2. All piping shall be shop finish painted.

2.3 COLOR CODING

- A. Piping and electrical conduit shall be color coded with colors as selected by the Engineer. Electrical conduits shall be painted the color of the wall/ceiling against which it is run. Conduits are not required to be painted if they are not running against a wall or ceiling.

2.4 NON-SLIP FLOOR COATING

- A. Concrete floors above the wet pit shall have an abrasive coating of Series 69 Hi-Build Epoxoline II as manufactured by Tnemec Co., Inc., or equal. Bare concrete shall be primed at a dry film thickness of 2.0-3.0 mils. The first coat shall have a dry film thickness of 2.0-3.0 mils which includes silica sand to provide a non-skid surface. The second coat shall have a dry film thickness of 2.0-3.0 mils. The epoxy coating shall be applied in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspect surfaces with regard to their suitability to receive a finish after preparatory work. The application of finish shall be an indication of the Contractor's acceptance of the surface.
- B. Clean surfaces to be painted of loose dirt and dust before painting is started. Adjacent surfaces shall also be clean before starting painting. Do preparatory work necessary to produce a surface suitable to receive the specified finish.
- C. Wash uncoated metal surfaces with mineral spirits to remove dirt and grease before applying paint materials. Blast profile shall not exceed 30% of total film thickness of coating. Preparation shall conform to primer manufacturer's requirements. Prime surfaces as soon as practical after preparation. Do not leave prepared, uncoated surfaces overnight. Touch up shop coats damaged by welding or abrasion.
- D. Prior to painting, all surfaces shall be prepared and cleaned as specified and required. Surfaces shall be dry before any paint is applied. Special surface preparation work shall be as directed by the manufacturer of the paint specified to be applied to the surface. Paint shall not be applied before the prepared surfaces are approved.
- E. Prior to painting steel, all welds, beads, blisters or protuberances, other than identification markings, shall be ground smooth. Pits and dents shall be filled, and other imperfections shall be removed. All rust, mill scale, oil, grease and dirt shall be removed by sandblasting in the shop in accordance with Society of Protective Coatings Specification No. SP-10, Near White (SSPC-SP-10). Cleaned metal shall be primed the same day immediately after sandblasting to prevent rusting.
- F. Prior to painting other metals, all welds, beads, blisters or protuberances, other than identification markings, shall be ground smooth and other imperfections shall be removed.

All nonferrous metals, galvanized steel and stainless steel whether shop primed or field primed, shall be solvent-cleaned in accordance with SSPC-SP-1 prior to the application of the primer. Nonferrous metal shall be treated with Oakite 747 LTS, as manufactured by Chemetel or equal before prime coat is applied.

- G. Pipe covering and duct covering shall have all adhering debris removed and indentations or unsightly spots smoothed out to an even surface and shall be brushed clean.
- H. Concrete surfaces and concrete masonry shall be brushed and washed. All loose dirt, free lime, form oil, curing compounds and other foreign matter shall be removed by approved methods. Concrete surfaces requiring repair shall be patched and surfaces to receive paint shall be spackled and repaired. Concrete surfaces to be painted shall be acid-etched as recommended by the manufacturer of the coating to be applied to produce a slightly granular surface required for adherence of the paint to the concrete unless otherwise indicated. Concrete and concrete masonry shall be thoroughly dry prior to painting.

3.2 PROTECTION OF NON-FINISH ITEMS

- A. Furnish and lay drop cloths or other means of protection for finished surfaces during the work.
- B. Before painting, remove hardware, accessories, plates, lighting fixtures and similar items or provide ample protection of such items. Upon completion of work in each area, replace above items. Use only skilled mechanics for removing and replacing items.
- C. If finished surfaces are damaged, entirely remove the stains or replace the damaged material, making good any damage to other work in connection therewith, without additional cost to the Owner.

3.3 APPLICATION

- A. The following items shall not be painted, unless otherwise specified: ducts, covering over ducts, registers, grilles, dampers and linkage, name and identification plates and tags, floor gratings, brass valves, stainless steel, wood, cast-iron piping installed underground, fiber reinforced plastics or resins, glazed cmu.
 - 1. The following items shall be furnished with the manufacturer's standard prime and finish coats applied in the shop: pumps, motors, air compressors, wall fans, control and SCADA panels, panelboards, transformers, unit heaters, aluminum fascia, motor control centers, hoisting equipment.
 - 2. The following items shall be shop primed and field painted: structural steel and wrought metals, pipelines, hangers and supports, valves, valve operators and stands, guard housings, steel lintels, hollow metal doors and frames.
 - 3. All items not shop primed or shop finished shall be field primed and finished where exposed to view.

The work shall generally include, but not be limited to, the following: interior concrete block, interior concrete walls, columns, beams and ceilings, covering over insulation on piping, electrical conduit, small piping and copper tubing, exterior PVC piping.

- B. The work shall include all touch-up and remedial painting as required until the completion and acceptance of the final work.
- C. Spray painting shall not be allowed.

3.4 INSTALLATION

- A. Furnish equipment for the proper execution of the work. Erect and place same in such a way as not to interfere with work of other trades. Upon completion, dismantle and remove same from the job site.
- B. Employ skilled mechanics to ensure good workmanship. Thoroughly mix materials immediately before application of paint. Surfaces shall be clean, dust free, dry and adequately illuminated. Each coat shall be thoroughly dry before applying succeeding coat.
- C. Finished work shall be uniform and of approved color, smooth and free from runs, sags, and defective application. Edges of paint adjoining other materials or colors shall be sharp and clean, without overlapping. Before applying succeeding coats, primers and undercoats shall be completely integral and performing the function for which they are specified. Prepare and touch up scratches, abrasions, or other disfigurement and remove any foreign matter between successive coats.
- D. Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than eight hours after cleaning under ideal conditions or sooner if conditions are not ideal.
- E. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination. Clean contaminated surfaces before applying next coat. Ensure method of cleaning contaminated surface follows manufacturer's recommendations.
- F. Primers and undercoats of paint and enamel shall be tinted or shaded different colors than the finish coats. Each coat of material shall be inspected and approved by the Engineer before application of the succeeding coat. Otherwise, no credit for the coat applied will be given and the work in question shall be recoated. Inform the Engineer when each coat is ready for inspection and approval.
- G. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.
- H. Painting shall not be done when the temperature is below 10 degrees C (50 degrees F) and when satisfactory results cannot be obtained due to high humidity or excessive temperatures. Paints or other finishes shall not be applied to wet or damp surfaces.

- I. All painting shall be done in accordance with the paint manufacturer's recommendations.
- J. All wall surfaces which will be concealed by equipment shall be painted before equipment installation.

3.5 CLEANING

- A. Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Rubbish, debris, empty paint cans and discarded materials shall be placed in metal containers and removed from the site.

3.6 SCHEDULE

A. Material Painting Schedule

Class of Work	Primer Shop Coat	Field or Shop Finish Coats		
		1st	2nd	3rd
Nonferrous Metal and Galvanized Steel:				
Interior		A	A	A
Exterior	I	A	A	C
Steel and Iron:				
Interior	B	B*	A	A
Exterior	B	B*	A	C
Submerged or Constantly Wetted	B	B*	D	D
Asphaltic Coated Steel		E*	A	A
Concealed in Masonry	B	B*		
Exposed to Potable Water	B	B*	B	F
Wrapped in Insulation	B	B*		
Exterior, Exposed to Process Wetting and Drying	B	B*	D	D
Concrete:				
Interior		A	A	A
Exterior		H	H	H
Interior Pipe:				
Interior Exposed or Immersed Ductile Iron		J	D	D
PVC		A	A	

*Touch-up bare metal with primer.

B. Paint Schedule

1. Alphabetical designations in the following list are given solely for the purpose of indicating the type and quality of materials desired. Equivalent material from other approved manufacturers may be substituted.

Symbo I	Product Name and Number	Volume Solids %	Dry Film Thickness	
			Micrometers	Mils Per Coat
A	Tnemec Series 69 Hi-Build Epoxoline II	69	51-76 um	(2.0-3.0 mils)
B	Tnemec Series 140-1225 Beige Pota-Pox Plus	69	102-152	(4.0-6.0)
C	Tnemec Series 73 Endura- Shield	58	51-76	(2.0-3.0)
D	Tnemec Series 69 Hi-Build Epoxoline II	69	76-127	(3.0-5.0)
E	Tnemec Series 90-97 Tneme-Zinc	63	64-89	(2.5-3.5)
F	Tnemec Series 140-WH02 (15BL) Pota-Pox Plus	69	102-152	(4.0-6.0)
G	Tnemec Series 69 Hi-Build Epoxoline II	69	178-254	(7.0-10.0)
H	Tnemec Series 180 Acrylic Emulsion	44	102-152	(4.0-6.0)
I	Tnemec Series 69 Inorganic Zinc Rich	69	51-76	(2.0-3.0)
J	Tnemec Series 1 Omnithane	61	64-89	(2.5-3.5)

C. Notes

1. Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, these areas shall be given one field coat of Tnemec Series 69 Hi-Build Epoxoline II. (G)
2. Stainless steel, where indicated shall be protected by two coats of clear acrylic lacquer conforming to the requirements of Military Specification MIL-L-81352A. Surface preparation shall consist of removing all oil and foreign matter by wiping clean with cloth and lacquer thinner.
3. Applicable to insulated and uninsulated pipes: Steel pipe not available with a shop coat shall be prime coated in the field immediately after installation.
4. Piping shall be painted up to and including the flanges attached to mechanical equipment. Electrical conduit shall be painted up to and including the flexible conduit connected to equipment.

5. All steel pipes, ductile iron fitting and flanges located at the wet well, intermediate floor and discharge floor shall be shop finish painted before shipment. Provide field touch-up paint as required.

D. General Color Scheme

1. General color scheme shall be as follows:
 - a. Exterior Concrete Walls - light beige.
 - b. Interior Concrete Walls – matching light “beige” color:(Provide a selection of “Beige” colors that are an array of close matches to the selected color for glazed CMU walls. Final color to be selected by Engineer.)
 - a. Interior Concrete Ceiling – white: (Provide a selection of “White” colors for review. Final color to be selected by Engineer.)
 - b. Interior Grade Floor - gray.
 - c. Lower Level Concrete Wall – Tannery.
 - d. Interior Steel Frame and Metal Trim – light gray.
 - e. Exterior Metal Trim (except aluminum and stainless steel) – light gray.
 - f. Exterior piping and appurtenances – Turbine Blue – verify with Engineer.
 - g. Interior piping – Turbine blue – verify with Engineer.
 - h. Electrical Conduits – light gray.
 - i. Fire protection equipment – standard red.
 - j. Hoist Beams/Trolley – Safety red.
 - k. Bollards – Safety yellow.
2. Note: Contractor to submit manufacturer’s color chart for Engineer’s selection.

END OF SECTION 09 91 00

DIVISION 10 - SPECIALITIES

SECTION 10 00 00 - SPECIALITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item of work includes the furnishing and installation of bulletin board, fire extinguishers, first aid kit, shop desk, nameplate, trash bins and related items to complete the work shown and specified.
- B. Refer to Division 1 for additional requirements.

1.2 RELATED SECTIONS

- A. Section 05 05 23 - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.
- B. Section 09 91 00 – Painting.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 1A.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handling shall be in accordance with the provisions of Section 01 01 00 – SUMMARY OF WORK.

1.5 GUARANTEE

- A. Provide guarantee under provisions of Section 1A.

1.6 BASIS OF PAYMENT

- A. Specialties shall be paid for as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for work described herein.

PART 2 – PRODUCTS

2.1 BULLETIN BOARD

- A. Furnish and install one (1) two panel bulletin board with glass doors as shown. Bulletin board panels shall be 1/4" cork mounted on hardboard. Doors shall have 1/4" glass and shall be continuously hinged with flat key tumbler locks. Overall dimensions shall be approximately 40" high, 36" long, 3" deep.

2.2 STATION IDENTIFICATION PLATE

- A. Furnish and secure in position and location, one cast aluminum tablet for each such required tablet. The tablet shall be made by a firm specializing in aluminum tablet work and shall be of best grade of aluminum available. Lettering shall be arranged as directed and of a style to be selected. All lettering and designs to be of embossed type, milled and polished. Background shall be pebble finish, left rough. A full-size rubbing shall be submitted for approval before casting.
- B. Lettering shall read as shown on drawing.

2.3 STAFF GAUGES

- A. Two staff gauges (one in the wet pit and one in the discharge chamber), calibrated in feet and tenths of a foot, shall be provided to show the depth of the water. Staff gauge range shall be from 0' to 20' for wet well and 0' to 5.5' for discharge chamber.
- B. Each gauge shall be porcelain enameled iron rod. The rods shall be professional type, 2-1/2" wide minimum, with large bold markings of a height for the full height of the wet well.
- C. Each staff gauge shall be attached and supported using corrosion resistant hardware at locations to avoid conflict with level controls, etc.

2.4 SHOP DESK

- A. A metal shop desk shall be provided. The desk shall have a 43 inch high work surface and shall be approximately 53 inches high by 34.5 inches wide by 30 inches deep. The unit shall have a rear top shelf riser, a 3.5 inch high drawer on nylon rollers and a large storage compartment with locking door and an adjustable shelf. The unit shall have 14 ga. corner posts and a minimum 20 ga. top and shall have a gray enamel painted finish.

2.5 FIRST AID KIT

- A. Furnish and install two first aid kits with brackets for wall mounting as directed in the pump room and electrical room. The kit shall be Model No. 640135 as manufactured by Johnson and Johnson or equal.

2.6 FIRE EXTINGUISHERS

- A. Furnish and install three (3) fire extinguishers as directed. The extinguishers shall be multipurpose Dry Chemical Type with a U.L. rating of 20A: 120B: C, 20 pound capacity in enameled steel containers. The extinguishers shall be installed with wall brackets of size required for type and capacity of extinguisher indicated.

2.7 CLOCK

- A. Clock shall be synchronous motor type, 12" face, 120 V. 60 Hz.

2.8 TRASH CAN

- A. Trash can shall be made of polyethylene and the capacity shall be approximately 40-50 gallon industrial type with lid, wheels/casters. To be located on the ground level of the wet well area.

PART 3 - EXECUTION:

3.1 INSTALLATION

- A. Install the specified specialties in accordance with manufacturer's recommendations and instructions to permit intended performance.
- B. The manufacturer or supplier of the specified specialties shall furnish a qualified field engineer for whatever period of time may be necessary to assist and direct the contractor in the proper installation of the equipment furnished, to observe and check initial performance, and whose duty shall include the instruction of the plant operating personnel in the proper operating and maintenance procedures.

3.2 PAINTING

- A. The specified specialties shall be painted in accordance with applicable AWWA standard specified and with Section 09 91 00 of these specifications.

3.3 TESTING

- A. The specialties shall be tested in place by the Contractor, and any defects in specialties or connections shall be corrected to the satisfaction of the Engineer.

END OF SECTION 10 00 00

DIVISION 23 – HEATING AND VENTILATION AND AIR CONDITIONING

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Duct labels.

1.2 ACTION SUBMITTAL

- A. Product Data: For each type of product indicated.
- B. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.3 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

END OF SECTION 23 05 53

DIVISION 23 – HEATING AND VENTILATION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- A. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance.

To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine operating safety interlocks and controls on HVAC equipment.
- J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.

3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.7 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.

- c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.

END OF SECTION 23 05 93

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Seam and joint construction.
8. Equipment installation based on equipment being used on Project.
9. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
10. Hangers and supports, including methods for duct and building attachment and vibration isolation.

- C. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.5 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches (102 mm).
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - 3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - 4. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 5. Unconditioned Space, Return-Air Ducts: Seal Class B.

6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

- 1. Wet well: 304 stainless steel.

- B. Supply Ducts:

- 1. Ducts Connected to supply fans:
 - a. Pressure Class: Positive 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: A.

- C. Exhaust Ducts:

- 1. Ducts Connected to exhaust fans
 - a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: A.

- D. Intermediate Reinforcement:

- 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
- 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.

- E. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm (5 m/s) or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.

- b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.

- c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Control dampers.
2. Flexible connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Wiring Diagrams: For power, signal, and control wiring.

C. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Arrow United Industries; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Metal Form Manufacturing, Inc.
 - 6. Nailor Industries Inc.
 - 7. Pottorff.

8. Ruskin Company.
9. Vent Products Company, Inc.

B. Frames:

1. Hat U Angle shaped.
2. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel 0.05-inch- (1.3-mm-) thick stainless steel.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches (152 mm).
2. Parallel- and opposed-blade design.
3. Galvanized-steel and Stainless steel.
4. 0.064 inch (1.62 mm) thick single skin or 0.0747-inch- (1.9-mm-) thick dual skin.
5. Blade Edging: Closed-cell neoprene or PVC.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel or stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

E. Actuators: Actuators and assembly located in the wet well and dry well shall be suitable for Class 1, Group D, Division 2 Hazardous locations.

2.4 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).

2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install stainless steel volume dampers in stainless steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install flexible connectors to connect ducts to equipment.
- H. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operate dampers to verify full range of movement.
 2. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. In-line centrifugal fans.
 - 2. Propeller fans.
 - 3. Centrifugal wall ventilators.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. BASIS OF PAYMENT

- D. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme Engineering & Manufacturing Corporation.
 2. Carnes Company.
 3. Greenheck Fan Corporation.
 4. JencoFan.
 5. Loren Cook Company.
 6. PennBarry.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
1. Companion Flanges: For inlet and outlet duct connections.
 2. Fan Guards: Inlet safety guard.
 3. Motor and Drive Cover (Belt Guard).
 4. Explosion proof disconnect.
 5. Explosion proof motor.
 6. Flex duct connectors
 7. Lorenized- special color to be determined by Architect.
 8. Vibration Isolators:
 - a. Static Deflection: 1 inch (25 mm).

2.2 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme Engineering & Manufacturing Corporation.
 2. Carnes Company.
 3. Greenheck Fan Corporation
 4. Loren Cook Company.
 5. PennBarry.

- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Fan Wheel: Replaceable, cast or extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Fan Drive:
 - 1. Resiliently mounted to housing.
 - 2. Statically and dynamically balanced.
 - 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 4. Extend grease fitting to accessible location outside of unit.
 - 5. Service Factor Based on Fan Motor Size: 1.4.
 - 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
- F. Accessories:
 - 1. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - 2. Wall Sleeve: Galvanized steel to match fan and accessory size.
 - 3. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.3 CENTRIFUGAL WALL VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Engineering & Manufacturing Corporation.
 - 2. Carnes Company.
 - 3. Greenheck Fan Corporation.
 - 4. Loren Cook Company.
 - 5. PennBarry.
- B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.
- C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.
- D. Belt Drives:
 - 1. Resiliently mounted to housing.
 - 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that cleaning and adjusting are complete.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 23 34 23

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Registers and grilles.
- B. Related Sections:
 - 1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 233300 "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.3 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Adjustable Bar Register Drum Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Krueger.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
2. Material: Stainless steel.
3. Finish: Satin Polish.
4. Face Blade Arrangement: Vertical spaced.
5. Damper Type: Stainless steel adjustable opposed blade.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. Install stainless steel registers and grilles with stainless steel fasteners.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 23 82 39.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CWP: Cold working pressure.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include location and size of each field connection.
 - 4. Include details of anchorages and attachments to structure and to supported equipment.
 - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 6. Indicate location and arrangement of integral controls.
 - 7. Wiring Diagrams: Power, signal, and control wiring.

- C. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

1.6 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, HEATING AND VENTILATION WORK.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Airtherm; a Mestek company.
 2. Berko.
 3. McQuay International.
 4. Modine.
 5. Trane Inc.

2.2 DESCRIPTION

- A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 2021.
- D. Comply with UL 823.
- E. Heater shall be suitable for Class I, Group D, Division 2 hazardous locations.

2.3 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Discharge Louver: Adjustable fin diffuser for horizontal units.
- C. Construction details: Heat exchanger and aluminum fan blade shall be housed in an industrial grade, corrosion resistant cabinet fabricated from polyester-coated 14 gauge steel with adjustable outlet louvers.
- D. Provide with factory provided wall or ceiling mounting kit suitable for heater location.

2.5 HEAT EXCHANGER

- A. The heat exchanger shall be liquid to air design utilizing a steel tube core with integral aluminum fins. Non toxic, inhibited, propylene glycol heat transfer fluid shall be used that provides freeze protection down to -49F. A pressure relief plug shall be utilized to provide over pressure protection. The heat exchanger shall include industrial grade electric heating elements.

2.6 CONTROLS

- A. The unit heater shall be provided with a unit mounted adjustable built-in thermostat, disconnect with external handle, fan only switch, and pilot light to indicate abnormal operation
- B. Provide a manual reset thermal cut out for over temperature protection, controlling magnetic contactor and 24V control circuit transformer housed in a NEMA 7, 9 cast aluminum enclosure.

2.7 FAN AND MOTOR

Fan motor shall include permanently lubricated ball bearings and built-in thermal overload protection. Motor to operate at line voltage and be prewired to the control enclosure to eliminate the need for separate field wiring to motor.

PART 3 - EXECUTION EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install propeller unit heaters to comply with NFPA 90A.
- B. Install propeller unit heaters level and plumb.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods.
- D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust initial temperature set points.

END OF SECTION 23 82 39.16

DIVISION 26 – ELECTRICAL

SECTION 26 05 11 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The scope of work under this Section shall generally be all electrical work required for the project work as specified or as indicated on the drawings.
- B. The electrical work shall include the furnishing and installing of various items of electrical equipment and, unless otherwise indicated, shall also include the electrical connection of various items such as electric pump motors, fan motors and similar items furnished under other Sections. The Contractor shall be responsible for ascertaining the extent of electrical connections required for items furnished under other Sections and for coordination the electrical work accordingly.
- C. Provide pedestal & metering cabinet pads per the Naperville Public Utilities Department for the two (2) 3 Phase services and install on 12" compacted crushed rock base.
- D. The specifications and drawings are intended to generally define the work required, but they do not include every equipment and installation detail. The work shall include all items and appurtenances required to fully complete the work, whether specifically identified or not, such that the electrical systems are complete and operational.
- E. Refer to Division 1 for other requirements relating to the furnishing and installing of work which shall apply to the work under this Division.

1.2 CODE COMPLIANCE

- A. Unless otherwise indicated, in the absence of more stringent requirements in the Specifications or on the Drawings, the work shall be in compliance with the requirements of the National Electrical Code.

1.3 STANDARDS

- A. Wherever the following abbreviations are used in these Specifications or on the Drawings, they are to be construed the same as the respective expressions represented:

AASHTO	American Association of State Highways and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
FM	Factory Mutual
ICEA	Insulated Power Cable Engineers Association
IES	Illuminating Engineering Society of North America
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Assoc.
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

- B. Wherever a reference is made to a standard or standard specification, the reference shall be to the edition current at the time of bidding, including any revisions or amendments.

1.4 VERIFICATION OF CONTRACT DRAWINGS

- A. The Contractor shall familiarize himself with the details of the total construction insofar as they may affect the work under this Division, including floor elevations, physical dimensions of structures, materials of construction and the nature of work required under other Divisions. No additional compensation will be granted for failure to consider the total project work.
- B. The contract drawings (Drawings) for electrical work are generally diagrammatic and do not necessarily depict all items to scale. The Drawings indicate the general locations of major elements of the electrical system, outlets, fixtures, pull boxes and the like, however, field conditions or interferences, may require changes in the installation. The Contractor shall coordinate his work to avoid interferences and shall obtain the approval of the Engineer prior to making any changes from the installation shown.
- C. Prior to installation, the Engineer may make reasonable minor changes in the locations of the installation without additional cost to the Owner.

1.5 COORDINATION

- A. The Contractor shall coordinate the work under this Division with the work of other trades. This shall include an orderly exchange of information and shall be accomplished such that the total work is not delayed and that interferences are avoided. The Contractor shall coordinate all electrical systems into a complete operational package. The Contractor shall assign one contact person for all such co-ordination work, has an understanding and working knowledge of the electrical control systems on this project. This person shall oversee and assume proper operation of the complete electrical control system including all testing and calibration as outlined herein. The Contractor shall provide the name and phone numbers of this individual at the preconstruction inspection. This cost shall be included in PUMP STATION ELECTRICAL WORK..

1.6 WORKMANSHIP

- A. The electrical work shall be performed in a neat and workmanlike manner in accordance with the best practices of the trade.
- B. Unless otherwise indicated, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.7 TESTING

- A. All electrical equipment and systems provided under this Division shall be adjusted and tested. The Contractor shall adjust, repair or replace faulty or improper Division 26 work or equipment discovered during testing.

- B. In addition, all electrical items provided under other Divisions and connected and/or adjusted under this Division shall be tested and if a failure occurs due to the connecting or adjusting methods used, the failure shall be remedied under this Division by repair, replacement, or change, as determined by the Engineer, at no additional cost to the Owner.
- C. Tests may be made progressively as portions of the work are complete.
- D. Tests shall be made in the presence of the Engineer.
- E. A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted to the Engineer for the record.
- F. Independent Contractor shall perform all tests necessary to assure proper functioning of materials and equipment. As a minimum, the tests shall include the following:
 - 1. Before making final connections check the insulation resistance of all cables of 3-phase circuits that operate above 150 volts.
 - 2. Check wiring for proper phase sequencing including buses, feeder cables and transformers and assure proper connection at motors for proper rotation.
 - 3. Measure and record the line-to-line and line-to-neutral voltages at the line side of the service entrance, all panel buses or main terminals and at the primary and secondary terminals of all transformers furnished under this Division except for control transformers which are integral to motor starter units. Set the taps on transformers as required or as directed by the Engineer.
 - 4. Check and record the motor nameplate data for each 3-phase motor. Check the ratings of motor circuit protective devices and assure compatibility of the devices for the connected motors. In particular, assure that the motor starter overload elements are proper for the motor nameplate full load amperes.
 - 5. Set control relays, protective relays and instruments in accordance with manufacturer's recommendations. Record the set points.
 - 6. Check all control circuits for proper functioning of all devices and check all switches, contactors, pushbuttons, limit switches, thermostats, circuit breakers and the like for proper operation.
 - 7. Check all alarm circuits for proper operation and proper set points, as applicable. Record any appropriate set points.
 - 8. Measure and record the line currents of each phase of each 3-phase motor under load.
 - 9. Align and adjust lighting fixtures and assure proper operation of all controls, ballasts and lamps.
 - 10. All equipment must be properly calibrated for proper operation of the system.
 - 11. See paragraph 3.9 of this Section for further testing requirements.
- G. Testing must be complete prior to final inspection. All instruments, tools, etc., required for the tests shall be provided by the Contractor. All equipment shall be properly calibrated for proper operation of the complete system. Additional testing may be requested by the Engineer during final inspection to spot-check test results or to demonstrate proper functioning of the systems. These tests shall be performed by the Contractor at no additional cost to the Owner.

H. The Contractor shall simulate the automatic operation of the complete pump station to assure proper operation. After assurance of proper operation, the Contractor shall demonstrate actual (real time) automatic operation to the Engineer's satisfaction.

J. Note that failure to test the equipment completely is not an allowance for an extension.

1.8 ELECTRICAL POWER SYSTEMS STUDIES

A. The electrical power system study shall include the following:

1. Short circuit analysis, protective device evaluation study, protective device coordination study, and arc flash study on entire power distribution system.
2. Portions of electrical distribution system from normal and alternate sources of power throughout distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions and maximum incident energy shall be covered in study.
3. Contractor shall engage services of independent engineering firm for purpose of performing electric power systems studies as specified.

B. Studies include following:

1. Utility Company incoming service lines.
2. Main switchboard.
3. Power transformers.
4. Motor control centers.
5. Pumps
6. Power and lighting distribution panels.
7. Cable, wire, and conduit systems.

C. Short Circuit Study

1. Provide complete report with printout data sheets using digital computer type programs as part of study.
2. Include utilities' short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected, and other source impedances.
3. Calculate short circuit momentary duty values and interrupting duty values based on assumed 3-ph bolted short circuit at switch gear base medium voltage controller, switchboard, low voltage MCC, panelboard, pertinent branch circuit panel, and other significant locations through system. Include short circuit tabulation of symmetrical fault currents and X/R ratios. List with respective X/R ratio each fault location, total duty on bus, and individual contribution from each connected branch.

C. Equipment Device Evaluation Study

1. Provide protective device evaluation study to determine adequacy of circuit breakers, molded case switches, automatic transfer switch, reduced voltage controllers, controllers, surge arresters, busways, and fuses by tabulating and comparing short circuit ratings of these devices with calculated fault currents. Apply appropriate multiplying factors based on system X/R ratios and protective device rating standards. Notify ENGINEER of problem areas or inadequacies in equipment due to short circuit currents and provide suggested alternate equipment.

D. Equipment Device Coordination Study

1. Provide protective device coordination study with necessary calculations and logic decisions required to select or check selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. Objective of study to obtain optimum protective and coordination performance from these devices.
2. Include as part of coordination study, medium and low voltage classes of equipment from utility's incoming line protective device down to and including largest rated device in 480 v MCCs and panelboards. Include phase and ground overcurrent protection as well as settings of other adjustable protective devices.
3. Draw time-current characteristics of specified protective devices in color on log-log paper or computer printout. Include with plots complete titles, representative one-line diagram and legends, associated Power Company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. Indicate types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing in-rush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits, and significant symmetrical and asymmetrical fault currents. Provide coordination plots for phase and ground protective devices on system basis. Provide sufficient number of separate curves to indicate coordination achieved.
4. Provide separate selection and settings of protective devices in tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings. Tabulate recommended power fuse selection for medium voltage fuses where applied in system. Notify ENGINEER of discrepancies, problem areas or inadequacies and provide suggested alternate equipment ratings and/or settings.

E. Arc Flash Study

1. Provide Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70E, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE).

2. Adjust system design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm². Provide suggested alternate equipment and settings to minimize incident energy levels.
3. Provide incident energy level (calories/cm²) for each equipment location and recommended PPE.
4. Based on the results of the incident energy study provide and install a warning label (orange <40 cal/cm²) or danger label (red > 40 cal/cm²) for each piece of equipment. The label must be readable in both indoor and outdoor environments and contain the following information:
 - a. Arc hazard boundary (feet and inches).
 - b. Working distance (feet and inches).
 - c. Arc flash incident energy at the working distance (calories/cm²).
 - d. PPE category and description including the glove rating.
 - e. Voltage rating of the equipment.
 - f. Limited approach distance (feet and inches).
 - g. Restricted approach distance (feet and inches).
 - h. Prohibited approach distance (feet and inches).
 - i. Equipment/bus name.
 - j. Date prepared.
5. Provide one day of arc flash safety training, travel time excluded and at jobsite or classroom designated by OWNER, that contains the requirements referenced in OSHA 1910.269, OSHA 1910 Subpart S and NFPA 70E. Training shall include but not be limited to the following:
 1. Proper use of the system analysis data.
 2. Interpretation of hazard labels.
 3. Selection and utilization of personal protective equipment.
 4. Safe work practices and procedures.

F. Upgrade Equipment

1. The contractor shall correct, rectify or upgrade equipment and or any deficiencies that surface due to the power system studies at no additional cost to the Owner.

1.8 DATA TO BE FILED WITH THE OWNER

- A. Submit shop drawings and product data under provisions of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. Certain data, as specified herein, shall be furnished to the Owner when installation and testing are complete, before final acceptance.
- B. The data shall be compiled in 8-1/2 x 11 inch format in high-quality heavyweight, hard cover binders with piano-style metal hinges or in an alternate format approved by the Engineer. Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders.

The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled.

C. Four sets of all required material shall be provided.

D. As a minimum, the data files shall include:

1. A table of contents.
2. Approved, final shop drawings and product data for all equipment and materials incorporated in the work under this Division.
3. Manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer.
4. A tabulation of cable insulation tests.
5. A tabulation of motor nameplate data.
6. A tabulation of required voltage tests.
7. A tabulation of required motor no load & full load current test data.
8. A tabulation of relay and control device set points.
9. A tabulation of alarm set points.
10. A Study Report providing summary of results of power systems study under paragraph 3.8 of this Section including:
 - a. Description, purpose, basis, and scope of study and single line diagram of power system.
 - b. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties and commentary regarding same.
 - c. Protective device time versus current color coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
 - e. Tabulation of appropriate tap settings for relay units.
 - f. Arc flash calculations and tabulation of incident energy level (calories/cm²) for each equipment location and recommended personal protective equipment (PPE).
11. Complete testing report for the testing of electrical systems under paragraph 3.9 of this Section utilizing NETA printed forms. Submit report no later than 30 days after testing is complete. Submit proof of testing agency qualification.

E. All data shall be neat and clearly legible. The table of contents and tabulations of set points and other recorded test data shall be typed. Sloppy, illegible, inaccurate, or incomplete data will not be accepted.

1.9 RECORD DRAWINGS

A. Alterations and additions to the contract documents which are made during the execution of the work shall be neatly and plainly marked in red on a set of Record Drawings kept at the contractor's field office for the project.

These drawings shall be updated as the work progresses and shall be available for inspection by the Engineer at all times during the course of the work.

- B. When the work is complete, and before final acceptance, a set of CAD generated Record Drawings and contract specifications shall be submitted to the Engineer for review and acceptance. Changes made to the contract documents shall be highlighted or identified. The set shall include the marked field set and a set of reproducible drawings. A set of reproducible drawings will be supplied to the Contractor for use in preparing the Record Drawings. The drawings shall each be stamped "RECORD DRAWING", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's supervising engineer or electrician.
- C. The Record Drawings must be submitted and must be acceptable to the Engineer prior to final acceptance. There will be no deviation from this requirement.

1.10 GUARANTEES

- A. Guarantees shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

1.11 CLASSIFICATION OF ELECTRICAL ENCLOSURES AND INSTALLATIONS IN PROJECT LOCATIONS

- A. Unless otherwise specified in the individual Specification Section or shown on Plans, type of electrical enclosures and installations shall be in accordance with the following:
- B. NEMA 7(CLASS I, Division 2, GROUP D): All spaces in the pump station including Pump Room, Intermediate Level, Wet Well, Dry Well and Stairwell, except otherwise indicated.

NEMA 1: Electrical Room.

NEMA 4X: Outdoor area and other unclassified area.

NEMA 12: Indoor area not defined.

1.12 BASIS OF PAYMENT

- A. Unless otherwise noted the work shall be paid for at the Contract lump sum price for PUMP STATION ELECTRICAL WORK, which shall be payment in full for the work described herein unless otherwise noted.
- B. The work for Temporary Electric Service specified under Subsection 3.4 shall be paid under the pay item TEMPORARY ELECTRIC SERVICE CONNECTION.
- C. The work for Permanent Electric Service specified under Subsection 3.5 shall be paid under the pay item ELECTRIC SERVICE CONNECTION.

PART 2 - PRODUCTS

2.1 SERVICE PEDESTAL & METERING CABINET PADS

A. Construction Requirements:

1. Concrete shall reach 4,000 psi at 28 days.
2. Reinforcing bars shall be number 4, ASTM A615 Grade 60. All reinforcing bars are to be epoxy coated. Epoxy coated bars shall conform to the requirement of AASHTO M284. Pad rebar are to be placed at 12 inch intervals, center to center, and be tied at points of crossing.
3. Joint tape shall be 1" x 1" Butyl Sealant as approved by the City of Naperville.
4. The manufacturer shall certify in writing that the pad meets or exceeds the City of Naperville standards. For field pours, 48 hour advance notice shall be provided to the Naperville DPU-E (420-6185) of the proposed concrete pours, so that an inspector may determine that City Standards have been met.

2.2 MATERIALS AND EQUIPMENT

A. Quality

All materials, equipment and appurtenances shall be new, shall be suitable for the application and shall be the product of established, reputable manufacturers.

B. Standards

The construction, sizes, ratings and capacities of items shall be in conformance with the requirements of the NEC and with NEMA standards, as applicable.

C. UL Label

Unless otherwise indicated, materials and equipment shall bear the UL label whenever such labeling is available for the type of material or equipment being furnished.

D. Service Equipment

Equipment which is used as electric service equipment shall bear a UL listing: "SUITABLE FOR USE AS SERVICE EQUIPMENT".

E. Other Requirements

Refer to Division 1 for other requirements relating to materials and equipment.

PART 3 EXECUTION

3.1 GENERAL

- A. Provide other trades with advance information on locations and sizes of concrete pads, frames, boxes, sleeves and openings needed for the Work. Also provide information and shop drawings necessary to permit trades affected to install their Work properly and without delay.

- B. Prior to submittal of shop drawings coordinate electrical equipment, particularly motor control equipment and control panels, with all applicable equipment and systems furnished under other Divisions of the Specifications. Acknowledge in submittal drawings any designated instrument tag numbers when tag numbers are assigned in drawings or specifications. Acknowledge that coordination of all applicable equipment has been performed.
- C. The electrical system design, including, but not limited to, the type, size and quantity of equipment and components, layout, installation and connections as shown on Plans and/or as indicated in the Specifications, is based on electrical, electro-mechanical and/or electronic equipment supplied by selected manufacturers. If equipment furnished by the Contractor requires a different electrical system than that specified hereinafter or shown on Plans, the Contractor shall make all necessary modifications to the electrical system design, subject to the Owner's approval, to provide a complete electrical system ready for successful operation. The costs of making the modifications to the electrical system shall be entirely borne by the Contractor without extra cost to the Owner. If equipment furnished by the Contractor necessitates changes to electric, gas and/or telephone utilities' service equipment, or to the Work specified under other Sections of the Specifications, then the cost for making the changes shall also be entirely borne by the Contractor without extra cost to the Owner.
- D. Locate all equipment such that they are readily accessible for operation, maintenance, repair and replacement. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place. In general, such equipment is not to be blocked or concealed except where specifically permitted. Do not route conduits across or through access or maintenance space of other equipment. Where equipment is permitted to be concealed, provide approved access door. Where equipment is concealed in fire-resistance rated walls or partitions provide access doors having same fire-resistance rating as well as partitions in which door is placed.
- E. Where electrical equipment is to be installed in limited space, provide additional drawings (scale - minimum 1/4 in. = 1 ft.) as necessary to show physical and dimensional relationship between electrical equipment and adjacent equipment furnished under other Divisions of the Specifications. Acknowledge locations of adjacent structural or mechanical systems, including ductwork, piping, or equipment accesses. Acknowledge clearances established by all codes and regulations are met or exceeded.
- F. The installation shall be such that its components will function together as workable systems. It shall be complete, with all accessories necessary for its operation, and shall be left with all equipment properly adjusted and in working order. The Work shall be executed in conformity with the best practices and so as to contribute to efficiency of operation, minimum maintenance, accessibility and appearance.
- G. Location of electrical equipment shown on Plans is approximate and is subject to minor changes as directed by and at no extra cost to the Owner.
- H. Perform equipment tests as per manufacturer's instructions except where otherwise specified.

3.2 PROTECTION OF WORK

- A. All electrical work, including equipment, fixtures and appurtenances shall be protected from damage until final acceptance. Fixtures and equipment shall be covered to protect against dirt, moisture, paint and the like. The work shall be protected from mechanical injury by appropriate covering or shielding.
- B. Prior to final acceptance, protective measures shall be removed and equipment and items shall be cleaned as required to deliver the installation to the State in clean, undamaged condition.

3.3 CLEAN-UP AND SAFETY

- A. The work site shall be maintained in a clean condition, free of hazards, all in conformance with the requirements of Article 107 of the Standard Specifications. Special care shall be taken to assure that electrical systems are not left in an exposed or otherwise hazardous condition.
All electrical boxes, cabinets, pole handholes, etc., which contain wiring, either energized or non-energized, shall be closed or shall have their covers in place and shall be locked when possible, during off-work hours.

3.4 TEMPORARY ELECTRIC SERVICE

- A. Work under this Section shall include all equipment, wiring and appurtenances required for the complete, operational temporary electric service.
- B. All electric utility's charges for disconnecting the existing electric service and providing new service to the existing pump station shall be paid to the utility by the Contractor. The Contractor will be reimbursed the exact amount of these charges, plus any allowable administrative costs as permitted in Standard Specification Article 109.05 under a separate pay item,

TEMPORARY ELECTRIC SERVICE CONNECTION.

For bidding purposes, this item shall be estimated at \$50,000.

- C. The Drawings and Specifications indicate the general nature of work required for electric service. The Contractor shall verify the service requirements, shall ascertain the installation requirements and the items of equipment, wiring, appurtenances being furnished by the utility and shall provide all other material and work required for a complete installation.

3.5 PERMANENT ELECTRIC SERVICE

- A. Work under this Section shall include all equipment, wiring and appurtenances required for the complete, operational permanent electric service.
- B. All electric utility's charges for providing two new services to the new pump station shall be paid to the utility by the Contractor. The Contractor will be reimbursed the exact amount of these charges, plus any allowable administrative costs as permitted in Standard Specification Article 109.05 under a separate pay item,

ELECTRIC SERVICE CONNECTION.

For bidding purposes, this item shall be estimated at \$255,000.

- C. The Drawings and Specifications indicate the general nature of work required for electric service. The Contractor shall verify the service requirements, shall ascertain the installation requirements and the items of equipment, wiring, appurtenances being furnished by the utility and shall provide all other material and work required for a complete installation.
- D. Power metering cabinets shall consist of utility provided transformers, and meter socket in a NEMA 4X enclosure. Coordinate the transformer rating with the electric utility.
- E. All electric service work must conform to the requirements of the electric utility
- F. The Contractor shall obtain approval of the electric utility for the electric service and metering prior to installation. Copies of approved documents and drawings shall be submitted to the Engineer for the record prior to installation.

3.6 PEDESTAL & METERING CABINET PAD INSTALLATION

- A. The pedestal & metering cabinet pad shall be installed on a 12 inch compacted crushed rock base.
- B. Secondary conduits shall enter from the bottom of the pad. Exact location of the conduit stubs may vary: coordinate the exact location with the Naperville Department of Public Utilities – Electric (DPU-E) prior to construction.
- C. Protection posts in the form of 8 inch concrete filled steel pipes are required in areas of vehicular traffic. Posts shall be 4 feet below grade with 4 feet extended above grade. Each post shall be installed in an 18 inch diameter hole filled with concrete and set 1 foot off the exposed corners.

3.7 ELECTRIC SERVICE COORDINATION

- A. Existing Pump Station shall remain operational until new Pump Station is operational. ComEd is to provide a temporary service to the existing pump station prior to removing the existing service. Contractor is responsible for coordinating with ComEd service disruptions such that one service is in constant operation. Contractor shall initiate cancelation of existing service, and once the new pump station is commissioned ensure that the process is completed including terminating billing and invoices for energy charges. The following constraints shall be followed:
 - 1. The temporary ComEd transformers, poles, and service extension shall be installed prior to disconnection of the existing ComEd equipment.
 - 2. Conduit and conductors from new Naperville transformers to the 480V switchgear shall be installed. Coordinate with Naperville for transformer terminations.

3. At this time, the new service will be connected to the new Pump Stations. Existing Pump Station is now powered from the new temporary ComEd service and new Pump Station is powered from new Naperville service.
 4. Contractor shall perform necessary testing of equipment at new Pump Station to verify all equipment is operational prior to the disconnection of existing ComEd equipment.
 5. Temporary service feeding existing Pump Station shall be disconnected. ComEd equipment that feeds existing Pump Station shall then be removed. Service disconnection to existing Pump Station shall only occur after new Pump Station is constructed and operational, and inflow and outflow sewers are complete.
- C. The Drawings and Specifications indicate the general nature of the work required for telephone service. The Contractor shall verify the service requirements, shall ascertain the installation requirements and the items of equipment, wiring and appurtenances being furnished by the utility and shall provide all other material and work required for a complete installation.
- D. All telephone service work must conform to the requirements of the telephone utility.
- E. The Contractor shall obtain approval of the telephone utility for the modification of the telephone wiring. Copies of approved Documents and drawings shall be submitted to the Engineer for the record prior to installation.

3.8 FINAL ACCEPTANCE INSPECTION

- A. When the work is complete, tested and fully operational, and only after the Record Documents have been reviewed and accepted by the Engineer, the Contractor shall schedule a Final Acceptance Inspection with the Engineer. The Contractor is cautioned to test for the proper operation of all equipment prior to the final acceptance inspection and to make any corrections necessary to establish proper operation. THE FINAL ACCEPTANCE INSPECTION SHALL NOT BE HELD WHILE FINAL CONNECTIONS AND CHECKS ARE BEING MADE.
- B. The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall be as further described in Division 1.

3.9 MAINTENANCE

- A. During the course of the construction work and until final acceptance, the Contractor shall be responsible for maintenance and operational integrity of the facility as specified in Division 1.

3.10 ELECTRICAL POWER SYSTEMS STUDIES

- A. Section includes:
 1. Short circuit analysis, protective device evaluation study, protective device coordination study, and arc flash study on entire power distribution system.

2. Portions of electrical distribution system from normal and alternate sources of power throughout distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions and maximum incident energy shall be covered in study.
3. Contractor shall engage services of independent engineering firm for purpose of performing electric power systems studies as specified.
4. The contractor is responsible to provide adequately rated electrical equipment at no additional cost to the owner if based on the power system study the equipment is found to be underrated.

B. Studies

1. Studies shall include following:
 - a. Utility Company incoming service lines.
 - b. Main switching station.
 - c. Power transformers.
 - d. Low voltage switchgear.
 - e. Motor control centers.
 - f. Power and lighting distribution panels.
 - g. Cable, wire, and conduit systems.

C. Short Circuit Study

1. Provide complete report with printout data sheets using digital computer type programs as part of study.
2. Include utilities' short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected, and other source impedances.
3. Calculate short circuit momentary duty values and interrupting duty values based on assumed 3-ph bolted short circuit at switch gear base medium voltage controller, switchboard, low voltage MCC, distribution panelboard, pertinent branch circuit panel, and other significant locations through system. Include short circuit tabulation of symmetrical fault currents and X/R ratios. List with respective X/R ratio each fault location, total duty on bus, and individual contribution from each connected branch.

D. Equipment Device Evaluation Study.

1. Provide protective device evaluation study to determine adequacy of circuit breakers, molded case switches, automatic transfer switches, knife switches, controllers, surge arresters, busways, and fuses by tabulating and comparing short circuit ratings of these devices with calculated fault currents. Apply appropriate multiplying factors based on system X/R ratios and protective device rating standards. Notify ENGINEER of problem areas or inadequacies in equipment due to short circuit currents and provide suggested alternate equipment.

E. Equipment Device Coordination Study.

1. Provide protective device coordination study with necessary calculations and logic decisions required to select or check selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. Objective of study is to obtain optimum protective and coordination performance from these devices.
2. Include as part of coordination study, medium and low voltage classes of equipment from utility's incoming line protective device down to and including largest rated device in 480 v MCCs and panelboards. Include phase and ground overcurrent protection as well as settings of other adjustable protective devices.
3. Draw time-current characteristics of specified protective devices in color on log-log paper or computer printout. Include with plots complete titles, representative one-line diagram and legends, associated Power Company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. Indicate types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing in-rush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits, and significant symmetrical and asymmetrical fault currents. Provide coordination plots for phase and ground protective devices on system basis. Provide sufficient number of separate curves to indicate coordination achieved.
4. Provide separate selection and settings of protective devices in tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings. Tabulate recommended power fuse selection for medium voltage fuses where applied in system.
Notify ENGINEER of discrepancies, problem areas or inadequacies and provide suggested alternate equipment ratings and/or settings.

F. Arc Flash Study

1. Provide Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70E, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE).
2. Adjust system design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm². Provide suggested alternate equipment and settings to minimize incident energy levels.
3. Provide incident energy level (calories/cm²) for each equipment location and recommended PPE.
4. Based on the results of the incident energy study provide and install a warning label (orange <40 cal/cm²) or danger label (red > 40 cal/cm²) for each piece of equipment. The label must be readable in both indoor and outdoor environments and contain the following information:

- a. Arc hazard boundary (feet and inches).
 - b. Working distance (feet and inches).
 - c. Arc flash incident energy at the working distance (calories/cm²).
 - d. PPE category and description including the glove rating.
 - e. Voltage rating of the equipment.
 - f. Limited approach distance (feet and inches).
 - g. Restricted approach distance (feet and inches).
 - h. Prohibited approach distance (feet and inches).
 - i. Equipment/bus name.
 - j. Date prepared.
5. Provide one day of arc flash safety training, travel time excluded and at jobsite or classroom designated by OWNER, that contains the requirements referenced in OSHA 1910.269, OSHA 1910 Subpart S and NFPA 70E. Training shall include but not be limited to the following:
- a. Proper use of the system analysis data.
 - b. Interpretation of hazard labels.
 - c. Selection and utilization of personal protective equipment.
 - d. Safe work practices and procedures.
6. Protective Device Testing, Calibration, and Adjustment
7. Comply with Section 3.12 TESTING ELECTRICAL SYSTEMS.

3.11 TESTING ELECTRICAL SYSTEMS

A. Summary

1. Prior to energizing equipment, retain services of recognized independent testing laboratory for purpose of performing inspections and tests as herein specified.
2. Ensure electrical equipment supplied by Contractor and Owner is operational within industry and manufacturer's tolerances and installed in accordance with Specifications.
3. Device Ratings and Settings: Verify ratings and settings of overload relays, motor circuit protectors, and overcurrent devices. Make final adjustments of devices in accordance with paragraph 3.8.

B. General

1. Test Work and equipment installed to ensure proper and safe operation in accordance with intent of Drawings and Specifications.
 - a. Check interlocking and automatic control sequences and test operation of safety and protective devices.
 - b. Correct defects found by Work of this Section.
 - c. Cooperate with Power Company, supplier, and manufacturer representatives in order to achieve proper intended operation of equipment.

2. Test, adjust, and record operating voltages at each system level before energizing branch circuits.
 - a. Transformer taps shall be adjusted to obtain as near as possible nominal system voltage.
 - b. Where transformer is under utility jurisdiction, obtain services of utility to correct voltage.
 - c. Replace devices and equipment damaged due to failure to comply with this requirement.
3. Balance load among feeder conductors at each panelboard, switchboard or substation and reconnect loads as necessary to obtain reasonable load balance on each phase. Electrical unbalance shall not exceed 20%.

C. Switchgear/Motor Controller Assembly.

1. Visual and Mechanical Inspections:
 - a. Inspect for physical damage.
 - b. Verify equipment supplied and connected in accordance with Specifications.
 - c. Inspect for proper alignment, anchorage, and grounding.
 - d. Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels.
 - e. Key interlock system shall be physically tested to ensure proper function.
 - f. Doors, panels, and sections shall be inspected for paint, scratches, and fit.
 - g. Mechanical operation of relays, switches, and other devices.
2. Electrical Tests:
 - a. Insulation Resistance Test: Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for 1 min. Test voltage and minimum acceptable values in accordance with Paragraph 3.9.C-3.b.
3. Test Values:
 - a. Bolt torque levels shall be in accordance with manufacturer's instructions.
 - b. Insulation resistance test shall be performed in accordance with following:

Insulation Resistance Test Voltage	
Voltage Rating	Test Voltage
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

- c. Values of insulation resistance less than rated kv +1 in Megohms shall be investigated and corrected.

D. Motor Controllers

1. Visual and Mechanical Inspections: Include following inspections and related work:
 - a. Motor Control Device Ratings and Settings: Verify ratings and settings as installed are appropriate for final loads and final system arrangement and parameters. Recommend final protective device ratings and settings where differences found. Use accepted revised ratings or settings to make final system adjustments.
 - b. Inspect for defects and physical damage and nameplate compliance with Drawings.
 - c. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's written instructions.
 - d. Check tightness of electrical connections of devices with calibrated torque wrench. Use manufacturers recommended torque values.
 - e. Clean devices using manufacturer's approved methods and materials.
 - f. Verify proper fuse types and ratings in fusible devices.
2. Electrical Tests:
 - a. Perform following in accordance with manufacturer's written instructions.
 - 1) Insulation resistance test of motor control devices conducting parts to extent permitted by manufacturer's written instructions. Insulation resistance less than 100 megaohms is not acceptable.
 - 2) Use primary current injection to check performance characteristics of motor circuit protectors and for overload relays of controllers for motors 15 hp and larger. Trip characteristics not within manufacturer's published time-current tolerances are not acceptable.
 - 3) Make adjustments for final settings of adjustable trip devices.
 - 4) Test auxiliary protective features such as loss of phase, phase unbalance, and undervoltage to verify operation.
 - 5) Check for improper voltages at terminals in controllers having external control wiring when controller disconnect opened. Voltages over 30v are unacceptable.
 - b. Correct deficiencies and retest motor control devices. Verify system tests that specified requirements are met.

E. Instrument Transformers

1. Visual and Mechanical Inspection:
 - a. Inspect for physical damage and compliance with Drawings.
 - b. Check mechanical clearances and proper operations of disconnecting and grounding devices associated with potential transformers.
 - c. Verify proper operation of grounding or shorting devices.

2. Electrical tests:

- a. Confirm transformer polarity electrically.
- b. Verify connection at secondary CT leads by driving low current through leads and checking for this current at applicable devices.
- c. Confirm transformer ratio.
- d. Measure insulation resistance of transformer secondary and leads with 500v megaohm meter.
- e. Measure transformer primary insulation with applicable overpotential tests.
- f. Verify connection of secondary PT leads by applying low voltage to leads and checking for this voltage at applicable devices.

F. Metering and Instrumentation

1. Visual and Mechanical Inspection:

- a. Examine devices for broken parts, indication of shipping damage, and wire connection tightness.
- b. Verify meter connections in accordance with single line meter and relay diagram.

2. Electrical Tests:

- a. Calibrate meters at midscale. Calibration instruments shall have precision no more than 50% of instrument being testing.
- b. Calibrate watthour meters to 1/2%.
- c. Verify instrument multipliers.

G. Grounding System

1. Testing:

- a. Subject completed grounding system to megger test at each Location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
- b. Measure ground resistance not less than 2 full days after last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
- c. Perform tests by 2 point method according to Section 9.03 of IEEE 81.

2. Maximum grounding resistance values are as follows:

- a. Equipment Rated 500 kVA and less: 10 ohms.
- b. Equipment Rated 500 to 1000 kVA: 5 ohms.
- c. Equipment Rated More than 1000 kVA: 3 ohms.
- d. Unfenced Substations and Pad-Mounted Equipment: 5 ohms.
- e. Manhole Grounds: 10 ohms.

3. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
4. Report: Prepare certified test reports, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

H. Ground Fault Systems

1. Visual and Mechanical Inspections:

- a. Inspect for physical damage and compliance with Drawings and Specifications.
- b. Inspect neutral main bonding connection to ensure following.
 - 1) Zero sequence system grounded upstream of sensor.
 - 2) Ground strap systems grounded through sensing device.
 - 3) Ground connection made ahead of neutral disconnect link.
- c. Inspect control power transformer to ensure adequate capacity for system.
- d. Manually operate monitor panels (if present) for the following:
 - 1) Trip test.
 - 2) No trip test.
 - 3) Non-automatic reset.
- e. Record proper operation and test sequence.
- f. Inspect zero sequence systems for symmetrical alignment of core balance transformers about current carrying conductors.
- g. Verify ground fault device circuit nameplate identification by actuation observation.
- h. Pickup and time delay settings shall be set in accordance with settings developed through coordination study and as approved by ENGINEER.

2. Electrical Tests:

- a. Test in accordance with manufacturer's instructions.
- b. Measure system neutral insulation resistance to ensure no shunt ground paths exist, neutral-ground disconnect link removed, neutral insulation resistance measured, and link replaced.
- c. Relay pickup current shall be determined by primary injection at sensor and circuit interrupting device operated.
- d. Relay timing shall be tested by injecting 150% and 300% of pickup current into sensor. Total trip time shall be electrically monitored.
- e. System operation shall be tested at 55% rated voltage.
- f. Zone interlock system shall be tested by simultaneous sensor current injective and monitoring blocking function.

3. Test Parameters:
 - a. For the power wires and cables the Contractor must Megger test them at 1000 volts. The minimum acceptable reading must be 250 Megohms. The Megger test must not be done until any and all splicing is completed.
 - b. Relay pickup current shall be within 10% of device dial or fixed setting, and in no case greater than 1,200 amps.
 - c. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves, but in no case longer than 1 sec.

3.12 ELECTRICAL IDENTIFICATION

A. Installation

1. Install As indicated where used for color coding.
2. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
3. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and or designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards. Use consistent designations throughout Project.
4. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
5. Self Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
6. Install painted identification as follows:
 - a. Clean surfaces of dust, loose material, and oily films before painting.
 - b. Prime Surfaces: For galvanized metal, use single component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy duty, acrylic resin block filler. For concrete surfaces, use clear, alkali resistant, alkyd binder type sealer.
 - c. Apply one intermediate and one finish coat of silicone alkyd enamel.
 - d. Apply primer and finish materials according to manufacturer's instructions.
7. Apply warning, caution, and instruction signs and stencils as follows:
 - a. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 - b. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 in. (9 mm) high lettering for emergency instructions on power transfer, load shedding, and or emergency operations.
8. Install Nameplate as follows:

- a. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide single line of text with 1/2 in. (13 mm) high lettering on 1-1/2 in. (38 mm) high label; where 2 lines of text are required, use lettering 2 in. (51 mm) high. Use black lettering on white background. Apply labels for each unit of following categories of equipment.
 - 1) Access doors and panels for concealed electrical items.
 - 2) Electrical switchgear.
 - 3) Motor control centers.
 - 4) Push button stations.
 - 5) Power transfer equipment.
 - 6) Transformers.
 - 7) Power generating units.
 - 8) Telephone switching equipment.
 - 9) Fire alarm master station or control panel.
 - 10) Security monitoring or control panel.
- b. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

3.13 EXCAVATION AND BACKFILL

- A. Excavation and backfill for work under this Division shall be provided under this Division in conformance with Division 2.

3.14 CONCRETE

- A. Concrete for equipment pads, conduit encasement, handholes, manholes and other work under this Division shall be provided under this Division in conformance with Division 3.

3.15 CUTTING AND PATCHING

- A. All cutting and patching of building materials required for work under this Division shall be provided under this Division.
- B. No structural members shall be removed, cut or otherwise modified without approval of the Engineer and any such work shall be done in a manner as directed by the Engineer.
- C. Cutting and patching shall be performed in a neat and workmanlike manner, consistent with the best practices of the appropriate trade. All patching shall be done in a manner consistent with the building material being patched.

- D. Holes made in concrete shall be made using a suitable core drill. The use of a star drill or air hammer will not be permitted.
- E. In new construction, sleeves, chases, inserts and the like required for work under this Division shall be provided under this Division and the furnishing and placement of these items shall be fully coordinated with the other trades involved so as not to delay the new construction.

END OF SECTION 26 05 11

DIVISION 26 – ELECTRICAL

SECTION 26 05 21 CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES: Conduits for cables and wiring.
- F. Section 26 09 14, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) Equipment.
- G. Section 26 24 13, SWITCHBOARD: Low voltage switchboard and electrical service transfer system.
- H. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- I. Section 26 24 19, MOTOR CONTROL CENTER: Low voltage combination starters and motor controls.
- J. Section 26 51 00, LIGHTING: Interior and exterior lighting fixtures.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
1. Manufacturer's Literature and Data: Showing each cable type and rating.
 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the Resident Engineer:
 - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
D2301-04 Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
- C. National Fire Protection Association (NFPA):
70-08 National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
WC 70-09 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- E. Underwriters Laboratories, Inc. (UL):
44-05 Thermoset-Insulated Wires and Cables
83-08 Thermoplastic-Insulated Wires and Cables
467-071 Electrical Grounding and Bonding Equipment
486A-486B-03 Wire Connectors
486C-04 Splicing Wire Connectors
486D-05 Sealed Wire Connector Systems
486E-94 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-07 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
514B-04 Conduit, Tubing, and Cable Fittings
1479-03 Fire Tests of Through-Penetration Fire Stops

1.7 GUARANTEES

- A. Guarantees shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

1.8 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.9 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be U/L listed and in accordance with NEMA WC-70 and as specified herein. All insulated conductors shall be rated for 600 Volts.
- B. Single Conductor:
 - 1. Shall be annealed copper.
 - 2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
 - 3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.
- C. Branch Circuits:
 - 1. Single Conductor Type THWN: Above ground and underfloor conduits.
 - 2. Single Conductor Type XHHW-2: Duct bank conduit.
 - 3. No. 12 AWG minimum size (unless otherwise noted) for branch circuit wiring, including motor circuits.
 - 4. Size 120 v branch circuits for length of run on the following basis.
 - a. 0 to 50 ft Run From Panelboard to first outlet: No. 12 AWG minimum.
 - b. 56 to 100 ft Run: Increase one wire size, i.e., No. 12 AWG becomes No. 10 AWG.
 - c. 101 to 150 ft Run: Increase two wire sizes, i.e., No. 12 AWG becomes No. 8 AWG.
 - d. 151 ft and above: Wiring sized for 3% maximum voltage drop.
 - 5. For other branch circuits, voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of the NEC 215.

D. CONTROL WIRING

1. Single conductor Type THWN: Above ground and underfloor conduits.
2. No. 12 AWG minimum size (unless otherwise noted).
3. Multi-wire cable assembly: Duct bank conduits.

E. Non-shielded Instrumentation, Graphic Indication, and Other Control Wiring Operating at Less Than 120 v: No. 14 AWG except as otherwise indicated with same insulation as control circuits.

1. Single conductor Type THWN, above ground and underfloor conduits.
2. Multi-wire cable assembly: Duct bank conduits.

F. Shielded instrumentation wiring, above ground and underfloor conduits:

1. PVC insulation, tinned copper (19 by 27) stranded, No. 16 AWG, twisted pair or triplet cabled with aluminum mylar shielding, stranded, tinned, No. 18 AWG copper drain wire, and overall black FR-PVC, 90°C, 600 volt jacket.
2. Multi-wire cable assembly: Duct bank conduits.

G. Telephone wire, above ground conduits:

1. Vinyl insulation, tinned copper, solid twisted pair, cabled conductors, and silver gray vinyl jacket.
 - a. Up to 4 conductors per cable: 22 AWG solid wire.
 - b. Over 4 conductors per cable: 24 AWG solid wire.
 - c. Duct Bank: High density polyethylene jacketed multi-wire cable assemblies.

H. Fire Alarm Circuits: Type THWN, copper conductor, in raceway.

I. Multi-Wire Control and Instrumentation Cable Assemblies:

1. Multi-conductor, color-coded cable with number and size of conductors indicated.
2. Where spare conductors are not indicated provide 10% spare conductors. One pair minimum.
3. Control and non-shielded instrumentation.
 - a. Bare soft stranded No. 14 or 12 AWG copper in accordance with ASTM B3.
 - b. Class B stranded in accordance with ASTM B8.
 - c. Type THWN insulation also meeting requirements of NEMA WC-5 with armor-nylon in accordance with UL 83-THWN.
 - d. Color coded in accordance with NEMA WC-5 Method I Table K-2.
 - e. Cabled with suitable fillers.
 - f. Overall black FR-PVC, 90°C, 600 volt sunlight resistant jacket.
4. Shielded Instrumentation:
 - a. Bare soft stranded No. 16 AWG copper in accordance with ASTM B3.
 - b. Class B stranded tinned copper in accordance with ASTM B8.

- c. PVC with nylon armor insulation.
- d. Twisted pairs color coded in accordance with NEMA WC-5 Method I Table K-2, and numbered.
- e. Individual and overall aluminum mylar shield and seven strand tinned copper drain wires.
- f. Overall black FR-PVC 90°C 600 volt sunlight resistant jacket.

J. Insulation:

- 1. XHHW-2 or THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

K. Color Code:

- 1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- a. Lighting circuit “switch legs” and 3-way switch “traveling wires” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the Resident Engineer.
- 2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
- 3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - a. Solid color insulation or solid color coating.

2.2 WIRE MESH CABLE GRIPS

- A. Provide Wire Mesh Cable Grips designed to hold the weight of vertical or sloping cable in Stainless Steel for size of cable as shown on the drawing in both a Closed Mesh/Double Eye/Single Weave and Closed Mesh/Single Eye/Single Weave eye style.
- B. Wire Mesh Cable grips shall be as manufactured by Remke Energy or approved substitute.

2.3 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.

B. Aboveground Circuits (No. 10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.

C. Aboveground Circuits (No. 8 AWG and larger):

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper conductors.
2. Field-installed compression connectors for cable size 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

D. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190° F [90° C], with integral insulation.

E. Terminations

1. Power Conductors: Compression crimp type lugs.
2. Control and Instrumentation Conductors: Compression crimp type fork tongue, insulated support type lugs on terminal strips. Do not splice.

F. Terminal Strips

1. Manufacturers:
 - a. Square D Co.
 - b. Buchanan.
 - c. Or Equal.
2. Channel mount snap-on type.
3. Individual gangable with nylon bases.
4. Solderless box lug type rated at 600 v to accommodate No. 22 to 8 AWG wire or as otherwise indicated.
5. Provide 20% spare terminals, but no less than 4 spare terminals.

2.4 ELECTRICAL IDENTIFICATION

A. Raceway and Conductor Labels

1. Standard Products: Where more than one type is listed for specified application, selection is Installer's option, but provide a single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.
2. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
 - a. Color: Black legend on orange field.
 - b. Legend: Indicates voltage.
3. Adhesive Labels: Preprinted, flexible, self adhesive vinyl. Legend is over-laminated with clear, wear and chemical resistant coating.
4. Pre-tensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color coded, acrylic bands sized to suit diameter of line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.
5. Colored Adhesive Tape: Self adhesive vinyl tape not less than 3 mils thick by 1 to 2 in. wide (0.08 mm thick by 25 to 51 mm wide).
6. Underground Line Warning Tape: Permanent, bright colored, continuous printed, vinyl tape with following features:
 - a. Size: Not less than 6 in. wide by 4 mils thick (152 mm wide by 0.102 mm thick).
 - b. Compounded for permanent direct burial service.
 - c. Embedded continuous metallic strip or core.
 - d. Printed Legend: Indicates type of underground line.
 - e. Aluminum, Wraparound Marker Bands: Bands cut from 0.014 in. (0.4 mm) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
 - f. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
 - g. Aluminum Faced Card Stock Tags: Wear resistant, 18 point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 in. (0.05 mm) thick, laminated with moisture resistant acrylic adhesive, and punched for fastener. Preprinted legends suit each application.
 - h. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2 in. (51 by 51 mm) by 0.05 in. (1.3 mm).

B. Engraved Nameplates and Signs

1. Legend plates shall be plastic, 2 ½" SQ minimum with black letters on white background. Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.
2. Engraved stock, melamine plastic laminate, 1/16 in. (1.6 mm) minimum thick for signs up to 20 sq in. (129 sq cm), 1/8 in. (3.2 mm) thick for larger sizes.
 - a. Engraved Legend: Black letters on white face.
 - b. Punched for mechanical fasteners.

3. Baked Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for application. 1/4 in. (6.4 mm) grommets in corners for mounting.
4. Exterior, Metal Backed, Butyrate Signs: Wear resistant, non-fading, preprinted, cellulose acetate butyrate signs with 0.0396 in. (1 mm), galvanized steel backing, with colors, legend, and size appropriate to application. 1/4 in. (6.4 mm) grommets in corners for mounting.
4. Fasteners for Plastic Laminated and Metal Signs: Self tapping stainless steel screws or No. 10/32 stainless steel machine screws with nuts, flat washers and lock washers.

C. Miscellaneous Identification Products

1. Cable Ties: Fungus-inert, self extinguishing, 1 piece, self locking, Type 6/6 nylon cable ties with following features:
 - a. Minimum Width: 3/16 in. (5 mm).
 - b. Tensile Strength: 50 lb (22.3 kg) minimum.
 - c. Temperature Range: Minus 40 to 185°F (Minus 4 to 85°C).
 - d. Color: As indicated where used for color coding.
2. Paint: Alkyd-urethane enamel. Primer as recommended by enamel manufacturer.

2.5 WIRE LUBRICATING COMPOUND

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 CONDUCTORS AND CABLES

A. Installation

1. Install wires and cables as indicated, according to manufacturer's written instructions and NECA "Standard of Installation".
2. Run wire and cable in conduit unless otherwise indicated on Drawings. Pull conductors into raceway simultaneously where more than 1 is being installed in same raceway.
 - a. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
 - b. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
 - c. Do not draw conductor into conduits until building is enclosed, watertight, and work causing cable damage has been completed.
3. Install cable supports and wire mesh grips for vertical feeders in accordance with NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

4. For panelboards, cabinets, switches, and equipment assemblies, neatly form, train, and tie cables in individual circuits.
5. Seal cable and wire entering building from underground between wire and conduit, where cable exits conduit, with non-hardening approved compound.
6. Install wire and cables in separate raceway systems as follows:
 - a. Exit lights.
 - b. Shielded Instrumentation
 - c. Telephone cables.
 - d. Fire Alarm System.
 - e. As required by NEC.
7. Where control or instrumentation cables are run in underground conduit and ducts provide multi-wire cable assemblies.
8. Where power cables and instrument/signal cables enter and pass through same or distribution box, steel barrier or separate raceways shall continue through box to avoid magnetic interaction between power cables and instrumentation conductors.
9. Do not run instrumentation cables into control cabinets or MCC unless cables are terminated in cabinet or MCC.
10. Wiring at Outlets: Install with at least 12 in. (300 mm) of slack conductor at each outlet.
11. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.
12. Drawings do designate number of conductors in conduit. CONTRACTOR is responsible for verifying number of conductors in conduit prior to installation. Location of branch circuits and switch legs indicated on Drawings may be routed differently as dictated by construction and these Specifications.

3.2 BRANCH CIRCUITS

- A. Motor branch circuits and branch circuits for 3 phase circuits shall not be combined.
- B. Branch circuits for single phase equipment devices from same LP or PP may be combined provided that such combining does not result in having to derate ampacity of conductors.

3.3 TERMINATIONS AND SPLICES

- A. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.
- B. Power Cable Splices (no splices in cables unless approved by Engineer):

1. Provide continuous lengths of cable without splices in motor circuits and feeders unless otherwise noted. Splices may be installed in motor circuits and feeders with prior approval by ENGINEER.
2. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
3. Use splice and tap connectors that are compatible with conductor material.
4. Where pre-insulated spring connectors are used for equipment connections, tape connector to wire to prevent loosening under vibration.
5. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.
6. Cable splices shall be made only in distribution boxes and junction boxes.

C. Power Cable Terminations:

1. Termination of wires with full compression type lugs installed with appropriate hand or hydraulic tool. Use proper dies to achieve the desired compression.
2. For screw type terminal blocks, terminations for stranded conductors shall be made with T & B lock-on fork connector with insulated sleeves.
3. Motor lead conductor terminations shall be made with a T & B or approved equal, full compression lug, full ring type, bolted, and taped as required. For connecting motor lead to service wiring fasten full ring lugs together with cadmium plated steel cap screws, and cover with a minimum of 2 layers 1/2 lap, 3M Scotch No. 33 tape; option: T & B "Motor Stub Splice Insulator".

D. Color Code Conductors:

1. Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.
2. Field applied, color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.
 - a. Colored, pressure sensitive plastic tape in half lapped turns for distance of 6 in. (150 mm) from terminal points and in boxes where splices or taps are made. Apply last 2 turns of tape with no tension to prevent possible unwinding. Use 1 in. (25 mm) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 in. (76 mm) from terminal and spaced 3 in. (76 mm) apart. Apply with special tool or pliers, tighten to snug fit, and cut off excess length.
3. 208/120-V Systems: As follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.

4. 480/277-V Systems: As follows:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: White with non-green stripe.
 - e. Ground: Green.

E. Power Circuit Identification:

1. Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, and switchboard rooms.
2. Legend: 1/4 in. (6.4 mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
3. Fasten tags with nylon cable ties; fasten bands using integral ears.

F. Apply identification to conductors as follows:

1. Conductors to Be Extended in Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
3. Multiple Control and Communications Circuits in Same Enclosure: Identify each conductor by its system and circuit designation. Use consistent system of tags, color coding, or cable marking tape.

3.4 CONTROL AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Control circuit wiring from same area for the same system returning to same panel, (e.g., LCP, DPC, etc.) may be combined provided signal and voltage types are not mixed.
- E. Following types of wiring shall not be combined with other types:
 1. 4-20 ma dc analog; Type 2 shielded cable.
 2. 24 vdc discrete (e.g., field or LCP powered dry contacts).

3.5 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.

- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.6 ACCEPTANCE CHECKS AND TESTS

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

END OF SECTION 26 05 21

DIVISION 26 - ELECTRICAL

SECTION 26 05 26 GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as made, supplementary, and grounding electrodes.
- C. The terms "connect" and "bond" is used interchangeably in this specification and has the same meaning.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- D. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.
- E. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- F. Section 26 24 13, SWITCHBOARD: Low voltage switchboard and electrical service transfer system.
- G. Section 26 24 19, MOTOR CONTROL CENTER: Low voltage combination starters and motor controls.
- H. Section 26 27 26, WIRING DEVICES: Receptacles, switches and multi-outlet devices.
- I. Section 26 51 00, LIGHTING: Interior and exterior lighting fixtures.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 - 1. Clearly present enough information to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

- A. American Society for Testing and Materials (ASTM):
 - B1-07..... Standard Specification for Hard-Drawn Copper Wire
 - B3-07..... Standard Specification for Soft or Annealed Copper Wire
 - B8-04..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 81-1983..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - C2-07 National Electrical Safety Code
- C. National Fire Protection Association (NFPA):
 - 70-08..... National Electrical Code (NEC)
 - 99-2005..... Health Care Facilities
- D. Underwriters Laboratories, Inc. (UL):
 - 44-05 Thermoset-Insulated Wires and Cables
 - 83-08 Thermoplastic-Insulated Wires and Cables
 - 467-07 Grounding and Bonding Equipment
 - 486A-486B-03 Wire Connectors

1.6 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm²] and larger shall be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC.

2.2 WIRE AND CABLE GROUNDING CONNECTORS

- A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
 - 1. Material: Copper.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Assembly of Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.

2.3 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 3/0 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 in. thick and 2 in. wide, except as indicated.

2.4 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.

- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.5 GROUNDING ELECTRODES AND TEST WELLS

- A. Grounding Rods: Copper-clad steel.
 - 1. Size: 3/4 in. by 120 in. (19 by 3000 mm).
- B. Plate Electrodes: Copper, square or rectangular shape. Minimum 0.10 in thick, size as indicated.
- C. Test Wells: Fabricate from 15 in. long, square-cut sections of 8 in. diameter, Schedule 80, PVC pipe or as detailed on Drawings.

2.6 GROUND CONNECTIONS

- A. Below Grade: Exothermic-welded type connectors.
- B. Above Grade:
 - 1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
 - 2. Connection to Building Steel: Exothermic-welded type connectors.
 - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
 - 4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

2.7 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

2.8 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.9 GROUNDING BUS

Pre-drilled rectangular copper bar with stand-off insulators, minimum 0.25 in [6.3 mm] thick x 4 in [100 mm] high in cross-section, length as shown on drawings, with 0.281 in [7.1 mm] holes spaced 1.125 in [28 mm] apart.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
 - 1. Secondary service neutrals: Contractor shall coordinate with the Utility and comply with the requirements of the Electric Utility Co.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INSTALLATION

- A. Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding Rods: Locate minimum of 1 rod length from each other and at least same distance from any other grounding electrode.
 - 1. Drive until tops are 2 in. (50 mm) below finished floor or final grade, except as otherwise indicated.
 - 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- C. Grounding Conductors: Route along shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Underground Grounding Conductors: Use bare tinned copper wire. Bury at least 24 in. (600 mm) below grade.
- E. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- F. Test Wells: One for each driven grounding electrode system, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1 in. 25 mm) maximum-size crushed stone or gravel.

3.3 CONNECTIONS

- A. Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers' published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make visible indication that connector has been adequately compressed on grounding conductor.

- H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

3.5 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

- D. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

- E. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

- F. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.6 CORROSION INHIBITORS

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.7 GROUND SYSTEM TESTING

- A. Subject complete grounding system to megger test at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
- B. Measure ground resistance not less than 2 full days after last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
- C. Maximum ground resistance values shall be as follows:
 - 1. Equipment rated 500 kVA and less: 10 ohms.
 - 2. Equipment rated 500 to 1000 kVA: 5 ohms.
 - 3. Equipment rated more than 1000 kVA: 3 ohms.
 - 4. Unfenced Substations and Pad-Mounted Equipment: 5 ohms
- D. Where resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
- E. Prepare certified test reports of ground resistance at each test location. Include observation of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.8 GROUND FAULT SYSTEM

- A. Visual and Mechanical Inspections:
 - 1. Inspect for physical damage and compliance with Drawings and Specifications.
 - 2. Inspect neutral main bonding connection to ensure the following:
 - a. Zero sequence system grounded upstream of sensor.
 - b. Ground strap systems grounded through sensing device.
 - c. Ground connection made ahead of neutral disconnect link.
 - 2. Inspect control power transformer to ensure adequate capacity for system.

3. Manually operate monitor panels (if present) for the following:
 - a. Trip test.
 - b. No trip test.
 - c. Non-automatic reset.
4. Record proper operation and test sequence.
5. Inspect zero sequence systems for symmetrical alignment of core balance transformers about current carrying conductors.
6. Verify ground fault device circuit nameplate identification by actual observation.
7. Pickup and time delay settings shall be set in accordance with the contractors coordination study and as approved by the Engineer.

B. Electrical Tests:

1. Test in accordance with manufacturer's instructions.
2. Measure system neutral insulation resistance to ensure no shunt ground paths exist.
3. Relay pickup current shall be determined by primary injection at sensor and circuit interrupting device operation.
4. Relay timing shall be tested by injecting 150% and 300% of pickup current into sensor. Total trip time shall be electrically monitored.
5. System operation shall be tested at 55% rated voltage.

C. Test Parameters:

1. System neutral insulation shall be a minimum of 100 kohms, preferably 1 megaohm or larger.
2. Relay pickup current shall be within 10% of device dial or fixed setting, and in no case greater than 1,200 amps.
3. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves, but in no case longer than 1.

END OF SECTION 26 05 26

DIVISION 26 - ELECTRICAL

SECTION 26 05 33 RACEWAY AND BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.
- C. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- E. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 24 13, SWITCHBOARD: Low voltage switchboard and electrical service transfer system.
- G. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- H. Section 26 24 19, MOTOR CONTROL CENTER: Requirements for Motor Control Center and protection of motors.
- I. Section 26 27 26, WIRING DEVICES: Receptacles, switches and multi-outlet devices.
- J. Section 26 51 00, LIGHTING: Interior and exterior lighting fixtures.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.
- C. Shop Drawings:
 - 1. Size and location of main feeders.
 - 2. Size and location of panels and pull-boxes.
 - 3. Layout of required conduit penetrations through structural elements.
- D. Certifications:
 - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the Resident Engineer:
 - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the material has been properly installed.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
 - C80.1-05 Electrical Rigid Steel Conduit
 - C80.3-05 Steel Electrical Metal Tubing
 - C80.6-05 Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
 - 70-08 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
 - 1-05 Flexible Metal Conduits
 - 5-04 Surface Metal Raceway and Fittings
 - 6-07 Electrical Rigid Metal Conduits - Steel
 - 50-95 Enclosures for Electrical Equipment
 - 360-093 Liquid-Tight Flexible Steel Conduit
 - 467-07 Grounding and Bonding Equipment
 - 514A-04 Metallic Outlet Boxes
 - 514B-04 Conduit, Tubing, and Cable Fittings
 - 514C-96 Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
 - 651-05 Schedule 40 and 80 Rigid PVC Conduit and Fittings
 - 651A-00 Type EB and A Rigid PVC Conduit and HDPE Conduit

- 797-07 Electrical Metallic Tubing
- 1242-06 Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):

- TC-2-03 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
- TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing
- FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit,
Electrical Metallic Tubing and Cable

1.6 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Metal Conduit and Tubing
- B. Galvanized Rigid Steel Conduit: ANSI C80.1.
- C. Flexible Metal Conduit: Zinc-coated steel.
- D. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.
- E. Plastic- Coated Steel Conduit and Fittings: NEMA RN 1; rigid steel conduit system as specified with coated interior walls and external PVC coating, 40 mil thick.

2.2 NONMETALLIC CONDUIT

- A. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit: NEMA TC 2, Schedule 40 or 80 PVC.
- B. PVC Conduit Fittings: NEMA TC 3; match to conduit type and material.

2.3 FITTINGS

- A. Fittings for steel conduit:
 - 1. Steel or malleable iron, zinc galvanized or cadmium plated.
 - 2. Do not use set screw or indenter type fittings.
 - 3. Do not use aluminum or die cast fittings.
 - 4. GRS Connectors and Couplings:

- a. Threaded.
 - b. Insulated throat.
 - c. Gland compression type.
 - d. Rain and concrete type.
- 5) Comply with ANSI C80.4.
- 6) Comply with NEMA FB 1, compatible with conduit materials.
- B. Fittings for PVC Coated galvanized rigid steel conduits:
1. Use only fittings approved for use with that material. Patch nicks and scrapes with PVC coating after installing conduit.
- C. Conduit bodies:
2. Malleable iron with galvanized finish.
- D. Fittings for flexible metal conduit:
1. Insulated throat type.
 2. Threaded.
 3. Grounding type.
 4. Liquidtight: 1 piece sealing "O" rings with connectors when entering boxes or enclosures.
- E. PVC Conduit Fittings:
1. NEMA TC 3; match to conduit type and material.
- F. Expansion Joints:
1. Conduit expansion fittings complete with copper bonding jumper, Crouse-Hinds Type XJ.
 2. Conduit expansion/deflection fittings with copper bonding jumper, Crouse-Hinds Type XD.
- G. Seals:
1. Wall entrance, OZ/Gedney Type FSK or FSC.
- H. Drain Fittings:
1. Automatic Drain Breather:
 - a. Explosion proof - Safe for Class 1, Group C and D.
 - b. Capable of passing minimum 25 cc water/min and minimum 0.05 cu ft air/min at atmospheric pressure.

2. Condensate Drain:

- a. Conduit outlet body, Type T.
- b. Threaded, galvanized plug with 3/16 in. drilled holed through plug.

I. Hazardous Areas:

1. Explosion proof.
2. Horizontal seal fittings, Crouse-Hinds Type EYS.
3. Vertical seal fittings, Crouse-Hinds Type EYD.
4. Vertical seal fittings shall have drain type plug.

2.4 RACEWAY/DUCT SEALING COMPOUND

- A. Nonhardening, putty-like consistency workable at temperatures as low as 35°F.
- B. Compound shall not slump at temperature of 300°F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

2.5 CABLE TRAYS

A. Materials and Finishes

1. Cable Trays, Fittings, and Accessories: Fiberglass reinforced plastic (FRP) conforming to ASTM D635.
2. Fabricate cable tray products with rounded edges and smooth surfaces.

B. Sizes and Configurations

1. Conform to NEMA VE 1.
2. Ladder-Type Trays: Class 20C unless indicated.
3. Width: 12 in. (305 mm)
4. Inside Depth: 6 in. (152 mm)
5. Cross-Rung Spacing: 9 in. (229 mm)
6. Minimum Fitting Radius: 24 in. (610 mm)

C. Cable Tray Accessories

1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, manufactured with same materials and finishes as cable trays.
2. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 FIRE RESISTANT JOINT SEALERS

A. Manufacturers:

1. "Dow Corning Fire Stop Foam," Dow Corning Corp.
2. "Pensil 851," General Electric Co.

3. Or Equal.
- B. Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors.
- C. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.7 SUPPORTING DEVICES

- A. Materials
 1. Aluminum or Stainless Steel.
- B. Coatings
 1. Products for use outdoors.
 2. Use PVC coating where indicated on Drawings.
- C. Manufactured Supporting Devices
 1. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
 2. Fasteners: Types, materials, and construction features as follows:
 - a. Expansion Anchors: Carbon steel wedge or sleeve type.
 - b. Toggle Bolts: All steel springhead type.
 - c. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for intended service.
 - d. Nuts, Washers, and Bolts: Stainless steel.
 3. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
 4. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers.
 5. U-Channel Systems: Channels, with 9/16-in. dia. holes, at minimum of 8 in. on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacture.

2.8 FABRICATED SUPPORTING DEVICES

- A. Shop- or field-fabricate supports or manufacture supports assembled from U-channel components.
- B. Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide pipe sleeves of one of following:
 - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from following gage metal for sleeve diameter noted:
 - a. 3 in. and smaller: 20 ga.
 - b. 4 in. to 6 in.: 16 ga.
 - c. Over 6 in.: 14 ga.
 - 2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
 - 3. Plastic Pipe: Fabricate from Schedule 40 galvanized steel pipe.

2.9 CABINETS, BOXES, AND FITTINGS

- A. General
 - 1. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for use and location. Provide items complete with covers and accessories required for intended use. Provide gaskets for units in damp or wet locations.
- B. Miscellaneous Materials and Finishes
 - 1. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
 - 2. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
 - 3. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.
 - 4. Finishes:
 - a. Exterior Finish: Galvanized or Gray baked enamel for items exposed in finished locations except as otherwise indicated.
 - b. Interior Finish: Where indicated, white baked enamel.
- C. Metal Outlet, Device, and Small Wiring Box
 - 1. General:
 - a. Conform to UL 514A and UL 514B.

- b. Boxes shall be of type, shape, size, and depth to suit each location and application.
2. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
3. Galvanized Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

C. Pull and Junction Boxes

1. General: Comply with UL 50 for boxes over 100 cu in. volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
2. Galvanized Steel Boxes: Flat rolled, code gauge, sheet steel with welded seams. Where necessary to provide rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
3. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 304 of ASTM A167. Where necessary to provide rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.
4. Galvanized Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.
5. Boxes Approved for Classified Locations: Cast metal or cast nonmetallic boxes conforming to UL 886 listed and labeled for use in specific location classification, and with specific hazardous material encountered. Conduit entrances shall be integral threaded type.

D. Pavement Flood Float Alarm Box

1. Pavement flood float alarm box shall be constructed as indicated on the Drawings and as specified herein. Pavement flood float alarm box shall be provided for the Float Control System.
2. All hardware and metal parts shall be all stainless steel.
3. Fasteners shall be concealed or type that cannot be readily removed when the door is locked.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.

- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 RACEWAYS

A. Examination

- 1. Examine surfaces to receive raceways, wireways, and fittings for compliance with installation tolerances and other conditions affecting performance of raceway system.
- 2. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

B. Wiring Methods

- 1. Outdoors, Damp or Wet Locations: Use following wiring methods unless otherwise noted on Drawings:
 - a. Outdoor Exposed: PVC-Coated galvanized rigid steel.
 - b. Damp or Wet Locations: PVC-Coated galvanized rigid steel.
 - c. Concealed: Galvanized rigid steel.
 - d. Underground Power and Control, Single Run: Rigid nonmetallic (PVC) conduit.
 - 1) Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.
 - e. Underground Power and Control, Grouped: Rigid nonmetallic (PVC) conduit.
 - 1) Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.
 - f. Underground Shielded Instrumentation Cables and Shielded Instrumentation Cables run in concrete slabs, Single Run or Grouped: Galvanized rigid steel.
 - g. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment):
- 2. Indoor Dry Locations: Use following wiring methods unless otherwise noted.
 - a. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit.
 - b. Exposed: Galvanized rigid steel conduit.

3. Hazardous classified locations: Use the following wiring methods unless otherwise noted on drawings.
 - a. Exposed and concealed: Galvanized rigid steel conduit.
4. Use 3/4 in. minimum size unless otherwise noted except conduit runs to room light switches may be 1/2 in.
5. Unless specifically indicated otherwise on Drawings or in Specifications, use galvanized rigid steel conduit for general wiring.
6. Encase galvanized rigid steel conduits installed underground or underfloor in at least 3 in. of concrete. PVC conduit may be used without encasing in concrete for underfloor conduit or where specifically indicated on Drawings.
 - a. Underground conduit shall be minimum of 1 in., buried at depth of not less than 24 in. below grade.
 - b. Provide conduits or ducts terminating below grade with means to prevent entry of dirt and moisture.
 - c. When using concrete encased PVC conduit provide PVC coated galvanized rigid steel elbows.
7. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1 in. (25 mm) concrete cover.
 - a. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - b. Space raceways laterally to prevent voids in concrete.
 - c. Run conduit larger than 1 in. trade size parallel to or at right angles to main reinforcement and spaced on center of at least 3 times conduit trade dia. with minimum 2 in. concrete covering. Conduits over 1 in. may not be installed in slab without approval of ENGINEER.
 - d. When at right angles to reinforcement, place conduit close to slab support.
 - e. Conduits embedded in concrete frame shall comply with applicable provisions of ACI 318.

C. Installation

1. Conceal raceways by enclosing within finished walls, ceilings, and floors, unless otherwise indicated.
2. Provide watertight conduit system where installed in wet places, underground or where buried in masonry or concrete.
 - a. Use threaded hubs when entering top of enclosures.
 - b. Use sealing type locknuts when entering sides or bottom of enclosures.
3. Install two spare 1 in. conduits from top of each flush mounted panelboard to area above ceiling for future use. On flush mounted panelboards located on first and higher level floors, provide two spare 1 in. conduits from bottom of panelboard to ceiling area of floor below for future use.

4. Keep raceways at least 6 in. (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
5. Install raceways level and square and at proper elevations. Provide adequate headroom.
6. Complete raceway installation before starting conductor installation.
7. Use temporary closures to prevent foreign matter from entering raceway.
8. Run concealed raceways with minimum of bends in shortest practical distance considering type of building construction and obstructions, except as otherwise indicated.
9. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow surface contours as much as practical.
 - a. Mount exposed horizontal runs as high above floor as possible, and in no case lower than 7 ft above floors, walkways, or platforms in passage areas.
 - b. Run parallel or banked raceways together, on common supports where practical.
 - c. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
10. Join raceways with fittings designed and approved for purpose and make joints tight.
 - a. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - b. Use insulating bushings to protect conductors.
11. Terminations: Where raceways are terminated with locknuts and bushings, align raceway to enter squarely, and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box. Use insulating bushings. Provide insulated grounding bushings to terminate ground wire.
12. Where terminations in threaded hubs, screw raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to box, and tighten chase nipple so no threads are exposed.
13. Install pull wires in empty raceways. Use monofilament plastic line having not less than 200 lb (90 kg) tensile strength. Leave not less than 12 in. (300 mm) of slack at each end of pull wire.
14. Telephone and Signal System Raceways 2 in. Trade Size and Smaller: In addition to above requirements, install in maximum lengths of 150 ft (45 m) and with maximum of two 90° bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
15. PVC Externally Coated Galvanized Rigid Steel Conduit: Use only fittings approved for use with that material. Patch nicks and scrapes in PVC coating after installing conduit.

D. Conduit Stub-Ups

1. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above finished slab.

2. Transition under floor conduit to PVC coated galvanized rigid steel conduit before rising above floor. Under floor conduit elbows shall be PVC coated galvanized rigid steel conduit. Extend the PVC coated galvanized rigid steel conduit portion of the stub-up minimum 12 inch above floor or slab.

E. Conduit Bends

1. Make bends and offsets so inside diameter is not reduced. Unless otherwise indicated, keep legs of bend in same plane and straight legs of offsets parallel.
2. Provide NEMA standard conduit bends, except for conduits containing medium voltage cable, fiber optic cable, or conductors requiring large radius bends.

F. Flexible Connections

1. Use maximum of 6 ft (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures.
2. Terminate conduits at motor terminal boxes, motor operated valve stations or pipe-mounted instruments and other equipment subject to vibration with maximum of 3 ft (915 mm) liquid tight flexible metal conduit unless otherwise indicated.
3. Use liquid tight flexible conduit in wet or damp locations.
4. Use approved flexible connections in hazardous locations.
5. Install separate ground conductor inside flexible conduit connections.

G. Fittings

1. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. Install raceway sealing fittings at following points and elsewhere as indicated:
 - a. Where conduits enter or leave hazardous locations.
 - b. Where conduits pass from warm locations to cold locations, such as boundaries of refrigerated spaces and air-conditioned spaces.
 - c. Where otherwise required by NEC.
2. Use raceway fittings compatible with raceway and suitable for use and location. For GRS, use threaded galvanized rigid steel conduit fittings, except as otherwise indicated.
3. Install automatic breather drain fittings according to manufacturers written instructions. Locate fittings to drain conduit system and prevent condensate from entering device enclosures. Install automatic breather drain fittings at following points and elsewhere as indicated.
 - a. Where vertical seals are installed.
 - b. Low points in conduit system.
 - c. Below field instrumentation at junction boxes of flexible and rigid conduit.
 - d. Where otherwise required by NEC.
4. Install wall entrance seal as dictated by application where conduits pass through foundation walls below grade.

5. Install conduit expansion fittings complete with bonding jumper in following locations.
 - a. Conduit runs crossing structural expansion joints.
 - b. Conduit runs attached to 2 separate structures.
 - c. Conduit runs where movement perpendicular to axis of conduit may be encountered.
6. Where conduit passes from inside of building to outdoors, it shall be firmly packed at fitting nearest wall line with Johns-Manville Duxseal to depth of at least 1 in. after wires and cables are pulled in; or, if conduit enters directly into equipment, it shall be fitted with seal and drain fitting to prevent water entering equipment.

3.3 MOTORS AND VIBRATING EQUIPMENT

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

3.4 CABINETS, BOXES AND FITTINGS

- A. Installation, General
 1. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
 2. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
 3. Support and fasten items in accordance with Section 16B-2.11.
 4. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated
 5. Remove sharp edges where they may come in contact with wiring or personnel.
- B. Applications
 1. Hinged Door Enclosures: Sheet steel, baked enamel finish, NEMA type 12 enclosure except as indicated.
 2. Hinged Door Enclosures in Corrosive Locations: NEMA type 4X stainless steel metal enclosure, or as indicated on Drawings.
 3. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted:
 - a. Interior Dry Locations: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted:

- b. Locations Exposed to Weather or Dampness: Galvanized, cast metal, NEMA Type 3R.
 - c. Wet Locations: Stainless Steel, NEMA type 4X enclosures.
 - d. Corrosive Locations: Stainless Steel, NEMA type 4X enclosures.
4. Pull and Junction Boxes:
- a. Interior Dry Locations: Sheet steel, NEMA type 1 for flush mounting and ferrous Type FS or FD cast boxes with threaded conduit hubs for surface mounting.
 - b. Locations Exposed to Weather or Dampness: Galvanized, cast metal, NEMA Type 3R.
 - c. Wet Locations: Stainless Steel, NEMA type 4X enclosures.
 - d. Corrosive Locations: Stainless Steel, NEMA type 4X enclosures.
 - e. Hazardous (Classified) Locations: NEMA type listed and labeled for location and class of hazard indicated.
- C. Installation of Outlet Boxes
- 1. Outlets at Windows and Doors: Locate close to window or door trim.
 - 2. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so centers of columns are clear for future installation of partitions.
 - 3. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install boxes without plaster rings. Saw cut recesses for outlet boxes in exposed masonry walls.
 - 4. Gasketed Boxes: At following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
 - a. Exterior Locations.
 - b. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
 - c. Where exposed to moisture laden atmosphere.
 - d. Where indicated.
- D. Outlet Box Locations
- 1. Locate flush mounted wall boxes in corner of nearest brick or block to keep cutting to minimum.
 - 2. Location of outlets and equipment as shown on Drawings is approximate and exact location to be determined during construction.
 - 3. Mounting heights for devices and equipment to be measured from finished floor to centerline of device and unless otherwise noted on Drawings as follows.
 - a. Switches: 48 in. above floor.
 - b. AC Receptacles and Telephone Outlets: 15 in. above floor or 6 in. above counters, counter backsplashes, and baseboard radiators in finished areas; 48 in. above floor in unfinished areas.
 - c. Wall Bracket Lighting Fixtures: 8 in. above mirrors or 6 ft 6 in. above floor.

- d. Pushbuttons: 48 in. above floor.
- e. Disconnect Switches: 60 in. above floor

E. Installation of Junction Boxes

- 1. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 in. sq by 4 in. deep. Do not exceed 8 entering and 8 leaving raceways in single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed following:

Size of Largest Conductors in Box	Maximum No. of Conductors in Box sized per NEC Req.
No. 4/0 AWG	30
250 MCM	20
500 MCM	15
15 Over 500 MCM	10

- a. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 in. inside boxes.
- b. Mount pull boxes in inaccessible ceilings with covers flush with finished ceiling.
- c. Size: Provide pull and junction boxes for telephone, signal, instrumentation, control, and other systems at least 50% larger than would be required by the NEC for boxes smaller than 24 in. by 24 in., or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of type's normal for such systems.

END OF SECTION 26 05 33

DIVISION 26 - ELECTRICAL

SECTION 26 22 00 LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of dry-type general-purpose transformers.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES: Conduits and outlet boxes.
- F. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- G. Section 26 24 19, MOTOR CONTROL CENTER: Requirements for connection and control of motors and miscellaneous equipment.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, impedance, dimensions, weight, mounting details, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
 - 3. Complete nameplate data, including manufacturer's name and catalog number.

B. Dry-type transformers shall have the following features:

1. Transformers shall be self-cooled by natural convection, isolating windings, indoor dry-type. Autotransformers will not be accepted.
2. Rating and winding connections shall be as shown on the drawings.
3. Transformers shall have copper windings.
4. Ratings shown on the drawings are for continuous duty without the use of cooling fans.
5. K-Factor Rating: 220°C class 115°C maximum rise above 40°C for transformers 15 kVA or smaller; 220°C class 80°C maximum rise above 40°C for transformers larger than 15 kVA.
 - a. Transformer design prevents overheating when carrying full load with harmonic content corresponding to designated K-factor.
 - b. Nameplate states designated K-factor of transformer.
6. Insulation Class:
 - a. Insulation Class: 220°C class 115°C maximum rise above 40°C for transformers 15 kVA or smaller; 220°C class 80°C maximum rise above 40°C for transformers larger than 15 kVA.
7. Core and coil assemblies:
 - a. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.
 - b. Cores shall be grain-oriented, non-aging, and silicon steel.
 - c. Coils shall be continuous windings without splices except for taps.
 - d. Coil loss and core loss shall be minimized for efficient operation.
 - e. Primary and secondary tap connections shall be brazed or pressure type.
 - f. Coil windings shall have end filters or tie-downs for maximum strength.
8. Certified sound levels determined in accordance with NEMA ST-20, shall not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB
151 - 300 KVA	55 dB
301 - 500 KVA	60 dB

9. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
10. Transformers rated up to 15 kVA shall have two 5% full capacity taps below normal rated primary voltage. All transformers larger than 15 kVA shall have two 2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.
11. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.
12. Enclosures:
 - a. Comprised of not less than code gauge steel.
 - b. Outdoor enclosures shall be NEMA 3R.
 - c. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
 - d. Ventilation openings shall prevent accidental access to live components.
 - e. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.
13. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated on it.
14. Dimensions and configurations shall conform to the spaces designated for their installations.
15. Transformers shall meet the minimum energy efficiency values per NEMA TP1 as listed below:

kVA Rating	Output efficiency (%)
15	97
25	97.5
45	97.7
75	98

C. Finishes

1. The Transformer steel parts shall be cleaned and sprayed in controlled cleaning solutions by a 7-stage spray washer. The operation shall produce an iron phosphate coating of a minimum of 150 milligrams per square foot to meet MIL Specification TT-C-490. The primed metal parts shall be electrostatically coated with powder paint consisting of 670-011 ANSI-61 Acrylic Paint (Light Gray) with a gloss of 60 plus or minus 5 and thickness of 2.5 mils. The paint finish shall withstand a minimum of 1000 hours salt spray test.
2. Indoor Units: Separate; marked "Shield" for grounding connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of Transformer
- B. Verify that electrical power is available and of correct characteristics.

3.2 INSTALLATION

- A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer in the Motor Control Section as shown on the drawings.
- B. Install transformers with manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 6 in.
- D. Use flexible metal conduit for conductors from the transformer to the raceway systems.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Perform tests in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections.
 1. Compare equipment nameplate data with specifications and approved shop drawings.
 2. Inspect physical and mechanical condition.
 3. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.
 4. Perform specific inspections, electrical and mechanical tests as recommended by manufacturer.
 5. Verify correct equipment grounding.
 6. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.
- B. Tests: All transformers shall be subjected to these tests as per IS: 2026. All results obtained during the tests shall be furnished to the engineer for approval/comments.
 1. Measurement of winding resistance.
 2. Ratio, polarity and phase relationship.
 3. Impedance voltage
 4. No load losses and no load current

5. Load losses
6. Insulation resistance tests:
 - a. Test Voltage 1000 VDC
 - b. Min IR – 500 megohms
 - c. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer
7. Induced over voltage withstand test
8. Separate source voltage withstand test
9. Unbalance current test(unbalance current should not be more than 2% of full load current in neutral at full load condition)
10. Impulse voltage withstand test
11. Temperature rise test
12. Short circuit test
13. Heat run test

3.4 FOLLOW-UP VERIFICATION

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Low-Voltage Transformers, Include:
 - a. 1 manday for Installation Services.
 - b. 1 manday for Instructional Services.
- B. The start-up services for the Low-Voltage Transformers shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 26 22 00

DIVISION 26 - ELECTRICAL

SECTION 26 24 13 SWITCHboard

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, complete installation, and connection of switchboard.
- B. The power system feeding Switchboard shall be 480/277 volts, 60 Hertz, 3 phase, 4-wire, solidly grounded wye.
- C. The Switchboard shall have a short circuit rating of 35,000 amperes RMS symmetrical.
- D. The switchboard shall be an automatic transfer switch throw-over system as indicated on the drawings.
- E. Switchboard shall be a deadfront type.

1.2 RELATED WORK

- A. Section 01 01 01, Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 24 19, MOTOR CONTROL CENTER: Requirements for connection and control of motors and miscellaneous equipment.
- F. Section 26 36 23, AUTOMATIC TRANSFER SWITCH: Requirements for switching from one source to a secondary source.
- G. Section 40 94 23, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.
- H. Section 03 30 00, CAST IN PLACE CONCRETE: Requirements for concrete and reinforcing bars for the construction of foundations and pads.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

- A. Low-voltage switchboard shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified.

- B. Thoroughly test the switchboard at the factory with the circuit breakers in the connected position in their cubicles. The factory tests shall be in accordance with C37.20 and ANSI C37.51 and shall include the following tests:
1. Verify that circuit breaker sizes and types correspond to drawings and coordination study.
 2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 3. Confirm correct operation and sequencing of electrical and mechanical interlock systems by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
 4. Exercise all active components.
 5. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, by applying 1550 VAC for a duration of 1 min. and in accordance with manufacturer's published data.
 6. Perform insulation-resistance tests on control wiring with respect to ground. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
 7. Verify correct function of control transfer relays located in the switchboard with multiple control power sources.
 8. Perform phasing checks on dual-source switchboards to insure correct bus phasing from each source.
 9. Inspect indicating devices for correct operation.

1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Catalog Data: Submit catalog data and information as required to demonstrate that materials conform to the specification requirements. Data shall include features, characteristics, ratings, and settings of all adjustable components.
- C. Shop Drawings:
1. Clearly present sufficient information to determine compliance with drawings and specifications.
 2. Include electrical ratings, enclosure type, dimensions, weights, mounting details, front view, side view, equipment and device arrangement, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams, materials, connection diagrams for the switchboard, and nameplate schedule.
 3. For starters: a list of overload sizes for each motor and circuit breakers sizes.
- D. Manuals: Two weeks prior to the final inspection, submit four copies of the following to the Engineer:

1. Complete maintenance, operating and testing manuals, including wiring diagrams, technical data sheets, including load current, overload relay and settings of adjustable relays, and information for ordering replacement parts:
 - a. Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
 - b. Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
 - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
 - d. Instructions for testing and adjusting overcurrent protective devices.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
- C. National Fire Protection Association (NFPA):
70-05 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
UL 891 Dead-Front Switchboards
- E. Institute of Engineering and Electronic Engineers (IEEE):
C57.13..... Instrument Transformers

1.7 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.8 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE SWITCHBOARD

- A. The Contractor shall furnish and install, where indicated on the Drawings, a deadfront type low voltage metal-enclosed switchboard assembly as specified herein and as shown on the contract drawings.

- B. The switchboard shall be a GE Type Spectra, low voltage metal-enclosed switchboard, utilizing low voltage insulated case circuit breakers, a short circuit rating of 35,000 amperes RMS symmetrical and as herein specified or approved substitute.

2.2 COMPONENTS

- A. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.

B. Standard Features

1. Switchboards shall be a fully self-supporting structures with 90 inch tall vertical sections (excluding lifting eyes and pull boxes) bolted together to form required arrangement.
2. Switchboard frame shall be die formed, 12 gauge steel with reinforced corner gussets. Frame shall be rigidly bolted to support cover plates (code gauge steel), bus bars and installed devices during shipment and installation.
3. All sections may be rolled, moved or lifted into position. Switchboard shall be capable of being bolted directly to the floor without the use of floor sills.
4. All switchboard sections shall have removable top plate(s) to install conduit.
5. Front-Access switchboard shall be front and rear aligned.
6. Switchboard shall be UL listed.
7. All covers shall be fastened by hex head bolts.
8. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex head bolts.
9. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation and control wiring. Switchboard and devices shall be rated for the voltage and frequency listed on the drawings.
10. Switchboard current ratings, including all devices, shall be based on a maximum ambient temperature of 40 degree C per UL Standard 891. With no derating required, temperature rise of switchboards and devices shall not exceed 65 degrees C in a 40 degree C ambient environment.
11. Switchboard Service Entrance sections shall comply with UL Service Entrance requirements including a UL service entrance label, incoming line isolation barriers, and a removable neutral bond to switchboard ground for solidly grounded wye systems.

C. Incoming Section

1. Two incoming sections shall contain utility current transformers and main circuit breakers.
2. Furnish switchboard arranged for bottom entry of incoming cable. Provide crimp compression type lugs in the quantity and size required per the contract drawings. All lugs shall be tin-plated copper and UL listed for use with copper cable. Lugs shall be rated for 75 degree C. Cable.
3. Furnish switchboard where indicated on the drawings with a transition for close - coupled connection to a MCC.

D. Bus Bars

1. Bus bars shall be silver-plated copper. The bus bars shall have sufficient cross sectional area to meet UL 891 temperature rise requirements. Phase and neutral bus ampacity shall be as shown on the plans. The neutral bus shall have the same ampacity as the phase bus.
2. Bus bars shall be mounted on high impact, non-tracking insulated supports. Joints in the vertical bus are not permitted.
3. Bus bars shall be braced to withstand mechanical forces exerted during short circuit conditions as indicated in drawings, but in no case less than 100KA RMS SYM.
4. Bus joints shall be bolted with high tensile steel Grade 5 bolts. Belleville type washers shall be provided with aluminum bus.
5. Ground Bus shall be sized to meet UL 891. Ground bus shall extend full length of switchboard. Ground bus shall be copper
6. A-B-C bus arrangement (left to right, top to bottom, front to rear) shall be used throughout to assure convenient and safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.
7. All feeder device line and load connection straps shall be rated to carry current rating of device frame (not trip rating).
8. The main incoming bus bars shall be rated for the main protection device frame size or main incoming conductors, if there is no main device.
9. Main horizontal bus bars shall be fully rated and arranged for future extensions.

E. Enclosure

1. Switchboard shall be NEMA 12, deadfront construction or as indicated on drawings.

F. Micro Processor Based Metering Units

1. Provide a UL listed and digital multifunction power monitor. The monitor case shall be fully enclosed and shielded
2. The monitor shall accept a voltage monitoring range of up to 600 volts, phase to phase.
 - a. The Monitor shall withstand 200% rated current continuously. It shall withstand 10X rated current for at least 3 seconds. Isolation shall be no less than 2500V AC.
 - b. Surge withstand shall conform to IEEE C37.90.1, 62.41 and IEEE 1000-4
 - c. Shall have a standard ANSI C39.1 case mount.
3. The Monitor shall provide true RMS measurements of total pump station load in amps, voltage, maximum demand load in KW, phase to neutral and phase to phase; current, per phase and neutral; real power, reactive power, apparent power, power factor and frequency. Data shall be transmitted to remote locations in District 1 and at contractor's maintenance facility via SCADA.
 - a. The Monitor must be capable of providing readings for both instantaneous and average readings.
 - b. The Monitor must also be capable of providing all single phase real, apparent, reactive power and power factor values.

- c. The Monitor shall record and store total bi-directional energy. It shall include separate registers for positive and negative energy.
 - d. The Monitor shall record and store total bi-directional accumulated energy and total accumulated apparent energy.
 - e. The Monitor shall monitor max/min average demand values for all current and power readings. The demand interval shall be user programmable. Maximum and minimum values shall be stored with a date/time stamp.
4. The Monitor shall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power functions, and shall meet IEC687 (0.2%)
 5. The monitor shall include a three line, integrated, light-emitting diode (LED) display.
 - a. The Monitor must be capable of displaying one leg of volts, amps and total power simultaneously.
 - b. The display shall provide user access to all phase voltages (phase to neutral and phase to phase), currents (phase and neutral), watts, VARs, VA, power factor, frequency and kwh
 - c. The display must provide user access to max/min values for all displayed quantities.
 - d. The display shall have a % load bar display for ease of full load viewing
 6. The monitor shall be microprocessor based and shall be fully user programmable.
 7. The monitor shall be provided with an RS485 digital communications port. The Monitor shall communicate using a MODBUS RTU protocol and shall have a communication baud rate of at least 57k.
 8. The monitor shall be provided with one KYZ pulse outputs
 9. The Monitor shall have three serial communication ports; 1 RS232C and 2 RS485. Ports must be capable of communicating simultaneously to different devices.
 10. The Monitor shall communicate using a MODBUS RTU or DNP open protocol and support communications baud rates of up to 19.2K
 11. The Monitor shall calculate the harmonic signature, %THD and K-Factor for all voltage and current inputs with valid data for harmonic spectrum capability to the 32nd harmonic.
 12. The Monitor must be capable of capturing a graphic image of the waveform for each of the 6 channels of Voltage and Current and make it available in a RAM buffer for retrieval through the digital communication port.

G. Metering Transformers

1. All instrument transformers shall be UL listed and classified as indicated in drawings.
2. Current Transformers shall be as shown on drawings with burden and accuracy to support connected meters and relays as required by [ANSI/IEEE C57.13].
3. Potential transformers shall be provided where indicated on drawings with burden and accuracy to support connected meters and relays as required by [ANSI/IEEE C57.13].

I. Main Devices

1. Main device shall be individually mounted, insulated case circuit breaker. Provide device as specified in appropriate article below.
2. Where indicated provide the following with the main device:
 - a. Insulated case circuit breakers shall be individually mounted.
 - b. Mains shall be electrically operated, stationary mounted. Breakers shall be constructed of a high dielectric strength, glass reinforced insulating case. The interrupting mechanism shall be arc chutes. Steel vent grids shall be used to suppress arcs and cool vented gases. Interphase barriers shall to isolate completely each pole.
 - c. Breakers shall contain a true two-step stored energy operating mechanism which shall provide quick make, quick break operation with a maximum five cycle closing time. Breakers shall be trip free at all times. Common tripping of all poles shall be standard.
 - d. Insulated Case circuit breakers shall be rated to carry 100 percent of their frame ampacity continuously.
 - e. A charging handle, close push-button, open push-button, and Off/On/Charge indicator shall be located on the breaker escutcheon and shall be visible with the breaker compartment door closed.
 - f. Where drawout breakers are indicated on the drawings, the drawout design shall permit the breaker to be withdrawn from an engaged position, to a test position, and to a disengaged position.

J. Digital Electronic Trip Unit for Insulated Case Circuit Breakers

1. Each insulated case PowerBreak II breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, short circuits and ground faults. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation. Furnish GE Entelliguard TU digital electronic trip units as specified below.
2. As a minimum, the trip unit shall have the following protective functions unless otherwise indicated on the drawings:
 - a. adjustable current setting or long time pickup;
 - b. adjustable long time delay (22 bands);
 - c. switchable, adjustable short time pickup and delay (11 bands) with 3 I2t selectable slopes;
 - d. adjustable instantaneous pickup;
 - e. adjustable ground fault pickup and delay.
 - f. Reduced Energy Let-Through (RELT) Instantaneous trip. This feature shall provide a temporary setting for the instantaneous trip setting of the breaker. Setting shall be adjustable down to 1.5X of the rating plug and shall be enabled through a switch mounted on front of the switchboard.
 - g. Zone Selective Interlocking for Short Time, Ground Fault and Instantaneous protection.
 - h. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.

- i. Multi-button keypad to provide local setup and readout of all trip settings on the LCD.
 - j. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.
 - k. An integral test jack for testing via a portable test set and connection to a battery source.
 - l. A mechanism for sealing the rating plug and the trip unit.
 - m. Noise immunity shall meet the requirements of IEEE C37.90.2.
 - n. Display trip targets for long time, short time, and ground fault, if included.
 - o. The trip unit shall keep a log of the last ten events including overcurrent trips, protective relay trips. The log shall store rms currents, phase, type of trip, trip counter, time and date for each event.
 - p. Instantaneous trip shall utilize filtering which permits fully selective operation with downstream current limiting devices up to the short time rating of the circuit breaker, when the instantaneous pickup is set above the current limiting threshold.
 - q. The trip unit shall include Modbus RTU communication capability. The trip unit, through dedicated secondary terminals on the breaker, shall provide a communication port for communication with and access to a remote computer. All metering, set points, protective trip counts, and other event signaling shall be retrievable by the remote computer.
4. The trip unit shall include the following metering functions, which shall be displayed on the LCD (if the manufacturers trip unit cannot incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker):
- a. Current, RMS, each phase;
 - b. Voltage, RMS (V), line-to-line or line-to-neutral.
 - c. Energy (kWh, MWh, GWh), each phase and total, user resettable.
 - d. Peak Power Demand (KW, MW), user resettable.
 - e. Real power (KW, MW), each phase and total.
 - f. Reactive power (KVAR, MVAR), each phase and total.
 - g. Apparent power (KVA, MVA), each phase and total
 - h. Frequency (Hz).
 - i. Power factor.
 - j. Waveform capture capability. Upon triggering, a total of eight cycles of voltage (each phase) and current (each phase) shall be recorded. The eight cycles shall include four pre-trigger and four post-trigger cycles. The waveform capture shall be configurable to trigger by manually over communications (when specified), by a overcurrent trip, by a protective relay trip (when specified), or by a current alarm. Waveform data shall be available in "Comtrade" file format via serial communications or at a front port at the trip unit.
5. The trip unit shall include all of the following protective functions. It shall be possible to disable, by user programming, any combination of unwanted protective functions.

Except for reverse power, relay settings shall be in 1 percent steps over indicated range. Each function shall have a time delay, adjustable in 1-second increments (1 to 15 seconds) and shall be able to be switched OFF. If the manufacturer's trip unit cannot incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker.

- a. Undervoltage, adj. pickup, 50 to 90 percent; 1% increment adj. delay, 1 to 15 seconds.
- b. Overvoltage, adj. pickup, 110 to 150 percent; 1% increment adj. delay, 1 to 15 seconds.
- c. Voltage unbalance, adj. pickup, 10 to 50 percent; adj. delay, 1 to 15 seconds.
- d. Current unbalance, adj. pickup, 10 to 50 percent; 1% increment adj. delay, 1 to 15 seconds.
- e. Reverse power, selectable direction, adj. pickup, 10 KW to 990 KW; 10kW increment adj. delay, 1 to 15 seconds.

K. Automatic Throw-over System:

1. The switchboard manufacturer shall provide an automatic transfer switch as specified in Section 26 36 23 and as indicated on the drawings.

L. Surge Protective Devices (SPD)

1. Surge protective devices type 2 shall have UL 1449 3rd edition suppression ratings for each mode of protection, as follows:
 - a. 480/277 volt, 3 phase "WYE" – 800 volts.
 - b. 480 volt 3 phase "Delta" – 1500 volts.
2. Provide protection in all modes. Ten modes for "WYE" systems, L-L, L-N, L-G and N-G, and six modes for "Delta" systems, L-L and L-G.
3. The Catastrophic Protection System shall provide temporary over voltage and voltage swell protection to the following:
 - a. TOV - should be capable of surviving and continue to protect critical loads against multiple TOV events (described as 200% nominal voltage by 8 mS.
 - b. Swell- should be capable of protection against swells up to 180% nominal for 0.7 ohms load >18,000 cycles.
4. MOV's tested per ANSI/IEEE C62.33-1982.
5. Minimum Single Pulse Surge Current Capacity per ANSI/IEEE C62041-1991's standard 8 X 20 microsecond current waveform, shall not be less than as follows:
 - a. 300,000 amps, L-N
 - b. 300,000 amps, L-G min. amps per phase 600,000 (L-N plus L-G)

- c. 300,000 amps, N-G
 - d. 300,000 amps, L-L
- 6. Minimum continuous operating voltage of any component shall not be less than 115% of nominal operating voltage.
 - 7. All surge current devices shall incorporate low impedance plated busbars. No small gauge round wire, printed circuit boards, silicon avalanche diodes or plug-in connections are acceptable.
 - 8. Each MOV and capacitor shall be fused so that the failure of any component does not affect the operation or protection of the entire unit.
 - 9. Provide in metal enclosure NEMA rated suitable for the installed location.
 - 10. Accessories
 - a. Monitoring. One set of status monitoring lights that will provide visual indication of voltage present to the SPD. The lights shall also indicate the failure of MOV.
 - b. An audible alarm with battery backup, indicating lights showing loss of power and a surge counter shows the number of surges. Two sets of Form C contacts for remote monitoring.

2.3. FINISH

- A. The Motor Control Center steel parts shall be cleaned and sprayed in controlled cleaning solutions by a 7-stage spray washer. The operation shall produce an iron phosphate coating of a minimum of 150 milligrams per square foot to meet MIL Specification TT-C-490. The primed metal parts shall be electrostatically coated with powder paint consisting of 670-011 ANSI-61 Acrylic Paint (Light Gray) with a gloss of 60 plus or minus 5 and thickness of 2.5 mils. The paint finish shall withstand a minimum of 1000 hours salt spray test.

2.4 ACCESSORIES

- 1. Fuses
 - a. Manufacturer: Ferraz Shawmut (or equal).
 - b. Interrupting Rating of all fuses shall be [200,000] RMS amperes.
- 2. Furnish adhesive plastic strip mimic bus for switchboards.
- 3. Furnish nameplates for each device as indicated in drawings. Nameplates for Power System equipment shall be white with black engraved lettering. Lettering shall be a minimum of 1/2 inch high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of power branch as applicable. Secure nameplates with screws.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of 480V Switchboard
- B. Verify that electrical power is available and of correct characteristics.

3.2 PREPARATION

- A. Install concrete bases after dimensions of equipment are confirmed by equipment manufacturer.

3.3 INSTALLATION

- A. The installer shall provide all labor and perform all work to install and make operational all equipment necessary to assure a safe and reliable operation.
- B. Installation shall be in accordance with NEC, written instructions of the manufacturer, and as shown on the drawings.
- C. Install switchboard on concrete pad as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Bolt the switchboard to the concrete pad.
- D. Make connection to Motor Control Center as shown on the drawing.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the switchboard.

3.4 ACCEPTANCE CHECKS AND TESTS

Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage and required area clearances.
 - d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
 - e. Use calibrated torque-wrench method to verify the tightness of accessible bolted electrical connections, or perform a thermographic survey after energization.
 - f. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - g. Clean switchboard.
 - h. Inspect insulators for evidence of physical damage or contaminated surfaces.
 - i. Exercise all active components.
 - j. Verify the correct operation of all sensing devices, alarms, and indicating devices.
 - k. Inspect control power transformers.

2. Electrical Tests

- a. Perform insulation-resistance tests on each bus section.
- b. Perform overpotential tests as required, disconnect solid-state components or control devices if they cannot tolerate the applied voltage.
- c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
- d. CT/PT polarity and ratio tests.
- e. Primary injection test for breakers verifying settings.
- f. Functional operation of all devices.

3. Test Values:

- a. Bolt torque levels shall be in accordance with manufacturer's instructions.
- b. Insulation resistance test shall be performed in accordance with following:

Insulation Resistance Test Voltage	
Voltage Rating	Test Voltage
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

- c. Values of insulation resistance less than rated kv +1 in Megohms shall be investigated and corrected.

3.5 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.6 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the switchboard is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.7 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance.

This service shall include all equipment provided in this Section for the Switchboard, Include:

- a. 1 manday for Installation Services for Switchboard.
 - b. 1 manday for Instructional Services for Switchboard.
- A. The start-up services for the Switchboard shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 26 24 13

DIVISION 26 - ELECTRICAL

SECTION 26 24 15 METERING CABINET

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, complete installation, and connection of metering cabinets.
- B. The power system feeding the metering cabinet shall be 480/277 volts, 60 Hertz, 3 phase, 4-wire, solidly grounded wye.
- C. The metering cabinet shall have C/t and PT enclosures as indicated on the drawings.
- D. Metering Cabinet shall be a deadfront type switchboard and shall have a short circuit rating of 65,000 amperes RMS symmetrical.

1.2 RELATED WORK

- A. Section 01 01 01, Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 03 30 00, CAST IN PLACE CONCRETE: Requirements for concrete and reinforcing bars for the construction of foundations and pads.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Catalog Data: Submit catalog data and information as required to demonstrate that materials conform to the specification requirements. Data shall include features, characteristics, ratings, and settings of all adjustable components.
- C. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications.

2. Include electrical ratings, enclosure type, dimensions, weights, mounting details, front view, side view, equipment and device arrangement, wiring diagrams, materials, connection diagrams for the CT's, PT's, bolded pressure switch, and nameplate schedule.

D. Manuals: Two weeks prior to the final inspection, submit four copies of the following to the Engineer:

1. Complete maintenance, operating and testing manuals, including wiring diagrams, technical data sheets, and information for ordering replacement parts:

- a. Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
- b. Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
- c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
- d. Instructions for testing and adjusting overcurrent protective devices.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturers Association (NEMA):

C. Department of Public Utilities – Electrical (DPU-E) Service Rules and Policies:

D. National Fire Protection Association (NFPA):
70-05.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
UL 891Dead-Front Switchboards

F. Institute of Engineering and Electronic Engineers (IEEE):
C57.13.....Instrument Transformers

1.6 WARRANTY

A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

A. The work shall be paid at the contract lump sum price for

PUMP STATION ELECTRICAL WORK

which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 METERING CABINET

- A. The Contractor shall furnish and install, where indicated on the Drawings, deadfront type metering cabinets assembly as specified herein and as shown on the contract drawings.
- B. The metering cabinets shall be as per Naperville requirements, metal-enclosed cabinets, with current transformer, potential transformers and bolted transfer switch enclosures.

2.2 COMPONENTS

- A. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.
- B. Standard Features
 - 1. Metering cabinets shall be a fully self-supporting structures with 81 inch tall vertical section and wiring gutter as shown on the drawing.
 - 2. Metering cabinet frame shall be type 3R aluminum enclosure for outdoor use. Frame shall be rigidly bolted to support cover plates, bus bars and installed devices during shipment and installation.
 - 3. All sections may be rolled, moved or lifted into position. Metering cabinets shall be capable of being bolted directly to a concrete pad without the use of floor sills.
- C. Instrument transformer Cabinet
 - 1. The instrument transformer sections shall be as per DPU-E requirements, containing utility current transformers and potential transformer provide by DPU-E and as shown on the drawing.
- D. Main Switch
 - 1. The main switch sections shall contain a bolted pressure switch as manufactured by Boltswitch Inc., Class 'L' fusible bolted contact switch as shown on the drawing.
- D. Meter Fittings
 - 1. Provide meter fittings, sockets and meters per DPU-E requirements. All metering equipment must be submitted to DPU-E for approval.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of Metering Cabinet
- B. Verify that electrical power is available and of correct characteristics.

3.2 PREPARATION

- A. Install concrete bases after dimensions of equipment are confirmed by equipment manufacturer.

3.3 INSTALLATION

- A. Installation shall be in accordance with NEC, written instructions of the manufacturer, and as shown on the drawings.
- B. Install metering cabinets on concrete pad as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Bolt the metering cabinets to the concrete pad.
- c. Make connection to line side and load side cables as shown on the drawing.

3.4 ACCEPTANCE CHECKS AND TESTS

Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify appropriate anchorage and required area clearances.
- d. Verify that P/T's and C/T's sizes and types correspond to approved shop drawings.
- e. Use calibrated torque-wrench method to verify the tightness of accessible bolted electrical connections, or perform a thermographic survey after energization.
- f. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
- g. Clean Metering Cabinet.
- h. Inspect insulators for evidence of physical damage or contaminated surfaces.
- i. Exercise all active components.
- j. Verify the correct operation of all sensing devices, and indicating devices.
- k. Inspect control power transformers.

2. Electrical Tests

- a. Perform insulation-resistance tests on each bus section.
- b. Perform overpotential tests as required, disconnect solid-state components or control devices if they cannot tolerate the applied voltage.
- c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
- d. CT/PT polarity and ratio tests.
- e. Primary injection test for breakers verifying settings.
- f. Functional operation of all devices.

3. Test Values:

- a. Bolt torque levels shall be in accordance with manufacturer's instructions.

- b. Insulation resistance test shall be performed in accordance with following:

Insulation Resistance Test Voltage	
Voltage Rating	Test Voltage
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

- c. Values of insulation resistance less than rated kv +1 in Megohms shall be investigated and corrected.

3.5 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.6 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the metering cabinet is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.7 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Switchboard, Include:
 - a. 1 manday for Installation Services for Metering Cabinet.
 - b. 1 manday for Instructional Services for Metering Cabinet.
- B. The start-up services for the Switchboard shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 26 24 15

DIVISION 26 - ELECTRICAL

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 09 91 00, PAINTING: Identification and painting of panelboards.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one Section of Division 26.
- D. Section 26 05 21, ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- E. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 05 33, RACEWAY AND BOXES: Conduits and outlet boxes.
- G. Section 26 24 19, MOTOR CONTROL CENTER: Requirements for connection and control of motors and miscellaneous equipment.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

- A. Panelboard shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified.
- B. Thoroughly test the panelboard at the factory with the circuit breakers in the connected position in the panel. The factory tests shall be in accordance with C37.20 and ANSI C37.51 and shall include the following tests:
 - 1. Verify that circuit breaker sizes and types correspond to drawings and coordination study.
 - 2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 3. Exercise all active components.
 - 4. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data.

5. Perform phasing checks on panelboard to insure correct bus phasing from source.
6. Inspect indicating devices for correct operation.

1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 1. Sufficient information, shall be clearly presented to determine compliance with drawings and specifications.
 2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams, accessories, and weights of equipment. Complete nameplate data, including manufacturer's name and catalog number.
- C. Manuals:
 1. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets and wiring diagrams.
 2. If changes have been made to the maintenance and operating manuals that were originally submitted, then submit four copies of updated maintenance and operating manuals to the Resident Engineer two weeks prior to final inspection.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
 - PB-1-06 Panelboards
 - 250-08 Enclosures for Electrical Equipment (1000V Maximum)
- C. National Fire Protection Association (NFPA):
 - 70-2005 National Electrical Code (NEC)
 - 70E-2004 Standard for Electrical Life Safety in the Workplace
- D. Underwriters Laboratories, Inc. (UL):
 - 50-95 Enclosures for Electrical Equipment
 - 67-09 Panelboards
 - 489-09 Molded Case Circuit Breakers and Circuit Breaker Enclosures

1.7 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.8 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards and devices shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.
- B. Manufacturer's
1. G. E. Co
 2. Cutler-Hammer.
 3. Square-D Co.
- C. Panelboards shall be standard manufactured products.
- D. Panelboards shall be hinged "door in door" type with:
1. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
 2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand-operated latches are not acceptable.
 3. Push inner and outer doors shall open left to right.
- E. All panelboards shall be completely factory-assembled with molded case circuit breakers, and integral accessories as shown on the drawings or specified herein.
- F. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Provide lighting panelboard as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown.
- G. Panelboards shall conform to NEMA PB-1, NEMA AB-1, and UL 67 and have the following features:
1. Fully rated (100%) size copper bus bars with current ratings as shown on the panel schedule rigidly supported on molded insulators.
 2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
 3. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys of sizes suitable for the conductors to which they will be connected.
 4. Neutral bus shall be 100% rated, mounted on insulated supports.
 5. Grounding bus bar shall be equipped with screws or lugs for the connection of grounding wires.

6. Buses shall be braced for the available short-circuit current. Bracing shall not be less than 22,000 A symmetrical for 120/208 V and 120/240 V panelboards.
7. Branch circuit panelboards shall have buses fabricated for bolt-on type circuit breakers.
8. Protective devices shall be designed so that they can easily be replaced.
9. Where designated on panel schedule "spaces," include all necessary bussing, device support, and connections. Provide blank cover for each space.
10. Provide 20% spare breakers but not less than 5 breakers.
11. Series-rated panelboards are not permitted.
12. Install a printed schedule of circuits in each panelboard after approval by the Owner. Schedules shall be printed on the panelboard directory cards, installed in the appropriate panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights, devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.

2.2 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards.
2. Cabinet enclosure shall not have ventilating openings.
3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Circuit breakers shall be per UL 489, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt-on type.
- C. Molded case circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
 1. 120/208 V Panelboard: 22,000 A symmetrical.
 2. 120/240 V Panelboard: 22,000 A symmetrical.
 3. 277/480 V Panelboard: 22,000 A symmetrical.
- D. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100A frame or lower. Magnetic trip shall be adjustable from 3x to 10x for breakers with 600 A frames and higher.
- E. Breaker features shall be as follows:
 1. A rugged, integral housing of molded insulating material.
 2. Silver alloy contacts.
 3. Arc quenchers and phase barriers for each pole.
 4. Quick-make, quick-break, operating mechanisms.
 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

6. Electrically and mechanically trip free.
7. An operating handle which indicates ON, TRIPPED, and OFF positions.
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where indicated.
10. Provide breakers with padlockable breaker knobs.

2.4 SURGE PROTECTIVE DEVICES (SPD)

- A. Provide a surge protective devices that has UL 1449 3rd edition suppression ratings for each mode of protection, as follows:
 1. 120/208 volt, 3 phase “Wye” – 600 volts.
- B. Provide protection in all modes. Ten modes for “Wye” systems, L-L, L-N and L-G.
- C. The Catastrophic Protection System shall provide temporary over voltage and voltage swell protection to the following:
 1. TOV - should be capable of surviving and continue to protect critical loads against multiple TOV events (described as 200% nominal voltage by 8 mS.
 2. Swell- should be capable of protection against swells up to 180% nominal for 0.7 ohms load >18,000 cycles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of Panelboard.
- B. Verify that electrical power is available and of correct characteristics.

3.2 INSTALLATION

- A. Installation shall be in accordance with the manufacturer’s instructions, the NEC, as shown on the drawings, and as specified. Where shown on drawing, panel shall be installed in MCC section.
- B. Locate panelboards so that the present and future conduits can be conveniently connected.
- C. Install a printed schedule of circuits in each panelboard after approval by the Resident Engineer. Schedules shall be printed on the panelboard directory cards, installed in the appropriate panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights, devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.
- D. Unless otherwise noted, mount the fully-aligned panelboard in the motor control section as shown on the drawing, such that the maximum height of the top of trim above the finished floor shall not exceed 74 in.

- E. Wiring in panelboard gutter: Arrange conductors in groups and bundle and wrap with wire ties after completing load balancing.

3.3 ACCEPTANCE CHECKS AND TESTS

Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify appropriate anchorage and required area clearances.
- d. Verify that circuit breaker and conductor sizes and circuit designations and types correspond to approved shop drawings.
- e. Use calibrated torque-wrench method to verify the tightness of accessible bolted electrical connections, or perform a thermographic survey after energization.
- f. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
- g. IR test of each circuit.
- h. Continuity test of each circuit.
- i. Ensure equipment grounding and proper connection.
- j. Clean panelboard.
- k. Inspect insulators for evidence of physical damage or contaminated surfaces.
- l. Exercise all active components.

2. Electrical Tests

- a. Perform insulation-resistance tests on each bus section.
- b. Primary injection test for breakers verifying settings.
- c. Functional operation of all devices.

3. Test Values:

- a. Bolt torque levels shall be in accordance with manufacturer's instructions.
- b. Insulation resistance test shall be performed in accordance with following:

Insulation Resistance Test Voltage	
Voltage Rating	Test Voltage
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

- c. Values of insulation resistance less than rated kv +1 in Megohms shall be investigated and corrected.

3.4 IDENTIFICATION

- A. Install typewritten labels on inside door of each panelboard to indicate circuit information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front door.

3.5 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the panelboard is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

END OF SECTION 26 24 16

DIVISION 26 - ELECTRICAL

SECTION 26 24 18 MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the minimum requirements of Motors furnished under this contract. Motor requirements in other equipment specification sections shall supersede the requirements of this section.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Division 23: Heating, Ventilation and Air Conditioning
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- D. Section 26 05 21, CONDUCTORS AND CABLES: Cables and wiring.
- E. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 26 24 13, SWITCHBOARD: Requirements for providing power to MCC and miscellaneous equipment.
- G. Section 26 124 19, MOTOR CONTROL CENTER: Requirements for connection and control of motors and miscellaneous equipment.
- H. Division 40: SCADA
- I. Division 43: Liquid Handling Equipment

1.3 QUALITY ASSURANCE

- A. Unless otherwise indicated, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.4 FACTORY TESTS

- A. Low-voltage Motors shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified.
- B. The factory tests shall be in accordance with C37.20 and ANSI C37.51 and shall be as specified in each equipment specifications section.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).

B. Catalog Data: Submit catalog data and information as required to demonstrate that materials conform to the specification requirements. Data shall include features, characteristics and ratings of motors.

D. Shop Drawings:

1. Clearly present sufficient information to determine compliance with drawings and specifications.
2. Include electrical ratings, enclosure type, dimensions, weights, mounting details, front view, side view, equipment and device arrangement, running overcurrent protection and nameplate schedule.

E. Manuals: Submit in accordance with other equipment specification sections.

1.6 APPLICABLE PUBLICATIONS

A. The latest editions of the publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

1. National Electrical Manufacturers Association (NEMA)
2. National Fire Protection Association (NFPA)
3. National Electrical Code (NEC)
4. Underwriters Laboratories, Inc. (UL)
5. Institute of Engineering and Electronic Engineers (IEEE)

1.7 WARRANTY

C. Unless otherwise noted in other equipment specification sections, the Manufacturer shall warrant motor equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance.

1.8 DELIVERY, STORAGE AND HANDLING

A. Contractor shall store, protect, and handle products in accordance with the Manufacturer's recommended practices.

1.9 BASIS OF PAYMENT

A. Payment of motors shall be paid under other equipment specification sections.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Requirements below apply to motors covered by this Section except as otherwise indicated.
 - 1. Motors 1/2 hp and larger: Polyphase.
 - 2. Motors Smaller Than 1/2 hp: Single-Phase.
 - 3. Frequency Rating: 60 Hz.
 - 4. Voltage Rating: Determined by voltage of circuit to which motor is connected for following motor voltage ratings (utilization voltages):
 - a. 120 V Circuit: 115 V - motor rating.
 - b. 208 V Circuit: 200 V - motor rating.
 - c. 240 V Circuit: 230 V - motor rating.
 - d. 480 V Circuit: 460 V - motor rating.
- D. Service factors indicated for motors are minimum values and apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10% of motor voltage rating.
- E. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100% of rated capacity.
- F. Temperature Rise: Based on 40°C ambient except as otherwise indicated.
- G. Enclosure: Totally Enclosed Fan Cooled (TEFC) unless otherwise indicated in other sections and as required by NEC.
 - 1. Explosion proof motors approved for specific hazard classifications covered by NEC.
 - 2. Weather proof motors designed for outdoors and in wet areas.
- H. Copper Windings.

2.2 POLYPHASE MOTORS

- A. Squirrel-cage induction-type conforming to following requirements except as otherwise indicated.
- B. NEMA Design Letter Designation: "B"
- C. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading for application.
- D. Motor Efficiencies:

1. General purpose motors (not inverter duty/vector duty or explosion proof): NEMA Premium Energy Efficient Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Premium Energy Efficient Motors for that type and rating of motor.
 2. Explosion proof motors: NEMA Energy Efficient/High Efficiency Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Energy Efficient/High Efficiency Motors for that type and rating of motor.
- E. Multi-Speed Motors: Separate windings for each speed.
- F. Internal thermal Overload Protection for Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation.
- G. Motors for Reduced Inrush Starting: Coordinate with indicated reduced inrush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.
- H. Torque:
1. Breakdown torque shall be 200% or more of maximum torque load placed on motor shaft.
 2. Provided torque shall be 200% or more of maximum torque load placed on motor shaft.
 3. Supply special motors where load requirements exceed standard design.
- I. Open Drip Proof (ODP).
1. Energy Efficient.
 2. Protected Openings.
 3. Class B Insulation.
 4. 1.15 Service Factor.
 5. Cast iron construction.
- J. Totally Enclosed Fan Cooled (TEFC) and Totally Enclosed Non Ventilated (TENV).
1. Energy Efficient.
 2. 1.15 Service Factor, Class "F" Insulation.
 3. Cast iron construction; frame, conduit box, end shields, fan cover, inner caps for 182T frames and larger.
 4. Removable eyebolt.
 5. Suitable for indoor and outdoor installations.
 6. Diagonally split, neoprene gasketed, rotatable oversized conduit box with NPT threaded lead hole.
 7. Conduit box mounted, UL approved clamp type grounding lug.

8. Permanently numbered non-wicking loads.
9. Rust inhibitive non-washing lubricant.
10. Stainless steel nameplate with:
 - a. NEMA nominal efficiency.
 - b. AFBMA bearing numbers.
 - c. Lubrication instructions.

K. Explosion Proof.

1. Same features as TEFC.
2. Approved for NEC hazardous classified location as noted in equipment specification or as indicated on Drawings.
3. Automatic explosion proof breather drains.

L. Submersible pump and mixer motors.

1. Have explosion proof breather drains.
2. 1.10 service factor, unless otherwise indicated in equipment specification sections.

2.3 SINGLE-PHASE MOTORS

- A. One of the following types as selected to suit starting torque and other requirements of specific motor application:
1. Permanent Split Capacitor.
 2. Split-Phase Start, Capacitor-Run.
 3. Capacitor-Start, Capacitor-Run.
- B. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.
- C. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens power supply circuit to the motor, or control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
- D. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with NEC, written instructions of the manufacturer, and as shown on the drawings.
- B. Direct Connected Motors: Mount securely in accurate alignment.

1. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts furnished by manufacturer and tension belts in accordance with manufacturer recommendations.

3.2 ALIGNMENT

- A. Installer of motor is responsible for alignment.
- B. Check alignment of motors prior to startup.

3.3 FIELD QUALITY CONTROL

- A. Inspect wire and connections for physical damage and proper connection.
- B. Conduct insulation resistance (megger) test on each motor 15 hp and larger before energizing. Conduct test with 500 or 1,000 vdc megger. Test each phase separately and follow procedures listed below.
 1. Disconnect voltage sources, lightning arrestors, capacitors, and other potential low insulation sources from motor before connecting megger to motor.
 2. When testing phase, connect phases not under test to ground.
 3. Apply test voltage, phase to ground on each phase being tested. Record resistance reading at 30 sec and at 1 min after test voltage is applied. Divide 1 min reading by 30 sec reading to obtain dielectric absorption ratio (DAR). DAR shall be 1.25 or greater for phase to pass test.
 4. If phases have DAR of 1.25 or greater, attach tag to motor and mark tag "Insulation Resistance Test OK" and sign.
 5. If phases have DAR of less than 1.25, attach tag to motor and mark tag "Insulation Resistance Test Failed" and sign. Provide new motor and retest. Notify ENGINEER of failure and actions taken to correct.
 6. Connect equipment removed in Item 1 above.
- C. Before energizing motor, record motor's nameplate current on record drawing line diagrams. Size motor starter overload heaters with starter manufacturer's recommendation for given motor nameplate current, service factor, and power factor correcting capacitors, is provided.
- D. Check rotation of motor before connecting to driven equipment; before couplings are bolted or belts installed. Before motor is started to check rotation, determine that motor is lubricated. When rotation is correct, mark insulation resistance test tag "Rotation OK". Sign or initial test tag by person who checked motor rotation.
- E. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process.
- G. In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration.

3.4 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 - 1. Perform belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.
 - 2. Test shall be standard NEMA routine production test in accordance with NEMA MG 1.
 - 3. Visual and Mechanical Inspection
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage and required area clearances.

3.5 TRAINING

- A. Refer to other equipment specifications for training requirements.

END OF SECTION 26 24 18

DIVISION 26 - ELECTRICAL

SECTION 26 24 19 MOTOR CONTROL CENTER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, complete installation, and connection of the Motor Control Center to the Switchboard.
- B. The Motor Control Center shall be rated for 480/277 volt, three phase, 4 wire, 60 Hertz having a short circuit rating of 35,000 amperes RMS symmetrical.
- C. The Motor Control Center shall include Reduced Voltage Soft Start controllers (RVSS) for the 4 pumps.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 24 13, SWITCHBOARD: Requirements for providing power to MCC and miscellaneous equipment.
- F. Section 40 94 23, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.
- G. Section 03 30 00, CAST IN PLACE CONCRETE: Requirements for concrete and reinforcing bars for the construction of foundations and pads.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

- A. The Motor Control Center shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL and ANSI Standards. Factory tests shall be certified.
- B. Thoroughly test the Motor Control Center at the factory with the starters and circuit breakers in the connected position in their cubicles. The factory tests shall be in accordance with C37.20 and ANSI C37.51 and shall include the following tests:

1. Verify that starters and circuit breaker sizes and types correspond to drawings and coordination study.
2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
3. Confirm correct operation and sequencing of electrical and mechanical interlock systems by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
4. Exercise all active components.
5. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, by applying 1550 VAC for a duration of 1 min. and in accordance with manufacturer's published data.
6. Perform insulation-resistance tests on control wiring with respect to ground. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
7. Verify correct function of control relays located in the Motor Control Center with multiple control power sources.
8. Perform phasing checks on Motor Control Center to insure correct bus phasing.
9. Inspect indicating devices for correct operation.

1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Submit RVSS package to the Engineer for approval prior to factory assembly of the RVSS. The submittal package shall consist of the following:
 1. Elementary diagrams showing factory power and control wiring along with field wiring connections for line and load power connections and control wiring connections.
 2. Outline diagrams showing the overall enclosure and mounting dimensions with front and side views and weights as a minimum. The outline drawings shall also include conduit entry/exit locations along with intended conduit sizes.
 3. Voltage, horsepower, current rating, and product features from standard catalog sheets.
- C. Catalog Data: Submit catalog data and information as required to demonstrate that materials conform to the specification requirements. Data shall include features, characteristics, ratings, and settings of all adjustable components.
- D. Shop Drawings:
 1. Clearly present sufficient information to determine compliance with drawings and specifications.

2. Include electrical ratings, enclosure type, dimensions, weights, mounting details, front view, side view, equipment and device arrangement, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams, materials, connection diagrams for each motor control center, and nameplate schedule.
 3. For starters: a list of overload sizes for each motor and circuit breakers sizes.
- E. Manuals: Two weeks prior to the final inspection, submit four copies of the following to the Engineer:
1. Complete maintenance, operating and testing manuals, including wiring diagrams, technical data sheets, including load current, overload relay and settings of adjustable relays, and information for ordering replacement parts:
 - a. Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
 - b. Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
 - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
 - d. Instructions for testing and adjusting overcurrent protective devices.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
- ANSI/NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
 - ANSI/NFPA 70 National Electrical Code
 - SG-3 Low Voltage Power Circuit Breakers.
 - ICS 1-05 Industrial Control and Systems: General Requirements
 - ICS 2-05 Industrial Control and Systems: Controllers, Contactors, and Overhead Relays, Rated 600 volts
 - ICS 6-06 Industrial Control and Systems: Enclosures
 - FU 1-02 Low-Voltage Cartridge Fuses
 - 250-03 Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. National Fire Protection Association (NFPA):
- 70-05 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- UL 508 Industrial Control Equipment (only for devices included in specification)
 - 977 Safety Fused Power Circuit Devices
 - 1053 Ground Fault Sensing and Relaying Equipment
 - 845-05 Motor Control Centers
- E. Institute of Engineering and Electronic Engineers (IEEE):
- C37.13 Low Voltage AC Power Circuit Breakers Used in Enclosures

C37.20.1.....Standard for Metal-Enclosed Low-Voltage Power Circuit-
Breaker Switchgear
C57.13.....Instrument Transformers
C62.41.....Surge Voltage in Low Voltage AC Power Circuits

1.7 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
- B. Ship up to three motor control sections in individual shipping splits for ease of handling. Each shipping split shall be mounted on shipping skids and wrapped for protection.
- C. Contractor shall inspect and report concealed damage to carrier within 48 hours.
- D. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
- E. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

1.9 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE MOTOR CONTROL CENTER

- A. The Contractor shall furnish and install, where indicated on the Drawings, a deadfront type, low voltage metal-enclosed Motor Control Center assembly as specified herein and as shown on the contract drawings.
- B. The motor control center shall be a GE Evolution E9000, or approved substitute, low voltage motor control center, utilizing reduced voltage starters, low voltage combination starters and power circuit breakers, with a short circuit rating of 35,000 amperes RMS symmetrical or higher, and as herein specified.

2.2 COMPONENTS

- A. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.
- B. Structure
1. Enclosures shall be NEMA Type 12. Enclosures shall be suitable for front mounting.
 2. Wiring: NEMA ICS 3, Class I, Type B.
 3. Motor control center shall consist of the required number of vertical sections of heavy gauge sheet steel bolted together to form a rigid self-supporting assembly. A removable lifting angle shall be mounted to the motor control center at the top. Removable bottom channel sills shall be mounted front and rear of the vertical sections and shall extend the width of the lineup.
 4. Vertical sections shall be nominally 90-inch high and depth to match the switchboard. Section widths shall be 24-inches or 30-inches wide when required.
 5. The SCADA and Control panel enclosures shall be NEMA Type 12 floor mounted, front accessible only, metal enclosed type, arranged for cable and/or conduit entry from the top, bottom or sides, as required. Panel design shall allow easy access to all internal wiring and appurtenances. Ventilation fan, air filter, thermostatically controlled space heater, light kit and 120V receptacle shall be provided. The panel shall have a full piano hinge door(s) and a 3-point latch with a locking handle. The handle shall have a cylinder type lock keyed to match IDOT's system.
 6. Vertical sections shall be nominally 90-inch high and depth to match the motor control center. Section widths shall be 36-inches wide.
 7. The enclosure shall be finished inside and out. Exterior color shall match that for the motor control center, and the interior color shall be white or as otherwise approved by the Engineer.
- C. Wireways
1. Each vertical section shall contain a minimum 12-inch high top horizontal wireway and a 6" bottom wireway. When loads exit the bottom a 12" bottom wireway shall be provided. A removable hinged door shall cover the horizontal wireway.
 2. A separate vertical wiring trough shall be furnished in each vertical section adjacent to plug-in unit. The wire trough shall permit the installation of field wiring and shall isolate this wiring from the adjacent unit. No terminal blocks shall be located in the vertical wireway.
 3. Cable tie supports shall be furnished in the vertical wireway to hold cable and wiring in place. A removable hinged door shall cover the vertical wiring trough.
 4. A separate low-level signal raceway shall be provided within the vertical wiring trough.

D. Incoming Power

1. Incoming power to the motor control center shall be bus bars extended from the building switchboard as shown on the drawing.
 - a. Incoming bus shall enter the side of the motor control center and shall have a current rating as shown on the drawing.
2. If required, the motor control center shall be provided with an incoming transition section for close coupling with the switchboard.

E. Bus System

1. Power shall be distributed by means of a continuous horizontal bus with a current rating of 600 amperes.
2. The main bus shall be tin-plated .0003 micro inch thick copper.
3. The main bus shall be braced for 35,000 amperes RMS symmetrical.
4. The main bus shall be isolated by barriers from wire troughs, starters, and other areas.
5. There shall be double bolt connections on main bus joints and splice connections. Main bus splicing between shipping splits shall be accomplished from the front with no structural disassembly.
6. The main bus shall be fully rated and arranged for future extension.
7. The vertical bus in each section shall be rated 300 amperes and shall be tin-plated.
8. The vertical bus shall have a flame-retardant white polyester-glass insulation/isolation system. This system shall insulate the vertical bus front and rear. In addition, the barrier shall isolate each phase bus. Openings in the vertical bus insulation/isolation system shall permit the entry of unit stabs. Unused openings shall have plugs or covers to prevent the entry of foreign objects.
9. The vertical bus shall be braced the same as the main horizontal bus.
10. A non-insulated copper ground bus shall extend the full width of the motor control center with a minimum size of 2" x 1/4". The ground bus shall be rated same capacity as main phase bus. The ground bus shall be drilled and lugs furnished as specified.
11. A neutral bus shall be furnished full-width of line up. The neutral bus shall be same capacity as main horizontal phase bus. Lugs of the proper ampacity shall be furnished.

F. Units

1. Combination motor controller and feeder units shall employ molded case circuit breakers for branch circuit protection. Circuit breaker disconnects for combination motor starters shall be thermal-magnetic.
2. All combination starter and feeder units of plug-in construction shall utilize a positive guidance system to insure positive connection of the unit stabs to the section vertical bus. Insertion and removal of each unit shall not require the use of special tools.
3. Unit shelves shall be of a lift out design, so that the shelf may be removed without the use of special tools.
4. Connection from the power stabs to the unit disconnect shall be a direct connection.

5. Each circuit breaker starter unit size 1 through size 5 shall be of plug-in construction. Each feeder breaker rated 600A or less shall be plug-in construction.
6. Each unit compartment shall be equipped with a flange-formed pan type door. The door shall be mounted on the vertical section with removable hinge pins.
7. Each unit shall be equipped with an operating handle. The handle shall be connected to the disconnect operator using a direct drive and requiring no adjustments of linkage.
8. The handle shall be mechanically interlocked with the door preventing it from opening with the disconnect switch closed. The interlock shall also prevent the disconnect switch being closed with the door open. The interlock shall be capable of being defeated allowing the door to be opened with disconnect closed or disconnect closed with the door open.
9. The unit handle shall have provision for up to three padlocks in the off position. On circuit breaker units the handle shall have a "tripped" position in addition to OFF/ON.
10. Each unit shall be capable of being padlocked in a partially withdrawn position. In this position, the unit power stabs are disengaged from the vertical bus and no power can enter the unit.
11. Combination starter units specified with Type B or C wiring shall be supplied with split-type control terminal blocks. The terminal blocks shall be front mounted and shall allow the removal of the unit without disconnecting any of the control wiring. Combination starter units up to size 5 shall be plug-in construction and shall be capable of being removed without disconnecting any control leads from their terminal blocks.
12. Overload relays shall be:
 - a. Solid-state, ambient insensitive, self powered, including adjustable FLA, phase unbalance, phase loss protection, selectable overload class 10, with 2% accuracy and repeatability, built-in thermal memory to prevent hot motor starts, isolated 1 NO and 1 NC auxiliary contacts.
13. Control power for starter units shall be from:
 - a. Individual control power transformers furnished in each starter unit. One secondary lead shall be furnished with a fuse and the other lead shall be grounded. Control power primary fuses are required. The transformer shall be large enough to operate all indicating lights and control devices.
14. Starter units shall be provided with the following auxiliary devices:
 - a. auxiliary starter interlocks, 3 N/O, 3 N/C].
 - b. control / timing relays as shown on the drawings.
 - c. door mounted pilot devices shall be 30mm heavy duty:
 - 1) Start-stop pushbutton
 - 2) H-O-A selector switch
 - 3) Indicating lights quantity and color as shown on the drawing. Indicating lights shall be reduced voltage transformer push to test led type.
 - 4) Ammeter
 - 5) Ammeter selector switch

G. Reduced Voltage Soft Starter (RVSS)

1. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details. Furnish GE ASTAT XT or approved substitute.
2. The RVSS shall be capable of operating a NEMA design B induction motor with a full load current equal to or less than the continuous output current rating of the soft starter.
3. The RVSS shall be microprocessor controlled and shall consist of a power section, logic board, and field wiring interface terminal board for ease of access to control and power wiring as well as maintenance requirements. The RVSS shall consist of the following general components:
 - a. Three sets of back-to-back phased controlled power semiconductors rated 1400 PIV to 500V, 1600 PIV to 600V and 1800 PIV to 690V.
 - b. Integral thermal sensor to trip and disengage the soft starter on heat sink over temperature.
 - c. Programmable keypad and alphanumerical LCD display that indicates present mode of operation. The LCD keypad shall display programming and diagnostic data in full text.
 - d. LED indicators to show the following: On, Start, Run, Soft Stop, Stop, Save/Slow Speed, Dual Set/Reverse, & Fault.
 - e. Modbus RTU communications port.
4. The RVSS input power section shall be designed to operate at 460 Vac three phase input voltages.
5. The RVSS output power section shall be designed for three phase NEMA design B induction motor with amperage ratings from 8A through 820A depending on actual configuration.
6. RVSS shall include control power that is 120 Vac via a control power transformer.
7. All RVSS shall meet UL508A.
8. The RVSS shall include a Mag-Break motor circuit protector with a through-the-door handle interlocked to the enclosure door to provide a local and lockable means of removing all input power from the RVSS.
9. Branch circuit protection fuses shall be provided to protect the RVSS. Fuses shall be sized to provide proper branch circuit protection and be coordinated with other power circuit components.
10. The RVSS shall include door mounted operator devices and a through the door keypad to facilitate programming, control functions and diagnostics.

11. The RVSS shall include a line isolation contactor to remove three phase power from the starter and motor during stop and fault conditions.
12. An AC3 rated Bypass Starter with Class 20 motor overload relay will be included and controlled by the ASTAT XT to allow cooler and more efficient operation during run conditions. This will also allow the RVSS panel to run the motor using a full voltage, non-reversing starter in the event the RVSS trips.

H. RVSS PROTECTIVE AND DIAGNOSTIC FEATURES

1. In the event of a fault, the soft starter will have tripped. Faults must be reset to restart operation once their cause has been rectified. The soft starter shall offer the following Faults list:
 - a. External Fault (by a digital input).
 - b. Frequency out of Range
 - c. Heat Sink Over Temperature
 - d. Long Start Time
 - e. Overcurrent / Jam
 - f. Overload
 - g. Overvoltage
 - h. Phase Loss
 - i. Phase Sequence
 - j. Shorted SCR
 - k. Slow Speed Time
 - l. Thermistor Trip
 - m. Too Many Starts
 - n. Undercurrent
 - o. Undervoltage
 - p. Wrong Motor Connection
 - q. Wrong Parameters
 - r. Wrong Wiring Connection
 - s. RVSS panels with an AC3 rated bypass shall contain an adjustable Class 20 ambient compensated overload relay. The overload relay shall provide; single-phase protection, visible trip indication, selectable manual/automatic reset, and trip test.

I. Molded Case Circuit Breakers

1. Furnish GE Spectra RMS™ Molded Case Circuit Breakers.
2. Feeder circuit breakers to 600A shall be provided in a plug-in for connection to the MCC vertical bus.

3. Circuit breaker frames shall be constructed of a high-strength, molded, glass-reinforced polyester case and cover. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action, independent of the speed of the toggle handle operation. The design shall provide common tripping of all poles. Breakers shall be suitable for reverse feeding.
4. Breaker plug-in units shall be provided with an external operating handle which shall have ON and OFF position clearly marked on the outside of the breaker enclosure.
5. Breakers shall include factory installed mechanical lugs. Lugs shall be UL listed and rated 75 or 60/75 degrees C as appropriate. Breakers shall be standard, or 80 percent rated.
6. Breakers shall use digital true RMS sensing trip units and a rating plug to determine the breaker trip rating.
7. Breaker digital electronic trip units shall be as described in Article 2.02H.

J. Circuit Breaker Trips for Molded Case Breakers

1. Feeder molded case circuit breakers shall be supplied with digital electronic trips. Furnish GE microEntelliGuard digital electronic trip units or approved substitute that complies with all of the following.
2. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.
3. Long time and short time protective functions shall have true RMS sensing technology for harmonic rich currents including up to the 19th harmonic.
4. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.
5. Multi-button keypad to provide local setup and readout of all trip settings on the LCD.
6. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug. Rating plugs shall be available in sizes from 40% to 100% of the breaker sensor rating
7. An integral test jack for testing via a portable test set and connection to a battery source.
8. Noise immunity shall meet the requirements of IEEE C37.90.
9. Display trip targets for long time, short time, and ground fault, if included.
10. Visual illuminated indication of the trip unit (normal, pickup, trip, error).
11. The trip unit shall be provided with a 10 event trip history log. Each trip event shall be recorded with type, phase and magnitude of fault that caused the trip
12. As a minimum, the trip unit shall have the following protective functions:
 - a. Current setting or long time pickup, adjustable from 50% to 100% of the rating plug value.
 - b. Adjustable long time delay with typical inverse time characteristics (minimum of 10 bands). In addition, a set of straight line fuse shaped long time delay bands shall be provided to facilitate selectivity with downstream fuses (minimum 7 bands).
 - c. Instantaneous pickup, adjustable from 2.0 to 10 times the rating plug in 0.5 increments

- d. Short time pickup and delay. Short time pickup shall be adjustable from 1.5 to 9 times the long time pickup setting in 0.5 increments with an OFF option. Provide minimum of 12 short time delay bands with three selectable I2t bands.
 - e. Adjustable ground fault pickup and delay. Ground fault pickup shall be adjustable from 0.4 to 1.0 times the breaker sensor rating in 0.05 increments. Provide a minimum of 15 ground fault delay bands with three selectable I2t bands
13. The trip unit shall display rms current, each phase, on the LCD.
 14. The following monitored values shall also be displayed on the trip unit LCD:
 - a. Voltage, rms, line - to - line, or line - to - neutral;
 - b. Energy, KWH, total;
 - c. Demand KWH, over an adjustable time period of 5 to 60 minutes;
 - d. Peak demand, KW, user resettable;
 - e. Real power, KW, line - to - line, line - to - neutral;
 - f. Total (apparent) power, KVA, line - to - line, line - to - neutral.
 - g. Reactive Power, KVAR, line - to - line, line - to - neutral.
 - h. Power Factor (%)
 - i. Frequency (Hz)]
 15. Trip shall be provided with serial communications using Modbus RTU protocol. Manufacturer's literature shall provide full register map.
 16. Trip unit shall provide waveform capture capability for fault events. Capture data shall include 4 cycles before and 4 cycles after the event. Data shall be provided in a Comtrade file format for use by power management system.
 17. If a manufacturer's trip unit can not incorporate the above specified metering functions, separate device(s) with equal function shall be provided for each breaker

K. Motor Management Relays

1. Motor management shall be provided using a relay with complete protection, metering, and monitoring functions. The relay may be applied on induction motors from 200V to 7.2KV @ 60 Hz from 1 to 800 FLA
2. The protection functions shall include selectable overcurrent Class 10, 15, 20, & 30, adjustable current unbalance, Zero Sequence ground fault if specified on drawings, fixed over/under-voltage, adjustable Stall & Jam, selectable Load & Power Loss, auxiliary sense failure, stop motor and record event upon failure of an auxiliary device to change state upon command.
3. Monitoring and metering functions shall include:
 - a. Phase current, each phase and ground; average current; % current unbalance; voltage; power factor, three-phase power, elapsed motor hours.
 - b. Non-volatile memory that can store up to 10 trip events.

4. Control functions shall include:
 - a. Four output contacts with NEMA C150 pilot duty ratings. Two NO contacts shall be used to control motor contactors, one form-C contact shall be used to annunciate ground fault status as shown on drawings, and one form-C contact shall be used for programmable fault status indications.
 - b. Six digital inputs for the following: Run 1, Run 2, Stop, Trip, Operation Mode, Reset.
 - c. Power Loss auto restart. Upon power loss, the relay will record a power loss fault as well as latest motor condition and parameter settings. The relay shall have the ability to restart after a preset delay. The relay shall have an adjustable delay setting of 0.15 to 30 seconds, set at 10 seconds.

5. The Motor Protective relay shall include the following user interfaces:
 - a. Front mounted LED's indicators shall indicate module status, network status, overcurrent pickup, ground fault pickup and current unbalance pickup.
 - b. Dip-switch configuration for overload trip class (10, 15, 20, 30), DeviceNet MAC ID, and Baud Rate. Software shall not be required for configuring these values.
 - c. DeviceNet communications using a standard 5-pin sealed micro style (female) connector.
 - d. An RS232 port, using an RJ11, on relay shall be provided for PC or Display device to access the settings and following data:
 - 1) Phase Currents
 - 2) Average Phase Current
 - 3) Line Voltage
 - 4) KW
 - 5) Power Factor
 - 6) Elapse Time
 - 7) Trip record of last 10 events
 - 8) Address (MAC ID)
 - 9) Trip Class
 - 10) Baud rate
 - e. Programming and Display Unit (PDU)
 - 1) PDU shall have capability to configure the relay, display faults and all monitored parameters.
 - 2) PDU shall have a 4-line by 16 character LCD display and control keys.
 - 3) LED indicators on the PDU shall indicate control power availability and fault status.
 - f. EnerVista compatible Windows® based PC software which enables setpoint programming, file storage, on-line help, and real time display of status and measured data.

L. Miscellaneous Units:

1. The following units shall be included in the motor control center as indicated on the drawings:
 - a. Lighting and Power transformers
 - b. Lighting panelboards, type AQ or AL for 120/208V applications.
 - c. PLC'S
2. Furnish the following devices where indicated on Drawings.
 - a. Push-Button Stations and Selector Switches: NEMA 12, heavy-duty type.
 - b. Stop and Lockout Push-Button Station: Momentary-break push-button station with factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
 - c. Control Relays: Auxiliary and adjustable time-delay relays.
 - d. Elapsed Time Meters: Heavy duty with digital total running time readout in hours.

M. Enclosure shall be provided with adequate space for the installation of the moisture/temperature monitoring relay(s) provided by the pump manufacturer. Interface requirements shall be coordinated with the pump manufacturer.

2.3 FINISH

- A. The Motor Control Center steel parts shall be cleaned and sprayed in controlled cleaning solutions by a 7-stage spray washer. The operation shall produce an iron phosphate coating of a minimum of 150 milligrams per square foot to meet MIL Specification TT-C-490. The primed metal parts shall be electrostatically coated with powder paint consisting of 670-011 ANSI-61 Acrylic Paint (Light Gray) with a gloss of 60 plus or minus 5 and thickness of 2.5 mils. The paint finish shall withstand a minimum of 1000 hours salt spray test.

2.4 ACCESSORIES

1. Fuses
 - a. Manufacturer: Ferraz Shawmut (or equal).
 - b. Interrupting Rating of all fuses shall be [200,000] RMS amperes.
2. Furnish adhesive plastic strip mimic bus for switchboards.
3. Furnish nameplates for each device as indicated in drawings. Nameplates for Power System equipment shall be white with black engraved lettering. Lettering shall be a minimum of 1/2 inch high. Nameplates shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of power branch as applicable. Secure nameplates with screws.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of 480V Motor Control Center
- B. Verify that electrical power is available and of correct characteristics

3.2 PREPARATION

- A. Install concrete bases after dimensions of equipment are confirmed by equipment manufacturer.

3.3 INSTALLATION

- A. The installer shall provide all labor and perform all work to install and make operational all equipment necessary to assure a safe and reliable operation.
- B. Installation shall be in accordance with NEC, written instructions of the manufacturer, and as shown on the drawings.
- C. Install motor control center on concrete pad as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Bolt the motor control center to the concrete pad.
- D. Make connection to the switchboard as shown on the drawing.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the motor control center.

3.4 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify appropriate anchorage and required area clearances.
- d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
- e. Use calibrated torque-wrench method to verify the tightness of accessible bolted electrical connections, or perform a thermographic survey after energization.
- f. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
- g. Clean motor control center.
- h. Inspect insulators for evidence of physical damage or contaminated surfaces.
- i. Exercise all active components.
- j. Verify the correct operation of all sensing devices, alarms, and indicating devices.
- k. Inspect control power transformers.
- l. Check main bus connections, electrode conductor and equipment ground.

2. Electrical Tests

- a. Perform insulation-resistance tests on each bus section as shown paragraph 3.4, 3, b.
- b. Perform overpotential tests as required, disconnect solid-state components or control devices if they cannot tolerate the applied voltage.
- c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
- d. CT/PT polarity and ratio tests.
- e. Primary injection test for breakers verifying settings.
- f. Functional operation of all devices.
- g. Ground resistance test.
- h. Test of protective relays and verify trips and alarms.

3. Test Values:

- a. Bolt torque levels shall be in accordance with manufacturer's instructions.
- b. Insulation resistance test shall be performed in accordance with following:

Insulation Resistance Test Voltage	
Voltage Rating	Test Voltage
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

- c. Values of insulation resistance less than rated kv +1 in Megohms shall be investigated and corrected.

3.5 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.6 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the motor control center is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.7 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Motor Control Center, Include:
 - a. 1 manday for Installation Services for Motor Control Center.
 - b. 1 manday for Instructional Services for Motor Control Center.

- I. The start-up services for the Motor Control Center shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 26 24 19

DIVISION 26 - ELECTRICAL

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of wiring devices.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- C. Section 26 05 33, RACEWAY AND BOXES: Conduits and outlets boxes.
- D. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- E. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, construction materials, grade and termination information.
- C. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the Resident Engineer: Technical data sheets and information for ordering replacement units.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
70 National Electrical Code (NEC)

- C. National Electrical Manufacturers Association (NEMA):
 - WD 1 General Color Requirements for Wiring Devices
 - WD 6 Wiring Devices – Dimensional Requirements

- D. Underwriter’s Laboratories, Inc. (UL):
 - 5 Surface Metal Raceways and Fittings
 - 20 General-Use Snap Switches
 - 231 Power Outlets
 - 467 Grounding and Bonding Equipment
 - 498 Attachment Plugs and Receptacles
 - 943 Ground-Fault Circuit-Interrupters

1.6 CLASSIFICATION OF WIRING DEVICES AND INSTALLATIONS IN PROJECT LOCATIONS

- A. Unless otherwise specified or shown on Plans, type of wiring devices and installations shall be in accordance with the following:

NEMA 7(CLASS I, Division 2, GROUP D): All spaces in the Wet Well, Dry Well and Stairwell, except as otherwise indicated.
NEMA 1: Electrical Room.
NEMA 4: Outdoor area and other unspecified wet or damp area.
NEMA 12: Other area not defined.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Manufacturers
 - 1. Bryant Electric, Inc.
 - 2. GE Company; GE Wiring Devices.
 - 3. Hubbell, Inc.; Wiring Devices Div.
 - 4. Killark Electric Manufacturing Co.
 - 5. Pass & Seymour/Legrand; Wiring Devices Div.
 - 6. Pyle-National, Inc.; an Amphenol Co.

- B. Wiring Devices for Hazardous (Classified) Locations:
 - 1. Crouse-Hinds Electrical Co.; Distribution Equipment Div.
 - 2. Killark Electric Manufacturing Co.
 - 3. Pyle-National, Inc.; an Amphenol Co.

- C. Poke through, Floor Service Outlets:
 - 1. Hubbell, Inc.; Wiring Devices Div.

2. Pass & Seymour/Legrand; Wiring Devices Div.
3. Square D Co.
4. Wiremold.

2.2 RECEPTACLES

- A. Straight Blade and Locking Receptacles: Heavy Duty specification grade.
- B. GFCI Receptacles: Termination type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle. Design units for installation in 2-3/4 in. (70 mm) deep outlet box without an adapter.
- C. Isolated Ground Receptacles: Equipment grounding contacts connected only to green grounding screw terminal of device with inherent electrical isolation from mounting strap.
 1. Devices: Listed and labeled as isolated ground receptacles.
 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
- D. Industrial Heavy Duty Receptacles: Comply with IEC 309-1.
- E. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.
 1. Appleton Cat. No. EFS B175-2023M, Crouse-Hinds Cat. No. ENR 21201 with NEMA 5-20R.
 2. Plugs: Match receptacles. Furnish 1 plug for each receptacle installed.
- F. Color: White unless otherwise indicated or required by Code.

2.3 PENDANT CORD/CONNECTOR DEVICES

- A. Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy Duty grade.
 1. Body: Nylon with screw open cable gripping jaws and provision for attaching external cable grip.
 2. External Cable Grip: Woven wire mesh type made of high strength galvanized steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 1. Cord: Rubber insulated, stranded copper conductors, with type SOW-A jacket. Green insulated grounding conductor, and equipment rating ampacity plus minimum of 30%.
 2. Plug: Nylon body and integral cable clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

- A. Snap Switches: Heavy duty: quiet type.
- B. Snap Switches in Hazardous (Classified) Locations:
 - 1. Appleton EFS series, Crouse-Hinds EDS series.
 - 2. Comply with UL Standard 894.
- C. Color: White unless otherwise indicated or required by Code.

2.6 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 - 1. Plate Securing Screws: Metal with head color to match plate finish.
 - 2. Finished Spaces: 0.04 in. thick, Type 302, satin finished stainless steel.
 - 3. Unfinished Spaces: Galvanized steel.
 - 4. Exterior and wet locations: Weatherproof plates and covers.

2.7 PILOT DEVICES AND CONTROL STATION COMPONENTS

A. Manufacturers:

- 1. Allen Bradley 800T.
- 2. Square D Class 9001, Type K.
- 3. Cutler-Hammer 10250T.

B. Construction:

- 1. Heavy duty.
- 2. Watertight.
- 3. Oil-tight.
- 4. Flush panel mounting.
- 5. Match NEMA rating of associated Control Station (see below).

C. Pushbuttons:

- 1. Flush head unless specified elsewhere.
- 2. Contact Blocks:
 - a. Double break silver contacts.
 - b. Ac Ratings: 7,200 va make, 720 va break.
 - c. Single pole, double throw or double pole, single throw.
 - d. Up to six tandem blocks.
- 3. Momentary contact unless specified elsewhere.
- 4. Non-illuminated.
- 5. Legend plates, as required, for type of operation or as specified elsewhere.

D. Pushbuttons – Emergency Stop (ESTOP):

1. Jumbo red mushroom head.
2. Contact Blocks:
 - a. Double break silver contacts.
 - b. Ac Ratings: 7,200 va make, 720 va break.
 - c. Single pole, single throw.
 - d. Up to six tandem blocks as specified.
3. Push/pull.
4. Maintained contact.
5. Non-illuminated.
6. Legend plates:
 - a. Extra large.
 - b. Red.
 - c. "ESTOP".

E. Pullcord Lever Switches – Emergency Stop (ESTOP):

1. Manufacturer: Conveyor Components Company, Model RS.
2. Cast Aluminum housing.
3. Lever arm actuation.
4. Contact Blocks:
 - a. Double break silver contacts.
 - b. Ac Ratings: 7,200 va make, 720 va break.
 - c. Single pole, single throw.
 - d. Two tandem blocks: one form 'A', one form 'B', or two form 'C'.
5. Maintained contact.
6. Non-Illuminated.
7. Legend plate:
 - a. Oversize.
 - b. "ESTOP".
8. Provide vinyl coated safety cable, eyebolts and cable end fittings sufficient to span length of equipment.

F. Selector Switches:

1. Maintained position unless specified elsewhere.
2. Contact Blocks:
 - a. Double break silver contacts.
 - b. Ac Ratings: 7,200 va make, 720 va break.
 - c. Contact configuration as specified.

- d. Up to six tandem blocks.
3. Operators:
 - a. Number of positions as specified elsewhere.
 - b. Standard knob type unless specified elsewhere.
4. Legend plates as required for type of operation or specified elsewhere.

G. Pilot Lights:

1. LED type.
2. Colored lens as specified elsewhere.
4. Interchangeable lenses.
5. Rated for 120v, 60 Hz.
6. Push to test.
7. Legend plates as specified elsewhere.

H. Potentiometers:

1. Three-terminal potentiometer.
2. Resistance: 10 kOhm.
3. Power Rating: 2 watt, 50V ac/dc.
4. Resolution: 1 percent.
5. Linearity: +/- 5 percent.

I. Nameplates:

1. Engraved laminated plastic.
2. Letters 3/16 in. high.
3. Black letters on white background.
4. Identify per equipment controlled, using names found on Drawings.

2.8 CONTROL STATIONS

- A. REMOTE, START/STOP: One NO momentary contact pushbutton for start. One NC momentary contact pushbutton for stop. One green 120 VAC pilot light for on.
- B. REMOTE, START/BUMP/STOP: One NO momentary contact pushbutton for start. One NO momentary contact pushbutton for bump. One NC momentary contact pushbutton for stop. One yellow 120 VAC pilot light for bump.
- C. REMOTE, OPEN/CLOSE/STOP: One NO momentary contact pushbutton for open. One NO momentary contact pushbutton for close. One NC momentary contact pushbutton for stop. One green 120 VAC pilot light for open. One red 120 VAC pilot light for close.

2.9 EXTERIOR MOUNTED ALARM HORNS

- A. Manufacturers:
Federal Signal Vibratone, Model 350.

- B. 120 vac.
- C. NEMA 4X: Suitable for use in wet location or outdoors, gasketed, where specified.
- D. Wall or surface mounted, provide mounting lugs.
- E. Body to include outlet box.
- F. 3/4 in. conduit hubs.
- G. Annunciator unit to project 100 dB tone at 10 ft.
- H. Provide horn with projector cone.
- I. Gray enamel finish.

2.10 EXTERIOR MOUNTED ALARM LIGHTS

- A. Manufacturers:
 - 1. Appleton Electric Company.
 - 2. Crouse Hinds.
- B. 120 vac.
- C. NEMA 4X: Suitable for use in wet location or outdoors, gasketed, where specified.
- D. Surface-mounted, provide mounting lugs. Body to include mounting lugs.
- E. Aluminum mounting hood.
- F. Red glass globe with guard.
- G. 3/4 in. conduit hubs.

2.11 PROCESS INDICATORS, ELECTRONIC

- A. Manufacturers:
 - 1. Precision Digital.
 - 2. Red Lion, IMP.
 - 3. Moore Industries.
- B. 4-20mA dc Input.
- C. 4½ digit LED indicator.
- D. Loop powered.

E. Enclosures:

NEMA 7: Impact-resistant polycarbonate body, clear gasketed polycarbonate cover. ½” conduit hole in bottom of case. NEMA 7 XP: FM approved cast aluminum body, screw-type cast aluminum cover with view port. Two ¾” conduit holes.

F. Provide 2” pipe mounting kit as detailed.

G. Model: PD675-N, NEMA 4X; PD677-N, NEMA 7 XP.

2.12 PROXIMITY SWITCHES IN INTRUSION

A. Manufacturers:

1. ADT.
2. Sentrol.

B. Proximity switch for monitoring of building or control panel door position.

C. Solid State Hall Effect sensor with magnetic actuating bar.

D. Switch shall be commercial grade. Inductive, tubular or barrel type switches shall not be acceptable.

E. Provide dry contacts suitable for connection to PLC input. Use switch manufacturer's recommended switching relay/amplifier as necessary to affect proper interface. Relay/amplifier shall be installed in PLC panel.

2.20 CONTROL RELAYS

A. Manufacturers:

1. Potter and Brumfield.
2. Struthers Dunn.

B. Operating Data:

1. Pickup Time: 13 ms maximum.
2. Dropout Time: 10 ms maximum.
3. Operating Temperature: -45°F to 150°F.

C. ac Coil:

1. 120 or 240 vac.
2. Continuous rated.
3. 3.5 va inrush maximum.
4. 1.2 va sealed, maximum.
5. 50 to 60 Hz.
6. Light to indicate energization.
7. Minimum Dropout Voltage: 10% of coil rated voltage.

D. dc Coil:

1. 24 or 120 Vdc.
2. Continuous rated.
3. Light to indicate energization.
4. Minimum Coil Resistance:
 - a. 24 Vdc: 450 Ω .
 - b. 120 Vdc: 9,000 Ω .

E. Contacts:

1. Gold flashed fine silver, gold diffused for 1 amp or less resistive load.
2. Silver cadmium oxide.
3. 4 form C.
4. 120 vac.
5. 10 amp make, 1.5 amp break, (inductive).

F. Rated at 10 million operations.

G. 11 pin, square socket.

H. DIN rail mountable.

I. Enclosed and protected by polycarbonate cover.

J. Provide relay-retaining clips.

2.21 TIMERS

A. 24-hour Clock Timer (Repeat Cycle):

1. Manufacturers:
 - a. Tork Time Controls.
 - b. Intermatic.
 - c. Or equal.
2. Mounting: Surface.
3. Display: 24-hour LCD.
4. Contacts: 1 SPDT rated 20 A.
5. Set Points: 288 per 24-hour.
6. Skip Feature: 1 to 7 day adjustable.
7. Minimum On-Off Time: 5 min.
8. Time cycle programmable by keypad.
9. Power: 120 vac, 60 Hz.

B. Elapsed Time Meters:

1. Manufacturers:

- a. Engler.
- b. Eagle Signal.
- c. Or equal.

2. Mounting: Surface.
3. Digits: 5, non-reset.
4. Power: 120 vac, 60 Hz.

C. Interval/Duration Timer (Rear of Panel):

1. Manufacturers:
 - a. Potter and Brumfield, CN series.
 - b. Eagle Signal DM 100 series.
 - c. Or equal.
2. Mounting: Plug-in with dust tight cover.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.
- B. Mounting height as follows unless otherwise shown on Drawings:
 1. Switches: 48 in. above floor.
 2. AC Receptacles and Telephone Outlets: 18 in. above floor; 48 in. above floor in unfinished areas.
- C. Install devices and assemblies plumb and secure.
- D. Install wall plates when painting is complete.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- F. Protect devices and assemblies during painting.

3.2 IDENTIFICATION

- A. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be provided.
 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with engraved plastic laminate on wall plate.
 2. Receptacles: Identify panelboard and circuit number from which served. Use durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- B. Isolated Ground Receptacles: Connect to isolated ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

END OF SECTION 26 27 26

DIVISION 26 - ELECTRICAL

SECTION 26 29 21 DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of low voltage disconnect switches.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that is common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES 600 VOLTS AND BELOW: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- E. Section 26 05 33, RACEWAY AND BOXES: Conduits for cables and wiring.
- F. Section 26 24 19, MOTOR CONTROL CENTER: Requirements for Motor Control Center and protection of motors.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, and fuse types and classes.
 - 3. Show the specific switch and fuse proposed for each specific piece of equipment or circuit.

C. Manuals:

1. Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the Resident Engineer two weeks prior to final inspection.
2. Terminals on wiring diagrams shall be identified to facilitate maintenance and operation.
3. Wiring diagrams shall indicate internal wiring and any interlocking.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
FU I-07 Low Voltage Cartridge Fuses
KS I-06 Enclosed and Miscellaneous Distribution Equipment
Switches (600 Volts Maximum)
- C. National Fire Protection Association (NFPA):
70-08 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
98-04 Enclosed and Dead-Front Switches
248-00 Low Voltage Fuses
977-94 Fused Power-Circuit Devices

1.6 CLASSIFICATION OF DISCONNECT SWITCHES AND INSTALLATIONS IN PROJECT LOCATIONS

- A. Unless otherwise specified or shown on Plans, type of disconnect switch and installations shall be in accordance with the following:

NEMA 7(CLASS I, Division 2, GROUP D): All spaces in the Wet Well, Dry Well and Stairwell, except as otherwise indicated.
NEMA 1: Electrical Room.
NEMA 4: Outdoor area and other unspecified wet or damp area.
NEMA 12: Other area not defined.

1.7 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.8 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 DISCONNECTS, FUSES, AND CIRCUIT BREAKERS

A. Manufacturer's

1. Motor and Circuit Disconnects:

- a. G.E. Co.
- b. Square D Co.
- c. Cutler-Hammer.

B. Molded-Case Circuit Breakers:

- a. G.E. Co.
- b. Square D Co.
- c. Cutler-Hammer.

2.2 ENCLOSED SWITCHES

A. Enclosed Nonfusible Switch: NEMA KS 4X, Type HD handle lockable with 2 padlocks.

B. Enclosed Fusible Switch, 800 Amps and Smaller: NEMA KS 4X, Type HD, clips to accommodate specified fuses, enclosure consistent with environment (i.e. explosion proof) where located, handle lockable with a padlocks, and interlocked with cover in closed position.

1. Minimum Fault Current Rating: 35,000 symmetrical rms amperes.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Enclosed Molded-Case Circuit Breaker: NEMA AB 1, handle lockable with a padlocks.

B. Characteristics:

1. Frame size, trip rating, number of poles, and auxiliary devices as indicated.
2. Interrupting capacity rating to meet available fault current, 22,000 symmetrical rms amps minimum.
3. Appropriate application listing when used for switching fluorescent lighting loads or heating, air conditioning, and refrigeration equipment.

C. Interchangeable Trips: Circuit breakers, 200 amps and larger, with trip units interchangeable within frame size.

D. Field-Adjustable Trips: Circuit breakers, 400 amps and larger, with adjustable short time and continuous current settings.

E. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.

- F. Current Limiters: let-through ratings less than NEMA FU 1, Class RK-5.
- G. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.
- H. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
- I. Shunt Trip: Where indicated, 120 volts, 60 Hz.
- J. Accessories: As indicated on drawings.

2.4 MOTOR RATED TOGGLE SWITCHES

- A. Switches shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
- B. Units shall include thermal overload protection, red pilot light protection, NO/NC auxiliary contact and toggle operator.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches in accordance with the NEC and as shown on the drawings.
- B. Install enclosed switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
- C. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.
- D. Install enclosed switches and circuit breakers level and plumb.
- E. Install wiring between enclosed switches and circuit breakers and control/indication devices.
- F. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.2 DISCONNECTS, FUSES AND CIRCUIT BREAKERS

- A. Examination
- B. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front door.

3.4 SPARE PARTS

Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fusible disconnect switch installed on the project. Deliver the spare fuses to the Engineer.

END OF SECTION 26 29 21

DIVISION 26 - ELECTRICAL

SECTION 26 36 23 AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of open-transition automatic transfer switches with bypass isolation.

1.2 RELATED WORK

- A. Section 01 01 01 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section in Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personal safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAYS AND BOXES: Raceways for power and control wiring.
- F. Section 48 46 19, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Comply with OSHA – 29 CFR 1910.7 for the qualifications of the testing agency.

1.4 FACTORY TESTS

- A. Automatic transfer switches shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted per UL standards. Factory tests shall be certified. The following factory tests shall be performed:
 - 1. Visual inspection to verify that the ATS is as specified.
 - 2. Mechanical test to verify that ATS sections are free of mechanical hindrances.
 - 3. Insulation resistance test to ensure integrity and continuity of entire system.
 - 4. Main switch contact resistance test.
 - 5. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.
 - 6. Verify that ATS correspond to drawings and coordination study.
 - 7. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 8. Confirm correct operation and sequencing of electrical and mechanical interlock systems by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
 - 9. Exercise all active components.

10. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, by applying 1550 VAC for a duration of 1 min. and in accordance with manufacturer's published data.
11. Perform insulation-resistance tests on control wiring with respect to ground. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
12. Verify correct function of control transfer relays located in the ATS with multiple control power sources.
13. Perform phasing checks to insure correct bus phasing from each source.
14. Inspect indicating devices for correct operation.

1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Shop Drawings:
 1. Clearly present sufficient information to determine compliance with drawings and specifications.
 2. Include electrical ratings (including withstand), dimensions, weights, mounting details, conduit entry provisions front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, factory relay settings, and accessories.
 3. Complete nameplate data, including manufacturer's name and catalog number.
 4. A copy of the markings that are to appear on the transfer switch when installed.
- C. Manuals:
 1. When submitting the shop drawings, submit companion copies of complete maintenance and operating and maintenance manuals, including technical data sheets, wiring diagrams and information, such as telephone number, fax number and web sites, for ordering replacement parts.
 2. Two weeks prior to final inspection, submit four copies of a final updated maintenance and operating manual to the Architect.
 - a. Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
 - b. Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
 - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only:

- B. Institute of Electrical and Electronic Engineers (IEEE):
 - 446-95 Recommended Practice for Design and Maintenance of Emergency and Standby Power Systems
 - C37.90.1-02 Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
 - C62.41.1-02 Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
 - C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

- C. National Electrical Manufacturers Association (NEMA):
 - 250-03 Enclosure for Electrical Equipment (1000 Volts Maximum)
 - ICS 6-06 Enclosures
 - IC3 4-05 Industrial Control and Systems: Terminal Blocks
 - MG 1-07 Motors and Generators

- D. National Fire Protection Association (NFPA):
 - 70-08 National Electrical Code (NEC)
 - 99-05 Health Care Facilities
 - 110-10 Emergency and Standby Power Systems

- E. Underwriters Laboratories, Inc. (UL):
 - 50-95 Enclosures for Electrical Equipment
 - 508-99 Industrial Control Equipment
 - 891-05 Dead-Front Switchboards
 - 1008-96 Transfer Switch Equipment

1.7 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.8 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 OPEN-TRANSITION AUTOMATIC TRANSFER SWITCH

- A. The transfer switch shall be a GE Type ZTG series or approved substitute.

- B. General:
 - 1. Comply with UL, NEMA, NEC, ANSI, IEEE, and NFPA.
 - 2. Automatic transfer switches shall be air break, double throw interrupter type, electrically operated and mechanically held in both source #1 and source #2 positions. The switch operators shall be single solenoid or single motor operated and shall be momentarily energized by the sources to which the load is transferred. Switches shall be capable of transfer in either direction on 70% of rated voltage.

3. The automatic transfer switch shall be equipped with an integral bypass/isolation switch.
- C. Transfer time in either direction shall not exceed 5 seconds.
 - D. Unless otherwise indicated, the switch shall be rated for 480 volts. The current rating shall be as indicated, as a minimum. Main contacts and main current carrying parts shall be insulated for 600 volts. The rating of the switch shall be a 24-hour continuous rating in a non-ventilated enclosure for all classes of loads including resistance inductive, tungsten lamp and ballast loads. Temperature rise shall conform to NEMA standards.
 - E. Main contacts shall be mechanically held in position by the operating linkage without the use of hooks, latches, magnets or springs and the contacts shall be of a silver-tungsten alloy.
 - F. Separate arcing contacts, with magnetic blowouts shall be provided. Interlocked molded case circuit breakers or interlocked contactors will not be acceptable.
 - G. The number of poles shall be 4 (neutral shall be switched) as indicated. The four pole switch shall be equipped with four fully-rated poles, all operating on a common shaft and the short circuit rating of the fourth pole shall be identical to the rating of the main poles.
 - H. Not less than two auxiliary contacts, one closed on normal and one closed on emergency, rated not less than 10 amperes at 120 volts, shall be mounted on and actuated by the same shaft as the main contacts. Additional relay contacts, timers, control relays and associated wiring required for the functions indicated shall be front accessible. All wiring shall be tagged with self-sticking or tubular wire markers.
 - I. Except for the normal functioning of a programmed neutral position, failure of any component shall not result in a neutral position where both source #1 and source #2 contacts remain open. Also, the failure of any component shall not result in a condition where both source #1 and source #2 contacts are closed, or attempt to close at the same time.
 1. Switch operator has programmed neutral position arranged to provide midpoint between 2 working switch positions with an intention, controlled, timed pause during transfer at midpoint.
 2. Midpoint pause is adjustable from 0.5 to 30 sec minimum, and factory set at 2.0 secs, except as indicated.
 3. Time delay occurs for both transfer directions.
 - J. Switch components shall be easily maintainable from the front without removal of the switch from its enclosure and without disconnecting the main power cable. Adequate safety baffles and barriers shall be provided and all components shall be clearly identified.

K. Manual Operator

1. The transfer switch shall be equipped with a manual operator. The manual operator shall operate the switch in the same transfer time as normal electric operator transfer. Interlocking shall be provided to prevent electric operation of the switch when the manual operator is used. The manual operator shall be arranged to provide adequate shielding and protection from live electrical parts for operating personnel.

L. Withstand Rating, Tests and Certifications

1. Transfer switches for 480 volt circuits shall have a withstand rating of not less than 35,000 RMS symmetrical amperes at 20% power factor for a duration of 3 cycles at 480 volts without contact separation or damage.
2. In addition, they shall have a UL Standard 1008 listed withstand and closing rating, at 480 volts, when coordinated with molded case circuit breakers, of not less than 85,000 RMS symmetrical amperes.
3. Product data submitted for approval shall include copies of a report from an independent testing laboratory which documents that identical switches have met the requirements of UL Standard 1008 for the specified ratings. In addition, the data shall include certified copies of test documentation of the 3-cycle withstand requirements specified herein.
4. Also, the manufacturer shall document and certify that the switch has sufficient arc interrupting capabilities for 50 cycles of operation when operating between source #1 and source #2 for the following load:
 - a. 600% of rated current at 0.4 power factor.
 - b. 20% of rated current at 0.4 power factor.

M. Control Features

1. Each transfer switch shall include, as a minimum, the following features of control.
 - a. Emergency Transfer Time Delay

This time delay relay shall delay the transfer to the secondary source for a time to allow for momentary outages. This time delay shall be adjustable with a range of roughly 0 to 5 minutes.
 - b. Test Switch

A test switch shall be mounted on the enclosure door to simulate Failure of the active power source.

c. Indicating Lights

The switch shall have indicating lights mounted on the enclosure to indicate which position, normal or emergency, the switch is on, and an undervoltage indication light when the voltage drops below 70% of service voltage.

d. Normal Source Selector

The transfer selector switch shall be mounted on the enclosure door to allow either source to be selected as the normal source.

e. Programmed Neutral Position

The switch operation shall have a programmed, adjustable time neutral position to prevent mechanical damage to motors which are running at the time of transfer.

f. Override Switch

The transfer switch shall have an override switch, mounted on the enclosure door to hold transferred switch in the emergency position regardless of the status of the normal source.

g. Normal Retransfer Time Delay

This time delay relay shall delay the retransfer to normal and it shall be adjustable from 0 to 30 minutes; factory set at 10 minutes.

h. Transfer switch shall be provided with Modbus communication capability.

2.2 SEQUENCE OF OPERATION

- A. A voltage decrease of 70% in one or more phases of the active power source shall initiate the transfer sequence.
- B. The automatic transfer switch shall transfer the load from source #1 to source #2 when the frequency and voltage of source #2 has been confirmed to have the specified percent of rated value.
- C. Automatic transfer switch shall retransfer to source #1 only if the specified voltage of source #2 decreases in one or more phases.
- D. Exercise Mode: Transfer to secondary power source shall be accomplished by manual test switches on a selective basis.

2.3 BYPASS/ISOLATION SWITCH

- A. Provide automatic transfer switch with two-way bypass/isolation manual type switch. The bypass-isolation switch shall permit load by-pass to either source #1 or source #2 and complete isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.
- B. Operation: The bypass/isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
1. Bypass to source #1 (or source #2): Operation of bypass handle shall allow direct connection of the load to the source #1 or Source #2, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.
 - a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.
 - b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
 - c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be achievable without re-energization of the automatic transfer switch service and load connections.
 2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.
 - a. Interlocking: Provide interlocking as part of the bypass/ isolation switch to eliminate personnel-controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
 - b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
 - c. Visual verification: The isolation blades shall be visible in the isolated position.
 3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch with the isolation contacts closed and the load bypassed without interruption of power to the load.
- C. Ratings: The electrical capabilities and ratings of the bypass/isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.

2.4 AUXILIARY CONTACTS

- A. As a minimum the following auxiliary contacts shall be provided.
1. N.C. Opens on Source #1 failure
 2. N.C. Opens on Source #2 failure
 3. N.O. Closes when the transfer switch is in source #1 position
 4. N.O. Closes when the transfer switch is in source #2 position
 5. N.O. held closed, opens when the transfer switch is in bypass position
 6. N.O. held closed, opens when the transfer switch fails.

2.4 REMOTE ANNUNCIATION AND CONTROL FUNCTIONS

- A. Include the following functions for indicated automatic transfer switches:
1. Indication of sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
 2. Indication of switch position.
 3. Indication of switch in test mode.
 4. Indication of failure of digital communication link.
 5. Key-switch or user-code access to control functions of panel.
 6. Control of switch-test initiation.
 7. Control of switch operation in either direction.
 8. Control of time-delay bypass for transfer to source #1.
 9. Indication of bypass/isolation from transfer switch.
- B. Malfunction of remote annunciator and control system or communication link shall not affect functions of automatic transfer switches. Automatic transfer-switch sensing, controlling, or operating functions shall not depend on remote control for proper operation.

2.4.16 Instructional Data/Material

(a) Not less than 4 full sets of hardbound installation and maintenance manuals, complete with any appropriate descriptive literature and any special tools required to service transfer switches shall be provided. Where more than one size is provided, the material shall address each size and shall be clearly delineated. The material so furnished shall include complete wiring diagrams.

(b) Plastic-laminated step-by-step operating and test procedures, complete with schematic wiring diagrams shall be permanently attached to automatic transfer switch enclosures.

2.5 SPARE PARTS

Provide six control fuses for each automatic transfer switch with a different rating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location of 480V ATS.
- B. Verify that electrical power is available and of correct characteristics

3.2 INSTALLATION

- A. The installer shall provide all labor and perform all work to install and make operational all equipment necessary to assure a safe and reliable operation.
- B. Install the automatic transfer switch in the switchboard accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- D. Set field-adjustable intervals and delays, relays, and engine exerciser.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the automatic transfer switch.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. A factory-authorized service representative is to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 - 1. Following completion of automatic transfer switch installation and after making proper adjustments and settings, site tests shall be performed by the manufacturer's representative in accordance with manufacturer's written instructions to demonstrate that each automatic transfer switch functions satisfactorily and as specified. Minimum operational tests shall include the following:
 - a. Insulation resistance shall be tested, both phase-to-phase and phase-to-ground.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 - 2. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.
 - a. Simulate power failure of source #1 to automatic transfer switch and of source #2 with source #1 available.
 - b. Simulate loss of phase-to-ground voltage for each phase of power source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.

3. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
 - b. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - c. Power failure of source #1 shall be simulated by opening upstream protective device. This test shall be performed a minimum of two times.
 - d. Power failure of source #2 with source #1 available shall be simulated by opening upstream protective device for source #2. This test shall be performed a minimum of two times.
 - e. Low phase-to-ground voltage shall be simulated for each phase of source.
 - f. Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, auxiliary contacts, and supplemental features.
 - g. Manual and automatic transfer and bypass isolation functions shall be verified.
 - h. When any defects are detected, correct the defects and repeat the test as requested by the Engineer at no additional cost to IDOT.

3.4 IDENTIFICATION

- A. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front door.

3.5 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the switchboard is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.6 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Automatic Transfer Switch, Include:
 - a. 1 manday for Installation Services.
 - b. 1 manday for Instructional Services.
- A. The start-up services for the Automatic Transfer Switch shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 26 36 23

DIVISION 26 - ELECTRICAL

SECTION 26 51 00 LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of the lighting systems.

1.2 RELATED WORK

- A. Section 01 01 00 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
 - 1. Material and construction details include information on housing, optics system and lens/diffuser.
 - 2. Physical dimensions and description.
 - 3. Wiring schematic and connection diagram.
 - 4. Installation details.
 - 5. Energy efficiency data.
 - 6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.
 - 7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).
 - 8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).

C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer:
 - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
C62.41-91 Guide on the Surge Environment in Low Voltage (1000V and less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
70 National Electrical Code (NEC)
101 Life Safety Code
- D. National Electrical Manufacturer's Association (NEMA):
C82.1-97 Ballasts for Fluorescent Lamps - Specifications
C82.2-02 Method of Measurement of Fluorescent Lamp Ballasts
C82.4-02 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps
C82.11-02 High Frequency Fluorescent Lamp Ballasts
- E. Underwriters Laboratories, Inc. (UL):
496-96 Edison-Base Lampholders
542-99 Lampholders, Starters, and Starter Holders for Fluorescent Lamps
844-95 Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
924-95 Emergency Lighting and Power Equipment
935-01 Fluorescent-Lamp Ballasts
1029-94 High-Intensity-Discharge Lamp Ballasts
1029A-06 Ignitors and Related Auxiliaries for HID Lamp Ballasts

- 1598-00.....Luminaires
- 1574-04.....Standard for Track Lighting Systems
- 2108-04.....Standard for Low-Voltage Lighting Systems
- 8750-08.....Light Emitting Diode (LED) Light Sources for Use in Lighting Products

- F. Federal Communications Commission (FCC):
Code of Federal Regulations (CFR), Title 47, Part 18

1.6 CLASSIFICATION OF LIGHTING FIXTURES AND INSTALLATIONS IN PROJECT LOCATIONS

- A. Unless otherwise specified or shown on Plans, type of lighting fixtures and installations shall be in accordance with the following:

- NEMA 7(CLASS I, Division 2, GROUP D): All spaces in the Wet Well, Dry Well and Stairwell, except as otherwise indicated.
- NEMA 1 & 12: Electrical Room.
- NEMA 4: Outdoor area and other unspecified wet or damp area.
- NEMA 12: Other area not defined.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

- A. Fixtures and Fixture Components
 1. Metal Parts: Free from burrs, sharp corners, and edges.
 2. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.
 3. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
 4. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
 - a. White Surfaces: 85%.
 - b. Specular Surfaces: 83%.
 - c. Diffusing Specular Surfaces: 75%.
 - d. Laminated Silver Metallized Film: 90%.
 5. Lenses, Diffusers, Covers, and Globes: 100% virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

6. Fixture Support Components: Comply with Section 16B paragraph
 - a. Single-Stem Hangers: 1/2 in. (12 mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
 - b. Twin-Stem Hangers: Two, 1/2 in. (12 mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
 - c. Rod Hangers: 3/16 in. (5 mm) minimum diameter, zinc-plated, threaded steel rod.
 - d. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
7. Fluorescent Fixtures: Conform to UL 1570.
8. Fluorescent Ballasts: Electronic integrate circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
 - a. Certification by Electrical Testing Laboratory (ETL).
 - b. Labeling by Certified Ballast Manufacturers Association (CBM).
 - c. Type: Class P, high power factor, except as otherwise indicated.
 - d. Sound Rating: "A" rating, except as otherwise indicated.
 - e. Voltage: Match connected circuits.
 - f. Lamp Flicker: Less than 5%.
 - g. Minimum Power Factor: 90%.
 - h. Total Harmonic Distortion (THD) of Ballast Current: Less than 20%.
 - i. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
 - j. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
 - k. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp fixtures where possible.
 - l. Lamp-ballast connection method does not reduce normal life of lamps.
9. High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.
10. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include following features, except as otherwise indicated.
 - a. Metal Halide Ballasts:
 - 1) Pulse start ballast.
 - b. Operating voltage: Match system voltage.
11. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when fixture is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60% light output.
12. Incandescent Fixtures: Conform to UL 1571.
13. Exit Signs: Conform to UL 924 and following:
 - a. Sign Colors: Conform to local code.
 - b. Minimum height of Letters: Conform to local code.
 - c. Arrows: Include as indicated.

14. Emergency Lighting Units: Conform to UL 924.

- a. Battery: Sealed, maintenance-free, lead-acid type with minimum 10 yr nominal life and special warranty.
- b. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
- c. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.
- d. Wire Guard: Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
- e. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

B. Lamps

1. Linear T8 Fluorescent Lamps:

- a. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
 - b. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
 - c. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature of 4100°K, a Color Rendering Index (CRI) of greater than 70, average rated life of 20,000 hours, and be suitable for use with dimming ballasts, unless otherwise indicated.
 - d. Comply with ANSI C78 series that is applicable to each type of lamp.
2. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 3500 K and 85 CRI, except as otherwise indicated.
 3. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hrs at 3 hrs per start when used on rapid start circuits.
 4. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 4000 K and 70 CRI, except as otherwise indicated.

C. Finishes

1. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Supports for Suspended Fixtures: Brace pendants and rods over 48 in. (1200 mm) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
- B. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.2 CONNECTIONS

- A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replaced damaged fixtures and components.
 - 1. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source.
 - 2. Give advance notice of dates and times for field tests.
 - 3. Provide instruments to make and record test results.
 - 4. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include following information in tests of emergency lighting equipment:
 - a. Duration of supply.
 - b. Low battery voltage shutdown.
 - c. Normal transfer to battery source and retransfer to normal.
 - d. Low supply voltage transfer.
 - e. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
 - f. Report results of tests.
- B. Replace fixtures that show evidence or corrosion during Project warranty period.

3.4 ADJUSTING AND CLEANING

- A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 51 00

DIVISION 26 - ELECTRICAL

SECTION 26 88 00 PIPE BOLLARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing and installation of pipe bollards.

1.2 RELATED WORK:

- A. Section 01 01 01 – SUMMARY OF WORK
- B. Section 03 30 00 – CAST IN PLACE CONCRETE
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 GUARANTEES

- A. Guarantees shall be provided for materials and work provided under this Division as specified in Division 1.

1.5 SUBMITTALS:

- A. Submit the following
 - 1. Shop Drawings
 - a. Installation plan
 - b. Casing specifications
 - c. Paint product information
 - d. Excavation method and type of drilling method.

1.6 WARRANTY

- A. Manufacturer warrants materials to be free from defects in workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 MATERIALS:

- A. Steel bollards shall be new galvanized steel pipe, painted yellow. Paint shall conform to Rustoleum - yellow, or approved equivalent.
- B. Reflective Tape shall be highly reflective and pre-coated with an aggressive pressure sensitive adhesive for application to weather resistant surfaces. The adhesive shall be protected by an easy-release liner. Reflective tape shall be applied to flat bollard surface (with and without rivets). Reflective Tape shall be as manufactured by 3M, Diamond Grad Conspicuity Markings Series 983 or approved substitute.
- C. The concrete must conform to the recommendations and specifications for concrete as set forth in Section 03300 – Cast In Place Concrete

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Before commencing installation, examine substrate surfaces to determine that they are free of conditions which might be detrimental to proper and timely completion of the work. Start of work must indicate acceptance of the substrate.
- B. Tops of all bollards shall be uniform in height and line.
- C. The bollard shall be filled with concrete .
- D. Bollards shall be set in a concrete footing 5 feet deep, with 4 inches all around encasement, on 4 inch bed of gravel. Top of footing shall be flush with finished grade in paved areas and 2 inches above grade in gravel areas.
- E. Reflective Tape shall be applied around each bollard on 12" center from bottom.

END OF SECTION 26 88 00

DIVISION 28 – SAFETY AND CONTROL

SECTION 28 16 11 INTRUSION DETECTION SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

Provide and install an Intrusion Detection System, hereinafter referred to as IDS, as specified in this section.

1.2 RELATED WORK

- A. Section 01 01 00 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: For electrical installation.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): For power cables.
- D. Section 26 05 26, GROUNDING AND BONDING: For grounding of equipment.
- E. Section 26 05 33, RACEWAY AND BOXES: For infrastructure.
- F. Section 48 46 19, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the IDS as shown.
- B. The IDS shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with the SCADA system.

1.4 SUBMITTALS

- A. Submit below items in conjunction with Specification Sections 01 33 23 and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Provide a pre-installation and as-built design package in both electronic format and on paper.
- C. Submit the Intrusion Alarm Panel showing the layout of the intrusion alarm system devices and complete point to point wiring diagram.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
 - 1. Index Sheet that shall:
 - a. Define each page of the design package to include building name, and sheet number.

- b. Provide a list of all security abbreviations and symbols.
- c. Reference all general notes that are utilized within the design package.
- d. Specification and scope of work pages for all security devices that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.

F. Provide manufacturer IDS product cut-sheets. Submit for approval prior to commencement of work.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Security Industry Association (SIA):
- C. National Electrical Manufacturers Association (NEMA):
250-03 Enclosures for Electrical Equipment (1000 Volts Maximum)
- D. National Fire Protection Association (NFPA):
70-05 National Electrical Code
731-06 Standards for the Installation of Electric Premises Security Systems
- E. Underwriters Laboratories, Inc. (UL):
464-03 Audible Signal Appliances
639-97 Standards for Intrusion Detection Units

1.6 WARRANTY

- B. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. An Intrusion Alarm System shall be provided as generally shown on the drawings and specified herein for the purposes of detecting unauthorized entry into the pump station along with communicating various indicated trouble and intrusion alarms.

An Intrusion alarm condition shall be sent to the SCADA panel and the pump station control panel. All required input alarms shall be communicated via radio or telephone output to the designated destination.

- A. The system shall consist of a new NEMA 12 wall mounted panel with lockable hinged door, 120V - 12V transformer, DC power supply with battery and battery charger, digital dialer, a transmit LED, a 6 volt control relay, alarm buzzer, magnetic reed switches at the entry doors, a key operated alarm override switch at the main entry door with LED and other appurtenances in the Intrusion Alarm Panel as indicated or required.
- B. The magnetic reed switches shall consist of two elements, the magnet which mounts to the interior face of the door and the magnetically operated reed switch which mounts to the door frame. The switch contacts shall be closed when the door is open and open when the door is closed.
- C. The override switch shall be weatherproof, shall be suitable for recessed mounting in a masonry wall and shall be secured against unauthorized removal. The switch shall have two contacts; one contact for shutting the door switches, and one contact for connection to the SCADA panel. The switch shall be operated by a special key. The key shall be removable in both positions. The key shall match the Owner's existing keying system. The override switch shall have an LED to indicate open or closed position. The override switch shall have a tamper pushbutton incorporated into the design, which shall be held open by the cover plate and spring closed if the cover plate is removed.
- D. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.
- F. The panel shall operate on 120V, 60 Hz input and be as manufactured by AEGIS Protective Services or approved substitute.

PART 2 – EXECUTION

3.1 EXAMINATION

- A. Verify location of Intrusion Detection System panel and sensing devices.
- B. Verify that electrical power is available and of correct characteristics.

3.2 INSTALLATION

- A. The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- B. Deliver materials to the job site in the original unopened containers, clearly labeled with the manufacturer's name, equipment model and serial identification numbers, and UL logo.
- C. Prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or synchronization. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.

- D. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the intrusion detection system.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 - 1. Visual and Mechanical Inspection
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage and required area clearances.
 - d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
 - e. Exercise all active components.
 - f. Verify the correct operation of all detection devices, alarms, and indicating devices.
 - g. Inspect control power transformers.

3.4 IDENTIFICATION

- A. Install typewritten label on inside door of panel to indicate intrusion detection devices replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.5 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the intrusion detection system is in good operating condition and properly performing the intended function.
- A. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.6 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Intrusion Detection System, Include:

- a. 1 manday for Installation Services.
- b. 1 manday for Instructional Services.

B. The start-up services for the Intrusion Detection System shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 28 16 11

DIVISION 28 – SAFETY AND CONTROL

SECTION 28 31 00 FIRE ALARM DETECTION SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Provide and install a Fire Alarm Detection System, hereinafter referred to as FADS, as specified in this section.

1.2 RELATED WORK

- A. Section 01 01 00 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: For electrical installation.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW: For power cables.
- D. Section 26 05 26, GROUNDING AND BONDING: For grounding of equipment.
- E. Section 26 05 33, RACEWAY AND BOXES: For infrastructure.
- F. Section 48 46 19, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the FADS as shown.
- B. The FADS shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with the SCADA system.

1.4 SUBMITTALS

- A. Submit below items in conjunction with Specification Sections 01 33 23, and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Provide a pre-installation and as-built design package in both electronic format and on paper.
- C. Submit the Fire Alarm Panel showing the layout of the fire alarm system devices and complete point to point wiring diagram.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
 - 1. Index Sheet that shall:
 - a. Define each page of the design package to include building name, and sheet number.
 - b. Provide a list of all abbreviations and symbols.
 - c. Reference all general notes that are utilized within the design package.

- d. Specification and scope of work pages for all fire alarm devices that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all fire alarm system equipment utilized in the design package.
- E. Provide manufacturer FADS product cut-sheets. Submit for approval prior to commencement of work.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
- C. National Electrical Manufacturers Association (NEMA):
250-03 Enclosures for Electrical Equipment (1000 Volts Maximum)
- D. National Fire Protection Association (NFPA):
70-05 National Electrical Code
- E. Underwriters Laboratories, Inc. (UL):

1.6 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. A Fire Alarm System shall be provided as generally shown on the drawings and specified herein for the purposes of detecting fire or smoke in the pump station along with communicating various indicated trouble and fire alarms. A fire alarm condition shall be sent to the SCADA panel and the pump station control panel. All required input alarms shall be communicated via radio or telephone output to the designated destination. Fire alarm devices shall be rated for Class 1, Div. 2, Group D for the wet and dry areas.

- B. Provide a complete fire alarm system for the station including an emergency power supply consisting of a battery (minimum 10 year nominal life expectancy and sized to operate complete alarm system for period of 24 hours), charger (solid-state, fully automatic, variable charging-rate type that will completely charge fully discharged batteries in 4 hours or less), automatic transfer switch (transfers load to battery without loss of signals or status indications when normal power fails), and wall mounted control panel. The system shall be supervised and shall generate two isolated SPDT contact outputs for remote connection. One of these outputs shall be wired to the SCADA system and the other to the Pump Station Control Panel.
- C. The system shall be complete with three zones - the electrical room, the dry pump room, and the wet pump room. Smoke detectors with heat elements shall be provided as indicated on the Contract Drawings and shall be of the ionization type. Electronic horn/strobes as manufactured by System Sensors or Edwards shall be provided as shown on Plans. All equipment shall meet the NFPA requirements. Heat detector units shall have be combination fixed-temperature and rate-of-rise with mounting plate arranged for outlet box mounting; 135° F (57° C) fixed temperature setting, except as indicated.
- D. The system shall have provisions for receiving a non-latching normally open non-function contact (Combustible gas monitor horn relay). The contact closure shall activate the horn/strobes only, the other fire alarm system functions shall not be affected.
- E. Submittal information shall include all necessary internal and external wiring diagrams and installation requirements. Complete system connection diagrams of all initiating devices, notification appliance and end of line resistors shall be included.
- F. The system shall be the product of a single manufacturer having local available service. The system shall be UL listed and Factory Mutual approved.
- G. Horns: Electric-vibrating-polarized type, operating on 24 V dc, with provision for housing operating mechanism behind grille. Horns produce sound-pressure level of 90 dB, measures at 10 ft (3 m) from source.
- H. Visual Alarm Devices: Xenon strobe lights with clear or nominal white polycarbonate lens. Mount lenses on aluminum faceplate. Word "FIRE" is engraved in minimum 1 in. (25 mm) high letters on lens.
 - 1. Devices shall have candela reading as stated in NFPA 72.
- I. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.
- J. Manual Fire Alarm Stations:
 - 1. Shall be non-breakglass, address reporting type.
 - 2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.

3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE".
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.
6. Stations identified as key operated only shall have a single standardized lock and key separate from the control equipment.

K. Smoke Detectors:

1. Smoke detectors shall be UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

L. Heat Detectors:

1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2500 square feet.
3. Intermediate temperature rated (200 degrees F) heat detectors shall be utilized in all areas.

M. Fire Alarm Horn:

1. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
2. Shall be a minimum nominal rating of 80 dBA at ten feet.
3. Mount on removable adapter plates on conduit boxes.
4. Horn located outdoors shall be weatherproof type with metal housing and protective grille.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify location of Fire Alarm panel and devices.
- B. Verify that electrical power is available and of correct characteristics.

3.2 INSTALLATION

- A. The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- B. Deliver materials to the job site in the original unopened containers, clearly labeled with the manufacturer's name, equipment model and serial identification numbers, and UL logo.
- C. Prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or synchronization. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.
- D. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the fire alarm system.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 - 1. Visual and Mechanical Inspection
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify appropriate anchorage and required area clearances.
 - d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
 - e. Exercise all active components.
 - f. Verify the correct operation of all sensing devices, alarms, and indicating devices.
 - g. Inspect control power transformers.

3.4 IDENTIFICATION

- A. Install typewritten label on inside door of panel to indicate fire alarm device replacement information.

- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.5 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the fire alarm detection system is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.6 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Fire Alarm Detection System, Include:
 - a. 1 manday for Installation Services.
 - b. 1 manday for Instructional Services.
- B. The start-up services for the Fire Alarm Detection System shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 28 31 00

DIVISION 28 – SAFETY AND CONTROL

SECTION 28 35 10 GAS DETECTION SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

Provide and install a Gas Detection System to continuously monitor combustible and toxic gases and oxygen deficiency as shown on the drawings and as specified in this section.

1.2 RELATED WORK

- A. Section 01 01 00 – Summary of Work
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: For electrical installation.
- C. Section 26 05 21, CONDUCTORS AND CABLES (600 VOLTS AND BELOW): For power cables.
- D. Section 26 05 26, GROUNDING AND BONDING: For grounding of equipment.
- E. Section 26 05 33, RACEWAY AND BOXES: For infrastructure.
- F. Section 48 46 19, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): For control and operation of all security systems.

1.3 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing, installing, and the operation of the Combustible Gas Detection System as shown.
- B. The Combustible Gas Detection System shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with the SCADA system.

1.4 SUBMITTALS

- A. Submit below items in conjunction with Specification Sections 01 33 23, and Section 01 01 01 – Summary of Work, Part 1.6 Submittals (this includes samples, shop drawings, submittal schedules, and product data).
- B. Provide a pre-installation and as-built design package in both electronic format and on paper.
- C. Submit the Intrusion Alarm Panel showing the layout of the intrusion alarm system devices and complete point to point wiring diagram.
- D. Pre-installation design and as-built packages shall include, but not be limited to:
 - 1. Index Sheet that shall:

- a. Define each page of the design package to include building name, and sheet number.
 - b. Provide a list of all security abbreviations and symbols.
 - c. Reference all general notes that are utilized within the design package.
 - d. Specification and scope of work pages for all security devices that are applicable to the design package that will:
 - 1) Outline all general and job specific work required within the design package.
 - 2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
- F. Provide manufacturer IDS product cut-sheets. Submit for approval prior to commencement of work.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI)/Security Industry Association (SIA):
- C. National Electrical Manufacturers Association (NEMA):
250-03 Enclosures for Electrical Equipment (1000 Volts Maximum)
- D. National Fire Protection Association (NFPA):
70-05 National Electrical Code
- E. Underwriters Laboratories, Inc. (UL):
464-03 Audible Signal Appliances

1.6 WARRANTY

- A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of final acceptance. The warranty shall include all parts and labor.

1.7 BASIS OF PAYMENT

- A. The work shall be paid at the contract lump sum price for
PUMP STATION ELECTRICAL WORK
which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 GAS DETECTION SYSTEM

- A. The gas detection system shall be a microprocessor based central gas monitoring system capable of continuously monitoring ambient air for combustible and toxic gases and oxygen deficiency at locations as shown on the drawings, using remote gas sensors and transmitters designed to measure the concentrations of gases.
- B. The gas detection system shall be an Ultima X Series, Model 9020 as manufactured by Mine Safety Appliances Company (MSA), or approved substitute.
- C. The gas detection system shall measure and display gas concentration. The system shall provide identifiable audible and visual alarms when preset limits are exceeded. Relays for different alarm setpoint levels shall be provided for trouble alarm, gas sensing alarms and ventilation controls.
- D. The system shall consist of three (3) dual-channel monitor/readout units, one(1) relay programmer module, one(1) power supply unit, five (5) alarm relays, a horn relay, a buzzer and four(4) remotely mounted gas sensor/transmitter units. Two (2) independent monitoring channels shall be provided with each sensor/transmitter having a full scale range as specified. The sensor units shall be capable of being located remote from the monitor/readout unit by up to 3000 feet. Sensor unit shall receive power from and send signals corresponding to gas values to the monitor/readout unit. Each sensor unit shall be mounted in an stainless steel enclosures suitable for NEC Class I, Division 2, Group D hazardous locations. The sensor units shall have provisions for mounting to a wall or similar structure.
- E. All wiring connections shall be marked with functional designations such that connections can be made without the use of diagrams or tables. All connections must be easily accessible from the front. An external sealed switch shall be provided to allow for alarm reset and audible alarm silencing without opening the enclosure. All unused channel spaces shall be neatly blanked off.
- F. Alarms and relays at the monitoring/readout unit shall be set for the following levels of gas concentration:
 1. Gas "WARNING" alarm - 20% LEL
 2. Gas "ALARM" - 50% LEL
 3. Carbon Dioxide "ALARM" – 5%
 4. Low Oxygen "WARNING" alarm
- G. In response to a WARNING or ALARM signal from the gas detection system, due to a high concentration of combustible or toxic gas in the monitored space, an explosion-proof horn in the Pump Room shall be energized. The ventilation system for the monitored space shall be activated. The horn shall be provided as a part of this contract.
- H. A calibration test kit for field checking the calibration of the gas detection system shall be furnished. The kit shall be complete, including a light weight carrying case, dispensing valve, regulator assembly and hose, test coils and necessary cylinder for type of calibrating gas. The test kit shall be stored in an approved cabinet adjacent to and match the air monitor panel.

- I. Spare parts shall be provided for the air monitoring equipment as follows:
 - 1. One set of fuses, one sensor head assembly and one sensor.
- J. The services of a qualified representative of the manufacturer shall be provided to inspect the installation, make any adjustments, test the equipment, field calibrate the air monitoring equipment upon completion of the installation; after 24 hours of operation and again after one week; and instruct the operating personnel in the operation, calibration and maintenance of the equipment.
- K. The gas detection system shall include a locally mounted gas monitor unit, controller, calibration tube box, calibration kit and a remote gas sensors capable of continuously monitoring ambient air for combustible and toxic gas concentrations inside the wet and dry well as shown on the drawings and remote calibration.
- L. The gas sensors shall be an explosion proof, stainless steel infrared gas detector with display. Sensor unit shall receive power from and send signals corresponding to gas values to the monitor unit. The sensor shall be remotely mounted from the monitor. A calibration sample tube shall be connected to the sensor. 50 feet of sensor cable and sample tubing shall be connected to the sensor.
- M. The calibration tube box shall be a 6"x4"x4" stainless steel continuous hinge type 7 enclosure with a stainless steel or brass female quick connector for ¼" tubing and a protector plug or cap mounted on one side of the box.
- N. A non-intrusive hand held wireless remote infrared controller unit shall be provided for sensor calibration, clocking setting, Min/Max gas value and date of last calibration display. Installation, set-up, calibration and start-up of the sensor unit shall not require opening of the sensor/transmitter enclosure.
- O. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.

2.2 COMBUSTIBLE GAS DETECTORS

- A. Provide a Gas Detectors as Manufacturers by MSA Ultima XE Series, or approved substitute
- B. Provide varied gas detection sensor/transmitters.
- C. Provide single sensor wall mounted enclosures for sensor/transmitter. Sensor/transmitter enclosures shall be rated for Class I, Division 2, Group D environment.
- D. Provide permanently installed remote test gas applicator and tubing for all combustible gas detectors.
- E. Provide wall-mounted enclosures for associated monitoring unit. Monitoring unit enclosure shall be rated NEMA 7.
- F. Sensor Power: Loop Powered, 24 Vdc.4-20 mAdc into 600 ohms for each sensor input channel.

- G. Provide 1 portable calibration unit for each type of sensor. Monitoring Unit Power shall be 120 Vac.
- H. Provide Isolated, High/Low Fault alarm relay contacts for each sensor type with individual High/Low Fault alarm setpoints.
- I. Provide Gas Panel Trouble alarm relay for transmission to remote control panel.
- J. Provide relay contacts for local alarm light/horn and for transmission to remote monitoring device. Fault alarm relay contacts shall be latched until manually reset. Provide reset pushbutton integral to Monitoring Unit.
- K. Provide reset pushbutton integral to Monitoring Unit.

PART 2 – EXECUTION

3.1 EXAMINATION

- A. Verify location of Gas Monitoring panel and sensing devices
- B. Verify that electrical power is available and of correct characteristics.

3.2 INSTALLATION

- A. The Contractor shall install all system components and appurtenances in accordance with the manufacturer's instructions and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- B. Deliver materials to the job site in the original unopened containers, clearly labeled with the manufacturer's name, equipment model and serial identification numbers, and UL logo.
- C. Prepare for system activation by following manufacturer's recommended procedures for adjustment, alignment, or synchronization. Prepare each component in accordance with appropriate provisions of the component's installation, operations, and maintenance instructions.
- D. All field wires shall terminate on a terminal strips instead of directly connecting to the devices located inside the cabinet.
 - A.
- E. Provide the services of qualified technical representative(s) of the manufacturer during installation, field testing and startup of the combustible gas detection system.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:
 - 1. Visual and Mechanical Inspection

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Verify appropriate anchorage and required area clearances.
- d. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.
- e. Exercise all active components.
- f. Verify the correct operation of all sensing devices, alarms, and indicating devices.
- g. Inspect control power transformers.

3.4 IDENTIFICATION

- A. Install typewritten label on inside door of panel to indicate gas sensing replacement information.
- B. Equipment identification nameplate of engraved plastic laminate with black letters on white background shall be installed on the outside front doors.

3.5 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the gas detection system is in good operating condition and properly performing the intended function.
- B. The contractor shall correct or rectify any deficiencies noticed during the field test at no additional cost.

3.6 TRAINING

- A. The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance. This service shall include all equipment provided in this Section for the Gas Detection System, Include:
 - a. 1 manday for Installation Services.
 - b. 1 manday for Instructional Services.
- B. The start-up services for the Gas Detection System shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

END OF SECTION 28 35 10

DIVISION 33 - UTILITIES

SECTION 33 40 10– INTERIOR PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide pipe and fittings as specified on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Provide labor, materials, tools and equipments as necessary to install all fittings and accessories required for the completion of all pipelines covered in this Section.
- C. The sizes, types and classes of various pipelines shall be as shown on the Drawings.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Contract Documents.
- B. Section 09 91 00: Painting
- C. Section 33 40 20: Pipe Hangers and Supports
- D. Section 33 40 30: Pipe Specialties
- E. Section 43 01 50: General Mechanical Provisions
- F. Section 43 20 10: Valves and Appurtenances

1.3 REFERENCES

- A. Copper tubing and materials shall conform to AWWA Standard C800, and as specified herein.
- B. PVC Pipe and Fittings shall conform to the latest editions of the following:
 - 1. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100 mm through 300 mm) for Water Distribution.
 - 2. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350 mm through 1,200 mm) for Water Transmission and Distribution.

3. AWWA C907 – Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4 in. through 8 in (100 mm through 200 mm)/
4. AWWA C909 – Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. through 24 in. (100 mm through 600 mm), for Water Distribution.
5. ASTM D1785 – Poly (Vinyl-Chloride) (PVC) and Chlorinated Poly (Vinyl-Chloride) (CPVC) Plastic Pipe, Schedules 40, 80 and 120.
6. ASTM D2241 – Poly(Vinyl-Chloride) (PVC) Pressure-Rated Pipe (SDR PR Series).
7. ASTM D2464 – Threaded Poly (Vinyl-Chloride) (PVC) and Chlorinated Poly (Vinyl-Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
8. ASTM D2466 – Poly (Vinyl-Chloride) (PVC) and Chlorinated Poly (Vinyl-Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM D2467 – Poly (Vinyl-Chloride) (PVC) and Chlorinated Poly (Vinyl-Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2564 – Poly(Vinyl-Chloride) (PVC) Solvent Cements.
11. ASTM D2665 – Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
12. ASTM D2672 - Joints for Iron Pipe Size (IPS) Poly(Vinyl Chloride) (PVC) Pipe Using Solvent Cement
13. ASTM D3034 – Type PSM Poly (Vinyl-Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D3139 – Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
15. ASTM F438 – Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
16. ASTM F439 – Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
17. ASTM F477 – Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. ASTM F679 – Poly (Vinyl-Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

C. Ductile Iron Pipe and Fittings shall conform to the latest editions of the following:

1. AWWA C104(ANSI A21.4) - Cement-Mortar Lining for Ductile-Iron Pipe and Fitting for Water.
2. AWWA C105(ANSI A21.5) - Polyethylene Encasement for Ductile-Iron Pipe systems.
3. AWWA C110(ANSI A21.10) - Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. For Water and Other Liquids.
4. AWWA C111(ANSI A21.11) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115(ANSI A21.15) - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C150(ANSI A21.50) - Thickness Design of Ductile-Iron Pipe.
7. AWWA C151(ANSI A21.51) - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. AWWA C153(ANSI A21.53) - Ductile-Iron Compact Fittings, 3 In. Through 24 In. and 54 In. Through 64 In., for Water Service.
9. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
10. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.
11. AWWA C800 - Underground Service Line Valves and Fittings.
12. ANSI B18.2.1 - Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws.
13. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
14. ANSI B18.2.2, Square and Hex Nuts.
15. ASTM A48, Gray Iron Castings.

1.4 QUALITY CONTROL

- A. All materials furnished shall be from an established and reputable manufacturer or supplier with at least 5 years of experience.
- B. All pipe and appurtenances shall be new and of first class materials and construction. They shall be guaranteed to perform the services required and shall conform to the Special Provisions herein.
- C. Shop Testing: All pipe and fittings shall be inspected and tested at the manufacturing facility as required by the Standard Specifications to which the material is manufactured. Certified copies of test results for each lot of pipe furnished shall be submitted to the Engineer by the Contractor for approval before the pipe is shipped. The pipe shall be subject to inspection by the Engineer at the point of manufacture.

1.5 SUBMITTALS

- D. The required number of copies of shop drawings shall be provided in accordance with Division 1 of these Special Provisions.
- E. Completely detailed working drawings shall be submitted by the Contractor for approval. Such drawings shall show the piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, flexible couplings, anchors, hangers and supports, and other appurtenances. When any of the work is of special design, such work shall be shown in large detail and shall be completely described and dimensioned. Where indicated by the Engineer, each pipe section shall be marked with an identification number painted on the exterior of the pipe. If major damage should occur, the Engineer reserves the right to refuse the pipe or fitting, and the contractor shall promptly replace the same with undamaged material at no additional cost to the Owner.
- F. The Contractor must give notice in writing to the Engineer, sufficiently in advance of his intention to purchase or place a special order for any pipe required to be installed under this contract. Fully dimensioned drawings and/or manufacturers catalog cut sheets are to be submitted for review.
- G. The Contractor must submit to the Engineer certified copies of all test reports for tests conducted on the pipe by the manufacturer when requested by the Engineer.
- H. Contractor or manufacturer shall certify that all welders have been tested and are maintain current qualification in accordance with ANSI/ASME Boiler and Pressure Vessel Code Section IX, or ANSI/AWS B2.1, Standard for Welding Procedure and Performance Qualification.

- I. Certification of Design.
- J. Technical data on coatings and linings as well as a description of application method.
- K. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.6 STORAGE AND HANDLING

- A. Contractor shall properly store pipes and fittings and use sufficient care during installation to preclude damage to factory painted surfaces. In the event minor damage should occur, the pipe or fitting shall be repaired following manufacturer's procedures. If major damage should occur the Engineer reserves the right to refuse the pipe or fitting and the contractor shall promptly replace the same with undamaged material at no additional cost to the Owner.

1.7 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 BRASS PIPE AND FITTINGS

- A. Brass pipe shall be red brass pipe meeting the requirements of ASTM B43. Pipe sizes, wall thickness and dimensions shall meet the requirements of ASTM B251, Table 1, for regular pipe. Brass pipe-fittings shall be screwed end, malleable iron pattern, meeting the requirements of ANSI B16.15. They shall be finished rough, unless otherwise specified. Unions shall be of all brass or bronze with ground joints and shall be left semi-finished. Fittings shall be rated for steam working pressures up to 125 psi. Joints shall be screwed type with threads clean cut, tapered and smooth meeting the requirements of ANSI B2.1.

2.2 COPPER TUBING AND FITTINGS

- A. Copper tubing for non-buried use shall be Type L, hard drawn copper tubing, meeting the requirements of ASTM B88.
- B. Fittings for copper tubing shall be of the streamlined solder joint type, meeting the requirements of ANSI B16.22. Solder for lines carrying potable water shall be 95TA (95 percent tin and 5 percent antimony).

2.3 PVC PIPE AND FITTINGS

A. Pipe

1. PVC pipe and fittings for non-buried use, unless otherwise specified, shall be Schedule 40, 80 or 120 PVC pipe meeting the requirements of ASTM D1784 and ASTM D1785. Fittings shall be of the solvent welded socket type meeting the requirements of ASTM D2464, ASTM D2466, and ASTM D2467. Use compounds qualifying for a rating of 4000 psi for water at 73.4 degrees F.

2.4 DUCTILE IRON PIPE AND FITTINGS

A. Pipe

1. All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150/ANSI A21.50 and AWWA C151/ANSI A21.51.
2. In addition to external load, all pipe and fittings shall be designed for collapse vacuum pressure of -14.7 psi with a factor of safety of 2.0.
3. Ductile iron pipe shall have flanged, grooved, push-on, or mechanical joints of the sizes and classes as shown on the Drawings or as specified herein. Unless otherwise shown on the Drawings, flanged and grooved joint ductile iron pipe and fittings shall be used for non-buried service, while push-on and mechanical joint ductile iron pipe and fittings shall be used for buried service.
4. Unless otherwise shown on the Drawings, flanged and grooved joint ductile iron pipe shall be minimum thickness class 53 to enable threaded flanges or grooves for couplings/adapters.
5. Manufacturer's Statement: The manufacturer shall furnish a sworn statement that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of this standard.
6. Ductile iron pipe shall be as manufactured by Clow Water Systems Company, American Cast Iron Pipe Company, U.S. Pipe and Foundry Co., or approved equal.

B. Lining, Coating and Marking

1. General

- a. For ductile iron pipe, the class or nominal thickness, net weight without lining, and casting period shall be clearly marked on the exterior of each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe. Fittings shall have distinctly cast on them the standard to which the fitting conforms (AWWA C110 or AWWA C153), the pressure rating, nominal diameters of openings, manufacturer's identification, country where cast, and the number of degrees or fraction of the circle on the bends. Ductile iron fittings shall also have the letters "DI" or "DUCTILE" cast on them. If required, the pipe, fitting, or special shall be marked to adequately show the proper location within the pipeline by reference to layout drawings and schedules.
- b. Unless otherwise specified, the interior of ductile iron pipe and fittings shall have a cement mortar lining and asphaltic seal coat conforming to AWWA C104/ANSI A-21.4.
- c. Ductile iron pipe and fittings used for buried applications shall have an asphaltic exterior coating not less than one (1) mil thick per AWWA C151, AWWA C110 and AWWA C153.
- d. Ductile iron pipe and fittings that are exposed or immersed in liquid and not buried shall have an exterior coating suitable for the application and service as specified in Section 09 91 00 – Painting. Ductile iron pipe and fittings shall be delivered with a shop prime coat compatible with the exterior coating system specified in Section 09 91 00 - Painting. The exterior of exposed or immersed ductile iron pipe and fittings shall be thoroughly cleaned prior to shop prime coating. See Section 09 91 00 for surface preparation requirements.
- e. Exterior surfaces of castings to be encased in concrete shall not be coated.
- f. Machined surfaces shall be cleaned and coated with a suitable rust preventative coating at the shop immediately after being machined.

C. Joints

1. Flanged Joints

- a. Where shown on the Drawings, ductile iron pipe with flanged joints shall conform to AWWA C111/ANSI A21.11 and C115/ANSI A21.15. Flanged ductile iron pipe meeting these standards shall be flat faced and compatible with the following standards:

- i. ANSI B16.1, Class 125.
 - ii. ANSI B16.5, Class 150, flat face only.
 - iii. ANSI B16.42, Class 150, flat face only.
 - iv. AWWA C207, Class B, D and E steel flanges only.
- b. Flanges shall be ductile iron for use with ductile iron pipe. Use of gray iron flanges is not allowed.
- c. For flanged pipe, the flanges, with long hubs, shall be screwed on the threaded end of the pipe in the shop and the face of the flange and end of the pipe refaced together. There shall be no leakage through the pipe threads, and the flanges shall be designed to prevent corrosion of the threads from outside elements. Flanges shall conform to the requirements of ANSI B16.1, Class 125, and shall be faced and drilled to that standard unless special drilling is called for or required. They shall be faced accurately at right angles to the pipe axis, drilled smooth and true, and shall be covered with zinc duct and tallow or white lead immediately after facing and drilling. Where tap or stud bolts are indicated, flanges shall be tapped.
- d. Bolts, except as otherwise specified or indicated on the Drawings, shall meet the requirements of ASTM A193, Grade B8, Class 1, 304SS with ASTM A194, Grade 8 nuts.
- e. Flanged joints for wall castings that are flush with the masonry or concrete face shall be made up with Type 316 stainless steel stud bolts and nuts.

2. Plain End Joints

- a. Pipe for use with sleeve-type couplings or as otherwise shown on the Drawings shall have plain ends (without bells or beads). The ends shall be cast or machined at right angles to the axis. Field cutting of plain ends shall be in accordance with manufacturer's instructions.

D. Fittings

1. Flanged Fittings

- a. Fittings shall conform to the requirements of ANSI A21.10 and shall be at least Class 150.

- b. Flanged fittings shall be faced and drilled in accordance with ANSI A21.10 except that special drilling or tapping shall be provided as necessary to ensure correct alignment and bolting.
 - c. Flanged fittings, which are not available under ANSI A21.10 (e.g. laterals or reducing ells), shall be furnished to conform to the requirements of ANSI B16.1 in the 125-lb. pressure class.
 - d. Fittings shall be provided with standard bases when so indicated.
2. Special Fittings
- a. Fittings having nonstandard dimensions and cast especially for this project shall be of acceptable design. They shall be manufactured to meet the requirements of the same specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect.

E. Gaskets

1. Unless otherwise shown on the Drawings, gaskets shall be SBR rubber; or approved equal. Gaskets for flanged joints shall be of the ring type meeting the requirements of ANSI B16.21. Gaskets shall be 1/16-inch thick for pipe 12-inch diameter and smaller and 1/8-inch thick for pipe larger than 12-inch diameter.

F. Items to be Furnished with Ductile Iron Pipe:

1. In addition to straight lengths of pipe, beveled pipe, access manholes, reducers, adapters, outlets, sleeves, caps, plugs, blind flanges, etc., there shall be furnished all fittings, elbows, bends, tees, closures, night-caps, bolts, nuts, etc., required for complete pipeline construction, as shown on the Drawings, or required by field conditions.
2. Furnish all rubber gaskets and all special materials required for making the joints and all special materials required to be incorporated in certain pieces of pipe or fittings, such as materials for restrained joints, etc., as shown on the Drawings.
3. The pipe supplier shall furnish a suitable number of closure pieces, shorts and adapters, which, though not specifically called for on the Drawings, may still be needed for the completion of the Work at no extra cost to the Owner.

G. Installation requirements - In addition to the pipe manufacturer's installation guide, the following requirements shall be met:

1. Prior approval of the pipe manufacturer shall be required for the devices to be used to unload pipe, to move pipe, and to place pipe in the trench.
2. The pipe shall be unloaded, handled and placed using padded slings or other pipe manufacturer approved devices which distribute the weight of the pipe and prevent damage to the exterior coating, joint rings or pipe interior lining. The use of cables and other metal surfaces in contact with the pipe exterior is strictly prohibited.
3. Unloading or movement of the pipe by rolling or sliding at any time is strictly prohibited.
4. An acceptable device shall be used to distribute rubber gaskets uniformly around pipe on all joints.

PART 3 - EXECUTION

3.1 GENERAL

- A. Miscellaneous pipelines which are shown in diagram on the Drawings shall be arranged clear of other pipelines and equipment and be fitted and installed in a neat and workmanlike manner, in accordance with approved Shop Drawings. Adequate number of unions shall be provided in a main pipe and branch pipe runs to facilitate dismantling or removal of pipeline sections without disturbing adjacent branch or connecting lines.
- B. Couplings will be permitted only to joint standard lengths of pipe and as required to complete a straight run of pipe. Joining by couplings, of random lengths of pipe and cutting from standard lengths to form a required run, will not be permitted.
- C. Reducing fittings shall be used for all changes in pipe size. Brushing will not be permitted.
- D. All pipe shall be transported, delivered, and installed in accordance with the manufacturer's requirements.

3.2 FLANGED JOINTS

- A. Flanged joints shall be made with bolts or bolt studs with a nut on each end. Bolts, bolt studs, and nuts shall, except as otherwise specified or indicated on the Drawings, meet the requirements of ANSI B16.1 and ANSI B16.5. Steel flanges meeting ANSI B16.5 shall be flat faced when connecting to ANSI B16.1 iron flanges.

- B. Flanged joints for wall castings that are flush with the masonry or concrete face shall be made up with Type 316 stainless steel stud bolts and nuts.
- C. Flanged joints shall be made up tight, care being taken to prevent undue strain upon pump nozzles, valves and other pieces of equipment.

3.3 WELDING

- A. Welding of pipe joints where shown, specified, permitted, or required shall meet the requirements of the ANSI Code for Pressure Piping, unless otherwise specified. Pipe and fittings with wall thickness of 3/16 inch and larger shall have ends beveled for welding.
- B. Parts to be welded shall be securely held in place and in proper alignment during welding. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping. Welding shall be continuous around the joint and completed without interruption.
- C. Welds shall be single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee. Welds shall be free from cold cuts, pinholes, oxide inclusions or other defects.

3.4 TAPPED CONNECTIONS

- A. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed that listed in the appropriate table of the Appendix to ANSI A21.51 based on 3 full threads for gray iron and 2 full threads for ductile iron.
- B. Where the size of the connection exceeds that given above for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or permitted.
- C. All drilling and tapping of ductile-iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

3.5 HANGERS AND SUPPORTS

- A. All miscellaneous pipelines shall be permanently erected and supporting devices shall be furnished and installed as specified in Section 33 40 20, Pipe Hangers and Supports.

3.6 PAINTING

- A. Painting shall be as specified in Section 09 91 00.

3.7 TRANSPORTATION AND DELIVERY

- A. Every precaution must be taken to prevent damage to the pipe during transportation and delivery. Extreme care must be taken in loading and unloading the pipe and fittings. Such work must be done with the pipe under complete control at all times. Under no conditions may the pipe be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe.
- B. If in the process of transportation, handling, or installation, any pipe or fitting is damaged, such pipe or fitting must be replaced by the Contractor and be considered incidental to the construction and no additional payment will be allowed.

END OF SECTION 33 40 10

DIVISION 33 - UTILITIES

SECTION 33 40 20 – PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Erecting interior piping shall include providing supports, hangers and anchors, and installation of all interior and exposed exterior piping, valves, and appurtenances.
- B. Piping materials, coatings, and linings shall be as specified or shown on the Drawings. Piping shall be installed where shown or specified.
- C. Provide concrete pads for all floor mounted equipment.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Division 5: Metals
- C. Section 09 91 00: Painting
- D. Section 33 40 10: Interior Pipe and Appurtenances
- E. Section 33 40 30: Pipe Specialties
- F. Section 43 01 50: General Mechanical Provisions
- G. Section 43 20 10: Valves and Appurtenances

1.3 REFERENCES

- A. American Society for Testing Materials:
 - 1. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- B. Manufacturer's Standardization Society:
 - 1. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

C. American National Standards Institute (ANSI):

1. B31.1: Power Piping Code.

D. American Welding Society (AWS) Code:

1. A2.0: Structural Welding Code D1-1-7.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Prior to fabrication, submit a copy of the Contractor's piping layout drawing indicating location of supports, identified by hanger mark numbers.

C. Product Data: Provide manufacturer's catalog data for all components, including load capacity and dimensions.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

F. Shop and erection drawings stamped and signed by a Professional Engineer. Qualifications of manufacturer's Registered Professional Engineer stamping and sealing shop drawings and designs shall also be submitted if required by the Engineer. Shop and erection drawings shall include the following information:

1. Details of each support device with dimensions with a unique identification number.

2. A table of applied forces and/or moments.

3. A drawing showing the applied forces and moments.

4. Shop and field welds, including a description of each welding procedure.

G. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.5 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 DESIGN

- A. Hangers and supports not detailed shall be adequate to maintain the pipelines, valves, apparatus and equipment in proper position and alignment under all operating conditions with due allowance for expansion and contraction, and shall have springs where necessary. Hangers and supports shall be of standard design where possible, and be best suited for the service required with a working safety factor of not less than five (5). They shall be screw adjustable after installation were applicable. Chain, strap, T-bar, perforated bar and/or wire hangers are not acceptable.
- B. All supporting devices shall be designed to minimize interference with access and movement of valves and equipment. Injury hazard shall be considered and minimized in all protruding supporting devices.
- C. Hangers and supports shall include proper pipe protection saddles on pipes which are covered with insulation.
- D. Overhead hangers shall be supported by threaded rods properly fastened in place by suitable screws, clamps, inserts, bolts, or by welding.
- E. Brackets for the support of piping from walls and columns shall be made of welded steel unless otherwise specified on the Project Drawings, and shall be designed for three maximum loads classified as follows:
 - Light 750 pounds
 - Medium 1,500 pounds
 - Heavy 3,000 pounds
- F. When medium or heavy brackets are bolted to walls, backplates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. When the use of backplates is not practicable, the brackets shall be fastened to the wall in a manner that the safe bearing strength of the wall will not be exceeded.
- G. Pipe rolls or chairs shall be of cast iron. Pipe rolls shall be provided with threaded nuts or with sockets to take threaded rods.

- H. Saddle stands shall be the adjustable type. Each stand shall consist of a length of steel pipe fitted at the base with a standard threaded ductile iron flange and at the top with an adjustable saddle or roll. The base flanges shall be bolted to the floor foundation or concrete wall.
- I. Stanchions shall be of similar construction to the saddle stand, except that they shall be fitted at the top with cast-iron pipe saddle supports or with pipe stanchion saddles with yokes and nuts.
- J. Where adjustable supporting devices are not required, pipelines 3 inches in diameter and smaller may be supported on ductile iron, malleable iron or steel hooks, hook plates, rings or ring plates.
- K. Provide Type 316L stainless steel for pipe supports, hangers, guides, inserts, restraints, anchors, and appurtenant support items that are located in the wet well area and discharge chamber.
- L. Contact between piping and dissimilar metals such as hangers, building structural work or equipment subject to galvanic action is not acceptable.
- M. Manufacturers (or approved equal):
 - 1. Anvil
 - 2. Cooper (B-Line)
 - 3. Approved equal

2.2 PIPE HANGERS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon or stainless steel, adjustable swivel, split ring.
- B. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and over: Carbon steel or stainless steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
- E. Wall Support for Pipe Sizes 4 Inches (100 mm) and over: Welded steel bracket and wrought steel clamp.
- F. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded. ASTM A283 or ASTM A36 unless noted otherwise.

2.3 PIPE SUPPORTS

- A. Where piping of various sizes is to be supported together, space supports for largest pipe size and install intermediate supports for smaller diameter pipe.
- B. Provide minimum of 2 pipe supports for each pipe run unless approved by the Engineer.
- C. Where piping connects to equipment, support by a pipe support and not by equipment.
- D. Arrange pipe supports so that there is no interference with maintenance or removal of equipment or operation of valves.
- E. Unless otherwise indicated or authorized by Engineer, place piping running parallel to walls approximately 1-1/2 in. out from face of wall and at least 3 in. below ceiling.
- F. Pedestal pipe supports: adjustable with stanchion, adjustable saddle, and anchoring flange. Stanchion size per manufacturer's recommendations depending on pipe diameter. Provide grout between base plates and floor.
- G. Piping supports for vertical piping passing through floor sleeves: hot dipped galvanized steel riser clamps.
- H. Support piping to prevent strain on valve, fitting, or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise indicated. Do not install pipe supports in equipment access areas or bridge crane runs.
- I. Do not support piping from other piping.

2.4 ANCHORS

- A. Anchors shall be furnished and installed where specified, shown or required for holding the pipelines, valves, and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of an anchor shall be subject to approval by the Engineer.
- B. Anchors for piping shall be cast-iron chair type with steel straps, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

2.5 INSERTS

- A. Inserts for concrete shall be galvanized unless noted otherwise, and be installed in the concrete structures where required for fastening supporting devices.

- B. Inserts shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically. They shall be recessed near the upper flange to receive reinforcing rods.
- C. Inserts shall be designed so that they may be held in position during the concreting operations and carry safely the maximum load that can be imposed by the rod which they engage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 GENERAL

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide sheet lead packing between hanger or support and piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Piping, ducts, conduits, valves, etc. shall be supported from structural members, slabs, etc. only, not from other pipes, ducts, conduits, etc.

- L. Proceed with installation of pipe supports only after required building structural work has been completed and concrete support structure has reached its 28-day compressive strength.
- M. Install pipe supports to allow controlled movement of piping systems. Permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- N. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used, place 1/8 in. thick teflon, neoprene rubber, or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and pipe support.
- O. Prevent electrolysis in support of copper tubing by use of pipe supports which are copper plated or plastic coated.
- P. Perform welding in accordance with Structural Welding Code: Welding pipe wall attachments to pipe shall be governed by ANSI/ASME B31.1.
- Q. Support piping to prevent strain on valve, fitting, or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to nonrigid joints, and where otherwise indicated. Do not install pipe supports to limit access to equipment or maintenance areas.
- R. All piping shall be firmly supported and anchored in proper position and alignment, with due allowance for expansion and contraction
- S.
- T.
- U. Hanger rod diameters shall be as follows unless otherwise indicated by project drawings:

<u>PIPE SIZE</u> <u>Inches (mm)</u>	<u>HANGER ROD</u> <u>DIAMETER</u> <u>Inches (mm)</u>
1/2 to 1-1/4 (12 to 32)	3/8 (9)
1-1/2 to 2 (38 to 50)	3/8 (9)

2-1/2 to 3 (62 to 75)	1/2 (13)
4 to 6 (100 to 150)	5/8 (15)
8 to 12 (200 to 300)	7/8 (22)
14 and Over (350 and Over)	1 (25)
PVC (All Sizes)	3/8 (9)
C.I. Bell and Spigot(or No-Hub) and at Joints	5/8 (15)

3.3 EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches (100 mm) thick and extending 6 inches (150 mm) beyond supported equipment for all floor mounted equipment.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.
- E. Center thrust anchors between expansion joints and between elbows and expansion joints for suspended piping. Anchors must hold pipe rigid to force expansion and contraction movement to take place at expansion joints and/or elbows and to preclude separation of joints.

3.4 PIPING HANGERS AND SUPPORTS

- A. Unless otherwise specified or shown on the Drawings, or required by job conditions, hangers and supports for ductile iron horizontal pressure piping shall be installed as follows:

1. For Flanged Joint Piping: For pipe 3-inch to 24-inch diameter, minimum 2 hangers for each length 12 ft. or longer and 1 hanger for each length less than 12 ft. long.
- B. Unless otherwise specified or shown on the Drawings, or required by job conditions, hangers and supports for horizontal steel piping shall be installed as follows:

<u>Nominal Pipe Size, In.</u>	<u>Maximum Spacing, Ft.</u>
1/8 through 1-1/4	7
1-1/2, 2	10
2-1/2 through 3-1/2	12
4, 5	15
6	16
8 through 12	16
14	18
16, 18	20
20	22
24	24
30	24

- C. Unless otherwise specified or shown on the Drawings, or required by job conditions, hangers and supports for horizontal copper piping shall be installed as follows:

<u>Nominal Pipe Size, In.</u>	<u>Maximum Spacing, Ft.</u>
1/4 through 5/8	5
3/4, 1	6
1-1/4 through 2	7
2-1/2 through 4	9

- D. Unless otherwise specified or shown on the Drawings, or required by job conditions, spacing of hangers and supports for horizontal PVC piping shall be six (6) feet for all sizes.
- E. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a Certification from the manufacturer stating that such requirements have been complied with.

3.5 PAINTING

- A. Hangers, supports, anchors, and similar devices, not galvanized, shall be painted in accordance with Section 99 91 00 of these Special Provisions.

END OF SECTION 33 40 20

DIVISION 33 - UTILITIES

SECTION 33 40 30 – PIPE SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL

- A. Provide pipe specialties as specified on the project drawings, as specified herein, and as needed for a complete and proper installation.
- B. The Contractor shall provide labor, materials, tools and equipment as necessary to install all fittings and accessories required for the completion of all pipelines covered in this Section.
- C. Performance tests on all items submitted shall be performed in accordance with the guidelines set forth in this Section, Section 33 40 10, and as recommended by the manufacturer.
- D. The sizes, types and classes shall be as shown on the Contract Drawings.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Contract Documents.
- B. Section 09 91 00: Painting
- C. Section 33 40 10: Interior Pipe and Appurtenances
- D. Section 33 40 20: Pipe Hangers and Supports
- E. Section 43 01 50: General Mechanical Provisions
- F. Section 43 20 10: Valves and Appurtenances

1.3 REFERENCES

- A. Pipe Specialties shall be in accordance with the specification standards as indicated in Section 33 40 10, Interior Pipe and Appurtenances, and as stated herein.

1.4 QUALITY CONTROL

- A. All materials furnished shall be from an established and reputable manufacturer or supplier with at least 5 years of experience.
- B. All pipe and appurtenances shall be new and of first class materials and construction. They shall be guaranteed to perform the services required and shall conform to the Special Provisions herein.

1.5 SUBMITTALS

- A. The required number of copies of shop drawings shall be provided in accordance with Division 1 of these Special Provisions.
- B. The contractor shall submit material data sheets and detailed drawings of Piping Specialties demonstrating compliance with these Special Provisions.
- C. Technical data on coatings and linings as well as a description of application method.
- D. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.6 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 EXPANSION

- A. Provisions for flexibility in all pipelines shall be provided to allow the lines to expand and contract freely without injury to piping systems. The devices may be in the form of expansion joints, expansion couplings, swivel or swing joints or pipe bends, and shall include such anchors as may be shown, specified or required to make the devices effective.
- B. If expansion devices are not required, all runs of pipe subject to change in length shall be fabricated shorter than their theoretical length to the extent that there may be freedom to expand without increasing the stresses imposed when cold.

- C. Slip type expansion joints, having suitable packing shall be provided for the PVC piping in the manner and at the intervals recommended by the pipe manufacturer.
- D. Expansion joints shall be provided with adequate tie rods to limit the axial movement at the specified test pressures.
- E. Mechanical expansion joints shall be Style 63 as manufactured by Dresser Industries, or approved equal.

2.2 WALL SLEEVES AND CASTINGS

- A. Wall castings and make-up pieces shall meet the requirements of AWWA C100 and shall be a minimum of Class B. Special fittings, where required, shall be of an approved design, and laying lengths and other functional dimensions shall be determined by their positions in the pipelines and by the particular piping materials to which they connect.
- B. All wall castings and sleeves below grade and at other required locations shall be watertight. Where water-tightness is essential and at other locations where indicated, wall castings or sleeves shall be provided with an intermediate flange located approximately at the center of the wall.
- C. The Contractor shall install suitable sleeves at all points where pipes pass through walls or floors of structures where wall castings are not provided. Sleeves inside buildings and between floors shall be of steel with a minimum thickness of Schedule 40 and the space between the pipe and the sleeve shall be caulked with lead and oakum. Sleeves through walls of structures shall be cast iron solid sleeves, meeting the requirements of AWWA C100 with caulked bell and spigot or mechanical joint ends or link seal.
- D. Where indicated, the space between the pipe and sleeve shall be sealed using a mechanical link-type closure as manufactured by Thunderline Corporation or approved equal. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe wall opening. Sleeves shall be cast iron of size recommended by the manufacturer of the link-type closure.
- E. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by the Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two pipe sizes larger than piping run.

Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

F. Sleeves for installation in core drilled exterior walls shall be as follows:

1. Schedule 40 black steel pipe with ends cut square and reamed of sufficient length to carry 1/8-inch thick square steel base plates at both ends of the sleeve. Base plates to be 2 inches greater than sleeve diameter. The sleeves shall be of sufficient size to permit the full specified thickness of insulation or piping to pass through sleeve. Base plates shall be screwed into wall.
2. Spaces between pipe and wall sleeves shall be caulked with Minnesota Mining & Mfg. Co. Scotch Seal Brand #612 or approved equal sealant. Where space exceeds 1/2 inch, tightly pack first with 1.58 lb. density fiberglass and then caulk both ends with sealant specified.

2.3 DIELECTRIC COUPLINGS

- A. Where connections between pipelines or equipment of corrosion causing dissimilar metals are required, the junction of the two dissimilar metals shall be made through a dielectric insulating coupling, union, or other approved dielectric insulating device.

2.4 SLEEVE TYPE COUPLINGS

- A. For sleeve type couplings, diametrically opposite bolts shall be equally tightened on the connection so that the gaskets will be brought up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.
- B. Sleeve-type couplings for exposed ductile iron pipe shall be of steel and shall be Style 38 or 253 couplings as made by Dresser Industries, Inc., or approved equal. The coupling shall be provided with steel bolts and nuts.
- C. Flanged coupling adaptors shall be Style 128 as made by Dresser Industries, or approved equal.
- D. Sleeve type couplings shall be shop coated with Dresser Red "D" Shop Coat, Smith-Blair Standard Blue Shop Coat, or approved equal nontoxic material. Finish Coat shall be as indication in Section 09 91 00, Painting.

- E. Couplings shall have a minimum pressure rating equal to the test pressure of the pipeline.
- F. All couplings shall be furnished with the pipe stop removed.
- G. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid or gas within the pipe.

2.5 FILLING RINGS

- A. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the AWWA C111/ANSI A21.11 or C115/ANSI A21.15 Standards. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining pipe or equipment.

2.6 CORPORATION CONNECTIONS

- A. Valves, materials, and installations shall conform to AWWA C800 and ASTM B62. All taps shall be direct and shall not require saddles unless indicated otherwise on the Drawings. Corporation connections shall be installed at the sizes and locations indicated on the Drawings.
- B. Corporation valves shall be ball type rated for a working pressure of 300 psig.
- C. Corporation connection materials shall be manufactured by Mueller, Ford Meter Box, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Couplings will be permitted only to joint standard lengths of pipe and as required to complete a straight run of pipe. Joining by couplings, of random lengths of pipe and cutting from standard lengths to form a required run, will not be permitted.
- B. Reducing fittings shall be used for all changes in pipe size. Brushing will not be permitted.

3.2 HANGERS AND SUPPORTS

- A. All miscellaneous pipelines shall be permanently erected and supporting devices shall be furnished and installed as specified in Section 33 40 20, Pipe Hangers and Supports.

3.3 PAINTING

- A. Painting shall be as specified in Section 09 91 00 of the Special Provisions.

3.4 TESTING

- A. See individual specification sections in which piping specialties are installed for testing procedures for piping systems.

END OF SECTION 33 40 30

DIVISION 40

SECTION 40 94 23 – SCADA SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all SCADA SYSTEM described herein.
- B. The SCADA (Supervisory Control and Data Acquisition) system shall be provided to function as the "Master Control Station" for the Pump Station facility.
- C. The SCADA will be a PLC based system with an operator interface mounted on SCADA Panel SP47 for control, monitoring and system configuration. The following equipment and instrumentation, as a minimum, will be monitored/controlled via hardwired connections:
 - a. Main Switchboard
 - b. Motor Control Center
 - c. Automatic Transfer Switch
 - d. Pump Motor Controllers and Protection Devices
 - e. Level Sensing Systems
 - f. Pavement Float Switches
 - g. Slide Gates
 - h. Recirculation Pipe Valve
 - i. Combustible Gas Detection System
 - j. Fire Detection and Alarm System
 - k. Intrusion Detection System
- D. The operator interface shall consist of a graphical interface which provides a view of the pumping station. Several "screens" shall be designed in order to display the features of the facility.
- E. The SCADA system shall consist of, but not be limited to; programmable controllers, data communication equipment, displays as noted, process instrumentation and control devices, uninterruptible power systems (UPS), and other devices as required and/or as indicated on Plans.

- F. All materials, equipment, labor, programming, configuration and installation services, and incidentals required to achieve a fully integrated and operational system shall be furnished and installed complete by a qualified Contractor with a minimum of 10-years experience. The Contractor shall design and coordinate the instrumentation and control system for proper operation with related equipment and materials.
- G. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under this Contract shall be included whether shown on the Plans or not.
- H. The Contractor shall provide all programming and configuration of equipment and software including development of graphic displays and reports. Displays and Report development shall be coordinated with existing IDOT standards.
- I. The Contractor shall install the control system and shall perform all on-site testing, start-up, and training of IDOT's staff.
- J. All necessary coordination required for interfacing the proposed pump station facility with the proposed SCADA system shall be provided by the Contractor.

1.2 RELATED SECTION

- A. Section 01 01 01 – Summary of Work
- B. Section 26 24 13 – Switchboard
- C. Section 26 24 19 – Motor Control Centers
- D. Section 26 36 23 – Automatic Transfer Switches
- E. Section 28 16 11 – Intrusion Detection System
- F. Section 28 31 00 – Fire Detection and Alarm
- G. Section 28 35 10 – Combustible Gas Detection System
- H. Section 40 94 24 – HMI Improvements
- I. Section 43 20 10 – Valves and Appurtenance
- J. Section 43 20 20 – Hydraulic Gates
- K. Section 43 20 10 – Valves and Appurtenance
- L. Section 43 21 39 – Submersible Pumps
- M. Section 43 21 43 – Sump Pumps

1.3 REFERENCES

- A. ISA Standards and Recommended Practices for Instrumentation and Control.

1.4 SUBMITTALS

- A. Submit product data, shop drawings, project documentation, O & M Data and record documents in accordance with the provisions of Specification Section 01 01 01 Part 1.6 - SUBMITTALS and the following specific information.
- B. Product Data
 - a. Bill of Material: List all the materials and equipment to be furnished. Tag number, manufacturer's complete catalog number, service, location, and cross-reference numbers of instruction sheet, specification data sheet and wiring diagram shall be included under each item.
 - b. Specification Data and Drawings: Furnish instrument specification data sheet as per ISA standard instrument specification form, if applicable, wiring and/or connection diagram, outline dimensions, installation diagram and manufacturer's catalog for each instrument. A common set of drawings with setting and/or scale individually listed may be furnished for instruments with identical specification except setting and/or scale.
 - c. Panel Drawings: Furnish panel drawings for each instrument/control panel. List bill of materials, show panel or cabinet structure, outline dimension, general arrangement, devices, cutouts and mounting details of instruments and control devices, terminal blocks, wire ways and piping.
- C. System Diagrams
 - a. Instrument Loop Diagram: Show all analog and digital loops for all instrument sensors, secondary instruments, I/O functions, alarms, control and displays using ISA standard symbols per ISA Standard S5.4.
 - b. SCADA System Block Diagram: Show system hardware configuration and identify model numbers of each system component.
 - c. Schematic diagrams, point-to-point internal wiring diagrams, point-to-point field wiring diagrams, and other necessary diagrams and installation requirements for the SCADA system and other components and systems that are interfaced to these systems.
 - d. Interconnecting Wiring and/or Piping Diagrams: Show schematically the wiring and piping runs for each instrumentation and control system. The diagram shall show and identify, with location noted, all instruments, piping and appurtenances furnished under this section and related electrical equipment furnished under other Sections. All terminal blocks and pipe taps shall be identified.

D. Software Documentation

- a. Submit system software, application software, I/O point data base listing, programming ladder diagrams, graphic pages and report forms in prints. Software, application programs, ladder diagrams and control logics shall also be submitted in 740MB CD-R.

E. Instruction Manuals

- a. Submit instruction manuals covering installation, operation, calibration, maintenance, diagnostic and repair for all hardware and software.

F. Record Documents

- a. Accurately record actual calibration setting and scales of instruments.

1.5 WORK FOR HIRE

- A. Any and all configuration, programming, setup or other software functions (SOFTWARE) performed on all intelligent devices provided as part of this Project is to be considered "Work for Hire" under the 1976 Copyright Act as amended (title 17 of the United States Code). The SOFTWARE shall be owned by IDOT and shall be turned over to IDOT fully documented as the work is completed.
- B. IDOT intends only to obtain the SOFTWARE for its own use.
- C. IDOT will not prevent the SOFTWARE supplier from reuse of the SOFTWARE concepts and ideas for other projects. Any reuse of the SOFTWARE concepts and ideas generated under this Project is solely the responsibility of the SOFTWARE supplier. The SOFTWARE supplier shall defend, indemnify and hold harmless IDOT from all claims, damages and expenses (including reasonable litigation costs), arising out of any use, misuse or misapplication of SOFTWARE concepts and ideas.

1.6 OPERATIONAL AND PERFORMANCE REQUIREMENTS

A. General

- a. The SCADA System will be designed for full automatic control and monitoring of the pump station. The individual pumps in the station will be called to start and stop due to the water level in the wet well. Under normal conditions the water level will be measured via a primary and secondary bubbler type level measuring systems. The station will also be equipped with a direct action float switch level system as a backup to the primary and secondary bubbler systems. Finally, the control system will also allow for manual operation.
- b. The Low Flow Pump will be the first pump to start and the last one to stop. The Main Flow Pumps (MFP-1, MFP-2 and MFP-3) will operate in a 3-pump alternator sequence with one of the pumps designated as a standby. The operator shall select which pump shall be designated as standby via a selector switch mounted on Control Panel CP47.

The lead and lag pump alternation shall occur when all pumps are off in a pumping cycle. System operation shall be the same no matter which level control system is functioning.

- c. The SCADA system will interface with the District's supervisory control system via a fiber optic Ethernet connection and a hardwired leased line telephone will be provided for backup. The fiber optic cable connection shall be provided by others in the future. The SCADA system shall be designed to allow for control of Pump Station 47 from remote location in the future.

B. Manual Pump Operation

- a. The Pump Station includes (4) pumps. Each of the (4) pump motors are equipped with a starter with a Manual/Off/Auto selector switch. When the switch is in the Manual mode, the respective pump will immediately start, assuming no fault conditions. When in Auto mode, the respective pump shall be started and stopped based on Sequence of Operation detailed below.

C. Automatic Pump Operation Via Bubbler Type Leveling System

- a. The pump operation shall be automatically staged based on the water level in the wet well. The level in the wet well shall be monitored via (2) independent level sensing systems. The main level sensing system shall consist of primary and secondary redundant bubbler systems. The level transducers shall monitor the wet well liquid level and generate electronic analog process control signals proportional to the head of liquid. The signals shall be monitored by a Programmable Logic Controller (PLC-CP47) installed in Control Panel (CP47). The PLC establishes the "ON-OFF" set points for the (4) pumps based on wet well conditions. Pump operating sequence and pump availability is also established via the PLC.
- b. On a rise in wet well liquid level, the Low Flow Pump motor will start. With the low flow pump running and a further rise in liquid level, the lead pump setpoint causes the lead motor to start and the low flow pump to stop. With the lead pump running and a further rise in liquid level, the lag pump setpoint causes the lag pump motor to start. As the wet well liquid level falls, the pumps stop in succession in response to commands by the PLC.
- c. The following tables summarize the sequence of pump operation for rising and falling wet well conditions.

Rising Wet Well Condition	
Wet Well Level Elevation	Pump Operation Sequence
676.00 feet	Low Flow Pump Start
678.00 Feet	Lead Main Flow Pump Start / Low Flow Pump Stop
680.00 feet	Lag Main Flow Pump Start
682.30 feet	High Water Alarm

Falling Wet Well Condition	
Wet Well Level Elevation	Pump Operation Sequence
678.00 Feet	Lag Main flow Stop
676.00 Feet	Lead Main Flow Pump Stop / Low Flow Pump Start
674.00 Feet	Main Flow Pump Failure To Stop Alarm
672.00 Feet	Low Flow Pump Stop
671.50 Feet	Low Water Alarm

- d. The next main flow pump (including the pump designated as standby) in sequence will automatically start in the event the lead or lag main flow pump fails to start for whatever reason when automatically required by the control system. The failed pump is removed from automatic service and is by-passed by the controller until manually reset.

D. Automatic Pump Operation Via Float Switch Leveling System

- a. The backup level sensing system shall be a series of (7) floats. The system will only be active if the primary and secondary bubbler type leveling system, as described above, fails or if the operator selects float operation via a selector switch mounted on Control Panel CP47. The floats shall be mounted at specific levels in the wet well. Refer to the FLOAT CONTROL SYSTEM Section of this Specification and Plans for additional details.

- b. The pump operation shall be automatically staged based on the water level in the wet well. The control of pump operation shall be identical to that described above for the bubbler system. The PLC shall not be used for pump control and staging when the Float Switch Level System is operating. Rather relay logic as detailed on the Plans shall be used.

E. Integrated Protective Controls

- a. The control system shall include the following protective features to protect the motor. These features shall be active in manual and automatic modes of operation no matter which type of leveling sensing system is active.
 - i. Low Level Cutout shall inhibit pump operation upon occurrence of a predetermined low liquid level in the wet well. The Annunciator Panel shall identify this condition via a pilot light. Restoration of pump operation is automatic upon rise in wet well liquid level to the predetermined set point.
 - ii. Dedicated Pump Overtemperature Relay monitors thermal switches in the respective pump motor windings and locks-out pump operation upon occurrence of a high motor temperature. A door mounted pilot light indicating "OVERTEMP" is energized while the motor is locked-out. The affected pump motor remains locked-out until the associated "RESET" pushbutton is depressed following correction of the problem. A door mounted selector switch shall provide the operator with the option of bypassing the lock-out feature. Refer the motor wiring diagrams for additional details.
 - iii. Dedicated Pump Seal Probe Relay monitors moisture probes in the oil seal chamber of the pumps. The presence of moisture activates the associated probe relay, which locks-out the associated pump and energizes a door-mounted pilot light ("SEAL FAILURE"). The affected pump motor remains locked-out until the associated "RESET" pushbutton is depressed following correction of the problem. A door mounted selector switch shall provide the operator with the option of bypassing the lock-out feature. Refer the motor wiring diagrams for additional details.
 - iv. Refer to the motor wiring diagrams for additional motor protective details.

1.7 GUARANTEES AND WARRANTEES

- A. Guarantees and warrantees shall be provided in accordance with the provisions of Specification Section 01 01 01 Part 1.7 – GUARANTEES AND WARRANTEES and the following specific information.
- B. Contractor shall provide a one year warranty from dated of final acceptance, including parts and labor.
- C. All hardware and software furnished under this contract including but not limited to the microprocessors, accessory peripherals, discrete devices, analog instruments and control devices shall be unconditionally guaranteed.

1.8 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION SCADA EQUIPMENT.

1.9 DELIVERY, STORAGE AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Division 1.

1.10 SCADA SYSTEM I/O

- A. Refer to the Plans for details regarding I/O requirements.

1.11 MASTER PLC I/O POINTS VIA ETHERNET

- A. Motor Control Center MCC-P47

- a. The following data points shall be transmitted from the MCC digital customer metering package to PLC-CP47 located in CP47 via an Ethernet connection:

- i. Electric Service No. 1 Phase A, B & C Voltage (0 to 480VAC)
- ii. Electric Service No. 1 Phase A, B & C Amperage (0 to 600 Amps)
- iii. Electric Service No. 1 KW
- iv. Electric Service No. 1 Max Demand
- v. Electric Service No. 1 Power Factor
- vi. Electric Service No. 2 Phase A, B & C Voltage (0 to 480VAC)
- vii. Electric Service No. 2 Phase A, B & C Amperage (0 to 600 Amps)
- viii. Electric Service No. 2 KW
- ix. Electric Service No. 2 Max Demand
- x. Electric Service No. 2 Power Factor

1.12 PLC I/O POINTS VIA CONTROLNET

- A. There are two redundant PLCs, PLC-SP47-01 & PLC-SP47-02, located in SCADA Panel SP47. There is a third PLC, PLC-CP47, which is located in Control Panel CP47. PLC-CP47 contains a redundant controller. The three PLCs are connected via a redundant ControlNet network configuration. The system requirements call for the following I/O points to be alarmed on the Annunciator Panel located on Control Panel CP47.

- a. Control Panel PLC Trouble
- b. Control Panel PLC Failure
- c. SCADA Panel PLC Trouble – Alarmed when trouble is sensed for PLC-SP47-01 or PLC-SP47-01
- d. SCADA Panel PLC Failure– Alarmed when PLC-SP47-01 or PLC-SP47-01 fails.
- e. The three PLCs shall monitor the status of the other PLCs. A PLC “Trouble Alarm” shall be triggered for any general fault that is sensed. A PLC “Failure” shall be triggered if it is sensed that a PLC has failed.

- B. All I/O data that is monitored or controlled at the Pump Station shall be available for transmission to District 1 Headquarters and the Electrical Maintenance Facility. The data shall be used for the development of Human Machine Interface (HMI) Screens. Refer to Specification Section 40 94 24 – HMI Improvements for additional details.

1.13 SYSTEM DESCRIPTION

- A. The following points are not intended to be a comprehensive list of the system's features, only summarize the major functions of the system. The SCADA system specified herein shall perform the following generalized functions:
 - a. Perform real-time process control, including proportional integral derivative control action, sequencing, process calculations, etc.
 - b. Collection and store accurate, reliable operating information for present and future uses.
 - c. Assist plant operating personnel by noting and communicating, off-normal operating conditions and equipment failures.
 - d. Accumulate and store equipment running times for use in preventative maintenance.
 - e. Provide color graphic displays and summary reports for use by the plant operating and supervisory personnel.
 - f. Provide trending for all analog values.
 - g. Provide control system diagnostics.

- B. The system is based on the SCADA system block diagram shown on Plans. The system shall include:
 - a. Programmable logic controllers (PLCs) with local input/output (I/O)
 - b. Graphical Interface Panel (GIP)
 - c. Network Communications
 - d. Telephone communications
 - e. Other capabilities as specified herein and shown on the SCADA system block diagram.

- C. All process control functions including PID, calculations, sequencing, set points, timing, etc., shall be done in the PLCs.

- D. The system shall allow the operator to monitor the status of pumps, valves, etc. (i.e., on-off, open-close, set point value, etc.) when viewing the GIP Screens.

PART 2: PRODUCTS

2.1 SCADA PANEL SP47 (LOCATED IN ELECTRICAL ROOM)

- A. The SCADA Panel shall house redundant PLCs, which shall be programmed for monitoring Pump Station operations. The PLCs shall be connected to the PLC located in Control Panel. The PLCs shall interface with an Ethernet switch and telephone modem for communication with District 1 Headquarters and Electrical Maintenance Facility. Refer to the Plans for additional details.

2.2 CONTROL PANEL CP47 (LOCATED IN ELECTRICAL ROOM)

- A. The Control Panel shall house a PLC and discrete relay logic that shall control the starting and stopping of the low flow pump and three main flows to prevent highway flooding. The PLC shall be responsible for control and monitoring functions performed at the Pump Station. The PLC shall be interfaced to the redundant PLCs housed in the SCADA Panel. Refer to the Plans for additional details.

2.3 PROGRAMMABLE LOGIC CONTROLLERS

- A. An Allan-Bradley programmable logic controller (PLC) system shall be furnished and programmed to operate all functions herein specified. All analog and discrete inputs and outputs shall be provided as necessary. The logic program shall be of universal type architecture and shall not be of a proprietary language. In addition, the programmable controller shall be capable of being monitored from remote facilities via leased telephone lines and an Ethernet Network communication system. The programmable controller equipment supplier shall be responsible for coordinating and providing a complete and properly functioning software package for the control and operation of the equipment as specified herein.
- B. The Contractor shall furnish the station operational program. A CD ROM copy and printout of the PLC control program shall be furnished to IDOT at the time of start-up. Disk and printed copy of the operating program shall be maintained on the file with the Contractor.
- C. SCADA Panel PLCs PLC-SP47-001 & PLC-SP47-001: The system shall consist of two (2) redundant ControlLogix processors, two (2) ControlLogix System Redundancy Modules, two (2) Control Net communication interfaces, two (2) Ethernet modules, two (2) redundant hot-swappable power supplies, (1) Graphic Interface Panel(GIP), necessary cable assembly, and necessary specialty modules to form a complete system. The PLC shall be Allen-Bradley ControlLogix Redundant System with sufficient memory and I/O capacity to handle monitor and control functions of the system plus 25% spare memory. The PLC shall be mounted in the Electrical Room SCADA Panel SP47 and shall be programmed for monitoring and control functions.

- D. Control Panel PLC PLC-CP47: The system shall consist of a PLC consisting of (2) ControlLogix processors, two (2) Control Net communication interfaces, one(1) Ethernet modules, two (2) redundant hot-swappable power supplies, various analog and digital I/O modules, Communication gateways, necessary cable assembly, and necessary specialty modules to form a complete system. The PLC shall be an Allen-Bradley ControlLogix System with sufficient memory and I/O capacity to handle monitor and control functions of the system plus 25% spare memory and 10% spare I/O. The PLC shall be mounted in the control building Control Panel and shall be programmed for monitoring and control functions. The main processor module shall be capable of accepting additional I/O plug-in modules for expansion.

2.4 PLC PROGRAM DEVELOPMENT SOFTWARE SYSTEM

- A. The Contractor shall provide as part of the System a software package to allow off-line or on-line ladder logic program development, annotation and monitoring on an IBM or compatible personal computer operating under the computer operating system specified herein.
- B. The software shall be utilized for development of the ladder logic programs and transfer to the PLC. Provide all PLC configuration required to implement the control strategies specified in this Section and as shown on the Plans.
- C. The software package shall be completely menu driven and shall be distributed on standard CD's.
- D. All required hardware (including cables, cable adapters, etc.) to allow the PLC's connection to a Standard RS-232-C or USB personal computer port shall be furnished.
- E. The software package shall include a software license agreement allowing IDOT the rights to utilize the software as required for any current or future modification, documentation, or development of the PLC's furnished for this project.
- F. The software shall provide as a minimum the following functions.
- a. Annotation of all ladder elements with at least 3 lines of 6 characters each.
 - b. Annotation of all ladder rungs with at least 240 characters.
 - c. Provide visual "power flow" monitoring of circuit elements (when connected to the PLC).
 - d. Provide annotated ladder diagram printout for documentation purposes.
 - e. On-line help facility.

- f. Download or upload ladder program from the PLC to the PC.
 - g. Provide a ladder element and I/O cross reference table.
 - h. Provide all monitoring, forcing, programming error detection, searching, configuration, etc., functions as required to allow an operator/programmer to completely program a PLC.
- G. Programming software shall be Allen-Bradley RSLogix 5000 for Windows NT. Software shall be suitable for simultaneous operation with the computer based control system software specified herein. Provide means for development software operation without affecting on-line operation of the computer control system.

2.5 PLC PROGRAM SOFTWARE DEVELOPMENT PHASE

- A. The Contractor shall provide all PLC programming and configuration of equipment and software to ensure a fully functional system per the Plans and Specifications. Software development shall be coordinated with existing IDOT standards
- b. IDOT has standardized common elements of their PLC programming in an effort to have common program elements at all their pump stations. Specific details regarding these programming standards are not provided as part of the specification.
As part of the PLC Program Software Development Phase, the detailed requirements for the PLC Programming shall be provided. Refer to Part 3 of this Specification for details regarding the PLC Program Software Development Phase. The Contractor is responsible for providing and developing all software to meet this Specification and to ensure a functional system that meets IDOT's operational requirements.

2.6 GRAPHICAL INTERFACE PANEL (GIP)

- A. Provide a graphical interface panel incorporated into the PLC system as shown on the Plans. Graphical interface panel shall be configured to allow operator access to status and control of local processes being monitored by the PLC. Provide all software, hardware, cables, and appurtenances for a fully configured system.
- B. Provide industrial grade sealed panel suitable for panel mounting with keypad. Keypad shall include a minimum of 15 user definable panel buttons and 5 user definable control buttons. Provide 15 inch, 1024 x 768 pixel, 18-bit color graphics, active-matrix TFT display.
- C. Provide PLC communications interface drivers to allow direct access of the graphical interface panel to the PLC and network. During configuration, the Contractor shall assign specific addressing and input/output access to allow monitoring of the specific local process. Provide a minimum of two configurable serial local ports. Provide a minimum of two configurable serial communication ports.

- D. Provide Windows based configuration software with the graphical interface panels. Configuration software shall utilize fill-in-the-blank style structure and support a minimum of 30 control display pages per panel. Control pages shall be stored in non-volatile EEPROM memory. Configuration shall be performed using the POWS device specified herein.
- E. Provide screen templates for screen configuration including discrete indicator, analog numeric readout, message text display, graphical analog bar, register table, alarm windows, and control button. Panel software shall allow mixing of custom graphics and templates on any page configuration. Provide variable sizing of templates with no limitation on the number of elements on any alarm page.
- F. Provide custom graphic capability for a schematic, graphical representation of the process. Resolution of graphics shall be to the screen pixel level. Custom graphics shall have the ability to be animated including proportional and status color based strategies. Provide a library of pre-developed symbols based on ISA graphical standards.
- G. Provide alarm monitoring capabilities with audio output. Alarm buffer shall store a minimum of 100 alarms for scrolling, review, and acknowledgment by the operator using an alarm summary page. Provide alarm acknowledge and audio output silence logic. Alarm audio output shall be adjustable up to 2 watts maximum.
- H. Provide capacity for a minimum of 500 text messages.
- I. Provide all configuration, transfer and graphics software as required.
- J. Unit shall operate from 24V DC power source. Operating temperature range shall be 0-50°C with 20-80% humidity range, non-condensing. Provide a single Form C alarm fault contact rated a minimum of 1A at 120 VAC. Contact shall be wired into a discrete input of the PLC serving the GIP.
- K. Graphical interface panel shall be Allen-Bradley PanelView Plus 1500.

2.7 GIP SOFTWARE CONFIGURATION

- A. General: The GIP graphical presentation shall present graphic logic for the PanelView monitor. Specific details of the graphical presentation at the GIP are not necessarily shown on the Plans or described in the Control Descriptions. As part of the GIP Graphical Screen Development Phase, the detailed requirements for the GIP screens shall be defined. Refer to Part 3 of this Specification for details regarding the GIP Graphical Screen Development Phase. The Contractor is responsible for providing and developing all software and graphical interfaces to meet this Specification and to ensure a functional system that meets IDOT's operational requirements.

- B. The GIP shall provide the following screens as a minimum. This is a general listing. Additional “drilldown” screens may be required in order to present the graphical details in manner that is conducive to viewing by the operator. The final list of required screens shall be developed during the GIP Graphical Screen Development Phase.
- a. Main menu and navigation screens for the GIP screens presented in a general to specific hierarchy.
 - b. GIP Help screen(s) that summarize operator interface formats, use of function keys, navigational standards, etc.
 - c. System alarm screen that presents a list of critical system wide alarms. Operator acknowledgment of all system alarms shall be possible at the GIP panel or the Alarm Acknowledge pushbutton located on the Control Panel CP47. Refer to the Plans for additional details.
 - d. Local alarm screen that presents a list of local process alarms. Operator acknowledgment of all system alarms shall be possible at the GIP panel or the Alarm Acknowledge pushbutton located on the Control Panel CP47.
 - e. System status screens that summarize the present operational status of the major pump station equipment such as pumps, sluice gates, motorized valves, meters, floats, transducers, etc.
 - f. Electrical Distribution system one-line showing the status of the (2) Electrical Services, ATS, (2) main circuit breakers, circuit breakers feeding (4) pump motors mounted in the MCC, etc.
 - g. Customer Metering Screen detailing information gathered via the MCC digital metering equipment and ammeter information for the individual motors.
 - h. Building Status Screen that provides details on the status of room temperatures, Trash Rack Differential Level, Combustible Gas Alarm Panel, Intrusion Alarm Panel, Fire Alarm Panel, Pavement Flooded Status, Sump Pump Panel, UPS status, PLC Status, etc.
 - i. GIP Interface Screens shall match to the greatest extent possible IDOT’s standard formats used at other pump station installations. Details regarding IDOT’s standard formats shall be provided during the GIP Graphical Screen Development Phase.

2.8 ETHERNET DATA SWITCHES

- A. Manufacturers:
- a. Allen Bradley Stratix 6000 Fixed Managed Switch.
 - b. Or equal.

B. Features:

- a. Modular Ethernet expandable switch. Locate equipment in enclosure to allow addition of one additional "expansion module" in the future, including sufficient length of DIN rail.
- b. Store and forward switch in compliance with IEEE 802.3.2 priority classes in accordance with IEEE 802.1D, TCP/IP protocol.
- c. As a minimum the switch shall have the following port configuration:
 - i. (8) 10/100 Base T Mbps Auto Sensing Copper ports with RJ45 connection.
 - ii. (1) 1000 Mbps fiber port
- d. Ambient temperature (operation) - 0°C to 55 °C.
- e. Humidity: 10% to 95% non-condensing.

2.9 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM

- A. Uninterruptible Power Supplies (UPS) System shall be provided for the SCADA and instrumentation systems as shown on the Plans and specified herein. The UPS shall sustain operation during short-term power failures, and shall provide power for an orderly shutdown to prevent the loss of data during power failure and shall provide isolation between the control system and the plant power system.
- B. The UPS shall be a single phase, true on-line, solid unit with microprocessor controlled static inverter, hot pluggable batteries, battery charger, LED display and keypad.
- C. Under normal operating conditions, the critical load shall be continuously supplied by the UPS inverter. The battery charger shall maintain a float-charge on the battery. When AC line power fails, or goes out of tolerance, the inverter shall obtain power from the batteries and supply AC power to the loads without interruption.
- D. The UPS system shall be sized to sustain 1.5 times the connected full load for a minimum period of 30 minutes in an operating environment of 32°F to 104°F. Final UPS sizing is the responsibility of the Contractor.
- E. The UPS system shall be lightning and surge tested per ANSI/IEEE C62.41 and shall be capable of reducing an input spike to less than 3 volts on the output for a 2000 to 1 spike attenuation. The UPS system shall have 120 dB common mode and 60 dB Transverse mode noise attenuation.
- F. The UPS system shall provide a true separately derived power source as defined in the NEC article 250.30 with output neutral bonded to ground. There shall be no direct connection between input and output and less than 23 pf of effective input to output capacitance.

- G. The system input voltage shall be 120 VAC, 60 Hz, single phase. Provide external break before make disconnect switch to allow transition to like power for testing or removal of the UPS.
- H. The UPS system output shall be regulated to 120VAC \pm 3%, single phase three wire, 60 HZ \pm 0.5 HZ over the full dynamic range from no load to full load and low line VAC to high line VAC and low battery voltage to high battery voltage.
- I. The UPS system shall provide computer grade sine wave power with 5 percent or less total harmonic distortion.
- J. The UPS system capacity shall be rated in volt amperes (VA) while loaded with typical computer grade switch mode power supplies having a power factor of 0.6 to 0.7 and crest factor of 2.7 to 3.5.
- K. The UPS system shall have an efficiency of at least 92% when operated from AC line.
- L. The UPS system shall have built-in self-diagnostic monitoring capable of monitoring as a minimum AC volts in/out, AC current in/out, battery voltage, VA load, watts, power factor percent of full load, time of day, system hours, inverter hours and projected run time available. Unit shall have relay contacts that close to indicate that the UPS is running on battery power, the UPS battery capacity is running low and the UPS has failed or overloaded.
- M. The UPS system shall have a dual track redundant configuration that utilizes either line or inverter output for power and shall be designed to meet or exceed a MTBF of 100,000 hours.
- N. The system input voltage shall be 120 VAC, 60 Hz, single phase. Provide external break before make disconnect switch to allow transition to like power for testing or removal of the UPS.
- O. Provide hardwired input and output connections or as a minimum provide L5-30P input connection and (4) 5-20R output connections on a 3KVA unit. If larger unit is required, Contractor is responsible for determining input and output configuration to meet application needs.
- P. The UPS shall be designed with internal batteries and with the capabilities of adding external batteries to meet power ride-thru requirements. The batteries shall be sealed, no maintenance type rated to provide minimum continuous operation of connected equipment as specified herein.
- Q. The Contractor shall provide sizing data on the UPS listing all loads and calculations required for sizing the UPS system. As a minimum a 3 KVA unit shall be provided.

- R. A maintenance bypass switch shall be provided which shall allow for manual transfer of connected load to utility power permitting scheduled maintenance or UPS replacement without discontinuing power to the control panels. The electrical rating and capacity of the bypass switch shall match that of the UPS. Refer to the Plans for additional details regarding the wiring configuration between the UPS and Control Panels.
- S. The UPS system shall be as manufactured by Liebert, Oneac, MGE or approved Engineer's equal with output relay card, and extra battery module, if required.
- T. The maintenance bypass switch shall be the Liebert MicroPOD or approved Engineer's equal.

2.10 DIRECT ACTING FLOAT SWITCHES

A. Manufacturers:

- a. The float switches shall be Model 9G-EF floats as manufactured by Siemens Water Technologies, Control Systems Products
- b. Engineer approved equal.

B. Features:

- a. Provide required mounting accessories as detailed on the Plans. The floats shall sense water levels as shown on the Plans. The float shall contain a switch which closes or opens its contacts when floating in a horizontal position. Float switch shall not contain Mercury. Float switches shall be suitable for Class 1 Division 2 locations. Provide intrinsically safe barriers as required.
- b. Float switch body shall be constructed of Teflon-coated, 20 gauge, 316 stainless steel housing measuring not less than 5 1/2" (14 cm) in diameter. A long life, high reliability, potted SPST magnetic reed switch rated for not less than 100 VA at up to 250 Volts shall be mounted inside the float and connected to a multi-stranded, 2 conductor plus ground, 16 gauge, CPE jacketed cable. The cord shall have fine strand conductors (not more than 34 gauge) made especially for heavy flexing service. The cable connection point shall be potted in epoxy providing a strong bond to the float and reed switch forming a water/moisture tight connection. A flexible Neoprene sleeve, not less than 1/8" (3.2 mm) thick, shall be provided over the CPE jacketed cable extending not less than 5" (12.7 cm) from the top of the mounting bracket extending down through the cable mounting bracket hinge point to the top of the float switch body, providing cable stress point relief and extended operational life. Heavier gauge cable shall be provided as required to account for voltage drop considerations.

- c. A 316 stainless steel flanged cable mounting clamp assembly shall be supplied allowing pipe or cable mounting as specified below. The float cable-mounting bracket shall be flared on both sides providing hinge point stress relief to both sides of the cable.
- d. The float switch assembly shall provide a minimum of two pounds of buoyancy in solutions with a specific gravity of 1.0 (water) and shall have an operating temperature rating of -31 to 194 degrees F (-35 to +90 degrees C).
- e. Each float shall be provided with sufficient length of cable to allow a direct connection to the junction box or control panel without field splicing as detailed on the Plans.

2.11 IL 59 PAVEMENT FLOODED ALARM SYSTEM

- A. A single direct acting float switch shall be mounted in a control cabinet and mounted on retaining Wall W045 for detecting water on IL 59. Refer to the Civil Plans for location of the control cabinet and additional details.
- B. Refer to the DIRECT ACTING FLOAT SWITCHED section of this Specification for float switch requirements.
- C. The float switch shall be interfaced with Control Panel CP47 located in the Pump Station Electrical Room.
- D. The SCADA system will monitor the status of the float switch and provide an alarm when flood conditions are detected.

2.12 WET WELL FLOAT CONTROL SYSTEM

- A. The float control system shall include floats, interconnecting integral cable of a length required, and control logic for the functions indicated.
- B. Refer to the DIRECT ACTING FLOAT SWITCHES section of this Specification for float switch requirements.
- C. The system shall be intrinsically safe for installation in the wet well.
- D. The system shall be complete with control logic to provide the contacts for controls and alarm functions indicated.
- E. The system shall be complete with all required mounting hardware and accessories.
- F. The float system shall be complete with mounting arrangement with a stilling well of adequate size to forestall the attachment of large sections of ice to the floats during cold weather which could then disturb the system mounting. The mounting arrangement shall permit easy removal of the floats and easy realignment when replaced. Submit details for approval by the Engineer prior to installation.

2.13 WET WELL BUBBLER TYPE LEVEL SENSING SYSTEM

- A. Two (2) independent Bubbler Control Panels (BPC47-001 & BPC47-002) shall be provided. Each bubbler level sensing system shall be a self-contained, continuous flow type with a fully integrated pressure sensor capable of monitoring the variations of water level in the Wet Well by sensing back pressure on air sent through a bubbler tube. The bubbler type level sensing system shall be installed in the Electrical Room and mounted as indicated on the Plans. Each bubbler level sensing system shall meet the following criteria:
1. Input voltage into the system shall be 120 VAC, 60 Hz, 1 Phase.
 2. A 4-20mA scalable isolated analog output signal proportional to the Wet Well water level shall be provided for integration into the SCADA system.
 3. A normally open fault contact indicating a general fault condition with the bubbler system shall be provided for integration into the SCADA system.
 4. Each system provided shall have all components contained within a single NEMA 4 enclosure.
 5. Pressure range shall be suitable for measurement of the full range of Wet Well operating and alarm levels as indicated in the Project Documents. Pressure accuracy shall be at minimum +/- 1.0% of full scale over temperature range.
 6. A RS-232 interface shall be provided for system communications support.
 7. Each system shall contain one (1) oil less compressor unit to maintain pressure in an internal tank; with a microprocessor that determines how much pressure is needed in the tank, based on the current head pressure, to produce a constant bubble rate. Bubble rate shall be user selectable from 30 to 120 bubblers per minute.
 8. Provide a 0-150 psig pressure gauge to indicate tank pressure.
 9. The system shall have a purge feature that is designed to remove any sediment that may collect in or around the outlet of the orifice line. The purge process shall not interfere with level measurement in order to prevent erroneous readings and improper pump calls. The air purge process shall be initiated by the following methods:
 - a. Manual push-button operation.
 - b. A detection of reduced air flow.

- c. A timed purge cycle.
 - d. Immediately after the system is powered up after loss of power.
- 10. The system shall have a replaceable air filter/desiccator to limit moisture into the compressor intake air.
 - 11. Orifice lines shall be polyethylene type sized per the manufacturer's requirements.
 - 12. Bubbler type level sensing systems shall be provided by WaterLOG (YSI Incorporated), Digital Control Company, or approved equal.

2.14 TRASH RACK DIFFERENTIAL LEVEL SENSING SYSTEM

- A. Two (2) hydrostatic level sensors (LIT-007A and LIT-007B) shall be used to measure water level. Refer to the HYDROSTATIC TYPE LEVELS SENSING SYSTEM Section of this Specification for details regarding the level sensors. LIT-007A shall be mounted upstream of the Trash Rack and LIT-007B shall be mounted downstream of the Trash Rack. Refer to the Plans for additional details regarding the location and mounting requirements for the sensors. A 4-20mA signal proportional to water level shall be produced by each transmitter and those signals shall be fed to Programmable Logic Controller PLC-CP74 located in the Control Panel. The PLC shall calculate the differential level between the two signals. The PLC shall provide a 4-20mA output proportional to the differential level which shall be fed to a meter mounted on the Control Panel. The PLC shall be programmed to take into account the level offset in the difference in the mounting height of the transducers. The PLC shall provide an alarm when the differential level becomes too great indicating that the trash rack has become clogged. The differential level for this alarm shall be programmable by the operator via the GIP panel mounted on the Control Panel.

2.15 HYDROSTATIC TYPE LEVEL SENSING SYSTEM

- A. The hydrostatic type level transmitter shall include an upper and a lower assembly. The lower assembly shall include housing and gauge pressure diaphragm type transducer as specified herein.
- B. The hydrostatic type level transmitter upper assembly shall be installed in the Electrical Room and shall house the system signal conditioning and transient protective electronics and connections terminal block. A desiccant type or expansion bag type breathing system shall be installed. A labyrinth seal vent shall be provided on the side to allow atmospheric pressure access to the breathing system. The Upper assembly shall be housed in a NEMA 4 enclosure. A meter assembly shall be provided on the front of the panel for system readout and programming. A 4-20 mA scalable isolated analog output signal proportional to Wet Well water level shall be provided for integration into the SCADA system. The input voltage to the assembly shall be 120 VAC, 60 Hz, 1 Phase.

- C. The Connecting Cable between Lower and Upper Assemblies shall consist of ½" O.D., B.F. Goodrich Estane polyurethane jacket, a 3-conductor shielded AWG #16 cable and an integral breather tube which shall form the sealed breathing system between the expansion bag and the Lower Assembly.
- D. The liquid level transmitter shall be a 4-20 mA DC, 2-wire, 15-40 VDC loop powered type with its output signal directly proportional to the measured level excursion over a factory-calibrated range of zero to 15 ft. of water. The transducer shall be of the solid state head-pressure sensing type, suitable for continuous submergence and operation.
- E. The transducer housing shall be fabricated of type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon bonded to a synthetic rubber back/seal. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid STATE variable capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm which flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensation and high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory calibrated range.
- F. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures five times the full scale range being sensed. Metallic diaphragms and sensing principles employing LVDT's, resistive or pneumatic elements are not considered equal.
- G. The transmitter shall include easily accessible zero and span adjustments in the upper assembly. +20% zero and 3 to 100% span adjustment shall be provided, using potentiometer and dip switches. Zero and span adjustments shall be non-interactive for ease of calibration.
- H. The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the Upper Assembly. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.
- I. The level transmitter shall be intrinsically safe or an intrinsically safe barrier shall be provided for mounting in the control panel.
- J. The level transmitter shall be mounted as indicated on Plans.

- K. The level transmitter shall be manufactured by Ametek, Druck, Endress Hauser, or approved equal.

2.16 ULTRASONIC CLAMP-ON TYPE FLOW METER

- A. The Recirculation Pipe Flow Meter (FT-010), Main Flow Pump No. 1 Flow Meter (FT-001), Main Flow Pump No. 2 (FT-002), Flow Meter, Main Flow Pump No. 3 Flow Meter (FT-003), and the Low Flow Pump Flow Meter (FT-004) must be a clamp-on design precluding the requirement of penetrating into the pipe. The flow meter shall be completely microprocessor based utilizing a compression mode propagation measurement technique. The meters shall be of the size and mounted as indicated on the Plans.
- B. The meter shall have remote mounted transducers that permit separation of up to 300 meters using a coaxial or twin axial cable. The transducers shall be rated NEMA 6 (IP 67). Contractor shall be responsible for determining the proper cable length required to connect the transducer mounted on the recirculation pipe and the flow meter mounted on Control Panel CP47 located in the Electrical room. Refer to the Plans for additional details regarding the location of equipment.
- C. The flow meter electronics shall be housed in a NEMA Type 4 (IP65) enclosure and powered by 95-264VAC, 50-60Hz. The front panel shall consist of a two line backlit LCD display. The flow meter shall be suitable for panel mounting and shall have the following features as a minimum:
- a. Integral Front Panel Keypad for Programming
 - b. Flow Rate Display
 - c. Flow Totalizer Display
 - d. 4-20 mA Output
 - e. 0 to 1,000Hz Rate Pulse and Dual Alarm Outputs
 - f. USB Programming Port
 - g. RS485 Modbus Network Connection
 - h. Remote Totalizer Reset Capability
- D. The flow meter electronic assembly shall be intrinsically safe or an intrinsically safe barrier shall be provided.
- E. The flow meter shall have an accuracy of $\pm 1\%$ for flows from 4 to 40fps flow range. Repeatability shall be 0.5% of reading and a flow sensitivity of 0.001 fps.
- F. The furnished flow meter shall be Spirax Sarco UTM10 or Engineer's Approved equal.

G.

2.17 PUMP METER CONTROL PANEL

- A. The Pump Meter Control Panel (PMCP47) shall be located in the Electrical Room as indicated on the Plans. Provide a NEMA 12 Enclosure. The Individual Main and Low Flow Pump Meters shall be mounted in a the enclosure.
- B. Each meter shall be equipped with a 4-20mA output proportional to flow rate. The analog signal shall be wired to the PLC mounted in Control Panel CP47. The PLC shall total the individual meter flow rates and produce a 4-20mA signal proportional to the total station flow rate. The signal shall be wired to the Plant Total Flow Meter mounted on CP47. The PLC shall also calculate the station's totalized flow.
- C. The following equipment shall be included. This represents the minimum equipment required. Additional equipment may be required base on system operating requirements:
 - i. Main Flow Pump No. 1 Flow Meter (FT-001),
 - j. Main Flow Pump No. 2 (FT-002),
 - k. Flow Meter, Main Flow Pump No. 3 Flow Meter (FT-003)
 - l. Low Flow Pump Flow Meter (FT-004)
 - m. Intrinsically safe barriers
 - n. Equipment Ground Bus
 - o. Instrumentation Ground Bus.
 - p. Control terminal to support all required I/O plus additional spares.
 - q. Power supplies and any other ancillary equipment required to insure proper system.

2.18 MOTOR OPERATED SLIDE GATES

- A. Sequence of Operation
 - a. The Operator has the flexibility to operate the slide gate either locally at the gate itself or remotely at the motor control center via the Local/Off/Remote selector switch located on the unit. In both Local and Remote operation, the Operator can "Open", "Close" or "Stop" the movement of the gate. Pilot lights are provided both locally and remotely for indicating that the gate is fully open, fully closed or in an intermediate position.
- B. Refer to Specification Section 43 20 20, HYDRAULIC GATES, for additional details.

2.19 MOTOR OPERATED VALVES

A. Sequence of Operation

- a. The Operator has the flexibility to operate the valve either locally at the valve itself or remotely at Control Panel CP47 via the Local/Off/Remote selector switch located on the unit. In both Local and Remote operation, the Operator can “Open”, “Close” or “Stop” the movement of the valve. Pilot lights are provided both locally and remotely for indicating that the gate is fully open or fully closed.

- B. Refer to Specification Section 43 20 10, VALVES AND APPURTENANCES, for additional details.

2.20 AUTOMATIC TRANSFER SWITCH INTERFACE

- A. Refer to Specification Section 26 36 23, AUTOMATIC TRANSFER SWITCHES, for additional details.

2.21 FIRE DETECTION AND ALARM INTERFACE

- A. Refer to Specification Section 28 35 00, FIRE DETECTION AND ALARM, for additional details.

2.22 COMBUSTIBLE GAS DETECTION SYSTEM INTERFACE

- A. Refer to Specification Section 28 35 10, COMBUSTIBLE GAS DETECTION SYSTEM, for additional details

2.23 SUMP PUMP SYSTEM INTERFACE

- A. Refer to Specification Section 43 21 43, SUMP PUMPS, for additional details.

2.24 TELEPHONE MODEMS

- A. Provide 56K US Robotics Model 5686

2.25 INTRUSION DETECTION SYSTEM INTERFACE

- A. Refer to Specification Section 28 16 11, INTRUSION DETECTION SYSTEM, for additional details.

2.26 PILOT DEVICES AND CONTROL STATION COMPONENTS

A. Manufacturers:

- a. Allen Bradley 800T.

- b. Square D Class 9001, Type K.
- c. Cutler-Hammer 10250T.

B. Construction:

- a. Heavy duty.
- b. Watertight.
- c. Oil-tight.
- d. Flush panel mounting
- e. Size to mount in 30.5-mm diameter.
- f. Match NEMA rating of associated Control Station (see below)

C. Pushbuttons:

- a. Flush head unless specified elsewhere.
- b. Contact Blocks:
 - i. Double break silver contacts.
 - ii. Ac Ratings: 7,200 va make, 720 via break.
 - iii. Single pole, double throw or double pole, single throw.
 - iv. Up to six tandem blocks.
- c. Momentary contact unless specified elsewhere.
- d. Non-illuminated.
- e. Legend plates, as required, for type of operation or as specified elsewhere.

D. Pushbuttons – Emergency Stop (ESTOP)

- a. Jumbo red mushroom head.
- b. Contact Blocks:
 - i. Double break silver contacts.
 - ii. Ac Ratings: 7,200 va make, 720 via break.

- iii. Single pole, single throw.
- iv. Up to six tandem blocks as specified.
- c. Push/pull.
- d. Maintained contact.
- e. Non-illuminated.
- f. Legend plates:
 - i. Extra large.
 - ii. Red.
 - iii. "ESTOP".

E. Selector Switches:

- a. Maintained position unless specified elsewhere.
- b. Contact Blocks:
 - i. Double break silver contacts.
 - ii. Ac Ratings: 7,200 va make, 720 va break.
 - iii. Contact configuration as specified.
 - iv. Up to six tandem blocks.
- c. Operators:
 - i. Number of positions as specified elsewhere.
 - ii. Standard knob type unless specified elsewhere.
- d. Legend plates as required for type of operation or specified elsewhere.

F. Pilot Lights:

- a. Transformer type.
- b. Bayonet, 6 to 8 v bulb.
- c. Colored lens as specified elsewhere.

- d. Interchangeable lenses.
- e. Transformer rated for 120 v, 60 Hz.
- f. Push to test.
- g. Legend plates as specified elsewhere.

G. Control Stations:

- a. Describes enclosures used to house field pilot devices.
- b. NEMA ratings:
 - i. NEMA 7 in Class 1, Division 1 or 2 Hazardous (Classified) Locations.
 - ii. NEMA 4X 316 stainless steel in indoor wet/corrosive locations or outdoors.
 - iii. NEMA 12 in other areas.
- c. Nameplates:
 - i. Engraved laminated plastic.
 - ii. Letters 3/165 in. high.
 - iii. Black letters on white background.
 - iv. Identify per equipment controlled, using names found on Plans.

2.27 PROCESS INDICATORS, ELECTRONIC

A. Manufacturers:

- a. Precision Digital.
- b. Red Lion, IMP.
- c. Moore Industries.

B. Features:

- a. 4-20mA dc Input.
- b. ½ digit LED indicator.

- c. Loop powered.

C. Enclosures:

- a. Panel mounted as indicated on Plans.
- b. For below grade or outdoor installations: NEMA 4X: Impact-resistant polycarbonate body, clear gasketed polycarbonate cover ½” conduit hole in bottom of case.
- c. For Explosion Proof installations: NEMA 7 XP: FM approved cast aluminum body, screw-type cast aluminum cover with view port. Two ¾” conduit holes.
- d. Provide 2” pipe mounting kit as detailed.

D. Model: PD675-N, NEMA 4X; PD677-N, NEMA 7 XP.

2.28 TEMPERATURE SWITCHES – BUILDING STATUS

A. Manufacturers:

- a. Honeywell.

B. Features:

- a. Integral temperature indicator.
- b. Suitable for wall or ceiling mount.
- c. Adjustable high and low temperature setpoints.
- d. Dry contacts suitable for connection to PLC Reed Relay input.

2.29 TEMPERATURE SENSORS/TRANSMITTERS

A. Manufacturers:

- a. Minco
- b. Siemens
- c. Honeywell
- d. Engineer’s approved equal

B. Features:

- a. Temperature Sensor/transmitter shall be suitable for temperature ranges between -20 to 125 Degree F.
- b. Transmitter shall have 4-20 mA output proportional to ambient temperature and shall be integrated into the SCADA system.
- c. Temperature Sensor/transmitter for Electrical Room shall be wall mounted and housed in a NEMA 1 Enclosure.
- d. Temperature Sensor/transmitter for Electrical Room shall be wall mounted and housed in an Explosion Proof Enclosure.
- e. Units shall be UL Listed.

2.30 CONTROL RELAYS

A. Manufacturers:

- a. Potter and Brumfield
- b. Struthers Dunn.

B. Operating Data:

- a. Pickup Time: 13 ms maximum.
- b. Dropout Time: 10 ms maximum.
- c. Operating Temperature: - 45°F to 150°F.

C. AC Coil:

- a. 120 or 2409 vac.
- b. Continuous rated.
- c. VA inrush maximum.
- d. VA sealed, maximum.
- e. 50 to 60 Hz.
- f. Light to indicate energization
- g. Minimum Dropout Voltage: 10% of coil rated voltage.

D. DC Coil:

- a. 24 or 120 Vdc.
- b. Continuous rated.
- c. Light to indicate energization.
- d. Minimum Coil Resistance:
- e. 24 Vdc: 450 Ω .
- f. 120 Vdc: 9,000 Ω .

E. Contacts:

- a. Gold flashed fine silver, gold diffused for 1 amp or less resistive load.
- b. Silver cadmium oxide.
- c. form C.
- d. 120 vac.
- e. 10 amp make, 1.5 amp break (inductive).
- f. Rated at 10 million operations.
- g. 11 pin, square socket.
- h. DIN rail mountable.
- i. Enclosed and protected by polycarbonate cover
- j. Provide relay-retaining clips.

2.31 TIMERS

A. Interval/Duration Timer (Rear of Panel):

- a. Manufacturers:
 - i. Potter and Brumfield, CN series.
 - ii. Eagle Signal DM 100 series.
 - iii. Or equal.

- b. Mounting: Plug-in with dust tight cover.
- c. Type: Integrated circuit.
- d. Range: 0.5 sec to 99 min. Field selectable.
- e. Contacts: 2 DPDT contacts rated 10 amp. 120 vac.
- f. Power: 120 vac, 60 Hz.

B. Interval/Duration Timer (Front of Panel):

- a. Manufacturers:
 - i. Eagle Signal, CX300 series.
 - ii. Or equal.
- b. Type: Microprocessor.
- c. Timing Range: Five ranges from 200 sec to 200-hr field selectable.
- d. Contacts: 10 amp, 120 vac.
- e. Controls: Membrane switches for operator input.

2.32 TERMINAL BLOCKS

- A. Manufacturers:
 - a. Phoenix Contact.
 - b. Weidmuller.
 - c. Or equal.
- B. 300 v rating for 120 v circuits and below, 600 v rating for 480 v circuits.
- C. Clamping screw type.
- D. Isolating end caps for each terminal.
- E. Identification on both terminals.
- F. Clip-mounted on DIN rail.
- G. Accept AWG 12 to 22.

H. Feed-Through Terminals:

- a. 20 Amp rating.

I. Switched Terminals:

- a. Knife disconnect with test sockets.
- b. 10 Amp rating.

J. Fused Terminals:

- a. Hinged fuse removal/disconnect.
- b. 10 Amp rating.
- c. Include blown fuse indication.

2.33 ELECTRONIC CURRENT ISOLATOR

A. Manufacturers:

- a. Phoenix Contact Model MCR Series.
- b. Approved Engineer's equal.

B. Features

- a. Solid state instrument to electrically isolate one instrument loop from another instrument loop. Converter to accept 4-20mA dc input signal and provide equal but isolated and power-boostered output.
- b. Mounting: DIN Rail.
- c. Temperature compensated, calibration-free.
- d. Signals: Input: 4-20mA dc into 50 ohms. Output: 4-20mA dc into output for up to 500 ohms.
- e. Isolation: Common mode up to 700 vac between input and output.
- f. Accuracy: 0.5% of span.
- g. Provide power supply specific to isolator.

2.34 INTRINSICALLY SAFE BARRIERS AND RELAYS

- A. Manufacturers:
 - a. Gems Safe-Pak or Engineer's approved equal
- B. Provide intrinsically single channel safe barriers, dual channel safe barriers and relays as indicated on the Plans and as required to meet NEC requirements for explosion proof applications. All wiring between those rooms identified as Hazardous Locations and Non-Hazardous locations shall be provided with intrinsically safe barrier or relay as the installation calls for.
- C. Provide relays with 2NO/2NO auxiliary contacts or as indicated on the Plans. Provide additional contacts as required to meet installation requirements.

2.35 CONTROL PANEL FABRICATION

- A. General
 - a. Refer to Plans for additional details.
 - b. The panels shall match the general construction of the motor control center and shall be of the same height.
 - c. The panels shall conform to all application standards of NEMA and ANSI and shall consist of formed steel panels containing equipment and devices as indicated.
 - d. The panels shall be equipped with space heater(s) as specified for motor control centers.
- B. Enclosure
 - a. The SCADA and Control panels shall be NEMA 12 floor mounted, front accessible only, metal enclosed type, arranged for cable and/or conduit entry from the top, bottom or sides, as required. Panel design shall allow easy access to all internal wiring and appurtenances. Ventilation fan, air filter, thermostatically controlled space heater, light kit and 120V receptacle shall be provided.
 - b. The enclosure shall be of a height and depth to match the motor control center and of a width sufficient for the equipment to be housed.
 - c. The panel shall have a full piano hinge door and a 3-point latch with a locking handle. The handle shall have a cylinder type lock keyed to match the IDOT's system. The doors shall have a hinged gasketed door.
 - d. The enclosure shall be finished inside and out. Exterior color shall match that for the motor control center, and the interior color shall be white or as otherwise approved by the Engineer.

C. Devices and Appurtenances

- a. Unless otherwise indicated, pushbuttons, selector switches, indicating lights, relays, and other devices shall be provided as part of the control panel and shall be as specified for motor control centers. Devices similar by those in the motor control center panel shall be of the same manufacturer.
- b. Where indicated, certain devices shall be furnished under other Sections of the Specifications for installation under this Section. The control panel manufacturer shall coordinate the arrangement and wiring of these devices for a complete finish assembly. Such devices shall be factory installed by the panel manufacturer.
- c. Nameplates shall be white with black lettering and consistent on all panels and devices. Relays and all other devices located inside the panel shall be identified with nameplates.

D. Wiring

- a. Wiring shall be brought to terminal strips near the bottom of enclosures and 10 percent spare terminals shall be provided in each. The identification of terminals shall conform to the schematic diagrams and shall consist of adhesive labels as manufactured by Brady, Thomas, or equal.

2.36 CONTROL DEVICES AND WIRING

- A. Control devices, local instrument cables and wiring required on the equipment shall be furnished and installed at the factory.
- B. All small wiring for control or accessory equipment shall be installed in code approved wireways.

C. Wiring Conventions

- a. All wiring shall be of the following minimum.
 - i. Power wiring to power PLC power supply shall be #12 AWG MTW. PLC chassis shall be connected to the enclosure ground bus with #8 AWG MTW.
 - ii. Control panel doors shall be connected to the enclosure ground bus with #8 AWG MTW
 - iii. Single conductor I/O control wiring that is connected to 120VAC control circuits shall be No. 12 AWG MTW, minimum. Single conductor I/O control wiring that is not connected to 120VAC circuits shall be No. 14 AWG MTW, minimum.

The conductor shall be stranded copper for fixed wiring and extra flexible copper for wiring to components that are mounted to a movable surface, i.e. doors or hinged panels. The extra flexible conductors shall have 600 volts, 90 Degree C, polyvinyl chloride insulation with flameproof braid covering, Type TBS or cross-linked polyethylene, Type SIS. The conductor type for fixed mounted components shall be type THHN/THWN, 600 volt, 90 Degree C.

D. Cabling

- a. For indoor, Non-Plenum applications analog I/O shall be wired with Belden 8760 or equivalent, single twisted pair, shielded cable. For outdoor and Plenum applications analog I/O shall be wired with Belden 88760 or equivalent, single twisted pair, shielded cable. The drain-wire from each cable shall be connected an isolated ground bus. All shields shall be covered with clear Teflon tubing. The black conductor shall carry the positive signal (+) and the clear conductor shall carry the negative signal (-)
- b. Remote I/O (R I/O) communications circuits shall be wired with Belden 9463 or equivalent, twin-axial, shielded cable. Communications wiring shall cross AC conductors at a 90-degree angle. Where communication wiring must run parallel to AC conductors, a minimum of 2" separation must be maintained.
- c. All wires and cables that enter or leave the control panel must terminate at a terminal.

2.37 ALARM ANNUNCIATOR PANEL

- A. The Alarm Annunciator Panel shall be mounted on Control Panel CP47
- B. Unless otherwise indicated, alarm annunciators shall be of the plug-in relay type and shall be configured of single-alarm modules in an arrangement as indicated on the Plans or as otherwise directed by the Engineer.
- C. Each module shall be engraved as indicated on the Plans or as otherwise directed by the Engineer.
- D. The relay annunciator modules shall be individually removable from the front of the unit. Input and output terminals shall be accessible from the rear of the unit.
- E. Relays shall be hermetically sealed and shall be securely held in place by retaining clips or other means approved by the Engineer. Relays shall have silver/silver alloy contacts rated not less than 2 amperes at 120 volts. Each alarm module shall produce at least one isolated double throw auxiliary contact for remote connection.
- F. The annunciator shall operate in a "Sequence A" flashing mode as follows:

- a. The control logic selectable to incorporate lock-in or non-lock-in alarm activation. Lock-in selection shall maintain alarm status until the alarm has been acknowledged by depressing the acknowledge pushbutton at the annunciator. Non-lock-in selection shall permit alarm status to return to the normal off condition as soon as the alarm input is cleared.
- b. The following chart details the Nameplate status for each given condition.

Condition	Nameplate Status
Normal	Off
Alarm	Flashing
Acknowledge	Steady On
Normal (clear)	Off
Lamp Test	Steady On

- G. Each alarm window shall be illuminated with not less than two long-life lamps which shall be easily accessible for replacement.
- H. Each annunciator shall be complete with an integral flasher unit. Alarm logic, such as for the flasher, shall be solid state. The flasher shall not occupy a designated alarm module, i.e., if twelve alarm positions are shown, all shall be useable for alarms.
- I. Unless otherwise indicated, annunciators shall have provisions for an audible alarm and silence upon alarm “acknowledge” condition for possible future addition of an audible alarm.
- J. Each unit shall be complete with “ACKNOWLEDGE” and “LAMP TEST” pushbutton functions, with heavy duty oil-tight pushbuttons mounted adjacent to the alarm windows as shown on the Plans.
- K. Each unit shall be complete with a flush mounted alarm horn mounted adjacent to the alarm windows as shown on the Plans.
- L. Each annunciator shall be equipped with a power monitor relay to monitor the power supply to the unit, complete with a DPDT contact rated not less than 2 amperes at 120 volts for remote connection.
- M. Unless otherwise indicated, annunciators shall operate from 20 volt, 60 Hz supply.
- N. Unless otherwise indicated, annunciators shall be flush panel mounted.

- O. Blank alarm module units shall be fully equipped for alarms, complete with relays and logic.
- P. After power failure all alarm output contacts shall remain in the original positions just before the power failure.
- Q. For uniformity among stations, alarm annunciator shall be Ronan Model X3-1000, Panalarm Series 10, DeLine Model 11, or approved equal.

3.1 INSPECTION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 INSTALLATION

- A. The modification, demolition and installation of the SCADA equipment shall be scheduled to minimize interruption of automatic operation and monitoring of the pumping system. The contractor shall submit a detailed schedule for IDOT's approval
- B. The Contractor shall install the equipment in strict accordance with the approved Shop Drawings and the equipment manufacturer's recommendations
- C. Unload, unpack and transport equipment to prevent damage or loss.
- D. Protect from dust and other harmful materials
- E. The Contractor shall adjust the location of equipment to accommodate the work in accordance with field conditions encountered.
- F. The equipment shall be installed with workspace clearances required by the Code.
- G. The equipment shall be installed to permit maintenance and replacement of parts, and shall be clear of all openings with swinging or moving doors, partitions or access panels.
- H. Mounting Bases for Floor Mounted Control Panel
 - 1. The Contractor shall install each floor mounted control panel on a concrete housekeeping pad of sufficient with an apron as indicated on the Plans. Control Panel CP47 and SCADA Panel SP47 shall be mounted flush with the MCC mounted in the Electrical Room. Housekeeping pad shall be consistent for all equipment mounted adjacent to one another. The equipment shall be of such construction that when it is installed on the concrete pad there are no openings between the top of the pad and the bottom of the equipment.
 - 2. Each foundation shall be level, stable, and compacted to 95 percent Standard Proctor.
 - 3. Entryways or conduit locations shall be in accordance with manufacturer's approved Shop Drawings.

I. Wall Mounted Control Panels

1. Each wall mounted control panel shall be supported and mounted away from the wall with "C" shaped channel. The minimum separation between the equipment and the wall shall be 1 inch.
2. Each control panel shall be mounted with the top a maximum of 6' - 6" above the finished floor

J. Install in accordance with manufacturer's instructions.

K. Replace damaged components as directed by Engineer.

L. Provide all required cables, cords, and connective devices for interface with other control system components.

M. Field signal wiring and cables under this SECTION shall be installed in conduit.

3.3 **INSTALLATION OF INTRINSICALLY SAFE BARRIERS AND RELAYS**

A. Field wiring of intrinsically safe circuits is to be segregated from non-intrinsically safe wiring by use of suitable barriers, separate wireways or trays. Wire insulation to be .010" minimum.

B. Intrinsically safe and non-intrinsically safe connection points should be located sufficiently apart to prevent any possibility of bypassing or miswiring during installation or servicing of equipment.

C. The enclosure shall contain a cautionary statement as follows: "CAUTION: ANY SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY".

D. The device mounting bracket must be grounded to insure intrinsic safety. Resistance between bracket and ground electrode should be below one ohm. refer to Article 250 of the National Electrical Code for methods and practices.

E. Non-intrinsically safe wiring cannot be run in conduit or open raceways together with intrinsically safe wiring.

3.4 **PLC PROGRAM SOFTWARE AND GIP GRAPHICAL SCREEN DEVELOPMENT PHASE**

A. PLC software programming and GIP graphical screen development meetings must be conducted with the IDOT to ensure all operational and maintenance requirements are met. The following meetings are required:

1. Meeting No. 1 – Design Review

a. Meeting No. 1 is to be conducted at an IDOT location. A minimum of (1) 8-hour day must be allotted for this meeting.

b. The meeting is to include, but not limited to the following:

- i. IDOT's presentation of standardized PLC software programming elements
 - ii. An overview presentation of the manufacturer's GIP graphical screens
 - iii. Detailed overview of SCADA and control requirements
 - iv. Detailed overview of operational requirements
 - v. Detailed overview of proposed facility requirements
 - c. IDOT will provide CAD drawings of the project for use in GIP Screen development.
 - d. IDOT will provide electronic copy of programming software of standardized elements for the Contractor to use as a base in his software development.
 - e. The meeting must produce the following documents to aid the GIP screen software development:
 - i. A detailed list of GIP screens that are to be developed
 - ii. A written description of each that is to be developed
 - iii. A general color scheme for graphics
 - iv. Meeting minutes
2. Meeting No. 2 – 35% Design Completion
 - a. Meeting No. 2 is to be conducted at an IDOT location. A minimum of one (1) eight-hour day must be allotted for this meeting.
 - b. Contractor must review all requirements discussed with IDOT during Meeting No. 1.
 - c. The Contractor must present the preliminary PLC software programming. IDOT will provide comments regarding the presented material for incorporation into the PLC programming design. The requirements for Contractor's 90% Design Completion are to be established
 - d. The Contractor must present the preliminary GIP screen graphics. IDOT will provide comments regarding the presented material for incorporation into the GIP design. The requirements for Contractor's 90% Design Completion are to be established.
3. Meeting No. 3 – 90% Design Completion
 - a. Meeting No. 3 is to be conducted at an IDOT location. A minimum of 4 hours must be allotted for this meeting.

- b. Contractor must incorporate all required changes requested by IDOT during Meeting No. 2.
 - c. The level of completion must meet the 90% design requirements established at Meeting No. 2.
 - d. The Contractor must present a demonstration of the actual software operation to IDOT. A minimum of eight copies of the CD containing the software programming as presented in the meeting must be provided to IDOT. IDOT will review the information and provide written comments to the Contractor.
 - e. The Contractor must present a demonstration of the actual operation of GIP graphics to IDOT. A minimum of eight copies of the CD containing the GIP graphical screens as presented in the meeting must be provided to IDOT. IDOT will review the information and provide written comments to the Contractor.
4. Meeting No. 4
- a. Meeting 4 is to be conducted during Factory Acceptance Testing as detailed below.
 - b. Contractor must incorporate all required changes requested by the IDOT during Meeting No. 3.
 - c. The final executable version of the PLC software program must be presented. Upon review by IDOT, minor changes must be allowed during the Factory Acceptance Testing.
 - d. The final executable version of the GIP screen graphics must be presented. Upon review by IDOT, minor changes must be allowed during the Factory Acceptance Testing.
 - e. Contractor must provide detailed minutes of meeting to all individuals whom attended the meetings.

3.5 FACTORY ACCEPTANCE TESTING (FAT)

- B. The assembled control equipment, wiring and connections shall be tested in the factory. A full functional test shall be applied to each control panel. The manufacturer shall demonstrate to IDOT that each panel and/or group of panels properly function as designed and accepted.
- C. The Contractor shall be able to simulate the SCADA system within his facility. Shop testing shall include, but not necessarily be limited to, the following:
 - 1. Manually fill-in required additions to database
 - 2. Manual forcing of outputs

3. Operation of the control programs
 4. Recall of simulated data points on the displays and printers
 5. Recall of all reports with partial fill-in data and manual fill-in data at time of testing
 6. Routing testing of logger, alarm printer and LCD displays based upon manual input data
 7. Change of alarm and limit setpoints, etc., and observation of results
 8. Any additional testing which may be found to be necessary at the time the above is observed.
 9. During the Factory Acceptance Test, minor software adjustments must be finalized and incorporated into the final system.
 10. All necessary contact and analog inputs must be provided to permit satisfactory testing of the above.
- D. The Contractor must provide to IDOT a Factory Acceptance Test Plan and schedule forty-five (45) days before the scheduled Factory Acceptance Test. IDOT will review the Factory Acceptance Test Plan and schedule for content and reserves the right to make changes. The Contractor must provide the Director a copy of the final Factory Acceptance Test Plan and schedule ten (10) working days before the Factory Acceptance Test. The Contractor will be expected to do all necessary pretrial testing and debugging to ascertain that the system is in running order.
- E. At a minimum, the Factory Acceptance Test must allow for two (2) days of testing and review, but may require additional time depending on the results of the testing.
- F. IDOT reserves the right to be present for the Factory Acceptance Testing. The Contractor must include the costs of setting up and performing the test including the cost for transportation and lodging for up to two (2) of IDOT's representatives.
- G. During shop testing, the Contractor shall generate hard copy prints of all reports and graphics, indexes and point I.D.'s on both printer and LCD monitor for submittal, review and correction. A certified letter that the listed shop tests have been performed shall be submitted. IDOT reserves the right to be present when shop tests are run.

3.6 FIELD QUALITY CONTROL

A. Field Service:

1. The control panel equipment manufacturer(s) shall provide a qualified factory trained service engineer to provide technical direction for the installation and final adjustments of the equipment. As a minimum, the following shall be performed:

- a. Inspect wiring, components, connections, and equipment installation.
 - b. Assist in field testing of equipment.
 - c. Install and test SCADA software.
 - d. Install and test SCADA application.
 - e. Report results in writing
2. The service engineer shall certify that the equipment has been installed in accordance with the equipment manufacturer's recommendations.
 3. The service engineer shall be available for a minimum of two, 8-hour working days.

B. Installation and Start-Up:

1. The Contractor shall develop a specific plan for the startup of the new SCADA system and for cutover of control to the new system. No startup or cutover activities shall be performed until the plan has been successfully approved by the Engineer.
2. Coordinate so that all control panels, instrumentation, etc. provided under separate specifications are installed, integrated re ready for field testing.
3. The Contractor shall correct or rectify any deficiencies that are noted during field testing at no additional cost to IDOT.

3.7 SITE ACCEPTANCE TESTING

A. A Site Acceptance Test of the functions, software, and performance shall be conducted after all system elements have been installed and a complete checkout of all I/O points has been completed. The system site tests shall be performed to verify complete operation of the system, requiring a repeat of much of the comprehensive Factory Acceptance Test but with the equipment installed at the permanent sites, and shall include additional tests required to verify field installed equipment, which was not available during the FAT. The SCADA System Provider shall:

1. Verify all the facility installations
2. Demonstrate each functional requirement identified by the specification. This demonstration shall repeat the tests used during FAT, but using real rather than simulated conditions
3. Demonstrate all equipment control functions, including the operation of automatic control strategies. Actuation of field devices shall be closely coordinated with facility operations
4. Verify system performance parameters and system responses under field operational conditions.

5. Verify accuracy of documentation, especially operator's manuals, software documentation, and general system operating instructions
- B. The SCADA System Provider shall provide the appropriate technical representatives for the execution of the Site Acceptance Test. The SCADA System Provider's test support personnel shall be qualified to resolve and correct problems encountered with the system during the tests. In addition to test support personnel, the SCADA System Provider shall provide all test instruments and equipment necessary to troubleshoot any of the SCADA System Provider's proposed system problems encountered. The Engineer reserves the right to increase the requirements for test support personnel if support by the SCADA System Provider is inadequate.
- C. Final Acceptance Testing
1. Satisfactory operation of the work by IDOT shall be interpreted to mean that the work is sufficiently advanced to form a reliable system for system operation; the I/O control loops, software, control programs and peripheral equipment are operating properly; the necessary debugging programs have been performed; data output is reliable and control loops are operational. Equipment which was found to be ineffective or inoperable has been returned or replaced, and checking and calibrating of systems has been completed.
 2. Final acceptance test will be run for 40 days within which cumulative major component down time, consisting of the computer systems and the PLC's, does not exceed 8 hours. Repeat test if 8 hour limit is exceeded.
 3. Written acceptance by IDOT shall be the starting date of the guarantee period.

3.8 TRAINING

A. Operational Training

1. Operator training shall be provided at IDOT's facility concurrently with system installation on a prearranged formalized basis and shall include the necessary training aids in conjunction with actual work on the equipment supplied. Work shall include complete review of all operating and training manuals and physical application.
2. Training shall include operation of the SCADA system, set up the changes of control logic and set points, initiation of diagnostic routine, set up and revisions of graphic and report format, system shutdown and restart, etc. It shall also include care, maintenance and tuning of the monitor and screens.
3. Upon completion of this program, the operators shall be capable of operating the processor equipment, peripherals and I/O equipment to monitor and control the process, system shutdown and restart, diagnose system failure and to initiate routine switch over procedures and component replacement.
4. This training shall consist of a minimum of two (2) 3 day (8 hours per day) classes for 2 persons in each class. Training manuals shall be provided.

B. Programming Training

1. The Contractor shall make arrangement for two persons from IDOT District 1 to attend software manufacturers' regular programming classes held by the manufacturers or their representatives. The class shall not be less than 1 week for SCADA GIP software and 1 week for PLC programming (Allen-Bradley PLC). The training course fee shall be paid for by the Contractor. The manufacturer shall have regular training facilities within 40 miles of the Pumping Station.

C. Maintenance Training

1. The Contractor shall provide two 1-day on-site maintenance training classes for 2 persons in each class. The maintenance training may be combined with the OPERATOR TRAINING.

END OF SECTION 40 94 23

DIVISION 40

SECTION 40 94 24 – HMI IMPROVEMENTS

PART 1 - GENERAL

1.1 SCOPE OF SERVICES

- A. The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all SCADA SYSTEM described herein.
- B. The proposed Pump Station SCADA System shall be remotely monitored at District 1 Headquarters and the Electrical Maintenance Facility via Ethernet network and telephone communications. Each location currently monitors the current pump station, as well as, the other IDOT pump stations. Currently, Allen Bradley RSView is the Human Machine Interface (HMI) software that is installed at the workstations at these locations and is the means in which the operators monitor the pump stations.
- C. The work under this section includes the software development, installation, integration and testing of the HMI screens for the proposed pump station at both locations. IDOT's Electrical Maintenance Contractor shall be responsible for performing the work.
- D. Contractor is responsible for all necessary coordination with the Electrical Maintenance Contractor required for ensuring the proper functioning of the remote monitoring systems.

1.2 RELATED SECTION

- A. Section 40 94 23 – SCADA System

1.4 SUBMITTALS

- A. Submit product data, shop drawings, project documentation, O & M Data and record documents in accordance with the provisions of Section 1A and the following specific information.
- B. Copies of the following Product Data shall be provided to the EMC so that the makeup of the SCADA system can be understood and all PLC data points can be identified for development of the HMI software.
 - a. Bill of Material: List all the materials and equipment to be furnished. Tag number, manufacturer's complete catalog number, service, location, and cross-reference numbers of instruction sheet, specification data sheet and wiring diagram shall be included under each item.

- b. Specification Data and Drawings: Furnish instrument specification data sheet as per ISA standard instrument specification form, if applicable, wiring and/or connection diagram, outline dimensions, installation diagram and manufacturer's catalog for each instrument. A common set of drawings with setting and/or scale individually listed may be furnished for instruments with identical specification except setting and/or scale.

C. System Diagrams

- a. Instrument Loop Diagram: Show all analog and digital loops for all instrument sensors, secondary instruments, I/O functions, alarms, control and displays using ISA standard symbols per ISA Standard S5.4.
- b. SCADA System Block Diagram: Show system hardware configuration and identify model numbers of each system component.

D. Software Documentation

- a. Submit system software, application software, graphic pages and report forms in prints. Software, application programs, ladder diagrams and control logics shall also be submitted in 740MB CD-R.

E. Instruction Manuals

- a. Submit instruction manuals covering installation, operation, calibration, maintenance, diagnostic and repair for all hardware and software.

F. Record Documents

- a. Accurately record actual calibration setting and scales of instruments.

1.5 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be paid for under Article 109.04 of IDOT's Standard Specifications for Road and Bridge Construction.

END OF SECTION 40 94 24

DIVISION 41 – MATERIAL PROCESSING & HANDLING EQUIPMENT

SECTION 41 22 13 – BRIDGE CRANE

PART 1 - GENERAL

1.1 DESCRIPTION

A. SCOPE

1. This section specifies bridge cranes and hoisting equipment.
2. Runway beams and rail are part of the building steel package and are not included in this section.

B. CRANE SUMMARY

Span:	11 Ft.
Capacity:	2 Tons
Crane type:	Single girder, under running

CLASSIFICATION: CRANE SHALL BE DESIGNED AND CONSTRUCTED TO CMAA SPECIFICATION AS APPLICABLE, "CLASS 1, DIVISION 2, GROUP D, HAZARDOUS LOCATION.

Crane speed:	Single Speed
Crane drive:	Dual motor drive
Trolley speed:	Single Speed
Trolley drive:	Motorized
Hoist speeds:	Single Speed
Hoist type:	Electric wire rope
Hoist lift required:	35 Ft. minimum
Control:	Pendant from independent track on bridge

C. WORK INCLUDES THE FOLLOWING:

1. Detailed design of completed crane system, including bridge, end trucks, trolley, hoists, cabling, controls, and all appurtenances specified hereinafter.
2. Shop drawings.
3. Fabrication of a complete crane.
4. Inspection and shop testing.
5. Documentation and schedules.

1.2 REFERENCE STANDARDS

- A. Equipment furnished under this section shall comply in all respects with the requirements of the following standards:

1. OSHA - Occupational Safety and Health Administration: Part 1926.554 - Overhead Hoists, Part 1910.179 – Overhead and Gantry Cranes.
2. CMAA Crane Manufacturer’s Association of America:
 - a. Specifications for Under Running Single Girder Electric Overhead Cranes Utilizing Under Running Trolley Hoist - No. 74 (2004)
3. ANSI / ASME - American National Standards Institute / American Society of Mechanical Engineers
 - a. ANSI / ASME HST-4 – 1999 Performance Standard For Overhead Electric Wire Rope Hoists
 - b. ANSI / ASME B30.16 – 2007 Overhead Hoists (Underhung)
 - c. ANSI / ASME B30.2 - 2011 Overhead and Gantry Cranes (Top Running Bridge, Single Or Multiple Girder, Top Running Trolley Hoist)
 - d. ANSI / ASME B30.11 – 2010 Monorails and Underhung Cranes
 - e. ANSI / ASME B30.17 – 2006 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)
4. NEMA - National Electric Manufacturer’s Association (NEMA 7)
5. NEC - National Electric Code – Latest Edition Article 100, Article 240-1, Article 430-31, Article 430-51, Article 610-1, Article 610-31

1.3 SUBMITTALS

A. SHOP DRAWINGS AND EQUIPMENT DATA

1. Manufacturer’s catalog data for hoist.
2. Dimensional drawings and details for bridge crane system.
3. Wiring schematics. – ship with crane

B. OPERATIONS AND MAINTENANCE MANUALS (one set of Owner’s manuals in paper and on CD rom)

1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, and maintenance instructions.
3. Lubrication and maintenance instructions.
4. Guide to “troubleshooting”.

5. Parts list.
6. As-built drawing.
7. Test results.

1.4 APPLICABLE STANDARDS

- A. Contractor shall adhere to OSHA, state, and local safety guidelines, laws, rules, and regulations.
- B. Contractor shall conform to all applicable ANSI, CMAA, and HMI specifications and/or standards.
- C. Comply with CMAA specifications, as applicable.
- D. Long lead items include hoist, end trucks, drives and controls. Steel will not be ordered until shop drawings and submittals have been approved by the A/E.
- E. All electric equipment shall be UL labeled.

1.5 WARRANTIES

- A. Provide one-year equipment warranty

1.6 BASIS OF PAYMENT

- A. Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, BRIDGE CRANE.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Bridge crane package systems shall be provided by:
 1. CM HOIST – YALE
 2. ACCO WRIGHT
 3. DETROIT HOIST
- B. Hoist shall be Yale Americas electric wire rope type or approved equal.
 1. CM HOIST – YALE
 2. ACCO WRIGHT
 3. DETROIT HOIST

2.2 MATERIALS

<u>Components</u>	<u>Material</u>
Runway Beams	Steel, ASTM A36 or A992
Bridge beams	Steel, ASTM A36 or A992
End trucks	Steel, ASTM A36 (or equal)
Trolley	Steel, ASTM A36 (or equal)
Wheels	Bronze – spark resistant
Hooks	Forged steel

2.3 EQUIPMENT

A. HOIST AND TROLLEY

Hoisting motor(s) shall be totally enclosed with protection and minimum insulation meeting requirements for Class 1, Division 2, Group D hazardous locations Klaxon type bimetal switch for thermal protection.

1. The hoist shall be equipped with an electro-mechanical load-limiting device that shall prevent lifting more than 110% of the rated load.
2. Hoist and trolley motors shall be per 1.1B above, as applicable.
3. Hoisting motor(s) shall be single speed.
4. Trolley shall be furnished with an single speed control for smooth operation.
5. Trolley motors shall be inverter duty motors with minimum insulation and motor enclosures to meet the requirements listed above.
6. Rotary cam type limit switch equipped with 4 micro-switches shall be provided. Limit switch shall provide upper and lower limit of hoist travel, hoist slow down prior to reaching upper limit and phase sequence supervision at upper limit. An additional block operated limit shall be included.
7. Hoist motor brake shall be DC disc type with adequate torque to stop and hold over 125% of the hoist rated load.
8. Large diameter rope drum with a minimum of 36:1 drum to wire rope diameter ratio. Groove depth shall be at least 35% of rope diameter. The rope drum shall be equipped with a rope guide to help keep the rope aligned in the grooves of the drum.
9. Wire rope shall be constructed from stainless steel having a minimum safety factor of 5.
10. Hoist reeving shall be double reeved. Lateral hook drift shall not exceed 1/8 inch per foot of vertical travel on double reeved models.
11. The hoist nameplate is to carry a US rating. The actual hoist control enclosure rating shall be at least equivalent to NEMA 7 type.

12. Hooks shall be made of forged alloy steel and shall be fitted with a spring-loaded flipper-type safety latch. (Spark Resistent)
13. Hoist shall have a duty rating suitable for the load class and load cycles of the application.
14. AGMA quality class 12 machine cut, hardened and precision ground hoist gearing. The gears inside the hoist gearboxes on models up to 5 ton capacity are lubricated by semi-fluid grease. On models over 5 ton capacity the gears inside the hoist gearbox are lubricated with semi-fluid grease or oil.
15. AGMA quality class 10, hardened and precision ground trolley drive gearing, lubricated by semi-fluid grease.
16. Trolleys shall have safety drop lugs and energy absorbing bumpers.

B. RUNWAY BEAM

1. Runway Beam shall be designed and provided by the Bridge Crane Manufacturer per 1.1B above.
2. Runway beams and Bridge girders shall be constructed from welded box girders or Structural beams, Steel, ASTM A36 or A992, as required.

C. END TRUCKS AND BRIDGE DRIVE

1. End trucks shall be designed in accordance with CMAA specifications as applicable.
2. End trucks shall be bolted to runway beam.
3. Bridge drive shall be dual-motor (A-4 arrangement per CMAA).
4. Bridge drive shall be designed to stop the bridge within CMAA specifications.
5. End trucks shall be equipped with rail sweeps and energy-absorbing rubber bumpers.
6. Travel limit switches to be provided as necessary for safe operation.
7. Bridge shall be furnished with a single speed control for smooth operation.
8. Bridge motors shall be inverter duty motors with minimum insulation and motor enclosures to meet the requirements of Class 1, Division 2, Group D, hazardous locations.

9. AGMA quality class 10, hardened and precision ground bridge drive gearing, lubricated by semi-fluid grease.

D. POWER SUPPLY

1. Power supply for the hoist shall be 480 volt, 3 ph., 60 Hz. All power required for the operation of the hoist, trolley, and end trucks shall be developed from this source and meet NEMA 7 requirements.
2. Runway electrification shall be 4-bar safety type rigid conductors as manufactured by Insul-8, Duct-O-Wire Company or Wampfler and meet NEMA 7 requirements.. Wall mounted disconnect switch and power to runway conductors provided by Electrical Contractor.
3. Cross bridge electrification shall be flat cable style festoon system with terminal box, multi-conductor cord, plug connectors (when available) and accessories and meet NEMA 7 requirements.. Cables are to be hardwired when plug connectors are not available.

E. CONTROLS

1. The following controls shall be used as applicable:
 - a. Six-way operation, plug-in pushbutton pendant suspended from independent festoon track.
 - b. Pendant shall include Start (momentary) button and Emergency Stop (push to maintain, turn to release) that controls a mainline contactor in the bridge control panel.
 - c. Pushbutton shall be clearly marked with hoist, trolley and bridge travel directions.
 - d. Hoist shall be 2 speed magnetic reversing type (standard) and the trolley and bridge controls shall be variable frequency inverter control (standard), as required per section 1.01.B.
 - e. Electrical control enclosures shall be NEMA 7 type. Pushbutton enclosure shall have a rating of NEMA 7.

F. LABELING

1. Hoist and bridge beam shall be labeled with load rating.
2. A corrosion-resistant nameplate shall be fixed to the bridge with the following information:
 - a. Name of manufacturer
 - b. Mfg.'s model number and serial number
 - c. Capacity
 - d. Date of manufacture (month and year)
 - e.

G. PAINTING

1. Hoist and trolley shall be factory painted (2-part epoxy) per manufacturer's standards.
2. Bridge shall be shop cleaned, primed, and painted per manufacturer's standards.
3. The following items shall not be painted:
 - a. Rail surfaces in contact with wheels
 - b. Wheel running surfaces
 - c. Hoist wire rope
 - d. Conductor bar, festoon cables and supports

PART 3 – EXECUTION

3.1 INSTALLATION AND INSPECTION

- A. Inspect structure and crane rail erection for conformance with reviewed shop drawings and contract documents prior to installation of equipment. Bring nonconforming work to the attention of the customer prior to proceeding with crane installation. Non-conforming runway structure or installation must be corrected prior to load testing of crane system. Costs of delays or additional work due to nonconforming runway structure will be reimbursed by the Owner.
- B. Bridge crane shall be installed in conformance with manufacturer's instructions and inspected by a manufacturer's representative. Provide all necessary accessories to make bridge crane complete, usable, and capable of meeting the operating requirements specified in the Operating Requirements. Test, adjust and clean equipment for acceptance by Owner.

3.2 TESTING

- A. All crane equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the bridge and trolley to determine that the equipment shall perform smoothly and safely and that pendant cable length is sufficient to permit operation from desired floor levels. All tests shall be carried out with the bridge crane equipment loaded at 125 percent of capacity. The bridge crane provider shall provide the test weight loads. Any defects shall be corrected by the bridge crane provider without any expense to the Owner.

3.3 USE BY CONTRACTOR

- A. If crane is used by the Contractor, it shall be repaired, repainted, and otherwise refurbished to like new condition prior to its acceptance. The Contractor assumes all responsibility for operation and maintenance until the crane has been accepted by Owner.

3.4 CLEANUP

- A. Upon completion of work, area shall be cleaned and restored to original condition, acceptable to the Owner.

END OF SECTION 41 22 13

DIVISION 43 – LIQUID HANDLING EQUIPMENT

SECTION 43 01 50 – GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work under this section is subject to requirements specified under Divisions 1 of these Project Documents. The provisions of this section apply to all other sections under Divisions 22, 23, 33, 43, and 46.

1.2 CODE REQUIREMENTS

- A. All work, equipment, and material included under these Specifications shall conform to the requirements of the ordinances and codes having legal jurisdiction. The complete installation shall comply with all applicable National Fire Codes, UL Requirements, and State of Illinois Codes.

1.3 PERMITS AND FEES

- A. All permits, governmental fees, and licenses shall be secured and paid for as specified in Divisions 1. All other deposits, fees and inspection costs pertaining to installations and work shall be included under the respective section for Divisions 22, 23, 33, 43, and 46. Due and proper notice shall be given to the Engineer and all authorities concerned for required inspections.

1.4 COMPARISON OF DRAWINGS WITH CONDITIONS

- A. The Drawings accompanying these Special Provisions are design drawings and generally are diagrammatic. They do not show the exact location of the equipment. Some field adjustment may be required to fit equipment, piping, pumps, etc., to actual conditions encountered in the field.

1.5 MATERIALS, EQUIPMENT AND WORKMANSHIP

- A. All equipment and materials shall be of the best quality and shall bear the manufacturer's name, trade name and UL label in every case where a standard has been established for the particular material. All materials and equipment shall be installed in a neat, accurate, and workmanlike manner and in conformance with the manufacturers' recommendations. All systems and equipment shall operate within acceptable noise and vibration limits. All equipment shall be inherently safe and all moving parts shall be covered with guards. UL approved and labeled equipment and materials shall be used where applicable. Materials shall have a maximum flame spread of 25 and smoke development of 50.

- B. Performance Specifications take precedence over model numbers.

1.6 EQUIPMENT AND MATERIAL APPROVAL DRAWINGS AND SUBMITTALS

- A. Drawings and material descriptions shall be submitted to the Engineer in accordance with requirements of Division 1 of these Special Provisions as soon as practical after notice to proceed with the work. Submittal shall include the following information:
 - 1. Manufacturer's data sheets on all cataloged items to be used, including cuts, detailed descriptions and necessary shop drawings.
- B. Orders for materials and equipment shall not be placed until approval is obtained from the Engineer in writing. No shop drawings or submittal sheets shall be used in the work which does not bear the review stamp of the Engineer.
- C. Submittals shall meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.7 CUTTING AND PATCHING

- A. All necessary cutting, fitting, repairing, and finishing of new masonry work, metal work, carpentry work, sheet metal work, etc. that may be required for the operations contemplated in this Specification shall be provided by each trade for his respective work. This work shall be done by craftsmen skilled in their respective trades.
- B. No holes or cuts shall be made in structural steel members or in concrete construction without specific approval of the Engineer for each instance.

1.8 PROTECTION

- A. Each trade shall keep its respective duct openings closed by means of plugs or caps to prevent the entrance of foreign matter. All equipment shall be protected as required against dirt, water, freezing, chemical or mechanical damage, both before and after installation. Equipment damaged prior to final acceptance of the work shall be restored to their original condition or replaced by the respective trade.

1.9 GUARANTEE

- A. All material and workmanship shall be guaranteed for a period of one year from date of final acceptance of the work. Guarantee shall include all labor, material, and equipment as required to replace or repair any defects in an approved manner.

1.10 STANDARDS

- A. Wherever a material, article or piece of equipment is identified on the drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Engineer, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Engineer's written approval.
- B. Wherever the following abbreviations are used in these Specifications, or on the Drawings, they are to be construed the same as the respective expressions represented:

MHSWPS	<u>Manual for Highway Storm Water Pumping Station</u>
AASHTO	<u>American Association of State Highways and Transportation Officials</u>
ANSI	<u>American National Standards Institute</u>
ASME	<u>American Society of Mechanical Engineers</u>
ASTM	<u>American Society for Testing and Materials</u>
AWG	<u>American Wire Gauge</u>
AWWA	<u>American Water Works Association</u>
IPCEA	<u>Insulated Power Cable Engineers Association</u>
IES	<u>Illuminating Engineering Society</u>
NEC	<u>National Electrical Code</u>
NEMA	<u>National Electrical Manufacturers Association</u>
NESC	<u>National Electrical Safety Code</u>
UL	<u>Underwriters' Laboratories</u>
HIS	<u>Hydraulic Institute Standard</u>
FM	<u>Factory Mutual</u>

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers

SMACNA Sheet Metal and Air Conditioning Contractors' National Association

1.11 PROTECTION OF STRUCTURES AND EQUIPMENT

- A. Where permanent equipment called for under this Contract is installed before the erection of adequate protective structures, the Contractor, without additional compensation, shall provide approved effective and durable covers for the purpose of protecting such equipment against damage from the elements for any other cause.
- B. All mechanical and electrical equipment shall be coated, wrapped, and otherwise protected from snow, rain drippings or any sort, dust, dirt, mud and condensed water vapor during shipment, storage, installation and at all other times prior to use in service. Full details of proposed protective measures shall be submitted for approval to the Owner.
- C. Shipment to the job site of any mechanical and electrical equipment except as noted shall not be made until all roof structures and all other structural concrete work, including stripping of forms, has been completed.
- D. Storage of any equipment out of doors at any time other than in transit is absolutely prohibited regardless of the protection furnished. Should storage of equipment become necessary, storage shall be in a weatherproof warehouse. Any cost for equipment protection, warehousing or other work to meet the scheduled completion date shall be deemed to be included under the Contract with no additional payment.
- E. All structures, machinery, equipment, piping, electrical conduit, wiring and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury in performance of work under this Contract. The Contractor will be held responsible for any such damage or injury resulting from his operations and shall repair such damage immediately and to the satisfaction of the Superintendent.

1.12 MEASUREMENT AND VERIFICATION

- A. The Contractor shall examine the Plans and Specifications of each trade and familiarize himself with all job requirements.
- B. The Contractor shall field determine all measurements and construction requirements. Failure to be so informed about the requirements of all Contracts shall not be cause for extra compensation.

1.13 APPROVALS AND SUBSTITUTIONS OF MATERIALS OR SYSTEMS

- A. Materials, systems, and equipment shall be as indicated. Equipment, materials, or systems listed as approved substitutes may be used, but they must be equal in all respects as to performance, capacity, size, accessories, construction, etc. Any change in piping, wiring, mounting, engineering, drawings, etc., necessary because of a substitution shall be done by the Contractor making substitution at no extra cost to the Owner, or other Contractors.
- B. All systems, equipment, and materials shall be of the type and quality herein specified. Should equipment of lesser cost than that herein specified be proposed by the Contractor and be acceptable to both the Owner and Engineer, a corresponding credit shall be granted by the Contractor to the Owner.

1.14 SHOP DRAWINGS

- A. The Contractor shall submit to the Engineer for approval, a complete list of manufacturers of equipment proposed for the work. After receiving approval on the equipment manufacturers, this Contractor shall submit without delay or five (5) copies each of drawings or cuts of all equipment and accessories for the approval of the Engineer.
- B. Such submittals must contain outline dimensions, operating clearances and sufficient engineering data to indicate substantial compliance with the Project Documents, and to describe departures, if any.
- C. The Contract Plans contain information to a degree of detail which is considered to be both consistent with their scales and adequate to accomplish their purpose. Beyond this point they are diagrammatic. Where the equipment furnished differs materially from that indicated on the Contract Drawings, where indicated, or where the Contractor considers additional detail of shop drawings essential to the proper fabrication or installation of equipment, he shall prepare such drawings from field measurements and submit for approval. Approval granted on shop drawings is rendered as a service only and shall not be considered as a guarantee of measurements of building conditions; nor shall it be construed as relieving the Contractor of basic responsibilities under the Contract. Refer to other Specifications for additional shop drawing requirements.
- D. The General Contractor and each Specialty contractor involved shall approve shop drawings before submittal. No shop drawings will be reviewed by the Engineer unless the Contractors state that the equipment will meet space requirements and contract requirements.
- E. All drawings shall be 8½ x 11 or the size of the Engineering drawings.

1.15 COORDINATION

- A. The prime Contractor shall be responsible for coordination. Each Contractor shall cooperate with all other Contractors and subcontractors performing work on this project and, to that end, shall consult the drawings and Specifications for all trades to determine the nature and extent of work by others which adjoins or attaches to his work or to which his work attaches or joins. Cost of repairs or alterations of work in place made necessary by failure to observe this requirement will be charged to the Contractor so failing. Contractor shall refer to all drawings for dimensions, elevations, construction characteristics, layout, door swings, and general building items and equipment. All discrepancies shall be reported to the Owner as soon as the discovery is made and prior to commencing any of the affected portion of work. The Contractor shall be responsible for all his work fitting in place in approved, satisfactory, and workmanlike manner.
- B. Each Contractor and subcontractor shall confer with other Contractors and subcontractors at the site to coordinate his work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum head room and clearance may be obtained. Thermostat locations shall be confirmed. In the event that interferences develop, the Superintendent's decision will be final as to which trade shall relocate its work, the moving of pipe, ductwork, conduit or equipment to clear such interference at no extra cost.
- C. The Contractor and subcontractor shall cooperate with and assist other Contractors and subcontractors on the job in conformity with all trade jurisdictional rulings. He shall perform all work covered by the drawings and Specifications, which properly comes under the jurisdiction of the trade he represents, and shall include such work of other trades as is incidental to his work, or is specified to be included in his Contract. Where jurisdictional rules require the assistance of mechanics of one trade in the handling of equipment furnished by others or in the work of other trades, each Contractor shall provide such assistance.
- D. The Contractor under this section of the Specifications shall be responsible for the location and sizes of all openings in the floor slab and walls.

1.16 SPECIFICATIONS AND PLANS

- A. The Plans and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is a discrepancy between the Drawings and Specifications as to the quantity or quality to be provided, the greater quantity or better quality shall be provided.

1.17 TESTING

- A. All mechanical equipment and systems shall be adjusted and tested. The Contractor shall adjust, repair or replace faulty or improper mechanical work or equipment discovered during testing.
- B. Tests may be made progressively as portions of the work are complete.
- C. Tests shall be made in the presence of the Engineer.
- D. A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted for the record.
- E. The Contractor shall perform all tests necessary to assure proper functioning of materials and equipment. Specific special required tests shall be as described in individual equipment specifications, however, the absence of a specific test requirement does not relieve the Contractor from responsibility to adequately test the equipment and systems for proper operation.
- F. Except where otherwise specifically indicated, testing must be complete prior to final inspection. All instruments, tools, etc., required for the tests shall be provided by the Contractor. Additional testing may be requested by the Engineer during final inspection to spot-check test results or to demonstrate proper functioning of the systems. These tests shall be performed by the Contractor at no additional cost.

1.18 RECORD DRAWINGS

- A. Alterations and additions to the mechanical installation depicted on the contract drawings made during the execution of the work shall be neatly and plainly marked in red on a set of Record Drawings kept at the contractor's field office for the project. These drawings shall be updated as the work progresses and shall be available for inspection during the course of the work.
- B. Record Drawings shall be prepared and submitted in accordance with Division 1.

1.19 DATA TO BE FILED WITH THE OWNER

- A. Certain data, as specified herein, shall be furnished to the Owner when installation and testing are complete, before final acceptance.
- B. The data shall be compiled in 8-1/2 x 11-inch format in high-quality heavy-weight, hard cover binders with piano-style metal hinges or in an alternate approved format. Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders.

The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled.

- C. Four sets of the data files shall be provided.
- D. As a minimum, the data files shall include a table of contents, final approved shop drawings and product data for all equipment and materials, the manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer. All data shall be neat and clearly legible. The table of contents and tabulations of set points and other recorded test data shall be typed. Sloppy, illegible, inaccurate, or incomplete data will not be accepted.

1.20 MAINTANENCE

- A. During the course of the construction work and until final acceptance, the Contractor shall be responsible for maintenance and operational integrity of the facility as specified in Division 1.

1.21 FINAL ACCEPTANCE

- A. When the work is complete, tested and fully operational, and only after the Record Drawings have been reviewed and accepted, the Contractor shall schedule a Final Acceptance Inspection with the Engineer.
- B. The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall

END OF SECTION 43 01 50

DIVISION 43 – LIQUID HANDLING EQUIPMENT

SECTION 43 20 10 – VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section includes the furnishing and installation of all valves and miscellaneous piping appurtenances as shown on the Drawings and as specified herein.
- B. All valves shall be furnished and installed complete and operable at the locations and configurations indicated on the Drawings.
- C. Performance tests on all valves shall be performed in accordance with the guidelines set forth in this section.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Section 09 91 00: Painting
- C. Section 33 40 10: Interior Pipe and Appurtenances
- D. Section 33 40 20: Pipe Hangers and Supports
- E. Section 33 40 30: Pipe Specialties
- F. Section 43 01 50: General Mechanical Provisions
- G. Division 26: Electrical

1.3 REFERENCES

- A. Gate Valves shall meet the requirements of AWWA C500, and as supplemented herein.
- B. Swing Check Valves shall meet the requirements of AWWA C508, and as supplemented herein.

1.4 QUALITY CONTROL

- A. All valves, operators, and appurtenances shall be furnished by an established and reputable manufacturer with 5 years of experience in manufacturing of valves for water/wastewater.
- B. All equipment shall be new, of first class materials and construction, and guaranteed to perform the service required. Equipment shall conform to the Special Provisions, and shall be the product of the listed manufacturer, or similar and equal thereto, as approved by the Engineer.
- C. All valves of the same type shall be from the same manufacturer. Parts of valves of the same type and size shall be interchangeable.

1.5 SUBMITTALS

- A. The Contractor shall prepare and submit, for approval, drawings and details of the valves, operators and miscellaneous piping appurtenances that demonstrate the equipment being submitted complies with this Specification, including the following items:
 - 1. Installation instructions, manufacturer's product data, assembly views, lubrication instructions, and replacement parts list.
 - 2. Certified drawings indicating materials of construction.
 - 3. Painting Procedures.
 - 4. Operation and Maintenance manuals.
- B. Warranties shall be provided from the manufacturer for a period of five (5) years after the date of final acceptance and shall extend to the Owner.
- C. In addition to the requirements of Paragraph A above, valve actuators shall require the following additional submittal information:
 - 1. Actuator and motor shop test results.
 - 2. Schematic control and power wiring diagrams.
 - 3. Torque settings.
 - 4. Certification for the manufacturer that the actuator is suitable for the service conditions specified and indicated.

- D. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.6 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All valves shall have non-rising stems, unless otherwise shown or specified. All valves shall open when the handwheel, chainwheel, or operating nut is turned counterclockwise. Each operator shall be marked with an arrow and the word "Open". Provide operator types and configurations as indicated on the Project Drawings for gate and knife gate valves.
- B. End connection of valves shall be as indicated on the Project Drawings.

2.2 FLANGES

- A. Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Flanges shall be faced and drilled and shop coated with a rust preventive compound before shipment.
- B. Dimensions and drillings of flanges shall meet the requirements of ANSI B16.1, Class 125, unless otherwise specified or indicated on the Project Drawings. Special drillings shall be provided where required.
- C. Flanges shall meet the requirements of Section 33 40 10, Interior Pipe and appurtenances.

2.3 GATE VALVES

- A. Interior gate valves shall be provided with flange connections, installed as shown on the Project Drawings and in accordance to the requirements of Section 33 40 10.
- B. Valves shall be non-rising stem type, manufactured in accordance with AWWA Standard C515. Valves shall have clear waterway equal to the full nominal diameter of the valve. Valves shall be resilient wedge type, with arrow cast into operating nut or handwheel to indicate direction of opening.

- C. The valve bodies shall be cast iron meeting the requirements of ASTM A126 (Class B) or ductile iron meeting the requirements of ASTM A536, mounted with non-corrosive metals. All wearing surfaces shall be bronze or other approved non-corrosive material and there shall be no moving bearing or contact surfaces of iron in contact with iron.
- D. Wedge shall be cast iron or ductile iron totally encapsulated within molded rubber.
- E. Valves 14" and larger installed with the stem horizontal shall be equipped with bronze rollers, tracks, and scrapers if recommended by the manufacturer.
- F. Each valve shall have the manufacturer's name, pressure rating, and year in which manufactured cast on body. Prior to shipment from the factory, each valve shall be hydrostatically shell tested at a pressure of 400 psi in sizes 12" and smaller, and 300 psi in sizes 14" and larger. In addition, each valve shall be hydrostatically seat tested at a pressure of 200 psi in sizes 12" and smaller, and 150 psi in sizes 14" and larger.
- G. Gate valves shall be manufactured by the Clow Valve Company, Mueller, or approved equal.

2.4 KNIFE GATE VALVES

- A. Knife gate valves shall be rising-stem, bonnetless, wafer type made with a cast iron body.
- B. Flanges shall be drilled and tapped in accordance to ANSI B16.5, Class 150 and MSS SP-81.
- C. All wetted parts and the valve stem shall be 304 or 316 stainless steel. Stainless steel liner shall extend through the valve chest to the top of the packing gland.
- D. The valve gate shall be suitable for a 0 psi to 150 psi pressure differential.
- E. Valve shall have a round port with a replaceable EPDM resilient seat interlocked by a stainless steel retaining ring. The retaining ring shall act as a wiper blade to clean the gate before it passes over the seat. The resilient seat shall be captured and locked into place on three sides only exposing one surface for sealing. The seat shall be raised with a relieved area around the seat to prevent jamming.
- F. Valve port shall be full diameter port with no guides or wedges obstructing the port flow area.
- G. All ductile iron surfaces (interior & exterior) shall be coated with an epoxy coating per Section 09 91 00.

- H. Operators shall be handwheel or chainwheel type as indicated on the Project Drawings. Handwheels shall have a diameter of 16" (maximum).
- I. Knife gate valves shall be manufactured by Red Valve, or approved equal.

2.5 SWING CHECK VALVES

- A. Check valves shall be of swing type and shall meet the material, design, and testing requirements of AWWA C508. The valves shall have ductile or cast iron bodies and be rated for a working pressure of 200 psi for valves 12" and smaller, and 150 psi for valves 14" and larger.
- B. Swing check valves shall be installed at the pump discharge lines, opening to allow flow when the pump starts and providing a tight seal in the shut-off position.
- C. The valve shall be so constructed that by simply unbolting and lifting off the cover, the internal working parts may easily be removed and replaced without removing the valve from the line. The valve shall be furnished with outside lever and weight.
- D. Check valves shall be suitable for mounting in horizontal lines or vertical lines when flow is up.
- E. Check valves shall have stainless steel hinge pins conforming to ASTM A276 CR304, which operate in a bronze support bearing.
- F. Disc material shall be ductile iron conforming to ASTM A536 with a Buna-N disc seat.
- G. Valve seat material shall be bronze conforming to ASTM B62 or B148.
- H. Swing check valves shall have an air cushion system to minimize the slamming shut of the valve. The air cushion cylinder shall be constructed of bronze or stainless steel components, with the piston totally enclosed within the cylinder and not open at one end. The cushion cylinder assembly shall be externally mounted on the side of the valve body and be adjustable to cushion the closure of the valve. Cushioning shall be by air trapped in the cushion cylinder which shall be fitted with a one way adjustable control check valve to cushion disc contact to the seat at the shut-off point. Swing check valves shall be manufactured by the Milliken Valve Company, APCO Valve, or approved equal.

2.6 ELECTRIC VALVE ACTUATORS

- A. Where indicated on the Drawings, electric valve operators shall be furnished and installed for open-close service.

1. Actuators shall contain electric motor, gearing, manual over-ride, limit switches or sensors, torque switches or sensors, drive coupling, gear case, and automatic declutchable handwheel; as a self-contained unit. All calibration shall be possible without removing any covers and without the use of any special tools.
2. The motor shall be specifically designed for the actuator service and be 120 volts, single phase, 60 hertz. The motor shall be totally enclosed with class F insulation and protected by means of thermal sensors imbedded in the motor windings. Motor enclosure will be totally enclosed, non-ventilated.
3. Motor speed reduction shall be by means of a gear train consisting of hardened steel spur gears and self-locking worm and worm gear set. The worm shall be heat-treated alloy steel and have worm thread surface rolled or ground. The worm gear shall be bronze. Non-metallic gears in the power train are not acceptable.
4. Actuator enclosure shall be NEMA 7X. All external fasteners on the electric actuator will be stainless steel. Fasteners on limit switch and terminal compartments shall be captured to prevent loss while covers are removed.
5. All gearing shall be grease lubricated and designed to withstand the full stall torque of the motor.
6. The actuator shall include an adjustable torque feature to interrupt the motor power circuit if an obstruction is encountered in either direction of travel or when torque seating of valves is required for tight shut-off. The torque limit shall be calibrated to ensure maximum actuator rating is not exceeded.
7. Manual over-ride shall be by handwheel. Manual operation shall facilitate easy change-over from motor to manual operation when actuator is under load. Return from manual to electric mode of operation will be automatic upon motor operation. A seized or inoperable motor shall not prevent manual operation.
8. Position limits shall be mechanically geared and in step with the valve position at all times. Limit adjustment shall not be altered by manual operation. Position indication shall be in step with valve position at all times whether operation is electrically or manually operated.
10. The actuator shall be furnished with integral motor controls with a LCD graphic display or LED lights for displaying mode of operation, position, torque, alarm conditions, and any other appurtenant functions.
11. Electric valve actuators shall be manufactured by EIM Controls, or approved equal.

2.7 AIR/VACUUM RELEASE VALVES

- A. Contractor shall provide air/vacuum valves at pump discharge elbows, as indicated on the Plans, to remove air pockets upon pump start-up as well as allow air into the system when draining.
The air/vacuum valves shall be float operated and capable of automatically releasing air.
- B. Air/vacuum valves shall be manufactured and tested in accordance with AWWA C512.
- C. The diameter of the inlet and outlet shall be as indicated on the Plans, for use within an operating pressure range of 1-150 psig.
- D. Air/vacuum valves shall be installed in a vertical position. A full ported shut-off valve shall be installed below each valve in the event servicing is required.
- E. Aside from inlet and outlet ports, the air/vacuum valves shall have three additional ports for cleaning and backwash.
- F. Air/vacuum valve components shall be of the following materials:
 - 1. Body and Cover – Cast Iron per ASTM A126, Class B
 - 2. Float – Type 316 Stainless Steel
 - 3. Internal Parts – Type 316 Stainless Steel
 - 4. Seal – Buna-N
 - 5. Shut-Off Valves – Full port, bronze bodied as recommended by the manufacturer
- G. Air/vacuum valves shall be specifically designed for wastewater service applications and shall be manufactured by Cla-Val, Val-Matic, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. All valves shall be furnished and installed complete with operators, fittings, and piping as required.

2. Valves shall be installed in the positions indicated on the Drawings consistent with operators as indicated. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain on appurtenances during handling and installation. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.
 3. Valves shall be installed and supported adequately in conformance with the instructions of the manufacturer, and as indicated and specified.
 4. A gasket of uniform thickness shall be provided between flanges of valves in accordance with Section 33 40 10, Interior Pipe and Appurtenances.
- B. Provide the services of factory-trained service technician for valve actuator installations, specifically trained on type of equipment specified. Service technicians shall be required for a minimum ½ person-day per actuator, and be present for the following tasks as recommended by the actuator manufacturer:
1. Functional testing and calibrations.
 2. Field performance testing.
 3. Field operation and maintenance training.
 4. Any additional time required to assist in placing the equipment in operation or to correct deficiencies in installations, equipment or material shall be provided at no additional cost to the Owner.

3.2 TESTING

- A. All valves shall be given a hydrostatic shop pressure test at twice the working pressure specified. The valves shall be tested, first by applying the hydrostatic pressure with the valve open, and then with the valve closed. The valves shall be tight and secure under the test pressure.
- B. Field testing shall be conducted in conjunction with the testing of the piping system in which the valve is installed.

3.3 PAINTING

- A. Valve factory coating for interior and exterior surfaces of the valves shall be Liquid Bonded Epoxy and meet the requirements of the AWWA C550 latest revisions entitled "Protective Interior Coatings for Valves and Hydrants".
- B. Field painting of the valves and miscellaneous piping appurtenances shall be in accordance with the requirements specified under Section 09 91 00, Painting.

END OF SECTION 43 20 10

DIVISION 43 – LIQUID HANDLING EQUIPMENT

SECTION 43 20 20 – HYDRAULIC GATES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall provide all labor, materials, equipment and services required to furnish, install, test and place in satisfactory operation the hydraulic gates and all appurtenances as shown on the Plans, as specified herein or as required for a complete installation.
- B. All gates shall be furnished and installed complete and operable at the locations and configurations indicated on the Drawings.
- C. Performance tests on all gates shall be performed in accordance with the guidelines set forth in this section.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Section 09 91 00: Painting
- C. Section 33 40 10: Interior Pipe and Appurtenances
- D. Section 33 40 20: Pipe Hangers and Supports
- E. Section 33 40 30: Pipe Specialties
- F. Section 43 01 50: General Mechanical Provisions
- G. Division 26: Electrical

1.3 REFERENCES

- A. Fabricated stainless steel slide gates shall meet the requirements of AWWA C561, and as supplemented herein.
- B. Electric motor actuators shall meet the requirements of AWWA C540, and as supplemented herein.

1.4 QUALITY CONTROL

- A. All gates, operators, and appurtenances shall be furnished by an established and reputable manufacturer with five (5) years of experience in manufacturing of gates for water/wastewater.

- B. All equipment shall be new, of first class materials and construction, and guaranteed to perform the service required, and shall be the product of the listed manufacturer, or equal as approved by the Engineer.
- C. All gates of the same type shall be from the same manufacturer. Parts of gates of the same type and size shall be interchangeable.

1.5 SUBMITTALS

- A. The Contractor shall prepare and submit, for approval, drawings and details of the gates, operators, and miscellaneous appurtenances that demonstrate the equipment being submitted complies with this Specification, including the following items:
 - 1. Installation instructions, product data, detailed assembly drawings with dimensions, and replacement parts list.
 - 2. Certified drawings indicating materials of construction, including the material thickness of all structural components.
 - 3. Maximum bending stress and deflection of the gate under the maximum design head.
 - 4. Painting procedures where applicable.
 - 5. Operation and maintenance manuals.
 - 6. Design load calculations for deflection at maximum design head.
 - 7. Calculations indicating lifting force required to lift the gate.
- B. Warranties shall be provided from the manufacturer for a period of five (5) years after the date of final acceptance and shall extend to the Owner.
- C. In addition to the requirements of Paragraph A above, electric gate operators shall require the following additional submittal information:
 - 1. Operator and motor shop test results.
 - 2. Schematic control and power wiring diagrams.
 - 3. Operational settings.
 - 4. Certification for the manufacturer that the actuator is suitable for the service conditions specified and indicated.

- E. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.6 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All gates shall be installed and configured as indicated on the Project Drawings. All gates shall open when the handwheel or operating nut is turned counterclockwise. Each operator shall be marked with an arrow and the word "Open".

2.2 SLIDE GATES

- A. Design

- 1. Side gates shall be fabricated stainless meeting the requirements of AWWA C561, with leakage not to exceed 0.05 gpm/ft of wetted seal perimeter in seating head conditions and 0.10 gpm/ft in unseating head conditions.
- 2. Slide gates shall be able to withstand seating and unseating heads to a maximum of 20.0 feet.

- B. General

- 1. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service. All welds shall be performed by welders with AWS certification. Provide mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All iron and steel components shall be properly prepared and shop coated with a primer.
- 2. Materials of construction shall meet the following criteria:
 - a. Frame and Retainers – Stainless Steel, Type 304L or 316L, ASTM A240
 - b. Slide and Stiffeners – Stainless Steel, Type 304L or 316L, ASTM A240

- c. Stem – Stainless Steel, Type 304 or 316, ASTM A276
- d. Fasteners, Nuts, and Bolts – Stainless Steel, Type 304 or 316, ASTM A276
- e. Invert Seal – EPDM
- f. Seat/Seals and Facing – UHMWPE, ASTM D4020
- g. Lift Nuts – Bronze ASTM B584
- h. Pedestals – Stainless Steel, Type 304L or 316L, ASTM A276
- i. Operator Housing – Cast aluminum or ductile iron

C. Frame

1. The frame assembly, including the guide members, invert member and yoke members, shall allow for embedded mounting, mounting directly to a wall with anchor bolts and grout, or mounting to a wall thimble with mounting studs and a suitable mastic or gasket material. Mounting style shall be as shown on the Project Drawings.
2. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
3. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide member designs where water loads are transferred through the assembly bolts are not acceptable.
4. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts or the wall thimble studs.
5. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position.
6. Rigid top seal members shall be provided across the top of the opening and across the inverts.

D. Slide

1. The slide and reinforcing stiffeners shall be constructed of a flat plate and shall not deflect more than $1/360$ of the span or $1/16$ inch, whichever is smaller, under the maximum design head.

E. Seats and Seals

1. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide. The seat/seals shall extend to accommodate the $1-1/2$ x the height of the slide when the slide is in the fully closed or fully opened position. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate.
2. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
3. All seals must be bolted or otherwise mechanically fastened to the frame or slide. The seals shall be mounted so as not to obstruct the water way opening.
4. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

F. Stem and Guides

1. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 90,000 psi for stems that are 3 inches or less in diameter. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Project Drawings.
2. The operating stem shall transmit in compression at least 2 times the rated output of the manual operating mechanism with a 40-lb effort on the handwheel or crank.
3. Maximum slenderness ratio (L/r) of the stem shall not exceed 200. Stem guides shall be provided as recommended by the manufacturer.
4. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
5. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMWPE or bronze bushings

6. Stem design force shall be no less than 1.25 times the output thrust of the electric valve motor operator.

G. Wall Thimbles

1. The wall thimbles shall be cast iron and supplied by the gate manufacturer, with precautions made to prevent contact between dissimilar metals. Material thickness should be according to the manufacturer's recommendations and be of sufficient resistance to handle the operating forces. The wall thimble depth shall be sized for installation within the concrete wall in which the thimble is to be mounted.
2. A water stop shall be welded around the periphery of the thimble. Wall thimbles shall be designed to allow thorough and uniform concrete placement during installation. A suitable gasket or mastic material shall be provided to seal between the gate frame and the wall thimble.

H. Operating Mechanism

1. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head. Operating mechanism shall be operated with an 18" diameter handwheel.

- I. Slide Gates shall be manufactured by Whipps, or approved equal.

2.3 ELECTRIC MOTOR OPERATORS FOR SLIDE GATES

- A. General: The electric actuator shall include a motor, operator unit gearing, limit switch or sensors, torque switches or sensors, stem nut, automatic declutchable handwheel, and reversing motor starter; as a self-contained unit. The actuator shall meet AWWA C540 specifications. A 3-pole disconnect switch shall be built in the motor starter or furnished with the actuator for field mounting. All calibration shall be possible without removing any covers and without the use of any special tools.
- B. Enclosures: Provide actuator motor and all electrical enclosures NEMA 4X for the outdoor slide gate.
- C. Motor: The motor shall be 460 volts, 3 phase, 60 hertz specifically designed for slide gate operator service and shall be of high starting torque, totally enclosed, non-ventilated construction, with Class F insulation and protected by means of thermal sensors imbedded in the motor windings. The motor shall be easily removed through the use of a plug-in connector and shaft coupling.

The motor shall be of sufficient size to open or close the slide gate from any position and under any condition of operation to which the slide gate may be subjected to. The motor duty rating shall be sufficient for one complete cycle (open-close-open, or reverse) without exceeding its temperature rating and shall not be less than 30 minutes continuous. The motor shall be prelubricated and all bearings shall be of the anti-friction type.

- D. Operator Gearing: The gearing shall provide the capability of changing the output speed with a relatively fast, simple gear change. The power gearing shall consist of spur or helical gears and worm gearing. The spur or helical gearing and worm shall be of hardened alloy steel and the worm gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. All other gears shall be made of bronze or steel.
- E. Position Limits: Position limits shall be mechanically geared or monitored via a position encoder to the drive mechanism. Limit adjustment shall not be altered by manual operation. Position indication shall be in step with the gate position at all times whether operation is electrically or manually operated.
- F. Torque: The actuator shall include an adjustable torque feature to interrupt the motor power circuit if an obstruction is encountered. The torque limit shall be calibrated to ensure maximum actuator rating is not exceeded. The actuator motor shall be shut off in the event that abnormally high torque is realized in either direction of travel.
- G. Manual Operation: Manual over-ride shall be by handwheel. Manual operation shall facilitate easy change-over from motor to manual operation when actuator is under load. Return from manual to electric mode of operation will be automatic upon motor operation. A seized or inoperable motor shall not prevent manual operation.
- H. Provide stem protector for rising stem in suitable length and diameter to allow for full extension of the stem. Stem protector shall couple to the top of the operator by means of a national pipe thread (NPT) and shall be capped and vented.
- I. Hammerblow Device: The control shall have a built-in lost motion device that travels sufficiently enough to allow the motor to reach full speed before imparting a hammerblow to start in motion in either the closing or opening direction. This lost motion device also must permit motor to attain full speed before load is encountered, and load should be shared equally by two lugs cast integrally on the drive sleeve. Lost motion device is not to be provided for those gates used in inching, throttling, regulating, or modulating service.

- J. Controls: The actuator shall be furnished with integral motor controls with a LCD graphic display or LED lights for displaying mode of operation, position, torque, alarm conditions, and any other appurtenant functions.
- K. Temperature: The electric motor operators shall be capable of operating at a minimum ambient temperature of -40^o F without the need of an additional heating source.
- L. Electric motor operators for slide gates shall be manufactured by Limatorque, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All gates shall be furnished and installed complete with operators, fittings, and appurtenances as required and in accordance to the manufacturer's requirements.
- B. Gates shall be installed in the positions and configurations as indicated on the Project Drawings. All material shall be carefully inspected for defects in workmanship and material, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Gates and other equipment which do not operate as designated or are otherwise defective shall be repaired or replaced at the Contractor's expense.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The Contractor shall fill the void in between the gate frame and the wall with non-shrink grout in accordance with the manufacturer's recommendations.
- E. Wall thimbles and anchor bolts to be embedded in concrete shall be placed before the concrete is placed and supported and braced so they will remain in perfect alignment during placing of concrete and thereafter. An improperly placed wall thimble shall be removed and replaced at the Contractor's expense.

3.2 TESTING

- A. After installation, all gates shall be field tested in the presence of the Owner's representative to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured, and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption.

Each gate shall be water tested by the Contractor, at the discretion of the Engineer, to confirm that leakage does not exceed the specified allowable leakage. If leakage exceeds the indicated limits, modifications and corrections shall be made under the supervision of Manufacturer's Representative at no additional cost to the Owner.

- C. Provide the services of factory-trained service technician for all electric gate operator installations, specifically trained on type of equipment specified. Service technicians shall be required for a minimum one person-day per operator, and be present for the following tasks as recommended by the operator manufacturer:
2. Functional testing and calibrations.
 3. Field performance testing.
 4. Field operation and maintenance training.
 5. Any additional time required to assist in placing the equipment in operation or to correct deficiencies in the installation, equipment, or materials shall be provided at no additional cost to the Owner.

3.3 PAINTING

- A. Field painting shall be in accordance with the requirements specified under Section 09 91 00, Painting.

END OF SECTION 43 20 20

DIVISION 43 – LIQUID HANDLING EQUIPMENT

SECTION 43 21 39 – SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work under this Section includes the furnishing and installation of pumping units, base supports and pedestals, base elbows, and any associated items and appurtenances, complete and operational, as specified herein and on the Project Drawings.
- B. Each pump shall be designed as a completely submersible wastewater pump capable of pumping storm water, which may consist of sewage containing solids or fibrous material at the design criteria specified herein.
- C. The Contractor shall install and place in operation each pump provided by the pump manufacturer and shall provide all additional supports, fittings, power and control wiring, and accessories not provided by the pump manufacturer for a complete and functional pumping system. The pumps controls, electrical, SCADA, and piping shall be provided as indicated in other sections of the Special Provisions.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Section 09 91 00: Painting
- C. Section 33 40 10: Interior Piping and Appurtenances
- D. Section 33 40 20: Pipe Hangers and Supports
- E. Section 33 40 30: Pipe Specialties
- F. Section 43 01 50: General Mechanical Provisions
- G. Section 43 20 10: Valves and Appurtenances
- H. Division 26: Electrical
- I. Division 40: SCADA

1.3 QUALITY CONTROL

- A. The pumps furnished under this Section shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.
- B. The manufacturer shall be responsible for the operation and integration of all component parts, whether manufactured by the manufacturer or by third-party vendors. All equipment shall be new and of first class materials and construction, guaranteed to perform the service required.
- C. To ensure that all equipment is properly coordinated and will function in accordance with the intent of these Specifications, the Contractor shall obtain all the equipment specified herein from a pump manufacturer that shall be vested in the responsibility for the proper function of the pumps, including motors and accessories as shown on the Project Drawings and as specified. The Contractor, however, shall retain overall responsibility for equipment and control coordination, installation, testing, and operation.
- D. If the power demand of pumping units proposed to be provided for this Project exceeds the maximum horse power as specified, it is the Contractor's sole responsibility without additional cost to the Owner to upgrade all affected electrical facilities such as, but not limited to, wiring, conduits, motor controls, switchgear, transformers and incoming facilities to be able to operate all the pumping units satisfactorily and to meet the Specifications.

1.4 SUBMITTALS

- A. Submit the following documents:
 - 1. Shop Drawings showing all important details and loads on supporting structures including, but not limited to, the following:
 - a. All dimensions, calculations, and other information to be in USA English units of measure.
 - b. Complete description of all equipment being supplied including capacity, size, and materials of construction.
 - c. Certified shop and installation drawings showing plan, elevation, and appropriate cross sections and views, all details of construction, dimensions, piping connections, supports and spacing, and anchor bolt locations.
 - d. A complete schedule of materials and components.

- e. The weight of each component.
2. Descriptive literature, bulletins, and/or catalogs of the equipment including major subcomponents.
3. Pump/motor performance data including expected performance curves at operating conditions indicating speed, output capacity, total dynamic head, brake horsepower, and efficiency for each design point shown as in this Section.
4. Description of surface preparation and shop prime and finish painting of the equipment.
5. Complete motor data including a performance chart showing curves for torque, current, power factor, input KW, full load amperage, locked motor amperage, maximum one-half cycle inrush starting current, operating point amperage and efficiency. This data shall also include information on starting and no-load characteristics.
6. Data sheets and product manuals for all instrumentation.
7. A list of the manufacturer's recommended spare parts for five (5) years of operation, if any.
8. Manufacturer's certification that all materials to be furnished are in compliance with the applicable requirements of this specification and Division 1.
9. Installation instructions, including storage, handling, installation, and inspection of all equipment furnished under this specification with certification that the equipment is suitable for the installation shown on the drawings and the operating purpose intended.
10. Complete description of the warranty to be provided.
11. Proof that each pump/motor has been certified by UL or equivalently recognized independent testing laboratory for the model and size proposed.
12. Manufacturer's certification that the pump pedestals and supports to be constructed by the Contractor are suitable for the installation and operation of the pumps to be supplied.
13. List of ten (10) installations of submersible pumps, similar in size and design, which are permanently installed and operational.

B. Operating and Maintenance Manuals:

1. All dimensions, calculations, and other information to be in USA English units of measure.
2. Provide a list of components and catalog cuts fully describing all items including, but not limited to, all mechanical, electrical, and structural components:
3. General description of pump with certified performance data, pump curves, and model number.
4. Provide detailed information on structural, mechanical, electrical, or other changes or modifications necessary to adapt non-specified materials to the arrangement or details shown on the Drawings.
5. Mechanical drawings with general arrangement showing equipment dimensions, overall weights, weights of largest components requiring removal for maintenance, and clearances required around unit for maintenance access if applicable.
6. Indicate surface preparation and paint specifications.
7. Description of power and process control logic and process and instrumentation diagrams.
8. All scheduled maintenance requirements and routine inspections. Include maintenance summary forms.
9. A list of recommended spare parts.
10. A troubleshooting guide.
11. A detailed description of available service agreement programs.
12. The local sales representative contact information with the company name, contact person, phone numbers, email address, and physical address.

B. In addition to the normal Operation and Maintenance Manuals, manufacturer shall provide a spare manual (marked preliminary if that is the case) to allow for proper installation and operation prior to release of final Operation and Maintenance Manuals to the Owner.

C. All items required for submittal shall be submitted as a single package.

- D. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.5 MANUFACTURER QUALIFICATIONS

- A. Manufacturers shall have a record of over five (5) years of successful in-service performance for applications of submersible sewage pumps similar of the same type indicated for this project.
- B. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the Drawings and Specifications.
- C. The Contract Documents represent the minimum acceptable standards for the equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the Drawings and Specifications.
- D. The pump manufacturer shall provide the following Certifications:
1. Submit manufacturer's certification that he has carefully examined all of the Contract Documents in detail, including the arrangement and conditions of proposed structures affecting the performance of the pumping equipment units, and the detailed requirements of manufacturing and subsequent installation of the pumping equipment units.
 2. Submit manufacturer's certification that there are no omissions, ambiguities or conflicts in the Contract Documents or in the pumping station piping layout that affect the pumping units, as shown on the Drawings which have not already been clarified in writing by the Owner.
 3. Submit manufacturer's certification that they have reviewed the location and discharge piping design, the discharge valve locations and types, the loads imposed on the pumping units from the connections, the pumping unit locations such as the physical separation to each other and adjacent walls, the water to be pumped, and pumping station piping layout, as shown on the Drawings, and that any incidental modifications thereto will not affect the specified pumping unit performance and efficiency to be furnished under this Contract, and they will be solely responsible for furnishing and delivering pumping equipment that will perform and meet the requirements, as specified in the Contract Documents.
 4. Submit manufacturer's certification that they have inspected the storage of the pumping equipment and find no conditions that have adversely affected the equipment.

5. Submit manufacturer's certification that they have supervised the installation of the pumping equipment and that the pumping equipment has been properly installed.

1.6 WARRANTY

- A. The submersible pumps, including all subcomponents and appurtenances furnished by the manufacturer shall be warranted for a period of three (3) years, on a non-prorated basis, from the **date of final acceptance** under the operating conditions specified and warranted to be free from defects in workmanship, design or material. If the pumps should fail during the warranty period due to a defective part(s), the defective part(s) shall be replaced and the equipment restored to service at no expense to the Owner.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with the warranties made under the requirements of Contract Documents.
- C. Parts availability shall be guaranteed from the manufacturer for twenty (20) years from the date of initial operation. Should replacement parts not be available, the manufacturer must bring the unit to full working condition or replace the failed component with a new unit providing equal performance at no cost to the Owner.

1.7 PUMP OPERATION

- A. Pump operation is described in Division 40.
- B. Contractor shall be responsible to provide fully integrated facilities, which perform as described in this section, on the Drawings, and in other specification sections.

1.8 BASIS OF PAYMENT

- A. The work shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The pumps shall be suitable for installation and operation as indicated on the Project Drawings and as required by the Special Provisions.
- B. The pump units shall be non-clogging, submersible, centrifugal sewage pumps installed vertically in a dry well area as indicated on the Project Drawings.
- C. All components must be listed and labeled by Underwriter's Laboratory (UL) or equivalently recognized independent testing laboratory for operation in a NEC Class 1, Group D, Division II hazardous location. Pumps shall be of explosion proof design.

- D. The equipment shall be suitable for continuous operation in a high humidity environment and at full nameplate load while the motor is completely submerged, partially submerged, or totally non-submerged.
- E. All components shall be current production models.
- F. Pumps shall be manufactured by ITT-Flygt; or approved equal.

2.2 PUMP CHARACTERISTICS

- A. The pumps shall be designed for operation as follows:
 - 1. Pump performance requirements of Main Flow Pump-1, Main Flow Pump-2, and Main Flow Pump-3:

<u>Performance Criteria</u>	<u>Requirement</u>
Capacity at Primary Design Point (gpm)	3,000
Total Dynamic Head (TDH) at Primary Design Point (feet)	27.6
Min. Efficiency at Primary Design Point (%)	70
Min. Wire-to-Water Efficiency at Primary Design Point (%)	64
Capacity at Design Point No. 2 (gpm)	2,000
TDH at Design Point No. 2 (feet)	33.0
Capacity at Design Point No. 3 (gpm)	4,000
TDH at Design Point No. 3 (feet)	21.5
Minimum shut-off TDH (feet)	45
Maximum Pump Speed (rpm)	1,200
Nominal Motor horsepower (hp)	35
Minimum Motor Efficiency at Full Load (%)	87
Frequency (Hz)	60
Minimum Motor Power Factor at Full Load	0.82
Maximum Locked Rotor kVA/hp NEMA code letter	F or G
Pump Suction Diameter (inches)	16
Pump Discharge Diameter (inches)	12
Maximum Height of Installed Pumping Unit (inches)	96

Pump performance requirements of Low Flow Pump-4:

<u>Performance Criteria</u>	<u>Requirement</u>
Capacity at Design Point (gpm)	1,000
Total Dynamic Head (TDH) at Primary Design Point (feet)	32.4
Min. Efficiency at Primary Design Point (%)	73
Min. Wire-to-Water Efficiency at Primary Design Point (%)	65
Capacity at Design Point No. 2 (gpm)	600
TDH at Design Point No. 2 (feet)	44.0
Capacity at Design Point No. 3 (gpm)	1,400
TDH at Design Point No. 3 (feet)	20.0
Minimum shut-off TDH (feet)	60
Maximum Pump Speed (rpm)	1800
Motor horsepower (hp)	15
Minimum Motor Efficiency at Full Load (%)	87
Frequency (Hz)	60
Minimum Motor Power Factor at Full Load	0.78
Maximum Locked Rotor kVA/hp NEMA code letter	G or H
Pump Suction Diameter (inches)	8
Pump Discharge Diameter (inches)	6
Maximum Height of Installed Pumping Unit (inches)	60

- B. Each pumping unit shall be non-overloading throughout the entire operating range and shall have stable head-capacity characteristics so that the pumps shall be capable of operating at the low end of the pump curve without damage to the pump or motor as the head shall continue to decrease with an increasing capacity.
- C. Pump discharge and suction diameters shall be sized in accordance with the dimensions indicated on the Project Drawings.

2.3 PUMP DESIGN

- A. The pump(s) shall be capable of handling storm water at the design parameters indicated in this Section of the Special Provisions.
- B. All pumps shall be furnished with base elbows with 125 point flat face ANSI flanges, meeting ANSI standard B16.1 and in accordance with Section 33 40 10.
- C. Pumps shall be designed for use in a dry well application as indicated on the Project Drawings. Pump shall be of submersible construction with provisions included so that the pump and motor will maintain proper cooling, and will continue to operate satisfactorily should the dry well be subjected to flooding.
- D. A heavy-duty steel base shall be provided for mounting on the pump pedestals as indicated on the Project Drawings. The base shall be designed to support the weight of the pump and motor.
- E. Pumping units shall include suction elbows as indicated on the Project Drawings.

2.4 PUMP CONSTRUCTION

- A. All major pump components, including casing/volute, motor frame, and discharge elbow, shall be manufactured from cast iron, ASTM A-48 (Class 30 or better).
- B. All exposed bolts and nuts and miscellaneous hardware in contact with the pumped material shall be stainless steel.
- C. The impeller shall be of cast iron, ASTM A-48 (Class 30 or better) or ductile iron, ASTM A-536 (Class 65 or better); and shall be non-clogging without deforming, cutting, or chopping the solids. The impeller may be of single or multiple vane design, shall be smooth and finished throughout, and free of sharp edges. The impeller shall have a means of preventing the accumulation of solids or stringy material. The impeller shall be capable of being trimmed to meet specific hydraulic requirements and shall be held securely in place such that it is mechanically prevented from loosening by torque from either forward or reverse rotation.
- D. The casing and impeller shall be provided with a replaceable bronze or stainless steel wearing ring(s).
- E. The pump volute shall be of single piece design. Passages shall be smooth and large enough to pass any solids which may enter the impeller. The discharge flange design shall permit attachment to standard ANSI flanges/appurtenances.

- F. The rotating assembly (impeller, shaft, and rotor) shall be dynamically balanced such that undue vibration or other unsatisfactory characteristics will not result when the pump is in operation.

2.5 SHAFT AND SHAFT SEALS

- A. The pump and motor shaft shall be of one piece construction, amply sized to minimize shaft deflection. Each shaft shall be of stainless steel material and adequately designed to meet the maximum torque required at any normal startup condition or operating point in the system. Maximum deflection shall not exceed 0.002" at the lower seal. Each pump shaft shall be accurately machined to accommodate bearings, seals, and impeller. Carbon steel or chrome-plated shafts are not allowed.
- B. Each pump shall be equipped with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. Each seal interface shall be held in contact by its own spring system. The seals shall not require routine maintenance or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Seals shall be made of tungsten-carbide or silicon-carbide.
- C. Each pump shall be provided with a lubricant chamber for the shaft sealing system, which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug shall be easily accessible from the outside of the pump.
- D. When required, seal oil inspection shall be achieved without disassembly of the pump. The seal shall not require the pumped liquid as a lubricant nor shall the lower portion of the seal be mounted in the pumped medium.

2.6 BEARINGS

- A. Each pump shaft shall rotate on a minimum of two, permanently lubricated, greased, upper and lower bearings. Bearings shall be of sufficient design and spacing to properly transfer all radial and axial loads to the pump housing and minimize shaft deflection. Bearings shall be sized to provide a minimum L-10 bearing life of 40,000 hours anywhere on the flow versus head curve and shall protect the pump/motor from thrust in reverse directions.

2.7 COOLING SYSTEM

- A. Each pump shall be provided with an integral motor cooling system, consisting of a liquid chamber or jacket encircling the motor stator housing to provide heat dissipation by the uniform circulation of cooling liquid. The cooling media channels shall be non-clogging and shall not allow solids to enter or accumulate in the cooling media. The cooling system shall not allow air pockets to accumulate within the cooling media. The cooling system shall provide for continuous pump operation in liquid temperature up to 104 degrees F.

2.8 PROTECTION SYSTEMS

A. Leakage Detection

- 1. A leakage sensor shall be used to monitor and detect water in the stator chamber. The leakage sensor shall consist of a minimum of two (2) moisture probes or a single float switch, which when activated shall send an alarm. The alarm shall activate if leakage into the chamber reaches 50% chamber capacity (maximum), signaling the need to schedule an inspection.

B. Temperature

- 1. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. An alarm signaling an overheating of the motor shall activate should the thermal switches open.

2.9 MOTOR

- A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The motor shall be rated in accordance with NEMA MG1, Part 31. Motors shall be suitable for operation in a NEC Class 1, Group D, Division II hazardous location.
- B. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to control system.
- C. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be provided by the same manufacturer.

- D. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C.
- E. Power to each pump motor shall be 460 volt, three phase, 60 Hz.

2.10 POWER AND CONTROL CABLES

- A. Power and control cables conforming to the requirements of Division 26 of these specifications of length sufficient to allow connection to a control panel and/or junction box without splicing shall be factory installed and sealed watertight. Cable supports, grips, and other appurtenances shall be stainless steel.
- B. Power and control cables shall be neatly coiled and held in place with wire-ties or similar to preclude damage to the seals during shipment.
- C. The cable entry seal design shall insure a watertight and submersible seal to prevent liquid from entering the motor housing. The cable entry assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top.

2.11 OPERATION AND CONTROL

- A. General:
 - 1. Contractor shall be responsible for providing fully integrated facilities, which perform as described in this section, the plans, and in other specification sections.
 - 2. The pump controls shall be provided in accordance with Division 26, Electrical and Division 40, SCADA.
 - 3. Pumps shall function in rising water and in falling water as shown on the Project Drawings. Float level detecting devices shall be located in the wet well as shown, with one float supplied for each control level.

2.12 SUPPORT

- A. All equipment bolts, nuts, mounting plates, support brackets, washers, and accessories shall be A316 stainless steel, furnished by the equipment manufacturer.

- B. Manufacturer shall furnish a template to accurately locate the bolts for bolting the discharge elbow, mounting plates, support brackets, and accessories to install as indicated on the Project Drawings.

2.13 SHOP PAINTING

- A. All ferrous surfaces coming into contact with the pumped media shall be cleaned, primed and finish-painted at the factory with a spray coating of modified vinyl-zinc prime followed by a modified acrylic resin finish that meets or exceeds the requirements stated in Section 09 91 00.

2.14 SHOP ASSEMBLY AND INSPECTION

- A. Each submersible pump/motor shall be completely factory assembled and shipped ready for installation to include the power and control cables.
- B. Shop inspection shall be performed by a qualified inspector and certified by the manufacturer. The inspection shall be documented and all deficiencies noted, corrected, re-inspected and final completion formally authorized. Final shipment authorization shall be by the manufacturer to ensure completion of all fabrication, assembly, and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the Engineer upon request.

1.15 FACTORY PERFORMANCE TEST

- A. Upon completion of assembly, each pump shall be performance tested at the place of manufacture witnessed by a Licensed Professional Engineer experienced in the testing requirements of the most recent test code of the Hydraulic Institute.
- B. The submersible pumps shall be tested before shipment.
- C. The Licensed Professional Engineer shall sign, stamp and date the test procedure and results, certifying that the pumps were tested in the pump manufacturer's facility.
- D. Prior to testing, the manufacturer shall submit a detailed test plan with complete piping and instrumentation configuration diagram showing discharge pipe size. The location and quantity of all major instruments necessary for performance data, with corresponding distances from reference points, shall be identified. As a minimum the test plan shall include:
 1. Hydraulic Institute test procedure and method of calculating results.
 2. Functional testing of entire package, instrumentation, ancillary components and local control panel.

- E. All test equipment shall be calibrated and certified by an independent test agency no more than 12 months prior to the test date. Certificates shall show the stability of calibration over a period of at least one year.
- F. At a minimum, the submersible pumps shall be factory tested for a duration of not less than four (4) hours at maximum load.
- G. A power meter calibrated to NIST standards instantaneously monitoring all electrical legs for voltage and amperage to calculate instantaneous power usage shall measure the electrical power input as described, including all auxiliary systems. Measured power shall include wire-to-water and include all losses associated with electrical power, including, but not limited to the motor.
- H. Net delivered flow rate and discharge pressure shall be guaranteed with no negative tolerance. There shall be no tolerances or measuring uncertainties used in the reporting of test results.
- I. The Licensed Professional Engineer shall sign each copy of the test data log sheet certifying that the required tests were performed in strict accordance with these Specifications and the standards of the Hydraulic Institute.
- J. Four copies of test results, certified calibration records for all equipment used and signed/stamped test log shall be submitted to Engineer for approval and acceptance by Engineer prior to shipment of each submersible pump.
- K. Test results shall be included in the operations and maintenance manual in the form of head versus capacity graph to include curves for brake horsepower and NPSH for operation at full speed.
- L. The Engineer and Owner shall be provided with a minimum two (2) week notice of when the factory testing will be performed. The Engineer and a representative of the Owner shall be allowed to witness the factory testing at no additional cost to the Owner. The Contractor shall provide all transportation and lodging expenses for the Engineer and the representative of the Owner to witness the factory testing..
- M. If the certified factory test results demonstrate non-compliance with stated performance parameters for each duty point shown in this Specification Section, the submersible pumps shall be reworked and retested until it complies with the Specifications.
- N. Such reworking and retesting shall be at the pump manufacturer's expense including the time and expenses for a representative of the owner to witness the retesting.

2.16 SPARE PARTS

- A. A list of recommended spare parts shall be included in the Operating and Maintenance Manual submitted in accordance with paragraph 1.4.B, which are anticipated to be needed during the warranty period specified in paragraph 1.6. The manufacturer shall supply such spare parts for each pump furnished.

- B. Provide two (2) additional spare impellers from the manufacturer for Low Flow Pump-4.

2.17 PACKAGING AND SHIPPING

- A. Each factory assembled submersible pump and shall be enclosed mounted or crated to protect against damage during shipment.
- B. The parts and assemblies that are shipped unassembled including, but not limited to, anchor bolts, accessories, mounting plates, support brackets, nuts, washers, shall be packaged and tagged in a manner that will protect the equipment from damage and facilitate field installation.
- C. Spare parts, if any, shall be packed in containers bearing labels clearly designating contents and pieces of equipment to which they are applicable.

2.18 TOOLS

- A. If any pump components are of such construction that special wrenches, spanners, eyebolts, and tools are required to remove units, bolts, and parts, a complete set of such special tools shall be furnished by the Manufacturer for each pumping unit. The tools shall be of high quality and non-sparking construction. Each set shall be furnished in a metal tool case, which shall have a handle and provisions for padlocking.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pumping equipment shall fit in the spaces indicated on the drawings without appreciable revisions to the piping.
- B. Portions of the Work requiring Shop Drawings, Product Data or Sample submissions shall not begin until the submission has been approved by the Engineer. A copy of each approved Shop Drawing, Product Data and Sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

3.2 DELIVERY, STORAGE AND HANDLING:

- A. Inspect and inventory items upon delivery to site.
- B. Store and safeguard equipment, material and spare parts in accordance with manufacturer's recommendations.
- C. Deliver spare parts to Owner after completion of work.

3.3 INSTALLATION

- A. Furnish, install, finish, and place in service each submersible pump and all appurtenances in accordance with the manufacturer's recommendations and certified shop drawings, and as approved by the Engineer.
- B. Securely anchor the pump base plates, mounting plates, and brackets to the wet well floor/pedestal.
- C. Verify that each pump is easily installed and removed and that the pump discharge flange mates squarely with the pump base flange.
- D. Prior to startup of each pump, Contractor must provide the Engineer a copy of the Certificate of Proper Installation from the manufacturer. All installation and equipment deficiencies must be corrected prior to startup and testing.

3.4 ANCHORAGE

- A. All anchor bolts, nuts and washers shall be installed by the Contractor in accordance with the shop and installation drawings and instruction supplied by the manufacturer.

3.5 TOUCH-UP FIELD PAINTING

- A. After installation and approval of testing by the Engineer, apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop paint coating.

3.6 MANUFACTURER'S SERVICES

- A. Provide the services of a factory trained technician specifically trained on the type of pumping system specified to inspect the installation of the equipment, to make any necessary adjustments and test and place the equipment in satisfactory service. Submit qualifications of technician to Engineer for approval. The minimum man-day requirements specified are exclusive of travel time and do not relieve Contractor of his obligation to provide sufficient service to place equipment in satisfactory operation and in accordance with the manufacturer's instructions and warranty requirements. A written report covering the technician's findings and installation certification shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

- B. Minimum Man-Day Requirements:

Initial Installation assistance:	1 man-day
Start-up and calibration:	1/2 man-days

Field running test:	1 man-days
Operation and maintenance training:	1/2 man-days

3.7 FIELD TEST

A. After the installation of the units, the control system, and all appurtenances; the pumps and control system shall be subjected to a field running test for a minimum of 4 hours. The field test shall be made by the Contractor in the presence of the Engineer and as directed by the factory trained technician. The field test shall demonstrate the following under all conditions for each pump and the control system:

1. Has not been damaged by transportation or installation.
2. Is properly installed.
3. Has no mechanical defect.
4. Is in proper alignment.
5. Is properly connected.
6. Has correct rotation of the pump and motor shaft.
7. Current to all motor electrical leads is balanced.
8. Electrical and control cables are free of moisture and insulation defect.
9. Electrical and control cables are tight, properly connected, and labeled and tagged at the terminations.
10. Motor amperage is normal.
11. That there is no motor current imbalance, which shall be verified by measuring current and voltage for each phase.
12. That megger testing on all motors is performed per Section 26 24 18 and the manufacturer's requirements and acceptance standards.
13. Is free of overheating of any parts.
14. Is free of all objectionable vibration.
15. Is free of excessive noise.

16. Is free of overloading of any parts.
 17. Operates in full conformance to the design criteria specified in Section 2.2.
 18. At minimum wet well depths there is no leakage between the pump discharge flange and the pump base flange.
- B. A minimum of forty-eight (48) hours notification is required prior to testing.
 - C. All pumps shall be tested by creating actual operating conditions to demonstrate that the pumps and control system operate as specified.
 - D. The contractor is responsible for providing all labor, equipment, and incidentals required to complete the field running test.
 - E. A performance test log shall be submitted to the Engineer on completion of each test which records the pump model and serial number, test date, beginning test time, ending test time, motor horsepower, rotational speed, and all of the documentation specified in Section 3.7.A.
 - F. For any equipment that does not satisfy the condition specified, corrective measures shall be taken by the Contractor and pump manufacturer at no additional expense to the Owner and the equipment retested.

3.8 OPERATING AND MAINTENANCE TRAINING

- A. The field technician will provide representatives of the Owner with operation and maintenance instruction for all components of the pumps as required by Division 1 of these Special Provisions.

END OF SECTION 43 21 39

DIVISION 43 – LIQUID HANDLING EQUIPMENT

SECTION 43 21 43 – SUMP PUMP

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work under this Section includes furnishing and installation of the sump pump, controls, associated discharge piping, and appurtenances, complete and operational, as specified herein and on the Project Drawings.

1.2 RELATED WORK

- A. Work under this Section is also subject to the requirements specified under Division 1 of these Special Provisions.
- B. Section 09 91 10: Painting
- C. Section 33 40 10: Interior Piping and Appurtenances
- D. Section 33 40 20: Pipe Hangers and Supports
- E. Section 33 40 30: Pipe Specialties
- F. Section 43 01 50: General Mechanical Provisions
- G. Section 43 20 10: Valves and Appurtenances
- H. Division 26: Electrical
- I. Division 40: SCADA

1.3 QUALITY CONTROL

- A. Pump and appurtenances shall be Barnes Series 2SEV-L, or approved equal.
- B. All equipment shall be new and of first class materials and construction, guaranteed to perform the service required.
- C. Provide standard sump pump equipment manufactured by a company with no less than five (5) years of experience in the manufacture of such equipment. Manufacturer shall have installed a minimum of five (5) installations of comparable sized sumps.

- D. Pump and controls shall be suitable for operation in areas classified as Class I, Division II, hazardous locations.

1.4 SUBMITTALS

- A. Complete drawings of sump pumps, controls, and miscellaneous piping appurtenances.
- B. Pump performance curves and operational data.
- C. Pump Warranty. Warranty shall begin after the date of final acceptance.
- D. Painting Procedure and data sheets for shop prime coats.
- E. Provide Operation and Maintenance manuals.
- F. Spare parts list.
- G. In addition to the requirements of this section, submittals shall also meet the requirements of Division 1, Section 1.6, Submittals; including certifications that the equipment and materials to be provided will meet the requirements of this project.

1.5 SCOPE

- A. Furnish all labor, materials, equipment and discharge piping for the sump pumps, as indicated on the Project Drawings.
- B. The work includes, but is not limited to the following:
 - a. One (1) sump pump
 - b. One (1) control panel with three (3) floats and alarm.
 - c. Required power and control wires and cables.
 - d. All ball valves, check valves, fittings, plumbing specialties, required for all sump pump piping for complete installation.
 - e. All pipe hangers, supports, anchors, sleeves, concrete inserts to support the various piping systems and equipment.

1.6 BASIS OF PAYMENT

- A. The work under shall be paid as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for the work described herein.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMP

- A. One (1) submersible non-clog sewerage pump installed in the Dry Pit sump as indicated on the Project Drawings. The sump pump shall be capable of handling raw, unscreened sewage consisting of water, fibrous materials, and two (2) inch diameter spherical solids. The unit shall utilize a single mechanical shaft seal which will operate in an oil atmosphere.
- B. Pump Arrangement: Simplex
- C. Rating: Performance criteria – 20 GPM @ 30 Feet TDH
- D. Casing: Cast iron housing with protective epoxy coating for corrosion resistance and legs that elevate pump to permit flow into impeller.
- E. Pump Discharge: Discharge connection to 2" FNTP pipe connection.
- F. Impeller: Vortex type made from cast iron.
- G. Seals: Mechanical, Buna-N type.
- H. Motor: Thermal overload protection. Include a 3-conductor waterproof power cable and a 5 conductor control cable of length required for installation as indicated on Project Drawings, but not less than 30 feet.
- I. Pump Discharge Piping: Field cut, Schedule 80 PVC pipe.
- J. Power to pump shall be 240 volt, single phase, 60 Hz.

2.2 ALARM SYSTEM AND CONTROL PANEL

- A. The pump manufacturer shall supply a completely self-contained simplex motor control panel. The control panel shall provide short circuit and overload protection for the pump.
- B. The specified equipment shall be contained in the Sump Pump Control Panel (CP-SP) and be located in the electrical room. The control panel shall be integrated into the scada system as detailed in this Specification and on the Drawings.

- C. Provide a NEMA 12 rated wall mounted electrical enclosure the enclosure shall be formed of 14 gauge minimum, galvanized steel, with all surfaces phosphatized, then finished inside and out with ANSI 61 gray polyester powder finish. The enclosure shall conform to NEMA standards for type NEMA 12 enclosures and be UL listed.
- D. A ground bus/lug shall be provided in each enclosure. It shall be mounted directly on a ground bus/lug shall be provided in each enclosure. It shall be mounted directly on bare metal. All paint shall be completely removed where the ground-bus/lug is attached to the enclosure or sub-panel. A ground-stud/lug shall be welded on the lower, inside corner on all enclosure doors on which electrically powered devices are mounted. Control panel doors shall be connected to the enclosure ground bus with #8 AWG.
- E. The following equipment shall be included with the control panel. This represents the minimum equipment required. Additional equipment may be required base on system operating requirements, manufacture design and NEC,
 - 1. A thermal magnetic circuit breaker with operating handle shall be provided to protect the motor from short circuits and to serve as a motor branch circuit disconnect as required by the NEC. The operating handle shall be accessible from the front of the enclosure and have provisions for "lock-out". The operating mechanism shall not be through the door of the enclosure. Manufacturer shall be responsible for sizing the circuit breaker per NEC for protection of their equipment.
 - 2. A magnetic starter shall be provided for the pump motor. The starter shall be equipped with a bimetallic overload relay.
 - 3. A control transformer shall be provided to supply 115 volts for the control circuit. The transformer shall be a continuous duty, machine tool type, sized to meet the load requirements of the control circuit. The transformer primary shall be connected to the load side of the circuit breaker. One side of the secondary winding shall be grounded to the component mounting panel. A two (2) pole, 600 VAC, 30 ampere rated fuse block shall be provided for transformer primary winding; a one (1) pole, 250 VAC, 30 ampere fuse block will be provided for the secondary winding. Fuses shall be sized to protect the transformer in accordance with requirements of the NEC.
 - 4. Hand-Off-Auto Selector Switch.
 - 5. Pump "Running" Red Push-to-test type Pilot Light.
 - 6. Pump "Fault" Amber Push-to-test type Pilot Light.
 - a. "High Water" red colored alarm beacon. The alarm will be initiated when the water level in the sump pit reaches the "High Water" float switch activation level. The "High Water" level shall be no higher than elevation 672.50.

7. Sump pump moisture sensing relay
 8. Control power "ON/OFF" selector switch to control power to the floats and circuitry for additional protection.
 9. Intrinsically safe relays to interface with sump pump control items located in the Class 1, Group D, Division II environment.
 10. Terminal blocks shall be provided for connection of level controls and other control wiring as required for proper pump installation. Provide a minimum of 10% spare terminal blocks.
 11. The control shall be wired in accordance with all applicable requirements of the NEC. Control wiring shall be sixteen (16) AWG minimum red for control circuits and white for neutral grounded conductors. Power wiring shall be a minimum of 12 AWG black. All grounded conductors shall be green. Each conductor shall be numbered. All wiring shall be performed in a net and orderly manner
 12. Any other ancillary equipment required to insure proper system operation
- F. The following equipment shall be mounted on the control panel enclosure door:
1. Hand-Off-Auto Selector Switch
 2. Pump "Running" Pilot Light.
 3. Pump "Fault" Pilot Light.
 4. Control power "ON/OFF" selector switch.
 5. Start and Stop push buttons.
- G. The following inputs and outputs shall be wired to control panel terminal block for interfacing with the scada system.
1. Pump "Running" output from magnetic contactor auxiliary contact.
 2. Pump "Fault" output from either the motor overload relay or moisture detection relay.
 3. "High Water Alarm" from high water alarm float switch relay.
- H. Sequence of Operation
1. Manual Operation
 - a. When the Hand-Off-Selector switch is in the "Hand" position, the sump pump will start. The sump pump will continue to run until the selector switch is returned to the "Off" position or when the water level in the sum pit is below the "Stop" level sensor float switch activation level.

2. Automatic Control

- b. When the Hand-Off-Selector switch is in the “Auto” position, the sump pump will start when the water level in the sump pit is above the “Start” float switch activation level. The sump pump will continue to run until the selector switch is returned to the “Off” position or when the water level in the sum pit is below the “Stop” level sensor float switch activation level.
- I. Provide a “Stop”, “Start” and “High Water” level sensor floats, all adjustable, with mounting rods and electric cables. Contractor shall be responsible for sizing the required cables between the control panel and sump pump pit.

2.3 SUMP PUMP DISCHARGE PIPING

- A. Sump pump discharge pipe and fittings shall be 2” Schedule 80 PVC. See Section 33 40 10, Interior Piping and Appurtenances for details.
- B. Sump pump check valves shall be Schedule 80 PVC ball check. Shutoff valve for sump pump shall be Schedule 80 PVC Tru-Union ball valve, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. General: Connect piping to pumps as indicated on the Project Drawings. Install valves that are same size as piping connecting to pumps.
- B. Connect discharge pipe to discharge into the nearest catch basin sewer as shown on the Plans.
- C. Install ball check valve and ball valve on sump pump discharge.
- D. Install electrical connections for power, controls, and devices.
- E. Electrical power and control wiring and connections are specified in Division 26 Sections.

3.2 SUMP PUMP ADJUSTING

- A. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

3.3 SUMP PUMP COMMISSIONING

- A. Final Checks Before Startup: Perform the manufacturers recommended preventive maintenance operations and checks before startup, including the following.
 - 1. Check that pumps are free to rotate by hand. Do not operate pump, if bound or even drags slightly, until cause of trouble is determined and corrected.
 - 2. Check that pump controls are correct for required application.
- B. Starting procedure for pumps with shutoff power not exceeding safe motor power:
 - 1. Start motors.
 - 2. Open discharge valves.
 - 3. Observe leakage from stuffing boxes and adjust sealing liquid valves for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
 - 4. Check general mechanical operation of pumps and motors.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Installation and Start-up Services: None required.

3.5 CLEANING AND SHOP PAINTING

- A. Paint pumps with manufacturer standard primer in shop and finished coats in field per Section 09 91 00, Painting.

END OF SECTION 43 21 43

CITY OF NAPERVILLE ELECTRICAL PERMIT

The electrical permit application for the electrical service for the new pump station building has been submitted to and approved by the City of Naperville. A copy of the electrical permit application submitted to the City of Naperville will be provided to the Contractor at the preconstruction meeting. The Contractor will be responsible for obtaining the permit from the City of Naperville. The following are the City of Naperville's requirements to obtain the permit:

1. The Contractor or his sub-contractor performing the electrical work under this contract must be a registered Class A Electrical Contractor with the City of Naperville. Electrical contractor registration information is available at <http://www.naperville.il.us/electricalcontractorreg.aspx> or (630) 420-6046.
2. The Contractor or his sub-contractor must submit in person an Electrical Contractor Certification form to the City of Naperville Development Services located at 400 South Eagle Street; Naperville, Illinois 60540. The information Electrical Contractor Certification form can be obtained at <http://www.naperville.il.us/contractorforms.aspx>.
3. The Contractor or his sub-contractor shall pay the outstanding IAC fee and any inspection fees require by the City of Naperville. The IAC fee has been estimated to be \$38,190.

Basis of Payment: The cost of meeting these requirements shall be included in the contract unit price for the items being constructed under this permit. No additional compensation will be paid to the Contractor for any increase in the fees specified above or any additional fees required by the City of Naperville to obtain this permit.

DRILLED SOLDIER PILE RETAINING WALL

Effective: September 20, 2001

Revised: October 15, 2011

Description. This work shall consist of providing all labor, materials, and equipment necessary to fabricate and furnish the soldier piles, create and maintain the shaft excavations, set and brace the soldier piles into position and encase the soldier piles in concrete to the specified elevation. Also included in this work is the backfilling of the remainder of the shaft excavation with Controlled Low-Strength Material (CLSM), and the furnishing and installation of lagging. All work shall be according to the details shown on the plans and as directed by the Engineer.

The remainder of the retaining wall components as shown on the plans, such as concrete facing, shear studs, reinforcement bars, tie backs, hand rails, and various drainage items etc., are not included in this Special Provision but are paid for as specified elsewhere in this Contract.

Materials. The materials used for the soldier piles and lagging shall satisfy the following requirements:

- (a) The structural steel components for the soldier piles shall conform to the requirements of AASHTO M270, Grade 36 (M270M Grade 250), unless otherwise designated on the plans.
- (b) The soldier pile encasement concrete shall be Class DS according to Section 516.02.
- (c) The Controlled Low-Strength Material (CLSM), used for backfilling shaft excavations above the soldier pile encasement concrete and for backfilling secant lagging excavations, to the existing ground surface, shall be according to Article 1019.
- (d) Temporary casing shall be produced by electric seam, butt, or spiral welding to produce a smooth wall surface, fabricated from steel satisfying ASTM A252 Grade 2. The minimum wall thickness shall be as required to resist the anticipated installation and dewatering stresses, as determined by the Contractor, but in no case less than 1/4 in. (6 mm).
- (e) Drilling slurry shall consist of a polymer or mineral base material. Mineral slurry shall have both a mineral grain size that will remain in suspension with sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement. For polymer slurry, the calcium hardness of the mixing water shall not exceed 100 mg/L.
- (f) Timber Lagging. The minimum tabulated unit stress in bending (F_b), used for the design of the timber lagging, shall be 1000 psi (6.9 MPa) unless otherwise specified on the plans. When treated timber lagging is specified on the plans, the method of treatment shall be according to Article 1007.12. All timber shall meet the inspection requirements of Article 1007.01.
- (g) Precast Concrete Lagging. Precast concrete lagging shall be according to Section 504 of the Standard Specifications, except as modified herein. Unless specified otherwise, precast concrete lagging surfaces exposed to view in the completed wall shall be finished according to Article 503.15. When specified on the plans, the exposed surface shall be finished with a concrete form liner approved by the Engineer.

The back face of the panel shall be roughly screeded to eliminate open pockets of aggregate and surface distortions in excess of 1/4 in. Reinforcement for precast concrete lagging shall be epoxy coated. Lifting inserts shall have a total minimum design capacity based on yield strength of 4 times the dead load calculated for the width of lagging used. Fabric bearing pads, when specified on the plans, shall meet the requirements of Section 1082. Threaded inserts, or other accessories, cast into the precast concrete lagging shall be galvanized according to AASHTO M111 or M232 as applicable.

Equipment. The drilling equipment shall have adequate capacity, including power, torque and down thrust, to create a shaft excavation of the maximum diameter specified to a depth of 20 percent beyond the depths shown on the plans. Concrete equipment shall be according to Article 1020.03.

Construction Requirements. The shaft excavation for each soldier pile shall extend to the tip elevation indicated on the plans for soldier piles terminating in soil or to the required embedment in rock when rock is indicated on the contract plans. The Contractor shall satisfy the following requirements:

(a) Drilling Methods. The soldier pile installation shall be according to 516.06(a),(b), or(c).

No shaft excavation shall be made adjacent to a soldier pile with encasement concrete that has a compressive strength less than 1500 psi (10.35 MPa), nor adjacent to secant lagging until the CLSM has reach sufficient strength to maintain its position and shape unless otherwise approved by the Engineer. Materials removed or generated from the shaft excavations shall be disposed of by the Contractor according to Article 202.03. Excavation by blasting will not be permitted.

(b) Drilling Slurry. During construction, the level of the slurry shall be maintained at a height sufficient to prevent caving of the hole. In the event of a sudden or significant loss of slurry to the hole, the construction of that shaft shall be stopped and the shaft excavation backfilled or supported by temporary casing until a method to stop slurry loss, or an alternate construction procedure, has been developed and approved by the Engineer.

(c) Obstructions. Obstructions shall be defined as any object (such as but not limited to, boulders, logs, old foundations, etc.) that cannot be removed with normal earth drilling procedures, but requires special augers, tooling, core barrels or rock augers to remove the obstruction. When obstructions are encountered, the Contractor shall notify the Engineer and upon concurrence of the Engineer, the Contractor shall begin working to core, break up, push aside, or remove the obstruction. Lost tools or equipment in the excavation, as a result of the Contractor's operation, shall not be defined as obstructions and shall be removed at the Contractor's expense.

(d) Top of Rock. The top of rock will be considered as the point where rock, defined as bedded deposits and conglomerate deposits exhibiting the physical characteristics and difficulty of rock removal as determined by the Engineer, is encountered which cannot be drilled with earth augers and/or underreaming tools configured to be effective in the soils indicated in the contract documents, and requires the use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.

- (e) Design Modifications. If the top of rock elevation encountered is below that estimated on the plans, such that the soldier pile length above rock is increased by more than 10 percent, the Engineer shall be contacted to determine if any soldier pile design changes are required. In addition, if the type of soil or rock encountered is not similar to that shown in the subsurface exploration data, the Engineer shall be contacted to determine if revisions are necessary.
- (f) Soldier Pile Fabrication and Placement. The soldier pile is defined as the structural steel section(s) shown on the plans as well as any connecting plates used to join multiple sections. The types of soldier piles shall be defined as HP, W Sections, or Built-Up Sections. Cleaning and painting of all steel components, when specified, shall be as shown on the plans and accomplished according to the special provision for "Cleaning and Painting New Metal Structures". This work will not be paid for separately, but shall be considered included in the cost of Furnishing Soldier Piles of the type specified.

The soldier pile shall be shop fabricated such that no field welding is required. The Contractor shall attach suitable bracing or support to maintain the position of the soldier pile within the shaft excavation such that the final location will satisfy the Construction Tolerances portion of this Special Provision. The bracing or supports shall remain in place until the concrete for encasement has reached a minimum compressive strength of 1500 psi (10.35 MPa).

When embedment in rock is indicated on the plans, modification to the length of a soldier pile may be required to satisfy the required embedment. The modification shall be made to the top of the soldier pile unless otherwise approved by the Engineer. When the top of rock encountered is above the estimated elevation indicated on the plans, the soldier piles shall be cut to the required length. If the top of rock encountered is below that estimated on the plans, the Contractor shall either furnish longer soldier piles or splice on additional length of soldier pile per Article 512.05(a) to satisfy the required embedment in rock. In order to avoid delays, the Contractor may have additional soldier pile sections fabricated as necessary to make the required adjustments. Additional soldier pile quantities, above those shown on the plans, shall not be furnished without prior written approval by the Engineer.

- (g) Concrete Placement. Concrete work shall be performed according to Article 516.12 and as specified herein.

The soldier pile encasement concrete pour shall be made in a continuous manner from the bottom of the shaft excavation to the elevation indicated on the plans. Concrete shall be placed as soon as possible after the excavation is completed and the soldier pile is secured in the proper position. Uneven levels of concrete placed in front, behind, and on the sides of the soldier pile shall be minimized to avoid soldier pile movement, and to ensure complete encasement.

Following the soldier pile encasement concrete pour, the remaining portion of the shaft excavation shall be backfilled with CLSM according to Section 593. CLSM Secant lagging placement shall be placed as soon as practical after the shaft excavation is cleared.

- (h) Construction Tolerances. The soldier piles shall be drilled and located within the excavation to satisfy the following tolerances:

- (1) The center of the soldier pile shall be within 1 1/2 in. (38 mm) of plan station and 1/2 in. (13 mm) offset at the top of the shaft.
- (2) The out of vertical plumbness of the soldier pile shall not exceed 0.83 percent.
- (3) The top of the soldier pile shall be within ± 1 in. (± 25 mm) of the plan elevation.
 - (i) Timber Lagging. Timber lagging, when required by the plans, installed below the original ground surface, shall be placed from the top down as the excavation proceeds. Lagging shown above grade shall be installed and backfilled against prior to installing any permanent facing to minimize post construction deflections. Over-excavation required to place the timber lagging behind the flanges of the soldier piles shall be the minimum necessary to install the lagging. Any voids produced behind the lagging shall be filled with porous granular embankment at the Contractor's expense. When the plans require the Contractor to design the timber lagging, the design shall be based on established practices published in FHWA or AASHTO documents considering lateral earth pressure, construction loading, traffic surcharges and the lagging span length(s). The nominal thickness of the lagging selected shall not be less than 3 in. (75 mm) and shall satisfy the minimum tabulated unit stress in bending (F_b) stated elsewhere in this Special Provision. The Contractor shall be responsible for the successful performance of the lagging system until the concrete facing is installed. When the nominal timber lagging thickness(s) and allowable stress are specified on the plans, the timber shall be according to Article 1007.03.
 - (j) Precast Concrete Lagging. Precast concrete lagging, when required by the plans, installed below the original ground surface, shall be placed from the top down as the excavation proceeds. Lagging shown above grade shall be installed and backfilled against prior to installing any permanent facing to minimize post construction deflections. Over-excavation required to place the precast lagging behind the flanges of the soldier piles shall be the minimum necessary to install the lagging. Any voids produced behind the lagging shall be filled with porous granular embankment at the Contractor's expense. When the plans require the Contractor to design the precast concrete lagging, the design shall be based on established practices published in FHWA or AASHTO documents considering lateral earth pressure, construction loading, traffic surcharges and the lagging span length(s). The Contractor shall be responsible for the successful performance of the lagging system until the permanent concrete facing, when specified on the plans, is installed.

The precast concrete lagging shall be reinforced with a minimum of 0.31 square inches/foot (655 Sq. mm/meter) of horizontal and vertical reinforcement per unit width of lagging with a minimum thickness of 3 in. (75 mm).

When precast concrete lagging is exposed to view in the completed wall, shop drawings for the lagging shall be submitted according to Article 1042.03(b) and Article 105.04 of the Standard Specifications. The supplier selected by the Contractor shall submit complete design calculations and shop drawings, prepared and sealed by an Illinois Licensed Structural Engineer, for approval by the Engineer.

- (k) **Structure Excavation.** When structure excavation is necessary to place a concrete facing, it shall be made and paid for according to Section 502 except that the horizontal limits for structure excavation shall be from the face of the soldier pile to a vertical plane 2 ft. (600 mm) from the finished face of the wall. The depth shall be from the top of the original ground surface to the bottom of the concrete facing. The additional excavation necessary to place the lagging whether through soil or CLSM shall be included in this work.
- (l) **Geocomposite Wall Drain.** When required by the plans, the geocomposite wall drain shall be installed and paid for according to Section 591 except that, in the case where a concrete facing is specified on the plans, the wall drain shall be installed on the concrete facing side of the lagging with the pervious (fabric) side of the drain installed to face the lagging. When a concrete facing is not specified on the plans, the pervious (fabric) side of the drain shall be installed to face the soil. In this case, the drain shall be installed in stages as the lagging is installed. The wall drain shall be placed in sections and spliced, or kept on a continuous roll, so that as each piece of lagging is placed, the drain can be properly located as the excavation proceeds.

Method of Measurement. The furnishing of soldier piles will be measured for payment in feet (meters) along the centerline of the soldier pile for each of the types specified. The length shall be determined as the difference between the plan top of soldier pile and the final as built shaft excavation bottom.

The drilling and setting of soldier piles in soil and rock, will be measured for payment and the volumes computed in cubic feet (cubic meters) for the shaft excavation required to set the soldier piles according to the plans and specifications, and accepted by the Engineer. These volumes shall be the theoretical volumes computed using the diameter(s) of the shaft(s) shown in the plans and the depth of the excavation in soil and/or rock as appropriate. The depth in soil will be defined as the difference in elevation between the ground surface at the time of concrete placement and the bottom of the shaft excavation or the top of rock (when present), whichever is encountered first. The depth in rock will be defined as the difference in elevation between the measured top of rock and the bottom of the shaft excavation.

Drilling and placing CLSM secant lagging shall be measured for payment in cubic feet (cubic meters) of the shaft excavation required to install the secant lagging as shown in the plans. This volume shall be the theoretical volume computed using the diameter(s) shown on the plans and the difference in elevation between the as built shaft excavation bottom and the ground surface at the time of the CLSM placement.

Timber and precast concrete lagging shall be measured for payment in square feet (square meters) of lagging installed to the limits as shown on the plans. The quantity shall be calculated using the minimum lagging length required on the plans multiplied by the as-installed height of lagging, for each bay of lagging spanning between the soldier piles.

Basis of Payment. The furnishing of soldier piles will be paid for at the contract unit price per foot (meter) for FURNISHING SOLDIER PILES, of the type specified, for the total number of feet (meters) furnished to the job site. The cost of any field splices required due to changes in top of rock elevation shall be paid for according to Article 109.04.

The drilling and setting of soldier piles will be paid for at the contract unit price per cubic foot (cubic meter) for DRILLING AND SETTING SOLDIER PILES (IN SOIL) and DRILLING AND SETTING SOLDIER PILES (IN ROCK). The required shaft excavation, soldier pile encasement concrete and any CLSM backfill required around each soldier pile will not be paid for separately but shall be included in this item.

Timber lagging will be paid for at the contract unit price per square foot (square meter) for UNTREATED TIMBER LAGGING, or TREATED TIMBER LAGGING as detailed on the plans. Precast concrete lagging will be paid for at the contract unit price per square foot (square meter) for PRECAST CONCRETE LAGGING as detailed on the plans.

The secant lagging will be paid for at the contract unit price per cubic foot (cubic meter) for SECANT LAGGING. The required shaft excavation and CLSM backfill required to fill that excavation shall be included in this item.

Obstruction mitigation shall be paid for according to Article 109.04.

No additional compensation, other than noted above, will be allowed for removing and disposing of excavated materials, for furnishing and placing concrete, CLSM, bracing, lining, temporary casings placed and removed or left in place, or for any excavation made or concrete placed outside of the plan diameter(s) of the shaft(s) specified.

PIPE UNDERDRAINS FOR STRUCTURES

Effective: May 17, 2000

Revised: January 22, 2010

Description. This work shall consist of furnishing and installing a pipe underdrain system as shown on the plans, as specified herein, and as directed by the Engineer.

Materials. Materials shall meet the requirements as set forth below:

The perforated pipe underdrain shall be according to Article 601.02 of the Standard Specifications. Outlet pipes or pipes connecting to a separate storm sewer system shall not be perforated.

The drainage aggregate shall be a combination of one or more of the following gradations, FA1, FA2, CA5, CA7, CA8, CA11, or CA13 thru 16, according to Sections 1003 and 1004 of the Standard Specifications.

The fabric surrounding the drainage aggregate shall be Geotechnical Fabric for French Drains according to Article 1080.05 of the Standard Specifications.

Construction Requirements. All work shall be according to the applicable requirements of Section 601 of the Standard Specifications except as modified below.

The pipe underdrains shall consist of a perforated pipe drain situated at the bottom of an area of drainage aggregate wrapped completely in geotechnical fabric and shall be installed to the lines and gradients as shown on the plans.

Method of Measurement. Pipe Underdrains for Structures shall be measured for payment in feet (meters), in place. Measurement shall be along the centerline of the pipe underdrains. All connectors, outlet pipes, elbows, and all other miscellaneous items shall be included in the measurement. Concrete headwalls shall be included in the cost of Pipe Underdrains for Structures, but shall not be included in the measurement for payment.

Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for PIPE UNDERDRAINS FOR STRUCTURES of the diameter specified. Furnishing and installation of the drainage aggregate, geotechnical fabric, forming holes in structural elements and any excavation required, will not be paid for separately, but shall be included in the cost of the pipe underdrains for structures.

ABOVE GRADE INLET PROTECTION (BDE)

Effective: July 1, 2009

Revised: January 1, 2012

Add the following to Article 280.02 of the Standard Specifications:

“(m) Above Grade Inlet Filter1081.15(j)”

Add the following paragraph after the second paragraph of Article 280.04(c) of the Standard Specifications:

“When above grade inlet filters are specified, they shall be of sufficient size to completely span and enclose the inlet structure. Prior to ordering materials, the Contractor shall determine the size of the various drainage structures being protected.”

Add the following paragraph after the second paragraph of Article 280.08(d) of the Standard Specifications:

“Protection of drainage structures with rigid inlet protection assemblies will be paid for at the contract unit price per each for ABOVE GRADE INLET FILTERS.”

Add the following to Article 1081.15 of the Standard Specifications:

“(j) Above Grade Inlet Filters. Above grade inlet filters shall consist of a rigid polyethylene frame covered with a fitted geotextile filter. A clean, used fitted filter and a used rigid polyethylene frame in good condition meeting the approval of the Engineer may be substituted for new materials. Materials for the above grade inlet filter assembly shall be according to the following.

- (1) Frame Construction. Frame shall be constructed of a high density polyethylene copolymer. The design of the frame shall allow the structure to fit completely over the sewer inlet. The frame shall be a minimum of 26 in. (650 mm) tall and the top of the frame shall be designed with an opening to allow large volumes of water to pass through under high flow events. The frame shall conform to the following requirements:

Frame		
Material Property	Test Method	Value
Tensile Yield Strength	ASTM D 638	3600 psi (24.82 MPa)
Elongation at Break	ASTM D 638	>600%
Tensile-Impact Strength	ASTM D 1822	170 ft lb/sq in (230 J)
Brittleness Temperature	ASTM D 746	<-105°F (-76.11°C)
Environmental Stress Cracking	ASTM D 1693	>800 hours
Durometer Hardness, Shore A	ASTM D 2240	68

Vicat Softening Temperature	ASTM D 1525	254°F (123.33°C)
Deflection Temperature	ASTM D 648	157°F (69.44°C)
Coefficient of Linear Thermal Expansion	ASTM D 696	7x10 ⁻⁵ in/in/°F (12.6x10 ⁻⁵ m/m/°C)
Bulk Density	ASTM D 1895	37 lbs/cu ft (592.7 kg/cu m)

- (2) Fitted Geotextile Filter. The sides of the fitted geotextile filter shall be constructed of 100 percent continuous polyester needle-punched fabric. The filter shall be fabricated to provide a direct fit to the frame. The top of the filter shall integrate a coarse screening to allow large volumes of water to pass through in the event of heavy flows. This screening shall have a minimum apparent opening of 1/2 in. (13 mm). The filter shall have integrated anti-buoyancy pockets capable of holding no less than 3.0 cu ft (0.08 cu m) of stabilization material. Each filter shall have a label with the following information sewn to or otherwise permanently adhered to the outside: manufacturer's name, product name, and lot, model or serial number. The fitted geotextile filter shall conform to the following requirements:

Fitted Geotextile Filter		
Material Property	Test Method	Minimum Avg. Roll Value
Weight	ASTM D 3776	3.0 oz/sq yd +/- 10% (71.1 grams/sq m)
Grab Tensile Strength	ASTM D 4632	80 lb min. (36.29 kg)
Grab Tensile Elongation	ASTM D 4632	50%
Bursting Strength	ASTM D 3786	150 psi min. (1.03 MPa)
Puncture Resistance	ASTM D 4833	50 lb min. (22.68 kg)
Trapezoid Tearing Strength	ASTM D 4533	30 lb min. (13.61 kg)
Apparent Opening Size	ASTM D 4751	Sieve No. 70 (0.212 mm)
Permittivity	ASTM D 4491	2.0/sec
Water Permeability	ASTM D 4491	102 gal/min/sq ft (4150 liter/min/sq m)
UV Resistance	ASTM D 4355	70% at 500 hours

- (3) Certification. The manufacturer shall furnish a certificate with each shipment of above grade inlet filter assemblies, stating the amount of product furnished and that the material complies with these requirements."

AGREEMENT TO PLAN QUANTITY (BDE)

Effective: January 1, 2012

Revise the second paragraph of Article 202.07(a) of the Standard Specifications to read:

“When the plans or work have been altered, or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured. When plan quantities are revised by the issuance of revised plan sheets that are made part of the contract, and the Contractor and the Engineer have agreed in writing that the revised quantities are accurate, no further measurement will be required and payment will be made for the revised quantities shown.”

CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)

Effective: June 1, 2010

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term “equipment” refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown below. Equipment that is of a model year older than the year given for that equipment’s respective horsepower range shall be retrofitted:

Effective Dates	Horsepower Range	Model Year
June 1, 2010 ^{1/}	600-749	2002
	750 and up	2006
June 1, 2011 ^{2/}	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006
June 1, 2012 ^{2/}	50-99	2004
	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006

1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.

2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/otaq/retrofit/verif-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verde/verdev.htm>); or
- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

Diesel Retrofit Deficiency Deduction

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

CONSTRUCTION AIR QUALITY - DIESEL VEHICLE EMISSIONS CONTROL (BDE)

Effective: April 1, 2009

Revised: January 2, 2012

Diesel Vehicle Emissions Control. The reduction of construction air emissions shall be accomplished by using cleaner burning diesel fuel. The term "equipment" refers to any and all diesel fuel powered devices rated at 50 hp and above, to be used on the project site in excess of seven calendar days over the course of the construction period on the project site (including any "rental" equipment).

All equipment on the jobsite, with engine ratings of 50 hp and above, shall be required to: use Ultra Low Sulfur Diesel fuel (ULSD) exclusively (15 ppm sulfur content or less).

Diesel powered equipment in non-compliance will not be allowed to be used on the project site, and is also subject to a notice of non-compliance as outlined below.

The Contractor shall certify that only ULSD will be used in all jobsite equipment. The certification shall be presented to the Department prior to the commencement of the work.

If any diesel powered equipment is found to be in non-compliance with any portion of this specification, the Engineer will issue the Contractor a notice of non-compliance and identify an appropriate period of time, as outlined below under environmental deficiency deduction, in which to bring the equipment into compliance or remove it from the project site.

Any costs associated with bringing any diesel powered equipment into compliance with these diesel vehicle emissions controls shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall also not be grounds for a claim.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists, he/she will notify the Contractor in writing, and direct the Contractor to correct the deficiency within a specified time period.

The specified time-period, which begins upon Contractor notification, will be from 1/2 hour to 24 hours long, based on the urgency of the situation and the nature of the deficiency. The Engineer shall be the sole judge regarding the time period.

The deficiency will be based on lack of repair, maintenance and diesel vehicle emissions control.

If the Contractor fails to correct the deficiency within the specified time frame, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

If a Contractor or subcontractor accumulates three environmental deficiency deductions in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of contract time, waiver of penalties, or be grounds for any claim.

CONSTRUCTION AIR QUALITY - IDLING RESTRICTIONS (BDE)

Effective: April 1, 2009

Idling Restrictions. The Contractor shall establish truck-staging areas for all diesel powered vehicles that are waiting to load or unload material at the jobsite. Staging areas shall be located where the diesel emissions from the equipment will have a minimum impact on adjacent sensitive receptors. The Department will review the selection of staging areas, whether within or outside the existing highway right-of-way, to avoid locations near sensitive areas or populations to the extent possible. Sensitive receptors include, but are not limited to, hospitals, schools, residences, motels, hotels, daycare facilities, elderly housing and convalescent facilities. Diesel powered engines shall also be located as far away as possible from fresh air intakes, air conditioners, and windows. The Engineer will approve staging areas before implementation.

Diesel powered vehicle operators may not cause or allow the motor vehicle, when it is not in motion, to idle for more than a total of 10 minutes within any 60 minute period, except under any of the following circumstances:

- 1) The motor vehicle has a gross vehicle weight rating of less than 8000 lb (3630 kg).
- 2) The motor vehicle idles while forced to remain motionless because of on-highway traffic, an official traffic control device or signal, or at the direction of a law enforcement official.
- 3) The motor vehicle idles when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency.
- 4) A police, fire, ambulance, public safety, other emergency or law enforcement motor vehicle, or any motor vehicle used in an emergency capacity, idles while in an emergency or training mode and not for the convenience of the vehicle operator.
- 5) The primary propulsion engine idles for maintenance, servicing, repairing, or diagnostic purposes if idling is necessary for such activity.
- 6) A motor vehicle idles as part of a government inspection to verify that all equipment is in good working order, provided idling is required as part of the inspection.

- 7) When idling of the motor vehicle is required to operate auxiliary equipment to accomplish the intended use of the vehicle (such as loading, unloading, mixing, or processing cargo; controlling cargo temperature; construction operations, lumbering operations; oil or gas well servicing; or farming operations), provided that this exemption does not apply when the vehicle is idling solely for cabin comfort or to operate non-essential equipment such as air conditioning, heating, microwave ovens, or televisions.
- 8) When the motor vehicle idles due to mechanical difficulties over which the operator has no control.
- 9) The outdoor temperature is less than 32 °F (0 °C) or greater than 80 °F (26 °C).

When the outdoor temperature is greater than or equal to 32 °F (0 °C) or less than or equal to 80 °F (26 °C), a person who operates a motor vehicle operating on diesel fuel shall not cause or allow the motor vehicle to idle for a period greater than 30 minutes in any 60 minute period while waiting to weigh, load, or unload cargo or freight, unless the vehicle is in a line of vehicles that regularly and periodically moves forward.

The above requirements do not prohibit the operation of an auxiliary power unit or generator set as an alternative to idling the main engine of a motor vehicle operating on diesel fuel.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists based on non-compliance with the idling restrictions, he/she will notify the Contractor, and direct the Contractor to correct the deficiency.

If the Contractor fails to correct the deficiency a monetary deduction will be imposed. The monetary deduction will be \$1,000.00 for each deficiency identified.

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (DBE)

Effective: September 1, 2000

Revised: August 2, 2011

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract that the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined that the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates that, in the absence of unlawful discrimination, and in an arena of fair and open competition, DBE companies can be expected to perform **17.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work.

A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents that enough DBE participation has been obtained to meet the goal: or
- (b) The bidder documents that a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217)785-4611, or by visiting the Department's website at www.dot.il.gov.

BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement. The failure of the bidder to comply will render the bid not responsive.

- (a) The bidder shall submit a Disadvantaged Business Utilization Plan on Department forms SBE 2025 and 2026 with the bid.
- (b) The Utilization Plan shall indicate that the bidder either has obtained sufficient DBE participation commitments to meet the contract goal or has not obtained enough DBE participation commitments in spite of a good faith effort to meet the goal. The Utilization Plan shall further provide the name, telephone number, and telefax number of a responsible official of the bidder designated for purposes of notification of plan approval or disapproval under the procedures of this Special Provision.
- (c) The Utilization Plan shall include a DBE Participation Commitment Statement, Department form SBE 2025, for each DBE proposed for the performance of work to achieve the contract goal. For bidding purposes, submission of the completed SBE 2025 forms, signed by the DBEs and faxed to the bidder will be acceptable as long as the original is available and provided upon request. All elements of information indicated on the said form shall be provided, including but not limited to the following:
 - (1) The names and addresses of DBE firms that will participate in the contract;
 - (2) A description, including pay item numbers, of the work each DBE will perform;
 - (3) The dollar amount of the participation of each DBE firm participating. The dollar amount of participation for identified work shall specifically state the quantity, unit price, and total subcontract price for the work to be completed by the DBE. If partial pay items are to be performed by the DBE, indicate the portion of each item, a unit price where appropriate and the subcontract price amount;
 - (4) DBE Participation Commitment Statements, form SBE 2025, signed by the bidder and each participating DBE firm documenting the commitment to use the DBE subcontractors whose participation is submitted to meet the contract goal;
 - (5) if the bidder is a joint venture comprised of DBE companies and non-DBE companies, the plan must also include a clear identification of the portion of the work to be performed by the DBE partner(s); and,
 - (6) If the contract goal if not met, evidence of good faith efforts.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan submitted by the apparent successful bidder is approved. All information submitted by the bidder must be complete, accurate and adequately document that enough DBE participation has been obtained or document that good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work performance to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. The Utilization Plan will not be approved by the Department if the Utilization Plan does not document sufficient DBE participation to meet the contract goal unless the apparent successful bidder documented in the Utilization Plan that it made a good faith effort to meet the goal.

This means that the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts that the bidder has made. Mere *pro forma* efforts, in other words, efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases, and will be considered by the Department.
 - (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.
 - (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime Contractor might otherwise prefer to perform these work items with its own forces.
 - (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
 - (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.
 - b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable.

Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable.

- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
 - (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
 - (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.
- (b) If the Department determines that the apparent successful bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided that it is otherwise eligible for award. If the Department determines that the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification shall include a statement of reasons for the determination.
- (c) The bidder may request administrative reconsideration of a determination adverse to the bidder within the five working days after the receipt of the notification date of the determination by delivering the request to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764 (Telefax: (217)785-1524). Deposit of the request in the United States mail on or before the fifth business day shall not be deemed delivery. The determination shall become final if a request is not made and delivered. A request may provide additional written documentation and/or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be forwarded to the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person in order to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for consideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so.

A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

CALCULATING DBE PARTICIPATION. The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the prime Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
 - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
 - (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission is receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
 - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.

- (2) 100 percent goal credit for the cost of materials of supplies obtained from a DBE manufacturer.
- (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a regular dealer or manufacturer.

CONTRACT COMPLIANCE. Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the Participation Statement.

- (a) NO AMENDMENT. No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be submitted to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764. Telephone number (217)785-4611. Telefax number (217)785-1524.
- (b) TERMINATION OR REPLACEMENT. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in the Special Provision.
- (c) CHANGES TO WORK. Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract.
The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, than a new Request for Approval of Subcontractor shall not be required. However, the Contractor must document efforts to assure that the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.
- (d) ALTERNATIVE WORK METHODS. In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals.

Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:

- (1) That the replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award;
or
- (2) That the DBE is aware that its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
- (3) That the DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.

(e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the prime contractor;
- (3) The listed DBE subcontractor fails or refuses to meet the prime Contractor's reasonable, nondiscriminatory bond requirements;

- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1,200 or applicable state law.
- (6) You have determined that the listed DBE subcontractor is not a responsible contractor;
- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides to you written notice of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE contractor is unable to complete its work on the contract;
- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the prime Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the prime Contractor can self-perform the work for which the DBE contractor was engaged or so that the prime Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated, or fails to complete its work on the Contract for any reason the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal.

- (f) PAYMENT RECORDS. The Contractor shall maintain a record of payments for work performed to the DBE participants. The records shall be made available to the Department for inspection upon request. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than thirty calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Regional Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes that the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the BDE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.

- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.
- (h) RECONSIDERATION. Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of "Good Faith Effort Procedures" of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department.

ERRATA FOR THE 2012 STANDARD SPECIFICATIONS (BDE)

Effective: April 1, 2012

- Page 337 Article 505.04. Revise the subparagraph "(i) Match Making." to read "(i) Match Marking."
- Page 360 Article 506.07. In the first line of the second paragraph change "AASHTO/AWS D1.5/D1.5:" to "AASHTO/AWS D1.5M/D1.5:".
- Page 361 Article 506.08. In the third line of the sixth paragraph change "506.08(a)" to "506.08(b)".
- Page 531 Article 609.07. In the first paragraph delete "TYPE B, C, or D INLET BOX STANDARD 609001 or".
- Page 609 Article 703.05. In the first line of the second paragraph delete "or Type II".
- Page 989 Article 1083.02(a). In the seventh line of the first paragraph change "Table 14.7.5.2-2" to "Table 14.7.5.2-1".

FLAGGER AT SIDE ROADS AND ENTRANCES (BDE)

Effective: April 1, 2009

Revise the second paragraph of Article 701.13(a) of the Standard Specifications to read:

"The Engineer will determine when a side road or entrance shall be closed to traffic. A flagger will be required at each side road or entrance remaining open to traffic within the operation where two-way traffic is maintained on one lane of pavement. The flagger shall be positioned as shown on the plans or as directed by the Engineer."

Revise the first and second paragraph of Article 701.20(i) of the Standard Specifications to read:

“Signs, barricades, or other traffic control devices required by the Engineer over and above those specified will be paid for according to Article 109.04. All flaggers required at side roads and entrances remaining open to traffic including those that are shown on the Highway Standards and/or additional barricades required by the Engineer to close side roads and entrances will be paid for according to Article 109.04.”

FRICTION AGGREGATE (BDE)

Effective: January 1, 2011

Revise Article 1004.01(a)(4) of the Standard Specifications to read:

“(4)Crushed Stone. Crushed stone shall be the angular fragments resulting from crushing undisturbed, consolidated deposits of rock by mechanical means. Crushed stone shall be divided into the following, when specified.

- a. Carbonate Crushed Stone. Carbonate crushed stone shall be either dolomite or limestone. Dolomite shall contain 11.0 percent or more magnesium oxide (MgO). Limestone shall contain less than 11.0 percent magnesium oxide (MgO).
- b. Crystalline Crushed Stone. Crystalline crushed stone shall be either metamorphic or igneous stone, including but is not limited to, quartzite, granite, rhyolite and diabase.”

Revise Article 1004.03(a) of the Standard Specifications to read:

“1004.03 **Coarse Aggregate for Hot-Mix Asphalt (HMA)**. The aggregate shall be according to Article 1004.01 and the following.

- (a) Description. The coarse aggregate for HMA shall be according to the following table.

Use	Mixture	Aggregates Allowed				
Class A	Seal or Cover	<u>Allowed Alone or in Combination:</u> Gravel Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag Crushed Concrete				
HMA All Other	Stabilized Subbase or Shoulders	<u>Allowed Alone or in Combination:</u> Gravel Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag ^{1/} Crushed Concrete				
HMA High ESAL Low ESAL	Binder IL-25.0, IL-19.0, or IL-19.0L SMA Binder	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone ^{2/} Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Concrete ^{3/}				
HMA High ESAL Low ESAL	C Surface and Leveling Binder IL-12.5,IL-9.5, or IL-9.5L SMA Ndesign 50 Surface	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone ^{2/} Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag ^{4/} Crushed Concrete ^{3/}				
HMA High ESAL	D Surface and Leveling Binder IL-12.5 or IL-9.5 SMA Ndesign 50 Surface	<u>Allowed Alone or in Combination:</u> Crushed Gravel Carbonate Crushed Stone (other than Limestone) ^{2/} Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{5/} Crushed Steel Slag ^{4/ 5/} Crushed Concrete ^{3/}				
		<u>Other Combinations Allowed:</u>				
		<table border="1"> <tr> <td><i>Up to...</i></td> <td><i>With...</i></td> </tr> <tr> <td>25% Limestone</td> <td>Dolomite</td> </tr> </table>	<i>Up to...</i>	<i>With...</i>	25% Limestone	Dolomite
<i>Up to...</i>	<i>With...</i>					
25% Limestone	Dolomite					

Use	Mixture	Aggregates Allowed	
		50% Limestone	Any Mixture D aggregate other than Dolomite
		75% Limestone	Crushed Slag (ACBF) ^{5/} or Crushed Sandstone
HMA High ESAL	E Surface IL-12.5 or IL-9.5 SMA Ndesign 80 Surface	<u>Allowed Alone or in Combination:</u> Crushed Gravel Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{5/} Crushed Steel Slag ^{5/} Crushed Concrete ^{3/} No Limestone.	
		<u>Other Combinations Allowed:</u> <i>Up to...</i> <i>With...</i>	
		50% Dolomite ^{2/}	Any Mixture E aggregate
		75% Dolomite ^{2/}	Crushed Sandstone, Crushed Slag (ACBF) ^{5/} , Crushed Steel Slag ^{5/} , or Crystalline Crushed Stone
		75% Crushed Gravel or Crushed Concrete ^{3/}	Crushed Sandstone, Crystalline Crushed Stone, Crushed Slag (ACBF) ^{5/} , or Crushed Steel Slag ^{5/}
HMA High ESAL	F Surface IL-12.5 or IL-9.5 SMA Ndesign 80 Surface	<u>Allowed Alone or in Combination:</u> Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) ^{5/} Crushed Steel Slag ^{5/} No Limestone.	
		<u>Other Combinations Allowed:</u> <i>Up to...</i> <i>With...</i>	
		50% Crushed Gravel, Crushed Concrete ^{3/} , or Dolomite ^{2/}	Crushed Sandstone, Crushed Slag (ACBF) ^{5/} , Crushed Steel Slag ^{5/} , or Crystalline Crushed Stone

- 1/ Crushed steel slag allowed in shoulder surface only.
- 2/ Carbonate crushed stone shall not be used in SMA Ndesign 80. In SMA Ndesign 50, carbonate crushed stone shall not be blended with any of the other aggregates allowed alone in Ndesign 50 SMA binder or Ndesign 50 SMA surface.
- 3/ Crushed concrete will not be permitted in SMA mixes.
- 4/ Crushed steel slag shall not be used as leveling binder.
- 5/ When either slag is used, the blend percentages listed shall be by volume.”

IMPACT ATTENUATORS, TEMPORARY (BDE)

Effective: November 1, 2003

Revised: January 1, 2012

Description. This work shall consist of furnishing, installing, maintaining, and removing temporary impact attenuators of the category and test level specified.

Materials. Materials shall be according to the impact attenuator manufacturer's specifications and the following:

Item	Article/Section
(a) Fine Aggregate (Note 1).....	1003.01
(b) Steel Posts, Structural Shapes, and Plates	1006.04
(c) Rail Elements, End Section Plates, and Splice Plates	1006.25
(d) Bolts, Nuts, Washers and Hardware	1006.25
(e) Hollow Structural Tubing	1006.27(b)
(f) Wood Posts and Wood Blockouts	1007.01, 1007.02, 1007.06
(g) Preservative Treatment.....	1007.12
(h) Packaged Rapid Hardening Mortar	1018.01

Note 1. Fine aggregate shall be FA 1 or FA 2, Class A quality. The sand shall be unbagged and shall have a maximum moisture content of five percent.

CONSTRUCTION REQUIREMENTS

General. Impact Attenuators shall meet the testing criteria contained in either the National Cooperative Highway Research Program (NCHRP) Report 350 or MASH and shall be on the Department's approved list.

Installation. Impact attenuators shall be installed according to the manufacturer's specifications and include all necessary transitions between the impact attenuator and the item to which it is attached. Regrading of slopes or approaches for the installation shall be as shown on the plans.

Attenuator bases, when required by the manufacturer, shall be constructed on a prepared subgrade according to the manufacturer's specifications. The surface of the base shall be slightly sloped or crowned to facilitate drainage.

When water filled attenuators are used between November 1 and April 15, they shall contain anti-freeze according to the manufacturer's recommendations.

Markings. Sand module impact attenuators shall be striped with alternating reflectorized Type AA or Type AP fluorescent orange and reflectorized white horizontal, circumferential stripes. There shall be at least two of each stripe on each module.

Other types of impact attenuators shall have a terminal marker applied to their nose and reflectors along their sides.

Maintenance. All maintenance of the impact attenuators shall be the responsibility of the Contractor until removal is directed by the Engineer.

Relocate. When relocation of temporary impact attenuators is specified, they shall be removed, relocated and reinstalled at the new location. The reinstallation requirements shall be the same as those for a new installation.

Removal. When the Engineer determines the temporary impact attenuators are no longer required, the installation shall be dismantled with all hardware becoming the property of the Contractor.

Surplus material shall be disposed of according to Article 202.03. Anti-freeze, when present, shall be disposed of/recycled according to local ordinances.

When impact attenuators have been anchored to the pavement, the anchor holes shall be repaired with rapid set mortar; only enough water to permit placement and consolidation by rodding shall be used and the material shall be struck-off flush.

Method of Measurement. This work will be measured for payment as each, where each is defined as one complete installation.

Basis of Payment. This work will be paid for at the contract unit price per each for IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, NARROW); IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, WIDE); IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, RESETTABLE); IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, NARROW); IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, WIDE); or IMPACT ATTENUATORS, TEMPORARY (NON-REDIRECTIVE) of the test level specified.

Relocation of the devices will be paid for at the contract unit price per each for IMPACT ATTENUATORS, RELOCATE (FULLY REDIRECTIVE); IMPACT ATTENUATORS, RELOCATE (SEVERE USE); or IMPACT ATTENUATORS, RELOCATE (NON-REDIRECTIVE); of the test level specified.

Regrading of slopes or approaches will be paid for according to Section 202 and/or Section 204 of the Standard Specifications.

PAVEMENT PATCHING (BDE)

Effective: January 1, 2010

Revise the first sentence of the second paragraph of Article 701.17(e)(1) of the Standard Specifications to read:

“In addition to the traffic control and protection shown elsewhere in the contract for pavement, two devices shall be placed immediately in front of each open patch, open hole, and broken pavement where temporary concrete barriers are not used to separate traffic from the work area.”

PAYMENTS TO SUBCONTRACTORS (BDE)

Effective: June 1, 2000

Revised: January 1, 2006

Federal regulations found at 49 CFR §26.29 mandate the Department to establish a contract clause to require Contractors to pay subcontractors for satisfactory performance of their subcontracts and to set the time for such payments.

State law also addresses the timing of payments to be made to subcontractors and material suppliers. Section 7 of the Prompt Payment Act, 30 ILCS 540/7, requires that when a Contractor receives any payment from the Department, the Contractor shall make corresponding, proportional payments to each subcontractor and material supplier performing work or supplying material within 15 calendar days after receipt of the Department payment. Section 7 of the Act further provides that interest in the amount of two percent per month, in addition to the payment due, shall be paid to any subcontractor or material supplier by the Contractor if the payment required by the Act is withheld or delayed without reasonable cause. The Act also provides that the time for payment required and the calculation of any interest due applies to transactions between subcontractors and lower-tier subcontractors and material suppliers throughout the contracting chain.

This Special Provision establishes the required federal contract clause, and adopts the 15 calendar day requirement of the State Prompt Payment Act for purposes of compliance with the federal regulation regarding payments to subcontractors. This contract is subject to the following payment obligations.

When progress payments are made to the Contractor according to Article 109.07 of the Standard Specifications, the Contractor shall make a corresponding payment to each subcontractor and material supplier in proportion to the work satisfactorily completed by each subcontractor and for the material supplied to perform any work of the contract. The proportionate amount of partial payment due to each subcontractor and material supplier throughout the contracting chain shall be determined by the quantities measured or otherwise determined as eligible for payment by the Department and included in the progress payment to the Contractor. Subcontractors and material suppliers shall be paid by the Contractor within 15 calendar days after the receipt of payment from the Department. The Contractor shall not hold retainage from the subcontractors. These obligations shall also apply to any payments made by subcontractors and material suppliers to their subcontractors and material suppliers; and to all payments made to lower tier subcontractors and material suppliers throughout the contracting chain. Any payment or portion of a payment subject to this provision may only be withheld from the subcontractor or material supplier to whom it is due for reasonable cause.

This Special Provision does not create any rights in favor of any subcontractor or material supplier against the State or authorize any cause of action against the State on account of any payment, nonpayment, delayed payment, or interest claimed by application of the State Prompt Payment Act. The Department will not approve any delay or postponement of the 15 day requirement except for reasonable cause shown after notice and hearing pursuant to Section 7(b) of the State Prompt Payment Act. State law creates other and additional remedies available to any subcontractor or material supplier, regardless of tier, who has not been paid for work properly performed or material furnished. These remedies are a lien against public funds set forth in Section 23(c) of the Mechanics Lien Act, 770 ILCS 60/23(c), and a recovery on the Contractor's payment bond according to the Public Construction Bond Act, 30 ILCS 550.

PORTLAND CEMENT CONCRETE (BDE)

Effective: January 1, 2012

Revise Notes 1 and 2 of Article 312.24 of the Standard Specifications to read:

- “Note 1. Coarse aggregate shall be gradation CA 6, CA 7, CA 9, CA 10, or CA 11, Class D quality or better. Article 1020.05(d) shall apply.
Note 2. Fine aggregate shall be FA 1 or FA 2. Article 1020.05(d) shall apply.”

Revise the first paragraph of Article 312.26 of the Standard Specifications to read:

“**312.26 Proportioning and Mix Design.** At least 60 days prior to start of placing CAM II, the Contractor shall submit samples of materials for proportioning and testing. The mixture shall contain a minimum of 200 lb (90 kg) of cement per cubic yard (cubic meter). Portland cement may be replaced with fly ash according to Article 1020.05(c)(1). Blends of coarse and fine aggregates will be permitted, provided the volume of fine aggregate does not exceed the volume of coarse aggregate. The Engineer will determine the proportions of materials for the mixture. However, the Contractor may substitute their own mix design. Article 1020.05(a) shall apply and a Level III PCC Technician shall develop the mix design.”

Revise the second paragraph of Article 503.22 of the Standard Specifications to read:

Other cast-in-place concrete for structures will be paid for at the contract unit price per cubic yard (cubic meter) for CONCRETE HANDRAIL, CONCRETE ENCASUREMENT, and SEAL COAT CONCRETE.”

Add the following to Article 1003.02 of the Standard Specifications:

(e) Alkali Reaction.

- (1) ASTM C 1260. Each fine aggregate will be tested by the Department for alkali reaction according to ASTM C 1260. The test will be performed with Type I or II portland cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.90 percent or greater. The Engineer will determine the assigned expansion value for each aggregate, and these values will be made available on the Department's Alkali-Silica Potential Reactivity Rating List. The Engineer may differentiate aggregate based on ledge, production method, gradation number, or other factors. An expansion value of 0.03 percent will be assigned to limestone or dolomite fine aggregates (manufactured stone sand). However, the Department reserves the right to perform the ASTM C 1260 test.
- (2) ASTM C 1293 by Department. In some instances, such as chert natural sand or other fine aggregates, testing according to ASTM C 1260 may not provide accurate test results. In this case, the Department may only test according to ASTM C 1293.
- (3) ASTM C 1293 by Contractor. If an individual aggregate has an ASTM C 1260 expansion value that is unacceptable to the Contractor, an ASTM C 1293 test may be performed by the Contractor to evaluate the Department's ASTM C 1260 test result.

The laboratory performing the ASTM C 1293 test shall be approved by the Department according to the current Bureau of Materials and Physical Research Policy Memorandum "Minimum Laboratory Requirements for Alkali-Silica Reactivity (ASR) Testing".

The ASTM C 1293 test shall be performed with Type I or II portland cement having a total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.80 percent or greater. The interior vertical wall of the ASTM C 1293 recommended container (pail) shall be half covered with a wick of absorbent material consisting of blotting paper. If the testing laboratory desires to use an alternate container, wick of absorbent material, or amount of coverage inside the container with blotting paper, ASTM C 1293 test results with an alkali-reactive aggregate of known expansion characteristics shall be provided to the Engineer for review and approval. If the expansion is less than 0.040 percent after one year, the aggregate will be assigned an ASTM C 1260 expansion value of 0.08 percent that will be valid for two years, unless the Engineer determines the aggregate has changed significantly. If the aggregate is manufactured into multiple gradation numbers, and the other gradation numbers have the same or lower ASTM C 1260 value, the ASTM C 1293 test result may apply to multiple gradation numbers.

The Engineer reserves the right to verify a Contractor's ASTM C 1293 test result. When the Contractor performs the test, a split sample shall be provided to the Engineer. The Engineer may also independently obtain a sample at any time. The aggregate will be considered reactive if the Contractor or Engineer obtains an expansion value of 0.040 percent or greater.

Revise Article 1004.02(d) of the Standard Specifications to read:

"(d)Combining Sizes. Each size shall be stored separately and care shall be taken to prevent them from being mixed until they are ready to be proportioned. Separate compartments shall be provided to proportion each size.

- (1) When Class BS concrete is to be pumped, the coarse aggregate gradation shall have a minimum of 45 percent passing the 1/2 in. (12.5 mm) sieve. The Contractor may combine two or more coarse aggregate sizes, consisting of CA 7, CA 11, CA 13, CA 14, and CA 16, provided a CA 7 or CA 11 is included in the blend.
- (2) If the coarse aggregate is furnished in separate sizes, they shall be combined in proportions to provide a uniformly graded coarse aggregate grading within the following limits.

Class of Concrete ^{1/}	Combined Sizes	Sieve Size and Percent Passing						
		2 1/2 in.	2 in.	1 3/4 in.	1 1/2 in.	1 in.	1/2 in.	No. 4
PV ^{2/}	CA 5 & CA 7	---	---	100	98±2	72±22	22±12	3±3
	CA 5 & CA 11	---	---	100	98±2	72±22	22±12	3±3
SI and SC ^{2/}	CA 3 & CA 7	100	95±5	---	---	55±25	20±10	3±3
	CA 3 & CA 11	100	95±5	---	---	55±25	20±10	3±3
	CA 5 & CA 7	---	---	100	98±2	72±22	22±12	3±3
	CA 5 & CA 11	---	---	100	98±2	72±22	22±12	3±3

Class of Concrete ^{1/}	Combined Sizes	Sieve Size (metric) and Percent Passing						
		63 mm	50 mm	45 mm	37.5 mm	25 mm	12.5 mm	4.75 mm
PV ^{2/}	CA 5 & CA 7	---	---	100	98±2	72±22	22±12	3±3
	CA 5 & CA 11	---	---	100	98±2	72±22	22±12	3±3
SI and SC ^{2/}	CA 3 & CA 7	100	95±5	---	---	55±25	20±10	3±3
	CA 3 & CA 11	100	95±5	---	---	55±25	20±10	3±3
	CA 5 & CA 7	---	---	100	98±2	72±22	22±12	3±3
	CA 5 & CA 11	---	---	100	98±2	72±22	22±12	3±3

1/ See Table 1 of Article 1020.04.

2/ Any of the listed combination of sizes may be used.”

Add the following to Article 1004.02 of the Standard Specifications:

(g) Alkali Reaction.

- (1) Each coarse aggregate will be tested by the Department for alkali reaction according to ASTM C 1260. The test will be performed with Type I or II portland cement having a total equivalent alkali content (Na₂O + 0.658K₂O) of 0.90 percent or greater. The Engineer will determine the assigned expansion value for each aggregate, and these values will be made available on the Department’s Alkali-Silica Potential Reactivity Rating List. The Engineer may differentiate aggregate based on ledge, production method, gradation number, or other factors. An expansion value of 0.05 percent will be assigned to limestone or dolomite coarse aggregates. However, the Department reserves the right to perform the ASTM C 1260 test.
- (2) ASTM C 1293 by Department. In some instances testing a coarse aggregate according to ASTM C 1260 may not provide accurate test results. In this case, the Department may only test according to ASTM C 1293.
- (3) ASTM C 1293 by Contractor. If an individual aggregate has an ASTM C 1260 expansion value that is unacceptable to the Contractor, an ASTM C 1293 test may be performed by the Contractor according to Article 1003.02(e)(3).

Revise the first paragraph of Article 1019.06 of the Standard Specifications to read:

“1019.06 Contractor Mix Design. A Contractor may submit their own mix design and may propose alternate fine aggregate materials, fine aggregate gradations, or material proportions. Article 1020.05(a) shall apply and a Level III PCC Technician shall develop the mix design.”

Revise Section 1020 of the Standard Specifications to read:

“SECTION 1020. PORTLAND CEMENT CONCRETE

1020.01 Description. This item shall consist of the materials, mix design, production, testing, curing, low air temperature protection, and temperature control of concrete.

1020.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cement	1001
(b) Water	1002
(c) Fine Aggregate	1003
(d) Coarse Aggregate	1004
(e) Concrete Admixtures	1021
(f) Finely Divided Minerals	1010
(g) Concrete Curing Materials	1022
(h) Straw	1081.06(a)(1)
(i) Calcium Chloride	1013.01

1020.03 Equipment. Equipment shall be according to the following.

Item	Article/Section
(a) Concrete Mixers and Trucks	1103.01
(b) Batching and Weighing Equipment	1103.02
(c) Automatic and Semi-Automatic Batching Equipment	1103.03
(d) Water Supply Equipment	1103.11
(e) Membrane Curing Equipment	1101.09
(f) Mobile Portland Cement Concrete Plants	1103.04

1020.04 Concrete Classes and General Mix Design Criteria. The classes of concrete shown in Table 1 identify the various mixtures by the general uses and mix design criteria. If the class of concrete for a specific item of construction is not specified, Class SI concrete shall be used.

For the minimum cement factor in Table 1, it shall apply to portland cement, portland-pozzolan cement, and portland blast-furnace slag except when a particular cement is specified in the Table.

The Contractor shall not assume that the minimum cement factor indicated in Table 1 will produce a mixture that will meet the specified strength. In addition, the Contractor shall not assume that the maximum finely divided mineral allowed in a mix design according to Article 1020.05(c) will produce a mixture that will meet the specified strength. The Contractor shall select a cement factor within the allowable range that will obtain the specified strength. The Contractor shall take into consideration materials selected, seasonal temperatures, and other factors which may require the Contractor to submit multiple mix designs.

For a portland-pozzolan cement, portland blast-furnace slag cement, or when replacing portland cement with finely divided minerals per Articles 1020.05(c) and 1020.05(d), the portland cement content in the mixture shall be a minimum of 375 lbs/cu yd (222 kg/cu m). When the total of organic processing additions, inorganic processing additions, and limestone addition exceed 5.0 percent in the cement, the minimum portland cement content in the mixture shall be 400 lbs/cu yd (237 kg/cu m). When calculating the portland cement portion in the portland-pozzolan or portland blast-furnace slag cement, the AASHTO M 240 tolerance may be ignored.

Special classifications may be made for the purpose of including the concrete for a particular use or location as a separate pay item in the contract. The concrete used in such cases shall conform to this section.

TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA											
Class of Conc.	Use	Specification Section Reference	Cement Factor		Water / Cement Ratio lb/lb	S I u m p in. (4)	Mix Design Compressive Strength (Flexural Strength)			Air Content %	Coarse Aggregate Gradations (14)
			cwt/cu yd (3)				psi, minimum				
			Min.	Max			Days				
						3	14	28			
PV	Pavement Base Course	420 or 421 353	5.65 (1) 6.05 (2)	7.05	0.32 - 0.42	2 - 4 (5)	Ty III 3500 (650)	3500 (650)		5.0 - 8.0	CA 5 & CA 7, CA 5 & CA 11, CA 7, CA 11, or CA 14
	Base Course Widening	354									
	Driveway Pavement	423									
	Shoulders	483									
	Shoulder Curb	662									
PP	Pavement Patching Bridge Deck Patching (10)	442					3200 (600) Article 701.17(e)(3)b.				CA 7, CA 11, CA 13, CA 14, or CA 16
	PP-1		6.50 6.20 (Ty III)	7.50 7.20 (Ty III)	0.32 - 0.44	2 - 4	at 48 hours			4.0 - 7.0	
	PP-2		7.35	7.35	0.32 - 0.38	2 - 6	at 24 hours			4.0 - 6.0	
	PP-3		7.35 (Ty III) (8)	7.35 (Ty III) (8)	0.32 - 0.35	2 - 4	at 16 hours			4.0 - 6.0	
	PP-4		6.00 (9)	6.25 (9)	0.32 - 0.50	2 - 6	at 8 hours			4.0 - 6.0	
	PP-5		6.75 (9)	6.75 (9)	0.32 - 0.40	2 - 8	at 4 hours			4.0 - 6.0	
RR	Railroad Crossing	422	6.50 6.20 (Ty III)	7.50 7.20 (Ty III)	0.32 - 0.44	2 - 4	3500 (650) at 48 hours			4.0 - 7.0	CA 7, CA 11, or CA 14
BS	Bridge Superstructure Bridge Approach Slab	503	6.05	7.05	0.32 - 0.44	2 - 4 (5)		4000 (675)		5.0 - 8.0	CA 7, CA 11, or CA 14 (7)
PC	Various Precast Concrete Items	1042	5.65	7.05	0.32 - 0.44	1 - 4	See Section 1042			5.0 - 8.0	CA7, CA11, CA 13, CA 14, CA 16, or CA 7 & CA 16
	Wet Cast Dry Cast		5.65 (TY III)	7.05 (TY III)	0.25 - 0.40	0 - 1				N/A	
PS	Precast Prestressed Members	504	5.65 5.65 (TY III)	7.05 7.05 (TY III)	0.32 - 0.44	1 - 4			Plans 5000	5.0 - 8.0	CA 11 (11), CA 13, CA 14 (11), or CA 16
	Precast Prestressed Piles and Extensions	512									
	Precast Prestressed Sight Screen	639									

TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA											
Class of Conc.	Use	Specification Section Reference	Cement Factor		Water / Cement Ratio lb/lb	S I u m p in. (4)	Mix Design Compressive Strength (Flexural Strength)			Air Content %	Coarse Aggregate Gradations (14)
			cwt/cu yd (3)				psi, minimum				
			Min.	Max			Days				
						3	14	28			
DS	Drilled Shaft (12)	516	6.65	7.05	0.32 - 0.44	6 - 8 (6)		4000 (675)		5.0 - 8.0	CA 13, CA 14, CA 16, or a blend of these gradations.
	Metal Shell Piles (12)	512									
	Sign Structures	734									
	Drilled Shaft (12) Light Tower Foundation (12)	837									
SC	Seal Coat	503	5.65 (1) 6.05 (2)	7.05	0.32 - 0.44	3 - 5		3500 (650)		Optional 6.0 max.	CA 3 & CA 7, CA 3 & CA 11, CA 5 & CA 7, CA 7 & CA 11, CA 7, or CA 11
SI	Structures (except Superstructure)	503	5.65 (1) 6.05 (2)	7.05	0.32 - 0.44	2 - 4 (5)		3500 (650)		5.0 - 8.0	CA 3 & CA 7, CA 3 & CA 11, CA 5 & CA 7, CA 5 & CA 11, CA 7, CA 11, CA 13, CA 14, or CA 16 (13)
	Sidewalk	424									
	Slope Wall	511									
	Encasement	512									
	Box Culverts	540									
	End Section and Collar	542									
	Curb, Gutter, Curb & Gutter, Median, and Paved Ditch	606									
	Concrete Barrier	637									
	Sign Structures	734									
	Spread Footing										
	Concrete Foundation										
	Pole Foundation (12)	836									
Traffic Signal Foundation	878										
Drilled Shaft (12)											
Square or Rectangular											

- Notes:
- (1) Central-mixed.
 - (2) Truck-mixed or shrink-mixed. Shrink-mixed concrete will not be permitted for Class PV concrete.
 - (3) For Class SC concrete and for any other class of concrete that is to be placed underwater, except Class DS concrete, the cement factor shall be increased by ten percent.
 - (4) The maximum slump may be increased to 7 in. when a high range water-reducing admixture is used for all classes of concrete, except Class PV, SC, and PP. For Class SC, the maximum slump may be increased to 8 in. For Class PP-1, the maximum slump may be increased to 6 in. For Class PS, the 7 in. maximum slump may be increased to 8 1/2 in. if the high range water-reducing admixture is the polycarboxylate type.
 - (5) The slump range for slipform construction shall be 1/2 to 1 1/2 in.
 - (6) If concrete is placed to displace drilling fluid, or against temporary casing, the slump shall be 8 - 10 in. at the point of placement. If a water-reducing admixture is used in lieu of a high range water-reducing admixture according to Article 1020.05(b)(7), the slump shall be 2 - 4 in.
 - (7) For Class BS concrete used in bridge deck patching, the coarse aggregate gradation shall be CA 13, CA 14, or CA 16, except CA 11 may be used for full-depth patching.
 - (8) In addition to the Type III portland cement, 100 lb/cu yd of ground granulated blast-furnace slag and 50 lb/cu yd of microsilica (silica fume) shall be used. For an air temperature greater than 85 °F, the Type III portland cement may be replaced with Type I or II portland cement.
 - (9) The cement shall be a rapid hardening cement from the Department's "Approved List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs" for PP-4 and calcium aluminate cement for PP-5.
 - (10) For Class PP concrete used in bridge deck patching, the aggregate gradation shall be CA 13, CA 14, or CA 16, except CA 11 may be used for full-depth patching. In addition, the mix design shall have 72 hours to obtain a 4,000 psi compressive or 675 psi flexural strength for all PP mix designs.
 - (11) The nominal maximum size permitted is 3/4 in. Nominal maximum size is defined as the largest sieve which retains any of the aggregate sample particles.
 - (12) The concrete mix shall be designed to remain fluid throughout the anticipated duration of the pour plus one hour. At the Engineer's discretion, the Contractor may be required to conduct a minimum 2 cu yd trial batch to verify the mix design.
 - (13) CA 3 or CA 5 may be used when the nominal maximum size does not exceed two-thirds the clear distance between parallel reinforcement bars, or between the reinforcement bar and the form. Nominal maximum size is defined in Note 11.
 - (14) Alternate combinations of gradations sizes may be used with the approval of the Engineer. Refer also to Article 1004.02(d) for additional information on combining sizes.

TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA (metric)											
Class of Conc.	Use	Specification Section Reference	Cement Factor		Water / Cement Ratio kg/kg	S l u m p mm (4)	Mix Design Compressive Strength (Flexural Strength) kPa, minimum			Air Content %	Coarse Aggregate Gradations (14)
			kg/cu m (3)				Days				
			Min.	Max			3	14	28		
PV	Pavement Base Course	420 or 421 353	335 (1) 360 (2)	418	0.32 - 0.42	50 - 100 (5)	Ty III 24,000 (4500)	24,000 (4500)		5.0 - 8.0	CA 5 & CA 7, CA 5 & CA 11, CA 7, CA 11, or CA 14
	Base Course Widening	354									
	Driveway Pavement	423									
	Shoulders	483									
	Shoulder Curb	662									
PP	Pavement Patching Bridge Deck Patching (10)	442					22,100 (4150) Article 701.17(e)(3)b.				CA 7, CA 11, CA 13, CA 14, or CA 16
	PP-1		385 365 (Ty III)	445 425 (Ty III)	0.32 - 0.44	50 - 100	at 48 hours			4.0 - 7.0	
	PP-2		435	435	0.32 - 0.38	50 - 150	at 24 hours			4.0 - 6.0	
	PP-3		435 (Ty III) (8)	435 (Ty III) (8)	0.32 - 0.35	50 - 100	at 16 hours			4.0 - 6.0	
	PP-4		355 (9)	370 (9)	0.32 - 0.50	50 - 150	at 8 hours			4.0 - 6.0	
	PP-5		400 (9)	400 (9)	0.32 - 0.40	50 - 200	at 4 hours			4.0 - 6.0	
RR	Railroad Crossing	422	385 365 (Ty III)	445 425 (Ty III)	0.32 - 0.44	50 - 100	24,000 (4500) at 48 hours			4.0 - 7.0	CA 7, CA 11, or CA 14
BS	Bridge Superstructure Bridge Approach Slab	503	360	418	0.32 - 0.44	50 - 100 (5)		27,500 (4650)		5.0 - 8.0	CA 7, CA 11, or CA 14 (7)
PC	Various Precast Concrete Items Wet Cast Dry Cast	1042	335 335 (TY III)	418 418 (TY III)	0.32 - 0.44 0.25 - 0.40	25 - 100 0 - 25	See Section 1042			5.0 - 8.0 N/A	CA7, CA11, CA13, CA 14, CA 16, or CA 7 & CA 16
PS	Precast Prestressed Members	504	335 335 (TY III)	418 418 (TY III)	0.32 - 0.44	25 - 100			Plans 34,500	5.0 - 8.0	CA 11 (11), CA 13, CA 14 (11), or CA 16
	Precast Prestressed Piles and Extensions	512									
	Precast Prestressed Sight Screen	639									

TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA (metric)											
Class of Conc.	Use	Specification Section Reference	Cement Factor		Water / Cement Ratio kg/kg	S l u m p mm (4)	Mix Design Compressive Strength (Flexural Strength) kPa, minimum			Air Content %	Coarse Aggregate Gradations (14)
			kg/cu m (3)				Days				
			Min.	Max			3	14	28		
DS	Drilled Shaft (12)	516	395	418	0.32 - 0.44	150 - 200 (6)		27,500 (4650)		5.0 - 8.0	CA 13, CA 14, CA 16, or a blend of these gradations.
	Metal Shell Piles (12)	512									
	Sign Structures Drilled Shaft (12)	734									
	Light Tower Foundation (12)	837									
SC	Seal Coat	503	335 (1) 360 (2)	418	0.32 - 0.44	75 - 125		24,000 (4500)		Optional 6.0 max.	CA 3 & CA 7, CA 3 & CA 11, CA 5 & CA 7, CA 7 & CA 11, CA 7, or CA 11
SI	Structures (except Superstructure)	503	335 (1) 360 (2)	418	0.32 - 0.44	50 - 100 (5)		24,000 (4500)		5.0 - 8.0	CA 3 & CA 7, CA 3 & CA 11, CA 5 & CA 7, CA 5 7 CA 11, CA 7, CA 11, CA 13, CA 14, or CA 16 (13)
	Sidewalk	424									
	Slope Wall	511									
	Encasement	512									
	Box Culverts	540									
	End Section and Collar	542									
	Curb, Gutter, Curb & Gutter, Median, and Paved Ditch	606									
	Concrete Barrier	637									
	Sign Structures	734									
	Spread Footing Concrete Foundation	836									
Pole Foundation (12)	878										
Traffic Signal Foundation Drilled Shaft (12) Square or Rectangular											

- Notes:
- (1) Central-mixed.
 - (2) Truck-mixed or shrink-mixed. Shrink-mixed concrete will not be permitted for Class PV concrete.
 - (3) For Class SC concrete and for any other class of concrete that is to be placed underwater, except Class DS concrete, the cement factor shall be increased by ten percent.
 - (4) The maximum slump may be increased to 175 mm when a high range water-reducing admixture is used for all classes of concrete except Class PV, SC, and PP. For Class SC, the maximum slump may be increased to 200 mm. For Class PP-1, the maximum slump may be increased to 150 mm. For Class PS, the 175 mm maximum slump may be increased to 215 mm if the high range water-reducing admixture is the polycarboxylate type.
 - (5) The slump range for slipform construction shall be 13 to 40 mm.
 - (6) If concrete is placed to displace drilling fluid, or against temporary casing, the slump shall be 200 - 250 mm at the point of placement. If a water-reducing admixture is used in lieu of a high range water-reducing admixture according to Article 1020.05(b)(7), the slump shall be 50 – 100 mm.
 - (7) For Class BS concrete used in bridge deck patching, the coarse aggregate gradation shall be CA 13, CA 14, or CA 16, except CA 11 may be used for full-depth patching.
 - (8) In addition to the Type III portland cement, 60 kg/cu m of ground granulated blast-furnace slag and 30 kg/cu m of microsilica (silica fume) shall be used. For an air temperature greater than 30 °C, the Type III portland cement may be replaced with Type I or II portland cement.
 - (9) The cement shall be a rapid hardening cement from the Department's "Approved List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs" for PP-4 and calcium aluminate cement for PP-5.
 - (10) For Class PP concrete used in bridge deck patching, the aggregate gradation shall be CA 13, CA 14, or CA 16, except CA 11 may be used for full-depth patching. In addition, the mix design shall have 72 hours to obtain a 27,500 kPa compressive or 4,650 kPa flexural.
 - (11) The nominal maximum size permitted is 19 mm. Nominal maximum size is defined as the largest sieve which retains any of the aggregate sample particles.
 - (12) The concrete mix shall be designed to remain fluid throughout the anticipated duration of the pour plus one hour. At the Engineer's discretion, the Contractor may be required to conduct a minimum 1.5 cu m trial batch to verify the mix design.
 - (13) CA 3 or CA 5 may be used when the nominal maximum size does not exceed two-thirds the clear distance between parallel reinforcement bars, or between the reinforcement bar and the form. Nominal maximum size is defined in Note 11.
 - (14) Alternate combinations of gradation sizes may be used with the approval of the Engineer. Refer also to Article 1004.02(d) for additional information on combining sizes.

1020.05 **Other Concrete Criteria.** The concrete shall be according to the following.

- (a) Proportioning and Mix Design. For all Classes of concrete, it shall be the Contractors responsibility to determine mix design material proportions and to proportion each batch of concrete. A Level III PCC Technician shall develop the mix design for all Classes of concrete, except Classes PC and PS. The mix design, submittal information, trial batch, and Engineer verification shall be according to the "Portland Cement Concrete Level III Technician" course material.

The Contractor shall provide the mix designs a minimum of 45 calendar days prior to production. More than one mix design may be submitted for each class of concrete.

The Engineer will verify the mix design submitted by the Contractor. Verification of a mix design shall in no manner be construed as acceptance of any mixture produced. Once a mix design has been verified, the Engineer shall be notified of any proposed changes.

Tests performed at the jobsite will determine if a mix design can meet specifications. If the tests indicate it cannot, the Contractor shall make adjustments to a mix design, or submit a new mix design if necessary, to comply with the specifications.

- (b) Admixtures. The Contractor shall be responsible for using admixtures and determining dosages for all Classes of concrete, cement aggregate mixture II, and controlled low-strength material that will produce a mixture with suitable workability, consistency, and plasticity. In addition, admixture dosages shall result in the mixture meeting the specified plastic and hardened properties. The Contractor shall obtain approval from the Engineer to use an accelerator when the concrete temperature is greater than 60 °F (16 °C). However, this accelerator approval will not be required for Class PP, RR, PC, and PS concrete. The accelerator shall be the non-chloride type unless otherwise specified in the contract plans.

The Department will maintain an Approved List of Corrosion Inhibitors. Corrosion inhibitor dosage rates shall be according to Article 1020.05(b)(10). For information on approved controlled low-strength material air-entraining admixtures, refer to Article 1019.02. The Department will also maintain an Approved List of Concrete Admixtures, and an admixture technical representative shall be consulted by the Contractor prior to the pour when determining an admixture dosage from this list or when making minor admixture dosage adjustments at the jobsite. The dosage shall be within the range indicated on the approved list unless the influence by other admixtures, jobsite conditions (such as a very short haul time), or other circumstances warrant a dosage outside the range. The Engineer shall be notified when a dosage is proposed outside the range. To determine an admixture dosage, air temperature, concrete temperature, cement source and quantity, finely divided mineral sources and quantity, influence of other admixtures, haul time, placement conditions, and other factors as appropriate shall be considered. The Engineer may request the Contractor to have a batch of concrete mixed in the lab or field to verify the admixture dosage is correct. An admixture dosage or combination of admixture dosages shall not delay the initial set of concrete by more than one hour. When a retarding admixture is required or appropriate for a bridge deck or bridge deck overlay pour, the initial set time shall be delayed until the deflections due to the concrete dead load are no longer a concern for inducing cracks in the completed work.

However, a retarding admixture shall not be used to further extend the pour time and justify the alteration of a bridge deck pour sequence.

When determining water in admixtures for water/cement ratio, the Contractor shall calculate 70 percent of the admixture dosage as water, except a value of 50 percent shall be used for a latex admixture used in bridge deck latex concrete overlays.

The sequence, method, and equipment for adding the admixtures shall be approved by the Engineer. Admixtures shall be added to the concrete separately. An accelerator shall always be added prior to a high range water-reducing admixture, if both are used.

Admixture use shall be according to the following.

- (1) When the atmosphere or concrete temperature is 65 °F (18 °C) or higher, a retarding admixture shall be used in the Class BS concrete and concrete bridge deck overlays. The proportions of the ingredients of the concrete shall be the same as without the retarding admixture, except that the amount of mixing water shall be reduced, as may be necessary, in order to maintain the consistency of the concrete as required. In addition, a high range water-reducing admixture shall be used in bridge deck concrete. At the option of the Contractor, a water-reducing admixture may be used with the high range water-reducing admixture in Class BS concrete.
- (2) At the Contractor's option, admixtures in addition to an air-entraining admixture may be used for Class PP-1 or RR concrete. When the air temperature is less than 55 °F (13 °C) and an accelerator is used, the non-chloride accelerator shall be calcium nitrite.
- (3) When Class C fly ash or ground granulated blast-furnace slag is used in Class PP-1 or RR concrete, a water-reducing or high range water-reducing admixture shall be used.
- (4) For Class PP-2 or PP-3 concrete, a non-chloride accelerator followed by a high range water-reducing admixture shall be used, in addition to the air-entraining admixture. The Contractor has the option to use a water-reducing admixture with the high range water-reducing admixture. For Class PP-3 concrete, the non-chloride accelerator shall be calcium nitrite. For Class PP-2 concrete, the non-chloride accelerator shall be calcium nitrite when the air temperature is less than 55 °F (13 °C).
- (5) For Class PP-4 concrete, a high range water-reducing admixture shall be used in addition to the air-entraining admixture. The Contractor has the option to use a water-reducing admixture with the high range water-reducing admixture. An accelerator shall not be used. For stationary or truck-mixed concrete, a retarding admixture shall be used to allow for haul time. The Contractor has the option to use a mobile portland cement concrete plant, but a retarding admixture shall not be used unless approved by the Engineer.

For PP-5 concrete, a non-chloride accelerator, high range water-reducing admixture, and air-entraining admixture shall be used.

The accelerator, high range water-reducing admixture, and air-entraining admixture shall be per the Contractor's recommendation and dosage. The approved list of concrete admixtures shall not apply. A mobile portland cement concrete plant shall be used to produce the patching mixture.

- (6) When a calcium chloride accelerator is specified in the contract, the maximum chloride dosage shall be 1.0 quart (1.0 L) of solution per 100 lb (45 kg) of cement. The dosage may be increased to a maximum 2.0 quarts (2.0 L) per 100 lb (45 kg) of cement if approved by the Engineer. When a calcium chloride accelerator for Class PP-2 concrete is specified in the contract, the maximum chloride dosage shall be 1.3 quarts (1.3 L) of solution per 100 lb (45 kg) of cement. The dosage may be increased to a maximum 2.6 quarts (2.6 L) per 100 lb (45 kg) of cement if approved by the Engineer.
- (7) For Class DS concrete a retarding admixture and a high range water-reducing admixture shall be used. For dry excavations that are 10 ft (3 m) or less, the high range water-reducing admixture may be replaced with a water-reducing admixture if the concrete is vibrated. The use of admixtures shall take into consideration the slump loss limits specified in Article 516.12 and the fluidity requirement in Article 1020.04 (Note 12).
- (8) At the Contractor's option, when a water-reducing admixture or a high range water-reducing admixture is used for Class PV, PP-1, RR, SC, and SI concrete, the cement factor may be reduced a maximum 0.30 hundredweight/cu yd (18 kg/cu m). However, a cement factor reduction will not be allowed for concrete placed underwater.
- (9) When Type F or Type G high range water-reducing admixtures are used, the initial slump shall be a minimum of 1 1/2 in. (40 mm) prior to addition of the Type F or Type G admixture, except as approved by the Engineer.
- (10) When specified, a corrosion inhibitor shall be added to the concrete mixture utilized in the manufacture of precast, prestressed concrete members and/or other applications. It shall be added, at the same rate, to all grout around post-tensioning steel when specified.

When calcium nitrite is used, it shall be added at the rate of 4 gal/cu yd (20 L/cu m), and shall be added to the mix immediately after all compatible admixtures have been introduced to the batch.

When Rheocrete 222+ is used, it shall be added at the rate of 1.0 gal/cu yd (5.0 L/cu m), and the batching sequence shall be according to the manufacturer's instructions.

- (c) Finely Divided Minerals. Use of finely divided minerals shall be according to the following.

- (1) Fly Ash. At the Contractor's option, fly ash from approved sources may partially replace portland cement in cement aggregate mixture II, Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete.

The use of fly ash shall be according to the following.

- a. Measurements of fly ash and portland cement shall be rounded up to the nearest 5 lb (2.5 kg).
 - b. When Class F fly ash is used in cement aggregate mixture II, Class PV, BS, PC, PS, DS, SC, and SI concrete, the amount of portland cement replaced shall not exceed 25 percent by weight (mass).
 - c. When Class C fly ash is used in cement aggregate mixture II, Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete, the amount of portland cement replaced shall not exceed 30 percent by weight (mass).
 - d. Fly ash may be used in concrete mixtures when the air temperature is below 40 °F (4 °C), but the Engineer may request a trial batch of the concrete mixture to show the mix design strength requirement will be met.
- (2) Ground Granulated Blast-Furnace (GGBF) Slag. At the Contractor's option, GGBF slag may partially replace portland cement in concrete mixtures, for Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete. For Class PP-3 concrete, GGBF slag shall be used according to Article 1020.04.

The use of GGBF slag shall be according to the following.

- a. Measurements of GGBF slag and portland cement shall be rounded up to the nearest 5 lb (2.5 kg).
 - b. When GGBF slag is used in Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC and SI concrete, the amount of portland cement replaced shall not exceed 35 percent by weight (mass).
 - c. GGBF slag may be used in concrete mixtures when the air temperature is below 40 °F (4 °C), but the Engineer may request a trial batch of the concrete mixture to show the mix design strength requirement will be met.
- (3) Microsilica. At the Contractor's option, microsilica may be added at a maximum of 5.0 percent by weight (mass) of the cement and finely divided minerals summed together.

Microsilica shall be used in Class PP-3 concrete according to Article 1020.04.

- (4) High Reactivity Metakaolin (HRM). At the Contractor's option, HRM may be added at a maximum of 5.0 percent by weight (mass) of the cement and finely divided minerals summed together.
- (5) Mixtures with Multiple Finely Divided Minerals. Except as specified for Class PP-3 concrete, the Contractor has the option to use more than one finely divided mineral in Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete as follows.

- a. The mixture shall contain a maximum of two finely divided minerals. The finely divided mineral in portland-pozzolan cement or portland blast-furnace slag cement shall count toward the total number of finely divided minerals allowed. The finely divided minerals shall constitute a maximum of 35.0 percent of the total cement plus finely divided minerals. The fly ash portion shall not exceed 30.0 percent for Class C fly ash or 25.0 percent for Class F fly ash. The Class C and F fly ash combination shall not exceed 30.0 percent. The ground granulated blast-furnace slag portion shall not exceed 35.0 percent. The microsilica or high-reactivity metakaolin portion used together or separately shall not exceed ten percent. The finely divided mineral in the portland-pozzolan cement or portland blast-furnace slag blended cement shall apply to the maximum 35.0 percent.
- b. Central Mixed. For Class PV, SC, and SI concrete, the mixture shall contain a minimum of 565 lbs/cu yd (335 kg/cu m) of cement and finely divided minerals summed together. If a water-reducing or high-range water-reducing admixture is used, the Contractor has the option to use a minimum of 535 lbs/cu yd (320 kg/cu m).
- c. Truck-Mixed or Shrink-Mixed. For Class PV (only truck-mixed permitted), SC, and SI concrete, the mixture shall contain a minimum of 605 lbs/cu yd (360 kg/cu m) of cement and finely divided minerals summed together. If a water-reducing or high-range water-reducing admixture is used, the Contractor has the option to use a minimum of 575 lbs/cu yd (345 kg/cu m).
- d. Central-Mixed, Truck-Mixed or Shrink-Mixed. For Class PP-1 and RR concrete, the mixture shall contain a minimum of 650 lbs/cu yd (385 kg/cu m) of cement and finely divided minerals summed together. For Class PP-1 and RR concrete using Type III portland cement, the mixture shall contain a minimum of 620 lbs/cu yd (365 kg/cu m).

For Class PP-2 concrete, the mixture shall contain a minimum of 735 lbs/cu yd (435 kg/cu m) of cement and finely divided minerals summed together. For Class BS concrete, the mixture shall contain a minimum of 605 lbs/cu yd (360 kg/cu m). For Class DS concrete, the mixture shall contain a minimum of 665 lbs/cu yd (395 kg/cu m).

If a water-reducing or high range water-reducing admixture is used in Class PP-1 and RR concrete, the Contractor has the option to use a minimum of 620 lbs/cu yd (365 kg/cu m) of cement and finely divided minerals summed together. If a water-reducing or high-range water-reducing admixture is used with Type III portland cement in Class PP-1 and RR concrete, the Contractor has the option to use a minimum of 590 lbs/cu yd (350 kg/cu m).

- e. Central-Mixed or Truck-Mixed. For Class PC and PS concrete, the mixture shall contain a minimum of 565 lbs/cu yd (335 kg/cu m) of cement and finely divided minerals summed together.

- f. The mixture shall contain a maximum of 705 lbs/cu yd (418 kg/cu m) of cement and finely divided mineral(s) summed together for Class PV, BS, PC, PS, DS, SC, and SI concrete. For Class PP-1 and RR concrete, the mixture shall contain a maximum of 750 lbs/cu yd (445 kg/cu m). For Class PP-1 and RR concrete using Type III portland cement, the mixture shall contain a maximum of 720 lbs/cu yd (425 kg/cu m). For Class PP-2 concrete, the mixture shall contain a maximum of 735 lbs/cu yd (435 kg/cu m).
 - g. For Class SC concrete and for any other class of concrete that is to be placed underwater, except Class DS concrete, the allowable cement and finely divided minerals summed together shall be increased by ten percent.
 - h. The combination of cement and finely divided minerals shall comply with Article 1020.05(d).
- (d) Alkali-Silica Reaction. For cast-in-place (includes cement aggregate mixture II), precast, and precast prestressed concrete, one of the mixture options provided in Article 1020.05(d)(2) shall be used to reduce the risk of a deleterious alkali-silica reaction in concrete exposed to humid or wet conditions. The mixture options are not intended or adequate for concrete exposed to potassium acetate, potassium formate, sodium acetate, or sodium formate. The mixture options will not be required for the dry environment (humidity less than 60 percent) found inside buildings for residential or commercial occupancy.

The mixture options shall not apply to concrete revetment mats, insertion lining of pipe culverts, portland cement mortar fairing course, controlled low-strength material, miscellaneous grouts that are not prepackaged, Class PP-3 concrete, Class PP-4 concrete, and Class PP-5 concrete.

- (1) Aggregate Groups. Each combination of aggregates used in a mixture will be assigned to an aggregate group. The point at which the coarse aggregate and fine aggregate expansion values intersect in the following table will determine the group.

Aggregate Groups			
Coarse Aggregate or Coarse Aggregate Blend	Fine Aggregate Or Fine Aggregate Blend		
	ASTM C 1260 Expansion		
ASTM C 1260 Expansion	≤0.16%	>0.16% - 0.27%	>0.27%
≤0.16%	Group I	Group II	Group III
>0.16% - 0.27%	Group II	Group II	Group III
>0.27%	Group III	Group III	Group IV

- (2) Mixture Options. Based upon the aggregate group, the following mixture options shall be used. However, the Department may prohibit a mixture option if field performance shows a deleterious alkali-silika reaction or Department testing indicates the mixture may experience a deleterious alkali-silica reaction.

Group I – Mixture options are not applicable. Use any cement or finely divided mineral.

Group II – Mixture options 1, 2, 3, 4, or 5 shall be used.

Group III – Mixture options 1, combine 2 with 3, 4 or 5 shall be used.

Group IV – Mixture options 1, combine 2 with 4, or 5 shall be used.

- a. Mixture Option 1. The coarse or fine aggregates shall be blended to place the material in a group that will allow the selected cement or finely divided mineral to be used. Coarse aggregate may only be blended with another coarse aggregate. Fine aggregate may only be blended with another fine aggregate. Blending of coarse with fine aggregate to place the material in another group will not be permitted.

When a coarse for fine aggregate is blended, the weighted expansion value shall be calculated separately for the coarse and fine aggregate as follows:

$$\text{Weighted Expansion Value} = (a/100 \times A) + (b/100 \times B) + (c/100 \times C) + \dots$$

Where: a, b, c... = percentage of aggregate in the blend;
A, B, C... = expansion value for that aggregate.

- b. Mixture Option 2. A finely divided mineral shall be used as described in 1), 2), 3), or 4) that follow.

1. Class F Fly Ash. For cement aggregate mixture II, Class PV, BS, PC, PS, MS, DS, SC and SI concrete, the Class F fly ash shall be a minimum 25.0 percent by weight (mass) of the cement and finely divided minerals summed together.

If the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 4.50 percent for the Class F fly ash, it may be used only if it complies with Mixture Option 5.

2. Class C Fly Ash. For cement aggregate mixture II, Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete, Class C fly ash shall be a minimum of 25.0 percent by weight (mass) of the cement and finely divided minerals summed together.

If the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 4.50 percent or the calcium oxide exceeds 26.50 percent for the Class C fly ash, it may be used only per Mixture Option 5.

3. Ground Granulated Blast-Furnace Slag. For Class PV, PP-1, PP-2, RR, BS, PC, PS, DS, SC, and SI concrete, ground granulated blast-furnace slag shall be a minimum of 25.0 percent by weight (mass) of the cement and finely divided minerals summed together.

If the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 1.00 percent for the ground granulated blast-furnace slag, it may be used only per Mixture Option 5.

4. Microsilica or High Reactivity Metakaolin, Microsilica solids or high reactivity metakaolin shall be a minimum 5.0 percent by weight (mass) of the cement and finely divided minerals summed together.

If the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 1.00 percent for the Microsilica or High Reactivity Metakaolin, it may be used only if it complies with Mixture Option 5.

- c. Mixture Option 3. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.60 percent. When aggregate in Group II is involved and the Contractor desires to use a finely divided mineral, any finely divided mineral may be used with the cement unless the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 4.50 percent for the fly ash; or 1.00 percent for the ground granulated blast-furnace slag, microsilica or high reactivity metakaolin. If the alkali content is exceeded, the finely divided mineral may be used only per Mixture Option 5.
- d. Mixture option 4. The cement used shall have a maximum total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) of 0.45 percent. When aggregate in Group II or III is involved and the Contractor desires to use a finely divided mineral, any finely divided mineral may be used with the cement unless the maximum total equivalent available alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) exceeds 4.50 percent for the fly ash; or 1.00 percent for the ground granulated blast-furnace slag, microsilica, or high reactivity metakaolin. If the alkali content is exceeded, the finely divided mineral may be used only per Mixture Option 5.
- e. Mixture Option 5. The proposed cement or finely divided mineral may be used if the ASTM C 1567 expansion value is ≤ 0.16 percent when performed on the aggregate in the concrete mixture with the highest ASTM C 1260 test result. The laboratory performing the ASTM C 1567 test shall be approved by the Department according to the current Bureau of Materials and Physical Research Policy Memorandum "Minimum Laboratory Requirements for Alkali-Silica Reactivity (ASR) Testing". The ASTM C 1567 test will be valid for two years, unless the Engineer determines the materials have changed significantly. For latex concrete, the ASTM C 1567 test shall be performed without the latex. The 0.20 percent autoclave expansion limit in ASTM C 1567 shall not apply.

If during the two year time period the Contractor needs to replace the cement, and the replacement cement has an equal or lower total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$), a new ASTM C 1567 test will not be required.

The Engineer reserved the right to verify a Contractor's ASTM C 1567 test result. When the Contractor performs the test, a split sample may be requested by the Engineer. The Engineer may also independently obtain a sample at any time. The proposed cement or finely divided mineral will not be allowed for use if the Contractor or Engineer obtains an expansion value greater than 0.16 percent.

1020.06 Water/Cement Ratio. The water/cement ratio shall be determined on a weight (mass) basis. When a maximum water/cement ratio is specified, the water shall include mixing water, water in admixtures, free moisture on the aggregates, and water added at the jobsite. The quantity of water may be adjusted within the limit specified to meet slump requirements.

When fly ash, ground granulated blast-furnace slag, high-reactivity metakaolin, or microsilica (silica fume) are used in a concrete mix, the water/cement ratio will be based on the total cement and finely divided minerals contained in the mixture.

1020.07 Slump. The slump shall be determined according to Illinois Modified AASHTO T 119.

If the measured slump falls outside the limits specified, a check test will be made. In the event of a second failure, the Engineer may refuse to permit the use of the batch of concrete represented.

If the Contractor is unable to add water to prepare concrete of the specified slump without exceeding the maximum design water/cement ratio, additional cement or water-reducing admixture shall be added.

1020.08 Air Content. The air content shall be determined according to Illinois Modified AASHTO T 152 or Illinois Modified AASHTO T 196. The air-entrainment shall be obtained by the use of cement with an approved air-entraining admixture added during the mixing of the concrete or the use of air-entraining cement.

If the air-entraining cement furnished is found to produce concrete having an air content outside the limits specified, its use shall be discontinued immediately and the Contractor shall provide other air-entraining cement which will produce air contents within the specified limits.

If the air content obtained is above the specified maximum limit at the jobsite, the Contractor, with the Engineer's approval, may add to the truck mixer non air-entraining cement in the proportion necessary to bring the air content within the specified limits, or the concrete may be further mixed, within the limits of time and revolutions specified, to reduce the air content. If the air content obtained is below the specified minimum limit, the Contractor may add to the concrete a sufficient quantity of an approved air-entraining admixture at the jobsite to bring the air content within the specified limits.

1020.09 Strength Tests. The specimens shall be molded and cured according to Illinois Modified AASHTO T 23. Specimens shall be field cured with the construction item as specified in Illinois Modified AASHTO T 23. The compressive strength shall be determined according to Illinois Modified AASHTO T 22. The flexural strength shall be determined according to Illinois Modified AASHTO T 177.

Except for Class PC and PS concrete, the Contractor shall transport the strength specimens from the site of the work to the field laboratory or other location as instructed by the Engineer. During transportation in a suitable light truck, the specimens shall be embedded in straw, burlap, or other acceptable material in a manner meeting with the approval of the Engineer to protect them from damage; care shall be taken to avoid impacts during hauling and handling. For strength specimens, the Contractor shall provide a water storage tank for curing.

1020.10 **Handling, Measuring, and Batching Materials.** Aggregates shall be handled in a manner to prevent mixing with soil and other foreign material.

Aggregates shall be handled in a manner which produces a uniform gradation, before placement in the plant bins. Aggregates delivered to the plant in a nonuniform gradation condition shall be stockpiled. The stockpiled aggregate shall be mixed uniformly before placement in the plant bins.

Aggregates shall have a uniform moisture content before placement in the plant bins. This may require aggregates to be stockpiled for 12 hours or more to allow drainage, or water added to the stockpile, or other methods approved by the Engineer. Moisture content requirements for crushed slag or lightweight aggregate shall be according to Article 1004.01(e).

Aggregates, cement, and finely divided minerals shall be measured by weight (mass). Water and admixtures shall be measured by volume or weight (mass).

The Engineer may permit aggregates, cement, and finely divided minerals to be measured by volume for small isolated structures and for miscellaneous items. Aggregates, cement, and finely divided minerals shall be measured individually. The volume shall be based upon dry, loose materials.

1020.11 **Mixing Portland Cement Concrete.** The mixing of concrete shall be according to the following.

- (a) Ready-Mixed Concrete. Ready-mixed concrete is central-mixed, truck-mixed, or shrink-mixed concrete transported and delivered in a plastic state ready for placement in the work and shall be according to the following.
 - (1) Central-Mixed Concrete. Central-mixed concrete is concrete which has been completely mixed in a stationary mixer and delivered in a truck agitator, a truck mixer operating at agitating speed, or a nonagitator truck.

The stationary mixer shall operate at the drum speed for which it was designed. The batch shall be charged into the drum so that some of the water shall enter in advance of the cement, finely divided minerals, and aggregates. The flow of the water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of the mixing period. Water shall begin to enter the drum from zero to two seconds in advance of solid material and shall stop flowing within two seconds of the beginning of mixing time.

Some coarse aggregate shall enter in advance of other solid materials. For the balance of the charging time for solid materials, the aggregates, finely divided minerals, and cement (to assure thorough blending) shall each flow at acceptably uniform rates, as determined by visual observation. Coarse aggregate shall enter two seconds in advance of other solid materials and a uniform rate of flow shall continue to within two seconds of the completion of charging time.

The entire contents of the drum, or of each single compartment of a multiple-drum mixer, shall be discharged before the succeeding batch is introduced.

The volume of concrete mixed per batch shall not exceed the mixer's rated capacity as shown on the standard rating plate on the mixer by more than ten percent.

The minimum mixing time shall be 75 seconds for a stationary mixer having a capacity greater than 2 cu yd (1.5 cu m). For a mixer with a capacity equal to or less than 2 cu yd (1.5 cu m) the mixing time shall be 60 seconds. Transfer time in multiple drum mixers is included in the mixing time. Mixing time shall begin when all materials are in the mixing compartment and shall end when the discharge of any part of the batch is started. The required mixing times will be established by the Engineer for all types of stationary mixers.

When central-mixed concrete is to be transported in a truck agitator or a truck mixer, the stationary-mixed batch shall be transferred to the agitating unit without delay and without loss of any portion of the batch. Agitating shall start immediately thereafter and shall continue without interruption until the batch is discharged from the agitator. The ingredients of the batch shall be completely discharged from the agitator before the succeeding batch is introduced. Drums and auxiliary parts of the equipment shall be kept free from accumulations of materials.

The vehicles used for transporting the mixed concrete shall be of such capacity, or the batches shall be so proportioned, that the entire contents of the mixer drum can be discharged into each vehicle load.

- (2) Truck-Mixed Concrete. Truck-mixed concrete is completely mixed and delivered in a truck mixer. When the mixer is charged with fine and coarse aggregates simultaneously, not less than 60 nor more than 100 revolutions of the drum or blades at mixing speed shall be required, after all of the ingredients including water are in the drum. When fine and coarse aggregates are charged separately, not less than 70 revolutions will be required. Additional mixing beyond 100 revolutions shall be at agitating speed unless additions of water, admixtures, cement, or other materials are made at the jobsite. The mixing operation shall begin immediately after the cement and water, or the cement and wet aggregates, come in contact. The ingredients of the batch shall be completely discharged from the drum before the succeeding batch is introduced. The drum and auxiliary parts of the equipment shall be kept free from accumulations of materials. If additional water or an admixture is added at the jobsite, the concrete batch shall be mixed a minimum of 40 additional revolutions after each addition.
- (3) Shrink-Mixed Concrete. Shrink-mixed concrete is mixed partially in a stationary mixer and completed in a truck mixer for delivery. The mixing time of the stationary mixer may be reduced to a minimum of 30 seconds to intermingle the ingredients, before transferring to the truck mixer. All ingredients for the batch shall be in the stationary mixer and partially mixed before any of the mixture is discharged into the truck mixer. The partially mixed batch shall be transferred to the truck mixer without delay and without loss of any portion of the batch, and mixing in the truck mixer shall start immediately.

The mixing time in the truck mixer shall be not less than 50 nor more than 100 revolutions of the drum or blades at mixing speed. Additional mixing beyond 100 revolutions shall be at agitating speed, unless additions of water, admixtures, cement, or other materials are made at the jobsite. Units designed as agitators shall not be used for shrink mixing. The ingredients of the batch shall be completely discharged from the drum before the succeeding batch is introduced. The drum and auxiliary parts of the equipment shall be kept free from accumulations of materials. If additional water or an admixture is added at the jobsite, the concrete batch shall be mixed a minimum of 40 additional revolutions after each addition.

- (4) **Mixing Water.** Wash water shall be completely discharged from the drum or container before a batch is introduced. All mixing water shall be added at the plant and any adjustment of water at the jobsite by the Contractor shall not exceed the specified maximum water/cement ratio or slump. If strength specimens have been made for a batch of concrete, and subsequently during discharge there is more water added, additional strength specimens shall be made for the batch of concrete. No additional water may be added at the jobsite to central-mixed concrete if the mix design has less than 565 lbs/cu yd (335 kg/cu m) of cement and finely divided minerals summed together.
- (5) **Mixing and Agitating Speeds.** The mixing or agitating speeds used for truck mixers or truck agitators shall be per the manufacturer's rating plate.
- (6) **Capacities.** The volume of plastic concrete in a given batch will be determined according to AASHTO T 121, based on the total weight (mass) of the batch, determined either from the weight (masses) of all materials, including water, entering the batch or directly from the net weight (mass) of the concrete in the batch as delivered.

The volume of mixed concrete in truck mixers or truck agitators shall in no case be greater than the rated capacity determined according to the Truck Mixer, Agitator, and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturer's Bureau, as shown by the rating plate attached to the truck. If the truck mixer does not have a rating plate, the volume of mixed concrete shall not exceed 63 percent of the gross volume of the drum or container, disregarding the blades. For truck agitators, the value is 80 percent.

- (7) **Time of Haul.** Haul time shall begin when the delivery ticket is stamped. The delivery ticket shall be stamped no later than five minutes after the addition of the mixing water to the cement, or after the addition of the cement to the aggregate when the combined aggregates contain free moisture in excess of two percent by weight (mass). If more than one batch is required for charging a truck using a stationary mixer, the time of haul shall start with mixing of the first batch. Haul time shall end when the truck is emptied for incorporation of the concrete into the work.

The time elapsing from when water is added to the mix until it is deposited in place at the site of the work shall not exceed 30 minutes when the concrete is transported in nonagitating trucks.

The maximum haul time for concrete transported in truck mixers or truck agitators shall be according to the following.

Concrete Temperature at Point of Discharge °F (°C)	Haul Time	
	Hours	Minutes
50-64 (10-17.5)	1	30
>64 (>17.5) - without retarder	1	0
>64 (>17.5) - with retarder	1	30

To encourage start-up testing for mix adjustments at the plant, the first two trucks will be allowed an additional 15 minutes haul time whenever such testing is performed.

For a mixture which is not mixed on the jobsite, a delivery ticket shall be required for each load. The following information shall be recorded on each delivery ticket: (1) ticket number; (2) name of producer and plant location; (3) contract number; (4) name of Contractor; (5) stamped date and time batched; (6) truck number; (7) quantity batched; (8) amount of admixture(s) in the batch; (9) amount of water in the batch; and (10) Department mix design number.

For concrete mixed in jobsite stationary mixers, the above delivery ticket may be waived, but a method of verifying the haul time shall be established to the satisfaction of the Engineer.

- (8) Production and Delivery. The production of ready-mixed concrete shall be such that the operations of placing and finishing will be continuous insofar as the job operations require. The Contractor shall be responsible for producing concrete that will have the required workability, consistency, and plasticity when delivered to the work. Concrete which is unsuitable for placement as delivered will be rejected. The Contractor shall minimize the need to adjust the mixture at the jobsite, such as adding water, admixtures, and cement prior to discharging.
- (9) Use of Multiple Plants in the Same Construction Item. The Contractor may simultaneously use central-mixed, truck-mixed, and shrink-mixed concrete from more than one plant, for the same construction item, on the same day, and in the same pour. However, the following criteria shall be met.
 - a. Each plant shall use the same cement, finely divided minerals, aggregates, admixtures, and fibers.
 - b. Each plant shall use the same mix design. However, material proportions may be altered slightly in the field to meet slump and air content criteria. Field water adjustments shall not result in a difference that exceeds 0.02 between plants for water/cement ratio. The required cement factor for central-mixed concrete shall be increased to match truck-mixed or shrink-mixed concrete, if the latter two types of mixed concrete are used in the same pour.
 - c. The maximum slump difference between deliveries of concrete shall be 3/4 in. (19 mm) when tested at the jobsite. If the difference is exceeded, but test results are within specification limits, the concrete may be used.

The Contractor shall take immediate corrective action and shall test subsequent deliveries of concrete until the slump difference is corrected. For each day, the first three truck loads of delivered concrete from each plant shall be tested for slump by the Contractor. Thereafter, when a specified test frequency for slump is to be performed, it shall be conducted for each plant at the same time.

- d. The maximum air content difference between deliveries of concrete shall be 1.5 percent when tested at the jobsite. If the difference is exceeded, but test results are within specification limits, the concrete may be used. The Contractor shall take immediate corrective action and shall test subsequent deliveries of concrete until the air content difference is corrected. For each day, the first three truck loads of delivered concrete from each plant shall be tested for air content by the Contractor. Thereafter, when a specified test frequency for air content is to be performed, it shall be conducted for each plant at the same time.
 - e. Strength tests shall be performed and taken at the jobsite for each plant. When a specified strength test is to be performed, it shall be conducted for each plant at the same time. The difference between plants for strength shall not exceed 900 psi (6200 kPa) compressive and 90 psi (620 kPa) flexural. If the strength difference requirements are exceeded, the Contractor shall take corrective action.
 - f. The maximum haul time difference between deliveries of concrete shall be 15 minutes. If the difference is exceeded, but haul time is within specification limits, the concrete may be used. The Contractor shall take immediate corrective action and check subsequent deliveries of concrete.
- (b) Class PC Concrete. The concrete shall be central-mixed or truck-mixed. Variations in plastic concrete properties shall be minimized between batches.
- (c) Class PV Concrete. The concrete shall be central-mixed or truck-mixed.

The required mixing time for stationary mixers with a capacity greater than 2 cu yd (1.5 cu m) may be less than 75 seconds upon satisfactory completion of a mixer performance test. Mixer performance tests may be requested by the Contractor when the quantity of concrete to be placed exceeds 50,000 sq yd (42,000 sq m). The testing shall be conducted according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Field Test Procedures for Mixer Performance and Concrete Uniformity Tests".

The Contractor will be allowed to test two mixing times within a range of 50 to 75 seconds. If satisfactory results are not obtained from the required tests, the mixing time shall continue to be 75 seconds for the remainder of the contract. If satisfactory results are obtained, the mixing time may be reduced. In no event will mixing time be less than 50 seconds.

The Contractor shall furnish the labor, equipment, and material required to perform the testing according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Field Test Procedures for Mixer Performance and Concrete Uniformity Tests".

A contract which has 12 ft (3.6 m) wide pavement or base course, and a continuous length of 1/2 mile (0.8 km) or more, shall have the following additional requirements.

- (1) The plant and truck delivery operation shall be able to provide a minimum of 50 cu yd (38 cu m) of concrete per hour.
- (2) The plant shall have automatic or semi-automatic batching equipment.

(d) All Other Classes of Concrete. The concrete shall be central-mixed, truck-mixed, or shrink-mixed concrete.

1020.12 Mobile Portland Cement Concrete Plants. The use of a mobile portland cement concrete plant may be approved under the provisions of Article 1020.10 for volumetric proportioning in small isolated structures, thin overlays, and for miscellaneous and incidental concrete items.

The first 1 cu ft (0.03 cu m) of concrete produced may not contain sufficient mortar and shall not be incorporated in the work. The side plate on the cement feeder shall be removed periodically (normally the first time the mixer is used each day) to see if cement is building up on the feed drum.

Sufficient mixing capacity of mixers shall be provided to enable continuous placing and finishing insofar as the job operations and the specifications require.

Slump and air tests made immediately after discharge of the mix may be misleading, since the aggregates may absorb a significant amount of water for four or five minutes after mixing.

1020.13 Curing and Protection. The method of curing, curing period, and method of protection for each type of concrete construction is included in the following Index Table.

INDEX TABLE OF CURING AND PROTECTION OF CONCRETE CONSTRUCTION			
TYPE OF CONSTRUCTION	CURING METHODS	CURING PERIOD DAYS	LOW AIR TEMPERATURE PROTECTION METHODS
Cast-in-Place Concrete ^{11/}			
Pavement			
Shoulder	1020.13(a)(1)(2)(3)(4)(5) ^{3/ 5/}	3	1020.13(c)
Base Course			
Base Course Widening	1020.13(a)(1)(2)(3)(4)(5) ^{2/}	3	1020.13(c)
Driveway			
Median			
Barrier			
Curb			
Gutter	1020.13(a)(1)(2)(3)(4)(5) ^{4/ 5/}	3	1020.13(c) ^{16/}
Curb & Gutter			
Sidewalk			
Slope Wall			
Paved Ditch			
Catch Basin			
Manhole	1020.13(a)(1)(2)(3)(4)(5) ^{4/}	3	1020.13(c)
Inlet			
Valve Vault			
Pavement Patching	1020.13(a)(1)(2)(3)(4)(5) ^{2/}	3 ^{12/}	1020.13(c)
Bridge Deck Patching	1020.13(a)(3)(5)	3 or 7 ^{12/}	1020.13(c)
Railroad Crossing	1020.13(a)(3)(5)	1	1020.13(c)
Piles and Drilled Shafts	1020.13(a)(3)(5)	7	1020.13(d)(1)(2)(3)
Foundations & Footings			
Seal Coat	1020.13(a)(1)(2)(3)(4)(5) ^{4/ 6/}	7	1020.13(d)(1)(2)(3)
Substructure	1020.13(a)(1)(2)(3)(4)(5) ^{1/ 7/}	7	1020.13(d)(1)(2)(3)
Superstructure (except deck)	1020.13(a)(1)(2)(3)(5) ^{8/}	7	1020.13(d)(1)(2)
Deck			
Bridge Approach Slab	1020.13(a)(5)	7	1020.13(d)(1)(2) ^{17/}
Retaining Walls	1020.13(a)(1)(2)(3)(4)(5) ^{1/ 7/}	7	1020.13(d)(1)(2)
Pump Houses	1020.13(a)(1)(2)(3)(4)(5) ^{1/}	7	1020.13(d)(1)(2)
Culverts	1020.13(a)(1)(2)(3)(4)(5) ^{4/ 6/}	7	1020.13(d)(1)(2) ^{18/}
Other Incidental Concrete	1020.13(a)(1)(2)(3)(5)	3	1020.13(c)
Precast Concrete ^{11/}			
Bridge Slabs			
Piles and Pile Caps	1020.13(a)(3)(5) ^{9/ 10/}	As ^{13/}	9/
Other Structural Members		Required	
All Other Precast Items	1020.13(a)(3)(4)(5) ^{2/ 9/ 10/}	As ^{14/}	9/
		Required	
Precast, Prestressed Concrete ^{11/}			
All Items	1020(a)(3)(5) ^{9/ 10/}	Until Strand Tensioning is Released ^{15/}	9/

Notes-General:

- 1/ Type I, membrane curing only
- 2/ Type II, membrane curing only
- 3/ Type III, membrane curing only
- 4/ Type I, II and III membrane curing
- 5/ Membrane Curing will not be permitted between November 1 and April 15.

- 6/ The use of water to inundate foundations and footings, seal coats or the bottom slab of culverts is permissible when approved by the Engineer, provided the water temperature can be maintained at 45 °F (7 °C) or higher.
- 7/ Asphalt emulsion for waterproofing may be used in lieu of other curing methods when specified and permitted according to Article 503.18.
- 8/ On non-traffic surfaces which receive protective coat according to Article 503.19, a linseed oil emulsion curing compound may be used as a substitute for protective coat and other curing methods. The linseed oil emulsion curing compound will be permitted between April 16 and October 31 of the same year, provided it is applied with a mechanical sprayer according to Article 1101.09(b).
- 9/ Steam, supplemental heat, or insulated blankets (with or without steam/supplemental heat) are acceptable and shall be according to the Bureau of Materials and Physical Research's Policy Memorandum "Quality Control/Quality Assurance Program for Precast Concrete Products" and the "Manual for Fabrication of Precast, Prestressed Concrete Products".
- 10/ A moist room according to AASHTO M 201 is acceptable for curing.
- 11/ If curing is required and interrupted because of form removal for cast-in-place concrete items, precast concrete products, or precast prestressed concrete products, the curing shall be resumed within two hours from the start of the form removal.
- 12/ Curing maintained only until opening strength is attained for pavement patching, with a maximum curing period of three days. For bridge deck patching the curing period shall be three days if Class PP concrete is used and 7 days if Class BS concrete is used.
- 13/ The curing period shall end when the concrete has attained the mix design strength. The producer has the option to discontinue curing when the concrete has attained 80 percent of the mix design strength or after seven days. All strength test specimens shall remain with the units and shall be subjected to the same curing method and environmental condition as the units, until the time of testing.
- 14/ The producer shall determine the curing period or may elect to not cure the product. All strength test specimens shall remain with the units and shall be subjected to the same curing method and environmental condition as the units, until the time of testing.
- 15/ The producer has the option to continue curing after strand release.
- 16/ When structural steel or structural concrete is in place above slope wall, Article 1020.13(c) shall not apply. The protection method shall be according to Article 1020.13(d)(1).

17/ When Article 1020.13(d)(2) is used to protect the deck, the housing may enclose only the bottom and sides. The top surface shall be protected according to Article 1020.13(d)(1).

18/ For culverts having a waterway opening of 10 sq ft (1 sq m) or less, the culverts may be protected according to Article 1020.13(d)(3).

(a) Methods of Curing. Except as provided for in the Index Table of Curing and Protection of Concrete Construction, curing shall be accomplished by one of the following described methods. When water is required to wet the surface, it shall be applied as a fine spray so that it will not mar or pond on the surface. Except where otherwise specified, the curing period shall be at least 72 hours.

(1) Waterproof Paper Method. The surface of the concrete shall be covered with waterproof paper as soon as the concrete has hardened sufficiently to prevent marring the surface. The surface of the concrete shall be wetted immediately before the paper is placed. The blankets shall be lapped at least 12 in. (300 mm) end to end, and these laps shall be securely weighted with a windrow of earth, or other approved method, to form a closed joint. The same requirements shall apply to the longitudinal laps where separate strips are used for curing edges, except the lap shall be at least 9 in. (225 mm). The edges of the blanket shall be weighted securely with a continuous windrow of earth or any other means satisfactory to the Engineer to provide an air-tight cover. Any torn places or holes in the paper shall be repaired immediately by patches cemented over the openings, using a bituminous cement having a melting point of not less than 180 °F (82 °C). The blankets may be reused, provided they are air-tight and kept serviceable by proper repairs.

A longitudinal pleat shall be provided in the blanket to permit shrinkage where the width of the blanket is sufficient to cover the entire surface. The pleat will not be required where separate strips are used for the edges. Joints in the blanket shall be sewn or cemented together in such a manner that they will not separate during use.

(2) Polyethylene Sheeting Method. The surface of the concrete shall be covered with white polyethylene sheeting as soon as the concrete has hardened sufficiently to prevent marring the surface. The surface of the concrete shall be wetted immediately before the sheeting is placed. The edges of the sheeting shall be weighted securely with a continuous windrow of earth or any other means satisfactory to the Engineer to provide an air-tight cover. Adjoining sheets shall overlap not less than 12 in. (300 mm) and the laps shall be securely weighted with earth, or any other means satisfactory to the Engineer, to provide an air tight cover. For surface and base course concrete, the polyethylene sheets shall be not less than 100 ft (30 m) in length nor longer than can be conveniently handled, and shall be of such width that, when in place, they will cover the full width of the surface, including the edges, except that separate strips may be used to cover the edges. Any tears or holes in the sheeting shall be repaired. When sheets are no longer serviceable as a single unit, the Contractor may select from such sheets and reuse those which will serve for further applications, provided two sheets are used as a single unit; however, the double sheet units will be rejected when the Engineer deems that they no longer provide an air tight cover.

- (3) Wetted Burlap Method. The surface of the concrete shall be covered with wetted burlap blankets as soon as the concrete has hardened sufficiently to prevent marring the surface. The blankets shall overlap 6 in. (150 mm). At least two layers of wetted burlap shall be placed on the finished surface. The burlap shall be kept saturated by means of a mechanically operated sprinkling system. In place of the sprinkling system, at the Contractor's option, two layers of burlap covered with impermeable covering shall be used. The burlap shall be kept saturated with water. Plastic coated burlap may be substituted for one layer of burlap and impermeable covering.

The blankets shall be placed so that they are in contact with the edges of the concrete, and that portion of the material in contact with the edges shall be kept saturated with water.

- (4) Membrane Curing Method. Membrane curing will not be permitted where a protective coat, concrete sealer, or waterproofing is to be applied, or at areas where rubbing or a normal finish is required, or at construction joints other than those necessary in pavement or base course. Concrete at these locations shall be cured by another method specified in Article 1020.13(a).

After the concrete has been finished and the water sheen has disappeared from the surface, the concrete shall be immediately sealed with membrane curing compound of the type specified. The seal shall be maintained for the specified curing period. The edges of the concrete shall, likewise, be sealed immediately after the forms are removed. Two separate applications, applied at least one minute apart, each at the rate of not less than 1 gal/250 sq ft (0.16 L/sq m) will be required upon the surfaces and edges of the concrete. These applications shall be made with the mechanical equipment specified. Type III compound shall be agitated immediately before and during the application.

At locations where the coating is discontinuous or where pin holes show or where the coating is damaged due to any cause and on areas adjacent to sawed joints, immediately after sawing is completed, an additional coating of membrane curing compound shall be applied at the above specified rate. The equipment used may be of the same type as that used for coating variable widths of pavement. Before the additional coating is applied adjacent to sawed joints, the cut faces of the joint shall be protected by inserting a suitable flexible material in the joint, or placing an adhesive width of impermeable material over the joint, or by placing the permanent sealing compound in the joint. Material, other than the permanent sealing compound, used to protect cut faces of the joint, shall remain in place for the duration of the curing period. In lieu of applying the additional coating, the area of the sawed joint may be cured according to any other method permitted.

When rain occurs before an application of membrane curing compound has dried, and the coating is damaged, the Engineer may require another application be made in the same manner and at the same rate as the original coat. The Engineer may order curing by another method specified, if unsatisfactory results are obtained with membrane curing compound.

(5) **Wetted Cotton Mat Method.** After the surface of concrete has been textured or finished, it shall be covered immediately with dry or damp cotton mats. The cotton mats shall be placed in a manner which will not mar the concrete surface. A texture resulting from the cotton mat material is acceptable. The cotton mats shall then be wetted immediately and thoroughly soaked with a gentle spray of water. For bridge decks, a foot bridge shall be used to place and wet the cotton mats.

The cotton mats shall be maintained in a wetted condition until the concrete has hardened sufficiently to place soaker hoses without marring the concrete surface. The soaker hoses shall be placed on top of the cotton mats at a maximum 4 ft (1.2 m) spacing. The cotton mats shall be kept wet with a continuous supply of water for the remainder of the curing period. Other continuous wetting systems may be used if approved by the Engineer.

After placement of the soaker hoses, the cotton mats shall be covered with white polyethylene sheeting or burlap-polyethylene blankets.

For construction items other than bridge decks, soaker hoses or a continuous wetting system will not be required if the alternative method keeps the cotton mats wet. Periodic wetting of the cotton mats is acceptable.

For areas inaccessible to the cotton mats on bridge decks, curing shall be according to Article 1020.13(a)(3).

(b) **Removing and Replacing Curing Covering.** When curing methods specified above in Article 1020.13(a), (1), (2), or (3) are used for concrete pavement, the curing covering for each day's paving shall be removed to permit testing of the pavement surface with a profilograph or straightedge, as directed by the Engineer.

Immediately after testing, the surface of the pavement shall be wetted thoroughly and the curing coverings replaced. The top surface and the edges of the concrete shall not be left unprotected for a period of more than 1/2 hour.

(c) **Protection of Concrete, Other Than Structures, From Low Air Temperatures.** When the official National Weather Service forecast for the construction area predicts a low of 32 °F (0 °C), or lower, or if the actual temperature drops to 32 °F (0 °C), or lower, concrete less than 72 hours old shall be provided at least the following protection.

Minimum Temperature	Protection
25 – 32 °F (-4 – 0 °C)	Two layers of polyethylene sheeting, one layer of polyethylene and one layer of burlap, or two layers of waterproof paper.
Below 25 °F (-4 °C)	6 in. (150 mm) of straw covered with one layer of polyethylene sheeting or waterproof paper.

These protective covers shall remain in place until the concrete is at least 96 hours old. When straw is required on pavement cured with membrane curing compound, the compound shall be covered with a layer of burlap, polyethylene sheeting or waterproof paper before the straw is applied.

After September 15, there shall be available to the work within four hours, sufficient clean, dry straw to cover at least two days production. Additional straw shall be provided as needed to afford the protection required. Regardless of the precautions taken, the Contractor shall be responsible for protection of the concrete placed and any concrete damaged by cold temperatures shall be removed and replaced.

- (d) Protection of Concrete Structures From Low Air Temperatures. When the official National Weather Service forecast for the construction area predicts a low below 45 °F (7 °C), or if the actual temperature drops below 45 °F (7 °C), concrete less than 72 hours old shall be provided protection. Concrete shall also be provided protection when placed during the winter period of December 1 through March 15. Concrete shall not be placed until the materials, facilities, and equipment for protection are approved by the Engineer.

When directed by the Engineer, the Contractor may be required to place concrete during the winter period. When winter construction is specified, the Contractor shall proceed with the construction, including excavation, pile driving, concrete, steel erection, and all appurtenant work required for the complete construction of the item, except at times when weather conditions make such operations impracticable.

Regardless of the precautions taken, the Contractor shall be responsible for protection of the concrete placed and any concrete damaged by cold temperatures shall be removed and replaced.

- (1) Protection Method I. The concrete shall be completely covered with insulating material such as fiberglass, rock wool, or other approved commercial insulating material having the minimum thermal resistance R, as defined in ASTM C 168, for the corresponding minimum dimension of the concrete unit being protected as shown in the following table.

Minimum Pour Dimension		Thermal Resistance R
in.	(mm)	
6 or less	(150 or less)	R=16
> 6 to 12	(> 150 to 300)	R=10
> 12 to 18	(> 300 to 450)	R=6
> 18	(> 450)	R=4

The insulating material manufacturer shall clearly mark the insulating material with the thermal resistance R value.

The insulating material shall be completely enclosed on sides and edges with an approved waterproof liner and shall be maintained in a serviceable condition. Any tears in the liner shall be repaired in a manner approved by the Engineer. The Contractor shall provide means for checking the temperature of the surface of the concrete during the protection period.

On formed surfaces, the insulating material shall be attached to the outside of the forms with wood cleats or other suitable means to prevent any circulation of air under the insulation and shall be in place before the concrete is placed.

The blanket insulation shall be applied tightly against the forms. The edges and ends shall be attached so as to exclude air and moisture. If the blankets are provided with nailing flanges, the flanges shall be attached to the studs with cleats. Where tie rods or reinforcement bars protrude, the areas adjacent to the rods or bars shall be adequately protected in a manner satisfactory to the Engineer.

Where practicable, the insulation shall overlap any previously placed concrete by at least 1 ft (300 mm). Insulation on the underside of floors on steel members shall cover the top flanges of supporting members. On horizontal surfaces, the insulating material shall be placed as soon as the concrete has set, so that the surface will not be marred and shall be covered with canvas or other waterproof covering. The insulating material shall remain in place for a period of seven days after the concrete is placed.

The Contractor may remove the forms, providing the temperature is 35 °F (2 °C) and rising and the Contractor is able to wrap the particular section within two hours from the time of the start of the form removal. The insulation shall remain in place for the remainder of the seven days curing period.

- (2) Protection Method II. The concrete shall be enclosed in adequate housing and the air surrounding the concrete kept at a temperature of not less than 50 °F (10 °C) nor more than 80 °F (27 °C) for a period of seven days after the concrete is placed. The Contractor shall provide means for checking the temperature of the surface of the concrete or air temperature within the housing during the protection period. All exposed surfaces within the housing shall be cured according to the Index Table.

The Contractor shall provide adequate fire protection where heating is in progress and such protection shall be accessible at all times. The Contractor shall maintain labor to keep the heating equipment in continuous operation.

At the close of the heating period, the temperature shall be decreased to the approximate temperature of the outside air at a rate not to exceed 15 °F (8 °C) per 12 hour period, after which the housing maybe removed. The surface of the concrete shall be permitted to dry during the cooling period.

- (3) Protection Method III. As soon as the surface is sufficiently set to prevent marring, the concrete shall be covered with 12 in. (300 mm) of loose, dry straw followed by a layer of impermeable covering. The edges of the covering shall be sealed to prevent circulation of air and prevent the cover from flapping or blowing. The protection shall remain in place until the concrete is seven days old. If construction operations require removal, the protection removed shall be replaced immediately after completion or suspension of such operations.

1020.14 Temperature Control for Placement. Temperature control for concrete placement shall be according to the following.

- (a) Concrete other than Structures. Concrete may be placed when the air temperature is above 35 °F (2 °C) and rising, and concrete placement shall stop when the falling temperature reaches 40 °F (4 °C) or below, unless otherwise approved by the Engineer.

The temperature of concrete immediately before placement shall be a minimum of 50 °F (10 °C) and a maximum of 90 °F (32 °C). If concrete is pumped, the temperature of the concrete as placed in the forms shall be a minimum of 50 °F (10 °C) and a maximum of 90 °F (32 °C). A maximum concrete temperature shall not apply to Class PP concrete.

- (b) Concrete in Structures. Concrete may be placed when the air temperature is above 40 °F (4 °C) and rising, and concrete placement shall stop when the falling temperature reaches 45 °F (7 °C) or below, unless otherwise approved by the Engineer.

The temperature of the concrete immediately before placement shall be a minimum of 50 °F (10 °C) and a maximum of 90 °F (32 °C). If concrete is pumped, the temperature of the concrete as placed in the forms shall be a minimum of 50 °F (10 °C) and a maximum of 90 °F (32 °C).

When insulated forms are used, the maximum temperature of the concrete mixture immediately before placement shall be 80 °F (25 °C).

When concrete is placed in contact with previously placed concrete, the temperature of the mixed concrete may be increased to 80 °F (25 °C) by the Contractor to offset anticipated heat loss.

- (c) All Classes of Concrete. Aggregates and water shall be heated or cooled uniformly and as necessary to produce concrete within the specified temperature limits. No frozen aggregates shall be used in the concrete.
- (d) Temperature. The concrete temperature shall be determined according to Illinois Modified AASHTO T 309.

1020.15 Heat of Hydration Control for Concrete Structures. The Contractor shall control the heat of hydration for concrete structures when the least dimension for a drilled shaft, foundation, footing, substructure, or superstructure concrete pour exceeds 5.0 ft (1.5 m). The work shall be according to the following.

- (a) Temperature Restrictions. The maximum temperature of the concrete after placement shall not exceed 150 °F (66 °C). The maximum temperature differential between the internal concrete core and concrete 2 to 3 in. (50 to 75 mm) from the exposed surface shall not exceed 35 °F (19 °C). The Contractor shall perform temperature monitoring to ensure compliance with the temperature restrictions.
- (b) Thermal Control Plan. The Contractor shall provide a thermal control plan a minimum of 28 calendar days prior to concrete placement for review by the Engineer. Acceptance of the thermal control plan by the Engineer shall not preclude the Contractor from specification compliance, and from preventing cracks in the concrete. At a minimum, the thermal control plan shall provide detailed information on the following requested items and shall comply with the specific specifications indicated for each item.
- (1) Concrete mix design(s) to be used. Grout mix design if post-cooling with embedded pipe.

The mix design requirements in Articles 1020.04 and 1020.05 shall be revised to include the following additional requirements to control the heat of hydration.

- a. The concrete mixture shall be uniformly graded and preference for larger size aggregate shall be used in the mix design. Article 1004.02(d)(2) and information in the “Portland Cement Concrete Level III Technician Course – Manual of Instructions for Design of Concrete Mixtures” shall be used to develop the uniformly graded mixture.
- b. The following shall apply to all concrete except Class DS concrete or when self-consolidating concrete is desired. For central-mixed concrete, the Contractor shall have the option to develop a mixture with a minimum of 520 lbs/cu yd (309 kg/cu m) of cement and finely divided minerals summed together. For truck-mixed or shrink-mixed concrete, the Contractor shall have the option to develop a mixture with a minimum of 550 lbs/cu yd (326 kg/cu m) of cement and finely divided minerals summed together. A water-reducing or high range water-reducing admixture shall be used in the central mixed, truck-mixed or shrink-mixed concrete mixture. For any mixture to be placed underwater, the minimum cement and finely divided minerals shall be 550 lbs/cu yd (326 kg/cu m) for central-mixed concrete, and 580 lbs/cu yd (344 kg/cu m) for truck-mixed or shrink-mixed concrete.

For Class DS concrete, CA 11 may be used. If CA 11 is used, the Contractor shall have the option to develop a mixture with a minimum cement and finely divided minerals of 605 lbs/cu yd (360 kg/cu m) summed together. If CA 11 is used and either Class DS concrete is placed underwater or a self-consolidating concrete mixture is desired, the Contractor shall have the option to develop a mixture with a minimum cement and finely divided minerals of 635 lbs/cu yd (378 kg/cu m) summed together.

- c. The minimum portland cement content in the mixture shall be 375 lbs/cu yd (222 kg/cu m). When the total of organic processing additions, inorganic processing additions, and limestone addition exceed 5.0 percent in the cement, the minimum portland cement content in the mixture shall be 400 lbs/cu yd (237 kg/cu m). For a drilled shaft, foundation, footing, or substructure, the minimum portland cement may be reduced to as low as 330 lbs/cu yd (196 kg/cu m) if the concrete has adequate freeze/thaw durability. The Contractor shall provide freeze/thaw test results according to AASHTO T 161 Procedure A or B, and the relative dynamic modulus of elasticity of the mix design shall be a minimum of 80 percent. Freeze/thaw testing will not be required for concrete that will not be exposed to freezing and thawing conditions as determined by the Engineer.
- d. The maximum cement replacement with fly ash shall be 40.0 percent. The maximum cement replacement with ground granulated blast-furnace slag shall be 65.0 percent. When cement replacement with ground granulated blast-furnace slag exceeds 35.0 percent, only Grade 100 shall be used.

- e. The mixture may contain a maximum of two finely divided minerals. The finely divided mineral in portland-pozzolan cement or portland blast-furnace slag cement shall count toward the total number of finely divided minerals allowed. The finely divided minerals shall constitute a maximum of 65.0 percent of the total cement plus finely divided minerals. The fly ash portion shall not exceed 40.0 percent.

The ground granulated blast-furnace slag portion shall not exceed 65.0 percent. The microsilica or high-reactivity metakaolin portion used together or separately shall not exceed 5.0 percent.

- f. The time to obtain the specified strength may be increased to a maximum 56 days, provided the curing period specified in Article 1020.13 is increased to a minimum of 14 days.

The minimum grout strength for filling embedded pipe shall be as specified for the concrete, and testing shall be according to AASHTO T 106.

- (2) The selected mathematical method for evaluating heat of hydration thermal effects, which shall include the calculated adiabatic temperature rise, calculated maximum concrete temperature, and calculated maximum temperature differential between the internal concrete core and concrete 2 to 3 in. (50 to 75 mm) from the exposed surface. The time when the maximum concrete temperature and maximum temperature differential will occur is required if the time frame will be more than seven days.

Acceptable mathematical methods include ACI 207.2R "Report on Thermal and Volume Change Effects on Cracking of Mass Concrete" as well as other proprietary methods. The Contractor shall perform heat of hydration testing on the cement and finely divided minerals to be used in the concrete mixture. The test shall be according to ASTM C 186 or other applicable test methods, and the result for heat shall be used in the equation to calculate adiabatic temperature rise.

The Contractor has the option to propose a higher maximum temperature differential between the internal concrete core and concrete 2 to 3 in. (50 to 75 mm) from the exposed surface, but the proposed value shall not exceed 50 °F (10 °C). In addition, based on strength gain of the concrete, multiple maximum temperature differentials at different times may be proposed. The proposed value shall be justified through a mathematical method.

- (3) Proposed maximum concrete temperature or temperature range prior to placement.

Article 1020.14 shall apply except a minimum 40 °F (10 °C) concrete temperature will be permitted.

- (4) Pre-cooling, post-cooling, and surface insulation methods that will be used to ensure the concrete will comply with the specified maximum temperature and specified or proposed temperature differential. For reinforcement that extends beyond the limits of the pour, the Contractor shall indicate if the reinforcement is required to be covered with insulation.

Refer to ACI 207.4R "Cooling and Insulating Systems for Mass Concrete" for acceptable methods that will be permitted. A copy of the ACI document shall be provided to the Engineer at the construction site. If embedded pipe is used for post-cooling, the material shall be polyvinyl chloride or polyethylene. The embedded pipe system shall be properly supported, and the Contractor shall subsequently inspect glued joints to ensure they are able to withstand free falling concrete.

The embedded pipe system shall be leak tested after inspection of the glued joints, and prior to the concrete placement. The leak test shall be performed at maximum service pressure or higher for a minimum of 15 minutes. All leaks shall be repaired. The embedded pipe cooling water may be from natural sources such as streams and rivers, but shall be filtered to prevent system stoppages. When the embedded pipe is no longer needed, the surface connections to the pipe shall be removed to a depth of 4 in. (100 mm) below the surface of the concrete. The remaining pipe shall be completely filled with grout. The 4 in. (100 mm) deep concrete hole shall be filled with nonshrink grout. Form and insulation removal shall be done in a manner to prevent cracking and ensure the maximum temperature differential is maintained. Insulation shall be in good condition as determined by the Engineer and properly attached.

- (5) Dimensions of each concrete pour, location of construction joints, placement operations, pour pattern, lift heights, and time delays between lifts.

Refer to ACI 207.1R "Guide to Mass Concrete" for acceptable placement operations that will be permitted. A copy of the ACI document shall be provided to the Engineer at the construction site.

- (6) Type of temperature monitoring system, the number of temperature sensors, and location of sensors.

A minimum of two independent temperature monitoring systems and corresponding sensors shall be used.

The temperature monitoring system shall have a minimum temperature range of 32 °F (0 °C) to 212 °F (100 °C), an accuracy of ± 2 °F (± 1 °C), and be able to automatically record temperatures without external power. Temperature monitoring shall begin once the sensor is encased in concrete, and with a maximum interval of one hour. Temperature monitoring may be discontinued after the maximum concrete temperature has been reached, post-cooling is no longer required, and the maximum temperature differential between the internal concrete core and the ambient air temperature does not exceed 35 °F (19 °C). The Contractor has the option to select a higher maximum temperature differential, but the proposed value shall not exceed 50 °F (28 °C). The proposed value shall be justified through a mathematical method.

At a minimum, a temperature sensor shall be located at the theoretical hottest portion of the concrete, normally the geometric center, and at the exterior face that will provide the maximum temperature differential. At the exterior face, the sensor shall be located 2 to 3 in. (50 to 75 mm) from the surface of the concrete. Sensors shall also be located a minimum of 1 in. (25 mm) away from reinforcement, and equidistant between cooling pipes if either applies. A sensor will also be required to measure ambient air temperature. The entrant/exit cooling water temperature for embedded pipe shall also be monitored.

Temperature monitoring results shall be provided to the Engineer a minimum of once each day and whenever requested by the Engineer. The report may be electronic or hard copy. The report shall indicate the location of each sensor, the temperature recorded, and the time recorded. The report shall be for all sensors and shall include ambient air temperature and entrant/exit cooling water temperatures.

The temperature data in the report may be provided in tabular or graphical format, and the report shall indicate any corrective actions during the monitoring period. At the completion of the monitoring period, the Contractor shall provide the Engineer a final report that includes all temperature data and corrective actions.

(7) Indicate contingency operations to be used if the maximum temperature or temperature differential of the concrete is reached after placement.

(c) Temperature Restriction Violations. If the maximum temperature of the concrete after placement exceeds 150 °F (66 °C), but is less than 158 °F (70 °C), the concrete will be accepted if no cracking or other unacceptable defects are identified. If cracking or unacceptable defects are identified, Article 105.03 shall apply. If the concrete temperature exceeds 158 °F (70 °C), Article 105.03 shall apply.

If a temperature differential between the internal concrete core and concrete 2 to 3 in. (50 to 75 mm) from the exposed surface exceeds the specified or proposed maximum value allowed, the concrete will be accepted if no cracking or other unacceptable defects are identified. If unacceptable defects are identified, Article 105.03 shall apply.

When the maximum 150 °F (66 °C) concrete temperature or the maximum allowed temperature differential is violated, the Contractor shall implement corrective action prior to the next pour. In addition, the Engineer reserves the right to request a new thermal control plan for acceptance before the Contractor is allowed to pour again.

(d) Inspection and Repair of Cracks. The Engineer will inspect the concrete for cracks after the temperature monitoring is discontinued, and the Contractor shall provide access for the Engineer to do the inspection. A crack may require repair by the Contractor as determined by the Engineer. The Contractor shall be responsible for the repair of all cracks. Protective coat or a concrete sealer shall be applied to a crack less than 0.007 in. (0.18 mm) in width. A crack that is 0.007 in. (0.18 mm) or greater shall be pressure injected with epoxy according to Section 590.

QUALITY CONTROL/QUALITY ASSURANCE OF CONCRETE MIXTURES (BDE)

Effective: January 1, 2012

Add the following to Section 1020 of the Standard Specifications:

“1020.16 Quality Control/Quality Assurance of Concrete Mixtures. This Article specifies the quality control responsibilities of the Contractor for concrete mixtures (except Class PC and PS concrete), cement aggregate mixture II, and controlled low-strength material incorporated in the project, and defines the quality assurance and acceptance responsibilities of the Engineer.

A list of quality control/quality assurance (QC/QA) documents is provided in Article 1020.16(g), Schedule D.

A Level I Portland Cement Concrete (PCC) Technician shall be defined as an individual who has successfully completed the Department’s training for concrete testing.

A Level II Portland Cement Concrete (PCC) Technician shall be defined as an individual who has successfully completed the Department’s training for concrete proportioning.

A Level III Portland Cement Concrete (PCC) Technician shall be defined as an individual who has successfully completed the Department’s training for concrete mix design.

A Concrete Tester shall be defined as an individual who has successfully completed the Department’s training to assist with concrete testing and is monitored on a daily basis.

Aggregate Technician shall be defined as an individual who has successfully completed the Department’s training for gradation testing involving aggregate production and mixtures.

Mixture Aggregate Technician shall be defined as an individual who has successfully completed the Department’s training for gradation testing involving mixtures.

Gradation Technician shall be defined as an individual who has successfully completed the Department’s training to assist with gradation testing and is monitored on a daily basis.

- (a) Equipment/Laboratory. The Contractor shall provide a laboratory and test equipment to perform their quality control testing.

The laboratory shall be of sufficient size and be furnished with the necessary equipment, supplies, and current published test methods for adequately and safely performing all required tests. The laboratory will be approved by the Engineer according to the current Bureau of Materials and Physical Research Policy Memorandum “Minimum Private Laboratory Requirements for Construction Materials Testing or Mix Design”. Production of a mixture shall not begin until the Engineer provides written approval of the laboratory. The Contractor shall refer to the Department’s "Required Sampling and Testing Equipment for Concrete" for equipment requirements.

Test equipment shall be maintained and calibrated as required by the appropriate test method, and when required by the Engineer. This information shall be documented on the Department's "Calibration of Concrete Testing Equipment" form.

Test equipment used to determine compressive or flexural strength shall be calibrated each 12 month period by an independent agency, using calibration equipment traceable to the National Institute of Standards and Technology (NIST). The Contractor shall have the calibration documentation available at the test equipment location.

The Engineer will have unrestricted access to the plant and laboratory at any time to inspect measuring and testing equipment, and will notify the Contractor of any deficiencies. Defective equipment shall be immediately repaired or replaced by the Contractor.

- (b) Quality Control Plan. The Contractor shall submit, in writing, a proposed Quality Control (QC) Plan to the Engineer. The QC Plan shall be submitted a minimum of 45 calendar days prior to the production of a mixture. The QC Plan shall address the quality control of the concrete, cement aggregate mixture II, and controlled low-strength material incorporated in the project. The Contractor shall refer to the Department's "Model Quality Control Plan for Concrete Production" to prepare a QC Plan.

The Engineer will respond in writing to the Contractor's proposed QC Plan within 15 calendar days of receipt.

Production of a mixture shall not begin until the Engineer provides written approval of the QC Plan. The approved QC Plan shall become a part of the contract between the Department and the Contractor, but shall not be construed as acceptance of any mixture produced.

The QC Plan may be amended during the progress of the work, by either party, subject to mutual agreement. The Engineer will respond in writing to a Contractor's proposed QC Plan amendment within 15 calendar days of receipt. The response will indicate the approval or denial of the Contractor's proposed QC Plan amendment.

- (c) Quality Control by Contractor. The Contractor shall perform quality control inspection, sampling, testing, and documentation to meet contract requirements. Quality control includes the recognition of obvious defects and their immediate correction. Quality control also includes appropriate action when passing test results are near specification limits, or to resolve test result differences with the Engineer. Quality control may require increased testing, communication of test results to the plant or the jobsite, modification of operations, suspension of mixture production, rejection of material, or other actions as appropriate. The Engineer shall be immediately notified of any failing tests and subsequent remedial action. Passing tests shall be reported no later than the start of the next work day.

When a mixture does not comply with specifications, the Contractor shall reject the material; unless the Engineer accepts the material for incorporation in the work, according to Article 105.03.

- (1) Personnel Requirements. The Contractor shall provide a Quality Control (QC) Manager who will have overall responsibility and authority for quality control. The jobsite and plant personnel shall be able to contact the QC Manager by cellular phone, two-way radio or other methods approved by the Engineer.

The QC Manager shall visit the jobsite a minimum of once a week. A visit shall be performed the day of a bridge deck pour, the day a non-routine mixture is placed as determined by the Engineer, or the day a plant is anticipated to produce more than 1000 cu yd (765 cu m). Any of the three required visits may be used to meet the once per week minimum requirement.

The Contractor shall provide personnel to perform the required inspections, sampling, testing and documentation in a timely manner. The Contractor shall refer to the Department's "Qualifications and Duties of Concrete Quality Control Personnel" document.

A Level I PCC Technician shall be provided at the jobsite during mixture production and placement, and may supervise concurrent pours on the project. For concurrent pours, a minimum of one Concrete Tester shall be required at each pour location. If the Level I PCC Technician is at one of the pour locations, a Concrete Tester is still required at the same location. Each Concrete Tester shall be able to contact the Level I PCC Technician by cellular phone, two-way radio or other methods approved by the Engineer.

A single Level I PCC Technician shall not supervise concurrent pours for multiple contracts.

A Level II PCC Technician shall be provided at the plant, or shall be available, during mixture production and placement. A Level II PCC Technician may supervise a maximum of three plants. Whenever the Level II PCC Technician is not at the plant during mixture production and placement, a Concrete Tester or Level I PCC Technician shall be present at the plant to perform any necessary concrete tests. The Concrete Tester, Level I PCC Technician, or other individual shall also be trained to perform any necessary aggregate moisture tests, if the Level II PCC Technician is not at the plant during mixture production and placement. The Concrete Tester, Level I PCC Technician, plant personnel, and jobsite personnel shall have the ability to contact the Level II PCC Technician by cellular phone, two-way radio, or other methods approved by the Engineer.

For a mixture which is produced and placed with a mobile portland cement concrete plant as defined in Article 1103.04, a Level II PCC Technician shall be provided. The Level II PCC Technician shall be present at all times during mixture production and placement.

A Concrete Tester, Mixture Aggregate Technician, and Aggregate Technician may provide assistance with sampling and testing. A Gradation Technician may provide assistance with testing. A Concrete Tester shall be supervised by a Level I or Level II PCC Technician. A Gradation Technician shall be supervised by a Level II PCC Technician, Mixture Aggregate Technician, or Aggregate Technician.

- (2) Required Plant Tests. Sampling and testing shall be performed at the plant, or at a location approved by the Engineer, to control the production of a mixture. The required minimum Contractor plant sampling and testing is indicated in Article 1020.16(g) Schedule A.
- (3) Required Field Tests. Sampling and testing shall be performed at the jobsite to control the production of a mixture, and to comply with specifications for placement. For standard curing, after initial curing, and for strength testing; the location shall be approved by the Engineer. The required minimum Contractor jobsite sampling and testing is indicated in Article 1020.16(g), Schedule B.
- (d) Quality Assurance by Engineer. The Engineer will perform quality assurance tests on independent samples and split samples. An independent sample is a field sample obtained and tested by only one party. A split sample is one of two equal portions of a field sample, where two parties each receive one portion for testing. The Engineer may request the Contractor to obtain a split sample. Aggregate split samples and any failing strength specimen shall be retained until permission is given by the Engineer for disposal. The results of all quality assurance tests by the Engineer will be made available to the Contractor. However, Contractor split sample test results shall be provided to the Engineer before Department test results are revealed. The Engineer's quality assurance independent sample and split sample testing is indicated in Article 1020.16(g), Schedule C.
- (1) Strength Testing. For strength testing, Article 1020.09 shall apply, except the Contractor and Engineer beam strength specimens may be cured in the same tank.
- (2) Comparing Test Results. Differences between the Engineer's and the Contractor's split sample test results will not be considered extreme if within the following limits:

Test Parameter	Acceptable Limits of Precision
Slump	0.75 in. (20 mm)
Air Content	0.9%
Compressive Strength	900 psi (6200 kPa)
Flexural Strength	90 psi (620 kPa)
Aggregate Gradation	See "Guideline for Sample Comparison" in Appendix "A" of the Manual of Test Procedures for Materials.

When acceptable limits of precision have been met, but only one party is within specification limits, the failing test shall be resolved before the material may be considered for acceptance.

- (3) Test Results and Specification Limits.
- a. Split Sample Testing. If either the Engineer's or the Contractor's split sample test result is not within specification limits, and the other party is within specification limits; immediate retests on a split sample shall be performed for slump, air content, or aggregate gradation. A passing retest result by each party will require no further action.

If either the Engineer's or Contractor's slump, air content, or aggregate gradation split sample retest result is a failure; or if either the Engineer's or Contractor's strength test result is a failure, and the other party is within specification limits; the following actions shall be initiated to investigate the test failure:

1. The Engineer and the Contractor shall investigate the sampling method, test procedure, equipment condition, equipment calibration, and other factors.
2. The Engineer or the Contractor shall replace test equipment, as determined by the Engineer.
3. The Engineer and the Contractor shall perform additional testing on split samples, as determined by the Engineer.

For aggregate gradation, jobsite slump, and jobsite air content; if the failing split sample test result is not resolved according to 1., 2., or 3., and the mixture has not been placed, the Contractor shall reject the material; unless the Engineer accepts the material for incorporation in the work according to Article 105.03. If the mixture has already been placed, or if a failing strength test result is not resolved according to 1., 2., or 3., the material will be considered unacceptable.

If a continued trend of difference exists between the Engineer's and the Contractor's split sample test results, or if split sample test results exceed the acceptable limits of precision, the Engineer and the Contractor shall investigate according to items 1, 2, and 3.

- b. Independent Sample Testing. For aggregate gradation, jobsite slump, and jobsite air content; if the result of a quality assurance test on a sample independently obtained by the Engineer is not within specification limits, and the mixture has not been placed, the Contractor shall reject the material, unless the Engineer accepts the material for incorporation in the work according to Article 105.03. If the mixture has already been placed or the Engineer obtains a failing strength test result, the material will be considered unacceptable.
- (e) Acceptance by the Engineer. Final acceptance will be based on the Standard Specifications and the following:
- (1) The Contractor's compliance with all contract documents for quality control.
 - (2) Validation of Contractor quality control test results by comparison with the Engineer's quality assurance test results using split samples. Any quality control or quality assurance test determined to be flawed may be declared invalid only when reviewed and approved by the Engineer. The Engineer will declare a test result invalid only if it is proven that improper sampling or testing occurred. The test result is to be recorded and the reason for declaring the test invalid will be provided by the Engineer.
 - (3) Comparison of the Engineer's quality assurance test results with specification limits using samples independently obtained by the Engineer.

The Engineer may suspend mixture production, reject materials, or take other appropriate action if the Contractor does not control the quality of concrete, cement aggregate mixture II, or controlled low-strength material for acceptance. The decision will be determined according to (1), (2), or (3).

(f) Documentation.

- (1) Records. The Contractor shall be responsible for documenting all observations, inspections, adjustments to the mix design, test results, retest results, and corrective actions in a bound hardback field book, bound hardback diary, or appropriate Department form, which shall become the property of the Department. The documentation shall include a method to compare the Engineer's test results with the Contractor's results. The Contractor shall be responsible for the maintenance of all permanent records whether obtained by the Contractor, the consultants, the subcontractors, or the producer of the mixture. The Contractor shall provide the Engineer full access to all documentation throughout the progress of the work.

The Department's form MI 504M, form BMPR MI654, and form BMPR MI655 shall be completed by the Contractor, and shall be submitted to the Engineer weekly or as required by the Engineer. A correctly completed form MI 504M, form BMPR MI654, and form BMPR MI655 are required to authorize payment by the Engineer, for applicable pay items.

- (2) Delivery Truck Ticket. The following information shall be recorded on each delivery ticket or in a bound hardback field book: initial/final revolution counter reading, at the jobsite, if the mixture is truck-mixed; time discharged at the jobsite; total amount of each admixture added at the jobsite; total amount of water added at the jobsite; and total amount of cement added at the jobsite if the air content needed adjustment.

- (g) Basis of Payment and Schedules. Quality Control/Quality Assurance of portland cement concrete mixtures will not be paid for separately, but shall be considered as included in the cost of the various concrete contract items.

SCHEDULE A

CONTRACTOR PLANT SAMPLING AND TESTING			
Item	Test	Frequency	IL Modified AASHTO or Department Test Method ^{1/}
Aggregates (Arriving at Plant)	Gradation ^{2/}	As needed to check source for each gradation number	T 2, T 11, T 27, and T 248
Aggregates (Stored at Plant in Stockpiles or Bins)	Gradation ^{2/}	2,500 cu yd (1,900 cu m) for each gradation number ^{3/}	T 2, T 11, T 27, and T 248
Aggregates (Stored at Plant in Stockpiles or Bins)	Moisture ^{4/} : Fine Aggregate	Once per week for moisture sensor, otherwise daily for each gradation number	Flask, Dunagan, Pychnometer Jar, or T 255
	Moisture ^{4/} : Coarse Aggregate	As needed to control production for each gradation number	Dunagan, Pychnometer Jar, or T 255
Mixture ^{5/}	Slump, Air Content, Unit Weight / Yield, and Temperature	As needed to control production	T 141 and T 119 T 141 and T 152 or T 196 T 141 and T 121 T 141 and T 309

- 1/ Refer to the Department's "Manual of Test Procedures for Materials".
- 2/ All gradation tests shall be washed. Testing shall be completed no later than 24 hours after the aggregate has been sampled.
- 3/ One per week (Sunday through Saturday) minimum unless the stockpile has not received additional aggregate material since the previous test.
One per day minimum for a bridge deck pour unless the stockpile has not received additional aggregate material since the previous test. The sample shall be taken and testing completed prior to the pour. The bridge deck aggregate sample may be taken the day before the pour or as approved by the Engineer.
- 4/ If the moisture test and moisture sensor disagree by more than 0.5 percent, retest. If the difference remains, adjust the moisture sensor to an average of two or more moisture tests, using the Dunagan or Illinois Modified AASHTO T 255 test method. The Department's "Water/Cement Ratio Worksheet" form shall be completed when applicable.
- 5/ The Contractor may also perform strength testing according to Illinois Modified AASHTO T 141, T 23, and T 22 or T 177; or water content testing according to Illinois Modified AASHTO T 318; or other tests at the plant to control mixture production.

SCHEDULE B

CONTRACTOR JOBSITE SAMPLING & TESTING ^{1/}			
Item	Measured Property	Random Sample Testing Frequency per Mix Design and per Plant ^{2/}	IL Modified AASHTO Test Method
Pavement, Shoulder, Base Course, Base Course Widening, Driveway Pavement, Railroad Crossing, Cement Aggregate Mixture II	Slump ^{3/ 4/}	1 per 500 cu yd (400 cu m) or minimum 1/day	T 141 and T 119
	Air Content ^{3/ 5/ 6/}	1 per 100 cu yd (80 cu m) or minimum 1/day	T 141 And T 152 or T 196
	Compressive Strength ^{7/ 8/} or Flexural Strength ^{7/ 8/}	1 per 1250 cu yd (1000 cu m) or minimum 1/day	T 141, T 22 and T 23 Or T 141, T 177 and T 23
Bridge Approach Slab ^{9/} , Bridge Deck ^{9/} , Bridge Deck Overlay ^{9/} , Superstructure ^{9/} , Substructure, Culvert, Miscellaneous Drainage Structures, Retaining Wall, Building Wall, Drilled Shaft Pile & Encasement Footing, Foundation, Pavement Patching, Structural Repairs	Slump ^{3/ 4/}	1 per 50 cu yd (40 cu m) or minimum 1/day	T 141 and T 119
	Air Content ^{3/ 5/ 6/}	1 per 50 cu yd (40 cu m) or minimum 1/day	T 141 And T 152 or T 196
	Compressive Strength ^{7/ 8/} or Flexural Strength ^{7/ 8/}	1 per 250 cu yd (200 cu m) or minimum 1/day	T 141, T 22 and T 23 Or T 141, T 177 and T 23
Seal Coat	Slump ^{3/}	1 per 250 cu yd (200 cu m) or minimum 1/day	T 141 and T 119
	Air Content ^{3/ 6/}	As needed to control production	T 141 And T 152 or T 196
	Compressive Strength ^{7/ 8/} or Flexural Strength ^{7/ 8/}	1 per 250 cu yd (200 cu m) or minimum 1/day	T 141, T 22 and T 23 Or T 141, T 177 and T 23

CONTRACTOR JOBSITE SAMPLING & TESTING ^{1/}			
Curb, Gutter, Median, Barrier, Sidewalk, Slope Wall, Paved Ditch, Fabric Formed Concrete Revetment Mat ^{10/} , Miscellaneous Items, Incidental Items	Slump ^{3/ 4/}	1 per 100 cu yd (80 cu m) or minimum 1/day	T 141 and T 119
	Air Content ^{3/ 5/ 6/}	1 per 50 cu yd (40 cu m) or minimum 1/day	T 141 And T 152 or T 196
	Compressive Strength ^{7/ 8/} or Flexural Strength ^{7/ 8/}	1 per 400 cu yd (300 cu m) or minimum 1/day	T 141, T 22 and T 23 Or T 141, T 177 and T 23
All	Temperature ^{3/}	As needed to control production	T 141 and T 309
Controlled Low-Strength Material (CLSM)	Flow, Air Content and Compressive Strength	As needed to control production	Illinois Test Procedure 307

- 1/ Sampling and testing of small quantities of curb, gutter, median, barrier, sidewalk, slope wall, paved ditch, miscellaneous items, and incidental items may be waived by the Engineer if requested by the Contractor. However, quality control personnel are still required according to Article 1020.16(c)(1) The Contractor shall also provide recent evidence that similar material has been found to be satisfactory under normal sampling and testing procedures. The total quantity that may be waived for testing shall not exceed 100 cu yd (76 cu m) per contract.
- 2/ If one mix design is being used for several construction items during a day's production, one testing frequency may be selected to include all items. The construction items shall have the same slump, air content, and water/cement ratio specifications. The frequency selected shall equal or exceed the testing required for the construction item.

One sufficiently sized sample shall be taken to perform the required test(s). Random numbers shall be determined according to the Department's "Method for Obtaining Random Samples for Concrete". The Engineer will provide random sample locations.
- 3/ The temperature, slump, and air content tests shall be performed on the first truck load delivered, for each pour. Unless a random sample is required for the first truck load, testing the first truck load does not satisfy random sampling requirements.
- 4/ The slump random sample testing frequency shall be a minimum 1/day for a construction item which is slipformed.
- 5/ If a pump or conveyor is used for placement, a correction factor shall be established to allow for a loss of air content during transport. The first three truck loads delivered shall be tested, before and after transport by the pump or conveyor, to establish the correction factor. Once the correction is determined, it shall be re-checked after an additional 50 cu yd (40 cu m) is pumped, or an additional 100 cu yd (80 cu m) is conveyed. This shall continue throughout the pour. If the re-check indicates the correction factor has changed, a minimum of two truckloads is required to re-establish the correction factor. The correction factor shall also be re-established when significant changes in temperature, distance, pump or conveyor arrangement, and other factors have occurred.

If the correction factor is 3.0 percent or more, the Contractor shall take corrective action to reduce the loss of air content during transport by the pump or conveyor. The Contractor shall record all air content test results, correction factors and corrected air contents. The corrected air content shall be reported on form BMPR MI654.

- 6/ If the Contractor's or Engineer's air content test result is within the specification limits, and 0.2 percent or closer to either limit, the next truck load delivered shall be tested by the Contractor. For example, if the specified air content range is 5.0 to 8.0 percent and the test result is 5.0, 5.1, 5.2, 7.8, 7.9 or 8.0 percent, the next truck shall be tested by the Contractor.

If the Contractor's or Engineer's air content or slump test result is not within the specification limits, all subsequent truck loads delivered shall be tested by the Contractor until the problem is corrected.

- 7/ The test of record for strength shall be the day indicated in Article 1020.04. For cement aggregate mixture II, a strength requirement is not specified and testing is not required. Additional strength testing to determine early falsework and form removal, early pavement or bridge opening to traffic, or to monitor strengths is at the discretion of the Contractor. Strength shall be defined as the average of at least two cylinder or two beam breaks for field tests.
- 8/ In addition to the strength test, an air test, slump test, and temperature test shall be performed on the same sample. For mixtures pumped or conveyed, the Contractor shall sample according to Illinois Modified AASHTO T 141.
- 9/ The air content test will be required for each delivered truck load.
- 10/ For fabric formed concrete revetment mat, the slump test is not required and the flexural strength test is not applicable.

SCHEDULE C

ENGINEER QUALITY ASSURANCE INDEPENDENT SAMPLE TESTING		
Location	Measured Property	Testing Frequency ^{1/}
Plant	Gradation of aggregates stored in stockpiles or bins, Slump and Air Content	As determined by the Engineer.
Jobsite	Slump, Air Content and Strength	As determined by the Engineer.

ENGINEER QUALITY ASSURANCE SPLIT SAMPLE TESTING		
Location	Measured Property	Testing Frequency ^{1/}
Plant	Gradation of aggregates stored in stockpiles or bins ^{2/}	At the beginning of the project, the first test performed by the Contractor. Thereafter, a minimum of 10% of total tests required of the Contractor will be performed per aggregate gradation number and per plant.
	Slump and Air Content	As determined by the Engineer.
Jobsite	Slump ^{2/} and Air Content ^{2/ 3/}	At the beginning of the project, the first three tests performed by the Contractor. Thereafter, a minimum of 20% of total tests required of the Contractor will be performed per plant, which will include a minimum of one test per mix design.
	Strength ^{2/}	At the beginning of the project, the first test performed by the Contractor. Thereafter, a minimum of 20% of total tests required of the Contractor will be performed per plant, which will include a minimum of one test per mix design.

- 1/ The Engineer will perform the testing throughout the period of quality control testing by the Contractor.
- 2/ The Engineer will witness and take immediate possession of or otherwise secure the Department's split sample obtained by the Contractor.
- 3/ Before transport by pump or conveyor, a minimum of 20 percent of total tests required of the Contractor will be performed per mix design and per plant. After transport by pump or conveyor, a minimum of 20 percent of total tests required of the Contractor will be performed per mix design and per plant.

SCHEDULE D

CONCRETE QUALITY CONTROL AND QUALITY ASSURANCE DOCUMENTS

- (a) Model Quality Control Plan for Concrete Production (*)
- (b) Qualifications and Duties of Concrete Quality Control Personnel (*)
- (c) Development of Gradation Bands on Incoming Aggregate at Mix Plants (*)
- (d) Required Sampling and Testing Equipment for Concrete (*)
- (e) Method for Obtaining Random Samples for Concrete (*)
- (f) Calibration of Concrete Testing Equipment (BMPR PCCQ01 through BMPR PCCQ09) (*)
- (g) Water/Cement Ratio Worksheet (BMPR PCCW01) (*)
- (h) Field/Lab Gradations (MI 504M) (*)
- (i) Concrete Air, Slump and Quantity (BMPR MI654) (*)
- (j) P.C. Concrete Strengths (BMPR MI655) (*)
- (k) Aggregate Technician Course or Mixture Aggregate Technician Course (*)
- (l) Portland Cement Concrete Tester Course (*)
- (m) Portland Cement Concrete Level I Technician Course - Manual of Instructions for Concrete Testing (*)
- (n) Portland Cement Concrete Level II Technician Course - Manual of Instructions for Concrete Proportioning (*)
- (o) Portland Cement Concrete Level III Technician Course - Manual of Instructions for Design of Concrete Mixtures (*)
- (p) Manual of Test Procedures for Materials

* Refer to Appendix C of the Manual of Test Procedures for Materials for more information.”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: April 2, 2005

Revised: April 1, 2011

To account for the preparatory work and operations necessary for the movement of subcontractor personnel, equipment, supplies, and incidentals to the project site and for all other work or operations that must be performed or costs incurred when beginning work approved for subcontracting according to Article 108.01 of the Standard Specifications, the Contractor shall make a mobilization payment to each subcontractor.

This mobilization payment shall be made at least 14 days prior to the subcontractor starting work. The amount paid shall be equal to 3 percent of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor's work.

The mobilization payment to the subcontractor is an advance payment of the reported amount of the subcontract and is not a payment in addition to the amount of the subcontract; therefore, the amount of the advance payment will be deducted from future progress payments.

This provision shall be incorporated directly or by reference into each subcontract approved by the Department.

TEMPORARY EROSION AND SEDIMENT CONTROL (BDE)

Effective: January 1, 2012

Revise the first paragraph of Article 280.04(f) of the Standard Specifications to read:

“(f) Temporary Erosion Control Seeding. This system consists of seeding all erodible/bare areas to minimize the amount of exposed surface area. Seed bed preparation will not be required if the surface of the soil is uniformly smooth and in a loose condition. Light disking shall be done if the soil is hard packed or caked. Erosion rills greater than 1 in. (25 mm) in depth shall be filled and area blended with the surrounding soil. Fertilizer nutrients will not be required.”

Delete the last sentence of Article 280.08(e) of the Standard Specifications.

TRAFFIC CONTROL DEFICIENCY DEDUCTION (BDE)

Effective: August 1, 2011

Revise the third sentence of the third paragraph of Article 105.03(b) of the Standard Specifications to read:

“The daily monetary deduction will be \$2,500.”

UTILITY COORDINATION AND CONFLICTS (BDE)

Effective: April 1, 2011

Revised: January 1, 2012

Revise Article 105.07 of the Standard Specifications to read:

“**105.07 Cooperation with Utilities.** The Department reserves the right at any time to allow work by utilities on or near the work covered by the contract. The Contractor shall conduct his/her work so as not to interfere with or hinder the progress or completion of the work being performed by utilities. The Contractor shall also arrange the work and shall place and dispose of the materials being used so as not to interfere with the operations of utility work in the area.

The Contractor shall cooperate with the owners of utilities in their removal and rearrangement operations so work may progress in a reasonable manner, duplication or rearrangement of work may be reduced to a minimum, and services rendered by those parties will not be unnecessarily interrupted.

The Contractor shall coordinate with any planned utility adjustment or new installation and the Contractor shall take all precautions to prevent disturbance or damage to utility facilities. Any failure on the part of the utility owner, or their representative, to proceed with any planned utility adjustment or new installation shall be reported promptly by the Contractor to the Engineer.”

Revise the first sentence of the last paragraph of Article 107.19 of the Standard Specifications to read:

“When the Contractor encounters unexpected regulated substances due to the presence of utilities in unanticipated locations, the provisions of Article 107.40 shall apply; otherwise, if the Engineer does not direct a resumption of operations, the provisions of Article 108.07 shall apply.”

Revise Article 107.31 of the Standard Specification to read:

“107.31 Reserved.”

Add the following four Articles to Section 107 of the Standard Specifications:

“107.37 Locations of Utilities within the Project Limits. All known utilities existing within the limits of construction are either indicated on the plans or visible above ground. For the purpose of this Article, the limits of proposed construction are defined as follows:

(a) Limits of Proposed Construction for Utilities Paralleling the Roadway.

(1) The horizontal limits shall be a vertical plane, outside of, parallel to, and 2 ft (600 mm) distant at right angles from the plan or revised slope limits.

In cases where the limits of excavation for structures are not shown on the plans, the horizontal limits shall be a vertical plane 4 ft (1.2 m) outside the edges of structure footings or the structure where no footings are required.

(2) The upper vertical limits shall be the regulations governing the roadbed clearance for the specific utility involved.

(3) The lower vertical limits shall be either the top of the utility at the depth below the proposed grade as prescribed by the governing agency or the limits of excavation, whichever is less.

(b) Limits of Proposed Construction for Utilities Crossing the Roadway in a Generally Transverse Direction.

- (1) Utilities crossing excavations for structures that are normally made by trenching such as sewers, underdrains, etc. and all minor structures such as manholes, inlets, foundations for signs, foundations for traffic signals, etc., the limits shall be the space to be occupied by the proposed permanent construction, unless otherwise required by the regulations governing the specific utility involved.
- (2) For utilities crossing the proposed site of major structures such as bridges, sign trusses, etc., the limits shall be as defined above for utilities extending in the same general direction as the roadway.

It is understood and agreed that the Contractor has considered in the bid all of the permanent and temporary utilities in their present and/or adjusted positions as indicated in the contract. It is further understood the actual location of the utilities may be located anywhere within the tolerances provided in 220 ILCS 50/2.8 or Administrative Code Title 92 Part 530.40(c), and the proximity of some utilities to construction may require extraordinary measures by the Contractor to protect those utilities.

No additional compensation will be allowed for any delays, inconveniences, or damages sustained by the Contractor due to the presence of or any claimed interference from known utility facilities or any adjustment of them, except as specifically provided in the contract.

107.38 Adjustments of Utilities within the Project Limits. The adjustment of utilities consists of the relocation, removal, replacement, rearrangements, reconstruction, improvement, disconnection, connection, shifting, new installation, or altering of an existing utility facility in any manner.

Utilities which are to be adjusted shall be adjusted by the utility owner or the owner's representative or by the Contractor as a contract item. Generally, arrangements for adjusting known utilities will be made by the Department prior to project construction; however, utilities will not necessarily be adjusted in advance of project construction and, in some cases, utilities will not be removed from the proposed construction limits as described in Article 107.37. When utility adjustments must be performed in conjunction with construction, the utility adjustment work will be indicated in the contract.

The Contractor may make arrangements for adjustment of utilities indicated in the contract, but not scheduled by the Department for adjustment, provided the Contractor furnishes the Department with a signed agreement with the utility owner covering the adjustments to be made. The cost of any such adjustments shall be the responsibility of the Contractor.

107.39 Contractor's Responsibility for Locating and Protecting Utility Property and Services. At points where the Contractor's operations are adjacent to properties or facilities of utility companies, or are adjacent to other property, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

Within the State of Illinois, a State-Wide One Call Notice System has been established for notifying utilities. Outside the city limits of the City of Chicago, the system is known as the Joint Utility Locating Information for Excavators (JULIE) System. Within the city limits of the City of Chicago the system is known as DIGGER. All utility companies and municipalities which have buried utility facilities in the State of Illinois are a part of this system.

The Contractor shall call JULIE (800-892-0123) or DIGGER (312-744-7000), a minimum of 48 hours in advance of work being done in the area, and they will notify all member utility companies involved their respective utility should be located.

For utilities which are not members of JULIE or DIGGER, the Contractor shall contact the owners directly. The plan general notes will indicate which utilities are not members of JULIE or DIGGER.

The following table indicates the color of markings required of the State-Wide One Call Notification System.

Utility Service	Color
Electric Power, Distribution and Transmission	Safety Red
Municipal Electric Systems	Safety Red
Gas Distribution and Transmission	High Visibility Safety Yellow
Oil Distribution and Transmission	High Visibility Safety Yellow
Telephone and Telegraph System	Safety Alert Orange
Community Antenna Television Systems	Safety Alert Orange
Water Systems	Safety Precaution Blue
Sewer Systems	Safety Green
Non-Potable Water and Slurry Lines	Safety Purple
Temporary Survey	Safety Pink
Proposed Excavation	Safety White (Black when snow is on the ground)

The State-Wide One Call Notification System will provide for horizontal locations of utilities. When it is determined that the vertical location of the utility is necessary to facilitate construction, the Engineer may make the request for location from the utility after receipt of notice from the Contractor. If the utility owner does not field locate their facilities to the satisfaction of the Engineer, the Engineer will authorize the Contractor in writing to proceed to locate the facilities in the most economical and reasonable manner, subject to the approval of the Engineer, and be paid according to Article 109.04.

The Contractor shall be responsible for maintaining the excavations or markers provided by the utility owners.

The Contractor shall take all necessary precautions for the protection of the utility facilities. The Contractor shall be responsible for any damage or destruction of utility facilities resulting from neglect, misconduct, or omission in the Contractor's manner or method of execution or non-execution of the work, or caused by defective work or the use of unsatisfactory materials. Whenever any damage or destruction of a utility facility occurs as a result of work performed by the Contractor, the utility company will be immediately notified. The utility company will make arrangements to restore such facility to a condition equal to that existing before any such damage or destruction was done.

In the event of interruption of utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service.

If water service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

107.40 Conflicts with Utilities. Except as provided hereinafter, the discovery of a utility in an unanticipated location will be evaluated according to Article 104.03. It is understood and agreed that the Contractor has considered in the bid all facilities not meeting the definition of a utility in an unanticipated location and no additional compensation will be allowed for any delays, inconveniences, or damages sustained by the Contractor due to the presence of or any claimed interference from such facilities.

When the Contractor discovers a utility in an unanticipated location, the Contractor shall not interfere with said utility, shall take proper precautions to prevent damage or interruption of the utility, and shall promptly notify the Engineer of the nature and location of said utility.

(a) Definition. A utility in an unanticipated location is defined as an active or inactive utility, which is either:

(1) Located underground and (a) not shown in any way in any location on the contract documents; (b) not identified in writing by the Department to the Contractor prior to the letting; or (c) not located relative to the location shown in the contract within the tolerances provided in 220 ILCS 50/2.8 or Administrative Code Title 92 Part 530.40(c); or

(2) Located above ground or underground and not relocated as provided in the contract.

Service connections shall not be considered to be utilities in unanticipated locations.

(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work applicable to the utility or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows:

(1) Minor Delay. A minor delay occurs when the Contractor's operation is completely stopped by a utility in an unanticipated location for more than two hours, but not to exceed three weeks.

(2) Major Delay. A major delay occurs when the Contractor's operation is completely stopped by a utility in an unanticipated location for more than three weeks.

(3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the contractor's rate of production decreases by more than 25 percent and lasts longer than seven days.

(c) Payment. Payment for Minor, Major and Reduced Rate of Production Delays will be made as follows.

- (1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

- (2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to three weeks plus the cost of move-out to either the Contractor's yard or another job, whichever is less. Rental equipment may be paid for longer than three weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

- (3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Whether covered by (1), (2) or (3) above, additional traffic control required as a result of the operation(s) delayed will be paid for according to Article 109.04 for the total length of the delay.

If the delay is clearly shown to have caused work, which would have otherwise been completed, to be done after material or labor costs have increased, such increases may be paid. Payment for materials will be limited to increased cost substantiated by documentation furnished by the Contractor. Payment for increased labor rates will include those items in Article 109.04(b)(1) and (2), except the 35 percent and ten percent additives will not be permitted. On a working day contract, a delay occurring between November 30 and May 1, when work has not started, will not be considered as eligible for payment of measured labor and material costs.

Project overhead (not including interest) will be allowed when all progress on the contract has been delayed, and will be calculated as 15 percent of the delay claim.

- (d) Other Obligations of Contractor. Upon payment of a claim under this provision, the Contractor shall assign subrogation rights to the Department for the Department's efforts of recovery from any other party for monies paid by the Department as a result of any claim under this Provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this Provision."

WARM MIX ASPHALT (BDE)

Effective: January 1, 2012

Description. This work shall consist of designing, producing and constructing Warm Mix Asphalt (WMA) in lieu of Hot Mix Asphalt (HMA) for N30, N50, and N70 mixtures at the Contractor's option. Work shall be according to Sections 406, 407, 408, 1030, and 1102 of the Standard Specifications, except as modified herein. In addition, any references to HMA in the Standard Specifications, or the special provisions shall be construed to include WMA.

WMA is an asphalt mixture which can be produced at temperatures lower than allowed for HMA utilizing approved WMA technologies. WMA technologies are defined as the use of additives or processes which allow a reduction in the temperatures at which HMA mixes are produced and placed. WMA is produced by the use of additives, a water foaming process, or combination of both. Additives include minerals, chemicals or organics incorporated into the asphalt binder stream in a dedicated delivery system. The process of foaming injects water into the asphalt binder stream, just prior to incorporation of the asphalt binder with the aggregate.

Approved WMA technologies may also be used in HMA provided all the requirements specified herein, with the exception of temperature, are met. However, asphalt mixtures produced at temperatures in excess of 275 °F (135 °C) will not be considered WMA when determining the grade reduction of the virgin asphalt binder grade.

Materials.

Add the following to Article 1030.02 of the Standard Specifications.

“(h) Warm Mix Asphalt (WMA) Technologies (Note 3)”

Add the following note to Article 1030.02 of the Standard Specifications.

“Note 3. Warm mix additives or foaming processes shall be selected from the current Bureau of Materials and Physical Research Approved List, “Warm-Mix Asphalt Technologies”.”

Equipment.

Revise the first paragraph of Article 1102.01 of the Standard Specifications to read:

1102.01 Hot-Mix Asphalt Plant. The hot-mix asphalt (HMA) plant shall be the batch-type, continuous-type, or dryer drum plant. The plants shall be evaluated for prequalification rating and approval to produce HMA according to the current Bureau of Materials and Physical Research Policy Memorandum, “Approval of Hot-Mix Asphalt Plants and Equipment”. Once approved, the Contractor shall notify the Bureau of Materials and Physical Research to obtain approval of all plant modifications. The plants shall not be used to produce mixtures concurrently for more than one project or for private work unless permission is granted in writing by the Engineer. The plant units shall be so designed, coordinated and operated that they will function properly and produce HMA having uniform temperatures and compositions within the tolerances specified. The plant units shall meet the following requirements.”

Add the following to Article 1102.01(a) of the Standard Specifications.

“(13) Equipment for Warm Mix Technologies.

- a. Foaming. Metering equipment for foamed asphalt shall have an accuracy of ± 2 percent of the actual water metered. The foaming control system shall be electronically interfaced with the asphalt binder meter.
- b. Additives. Additives shall be introduced into the plant according to the supplier’s recommendations and shall be approved by the Engineer. The system for introducing the WMA additive shall be interlocked with the aggregate feed or weigh system to maintain correct proportions for all rates of production and batch sizes.”

Mix Design Verification.

Add the following to Article 1030.04 of the Standard Specifications.

“(d) Warm Mix Technologies.

- (1) Foaming. WMA mix design verification will not be required when foaming technology is used alone (without WMA additives). However, the foaming technology shall only be used on HMA designs previously approved by the Department.
- (2) Additives. WMA mix designs utilizing additives shall be submitted to the Engineer for mix design verification. Additional mixture verification requirements include Hamburg Wheel testing according to Illinois Modified AASHTO T324 and tensile strength testing according to Illinois Modified AASHTO T283 which shall meet the criteria in Tables 1 and 2 respectively herein. The Contractor shall provide the additional material as follows:
 - a. Four gyratory specimens to be prepared in the Contractor’s lab according to Illinois Modified AASHTO T324.
 - b. Sufficient mixture to conduct tensile strength testing according to Illinois Modified AASHTO T283.

Table 1. Illinois Modified AASHTO T324 Requirements ^{1/}

Asphalt Binder Grade	# Wheel Passes	Max Rut Depth in. (mm)
PG 76-XX	20,000	1/2 in. (12.5 mm)
PG 70-XX	15,000	1/2 in. (12.5 mm)
PG 64-XX	10,000	1/2 in. (12.5 mm)
PG 58-XX		

1/ Loose WMA shall be oven aged at 270 ± 5 °F (132 ± 3 °C) for two hours prior to gyratory compaction of Hamburg Wheel specimens.

Table 2. Tensile Strength Requirements

Asphalt Binder Grade	Tensile Strength psi (kPa)	
	Minimum	Maximum
PG 76-XX	80 (552)	200 (1379)
PG 70-XX		
PG 64-XX	60 (414)	200 (1379)"
PG 58-XX		

Production.

Revise the second paragraph of Article 1030.06(a) of the Standard Specifications to read:

“At the start of mix production for HMA, WMA, and HMA using WMA technologies, QC/QA mixture start-up will be required for the following situations; at the beginning of production of a new mix of a new mixture design, at the beginning of each production season, and at every plant utilized to produce mixtures, regardless of the mix.”

Insert the following after the sixth paragraph of Article 1030.06(a) of the Standard Specifications:

“Warm mix technologies shall be as follows.

- (1) Mixture sampled to represent the test strip shall include additional material sufficient for the Department to conduct Hamburg Wheel testing according to Illinois Modified AASHTO T324 and tensile strength testing according to Illinois Modified AASHTO T283 (approximately 110 lb (50 kg) total).
- (2) Upon completion of the start-up, WMA production shall cease. The Contractor may revert to HMA production provided a start-up has been previously completed for the current construction season for the mix design. WMA may resume once all the test results, including Hamburg Wheel results are completed and found acceptable by the Engineer.”

Add the following after the first paragraph of Article 1030.05(d)(2)c. of the Standard Specifications:

“During production of each WMA mixture or HMA utilizing WMA technologies, the Engineer will request a minimum of one randomly located sample, identified by the Engineer, for Hamburg Wheel testing to determine compliance with the requirements specified in Table 1 herein.”

Quality Control/Quality Assurance Testing.

Revise the table in Article 1030.05(d)(2)a. of the Standard Specifications to read:

Parameter	Frequency of Tests		Test Method See Manual of Test Procedures for Materials
	High ESAL Mixture Low ESAL Mixture	All Other Mixtures	
Aggregate Gradation % passing sieves: 1/2 in. (12.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 30 (600 μm) No. 200 (75 μm) Note 1.	1 washed ignition oven test on the mix per half day of production Note 4.	1 washed ignition oven test on the mix per day of production Note 4.	Illinois Procedure
Asphalt Binder Content by Ignition Oven Note 2.	1 per half day of production	1 per day	Illinois-Modified AASHTO T 308
VMA Note 3.	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	N/A	Illinois-Modified AASHTO R 35
Air Voids Bulk Specific Gravity of Gyrotory Sample Note 5.	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	1 per day	Illinois-Modified AASHTO T 312
Maximum Specific Gravity of Mixture	Day's production ≥ 1200 tons: 1 per half day of production Day's production < 1200 tons: 1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)	1 per day	Illinois-Modified AASHTO T 209

Note 1. The No. 8 (2.36 mm) and No. 30 (600 μ m) sieves are not required for All Other Mixtures.

Note 2. The Engineer may waive the ignition oven requirement for asphalt binder content if the aggregates to be used are known to have ignition asphalt binder content calibration factors which exceed 1.5 percent. If the ignition oven requirement is waived, other Department approved methods shall be used to determine the asphalt binder content.

Note 3. The G_{sb} used in the voids in the mineral aggregate (VMA) calculation shall be the same average G_{sb} value listed in the mix design.

Note 4. The Engineer reserves the right to require additional hot bin gradations for batch

Note 5. The WMA compaction temperature for mixture volumetric testing shall be 270 ± 5 °F (132 ± 3 °C) for quality control testing. The WMA compaction temperature for quality assurance testing will be 270 ± 5 °F (132 ± 3 °C) if the mixture is not allowed to cool to room temperature. If the mixture is allowed to cool to room temperature it shall be reheated to standard HMA compaction temperatures.”

Construction Requirements.

Revise the second paragraph of Article 406.06(b)(1) of the Standard Specifications to read:

“The HMA shall be delivered at a temperature of 250 to 350 °F (120 to 175 °C). WMA shall be delivered at a minimum temperature of 215 °F (102 °C).”

Basis of Payment.

This work will be paid at the contract unit price bid for the HMA pay items involved. Anti-strip will not be paid for separately, but shall be considered as included in the cost of the work.

FUEL COST ADJUSTMENT (BDE) (RETURN FORM WITH BID)

Effective: April 1, 2009

Revised: July 1, 2009

Description. Fuel cost adjustments will be made to provide additional compensation to the Contractor, or a credit to the Department, for fluctuations in fuel prices when optioned by the Contractor. The bidder shall indicate on the attached form whether or not this special provision will be part of the contract and submit the completed form with his/her bid. Failure to submit the form or failure to indicate contract number, company name and sign and date the form shall make this contract exempt of fuel cost adjustments for all categories of work. Failure to indicate “Yes” for any category of work will make that category of work exempt from fuel cost adjustment.

General. The fuel cost adjustment shall apply to contract pay items as grouped by category. The adjustment shall only apply to those categories of work checked “Yes”, and only when the cumulative plan quantities for a category exceed the required threshold.

Adjustments to work items in a category, either up or down, and work added by adjusted unit price will be subject to fuel cost adjustment only when the category representing the added work was subject to the fuel cost adjustment. Added work paid for by time and materials will not be subject to fuel cost adjustment. Category descriptions and thresholds for application and the fuel usage factors which are applicable to each are as follows:

(a) Categories of Work.

- (1) Category A: Earthwork. Contract pay items performed under Sections 202, 204, and 206 including any modified standard or nonstandard items where the character of the work to be performed is considered earthwork. The cumulative total of all applicable item plan quantities shall exceed 25,000 cu yd (20,000 cu m). Included in the fuel usage factor is a weighted average 0.10 gal/cu yd (0.50 liters/cu m) factor for trucking.
- (2) Category B: Subbases and Aggregate Base Courses. Contract pay items constructed under Sections 311, 312 and 351 including any modified standard or nonstandard items where the character of the work to be performed is considered construction of a subbase or aggregate, stabilized or modified base course. The cumulative total of all applicable item plan quantities shall exceed 5000 tons (4500 metric tons). Included in the fuel usage factor is a 0.60 gal/ton (2.50 liters/metric ton) factor for trucking.
- (3) Category C: Hot-Mix Asphalt (HMA) Bases, Pavements and Shoulders. Contract pay items constructed under Sections 355, 406, 407 and 482 including any modified standard or nonstandard items where the character of the work to be performed is considered HMA bases, pavements and shoulders. The cumulative total of all applicable item plan quantities shall exceed 5000 tons (4500 metric tons). Included in the fuel usage factor is 0.60 gal/ton (2.50 liters/metric ton) factor for trucking.
- (4) Category D: Portland Cement Concrete (PCC) Bases, Pavements and Shoulders. Contract pay items constructed under Sections 353, 420, 421 and 483 including any modified standard or nonstandard items where the character of the work to be performed is considered PCC base, pavement or shoulder. The cumulative total of all applicable item plan quantities shall exceed 7500 sq yd (6000 sq m). Included in the fuel usage factor is 1.20 gal/cu yd (5.94 liters/cu m) factor for trucking.
- (5) Category E: Structures. Structure items having a cumulative bid price that exceeds \$250,000 for pay items constructed under Sections 502, 503, 504, 505, 512, 516 and 540 including any modified standard or nonstandard items where the character of the work to be performed is considered structure work when similar to that performed under these sections and not included in categories A through D.

(b) Fuel Usage Factors.

English Units Category	Factor	Units
A - Earthwork	0.34	gal / cu yd
B – Subbase and Aggregate Base courses	0.62	gal / ton
C – HMA Bases, Pavements and Shoulders	1.05	gal / ton

D – PCC Bases, Pavements and Shoulders	2.53	gal / cu yd
E – Structures	8.00	gal / \$1000

Metric Units Category	Factor	Units
A - Earthwork	1.68	liters / cu m
B – Subbase and Aggregate Base courses	2.58	liters / metric ton
C – HMA Bases, Pavements and Shoulders	4.37	liters / metric ton
D – PCC Bases, Pavements and Shoulders	12.52	liters / cu m
E – Structures	30.28	liters / \$1000

(c) Quantity Conversion Factors.

Category	Conversion	Factor
B	sq yd to ton	0.057 ton / sq yd / in depth
	sq m to metric ton	0.00243 metric ton / sq m / mm depth
C	sq yd to ton	0.056 ton / sq yd / in depth
	sq m to metric ton	0.00239 m ton / sq m / mm depth
D	sq yd to cu yd	0.028 cu yd / sq yd / in depth
	sq m to cu m	0.001 cu m / sq m / mm depth

Method of Adjustment. Fuel cost adjustments will be computed as follows.

$$CA = (FPI_P - FPI_L) \times FUF \times Q$$

Where: CA = Cost Adjustment, \$
 FPI_P = Fuel Price Index, as published by the Department for the month the work is performed, \$/gal (\$/liter)
 FPI_L = Fuel Price Index, as published by the Department for the month prior to the letting, \$/gal (\$/liter)
 FUF = Fuel Usage Factor in the pay item(s) being adjusted
 Q = Authorized construction Quantity, tons (metric tons) or cu yd (cu m)

The entire FUF indicated in paragraph (b) will be used regardless of use of trucking to perform the work.

Progress Payments. Fuel cost adjustments will be calculated for each calendar month in which applicable work is performed; and will be paid or deducted when all other contract requirements for the items of work are satisfied. The adjustments shall not apply during contract time subject to liquidated damages for completion of the entire contract.

Final Quantities. Upon completion of the work and determination of final pay quantities, an adjustment will be prepared to reconcile any differences between estimated quantities previously paid and the final quantities. The value for the balancing adjustment will be based on a weighted average of FPI_P and Q only for those months requiring the cost adjustment. The cost adjustment will be applicable to the final measured quantities of all applicable pay items.

Basis of Payment. Fuel cost adjustments may be positive or negative but will only be made when there is a difference between the FPI_L and FPI_P in excess of five percent, as calculated by:

$$\text{Percent Difference} = \{(FPI_L - FPI_P) \div FPI_L\} \times 100$$

Return With Bid

**ILLINOIS DEPARTMENT
OF TRANSPORTATION**

**OPTION FOR
FUEL COST ADJUSTMENT**

The bidder shall submit this completed form with his/her bid. Failure to submit the form or properly complete contract number, company name, and sign and date the form shall make this contract exempt of fuel cost adjustments in all categories. Failure to indicate "Yes" for any category of work at the time of bid will make that category of work exempt from fuel cost adjustment. After award, this form, when submitted shall become part of the contract.

Contract No.: _____

Company Name: _____

Contractor's Option:

Is your company opting to include this special provision as part of the contract plans for the following categories of work?

Category A Earthwork. Yes

Category B Subbases and Aggregate Base Courses Yes

Category C HMA Bases, Pavements and Shoulders Yes

Category D PCC Bases, Pavements and Shoulders Yes

Category E Structures Yes

Signature: _____ **Date:** _____

STEEL COST ADJUSTMENT (BDE) (RETURN FORM WITH BID)

Effective: April 2, 2004

Revised: April 1, 2009

Description. Steel cost adjustments will be made to provide additional compensation to the Contractor, or a credit to the Department, for fluctuations in steel prices when optioned by the Contractor. The bidder shall indicate on the attached form whether or not this special provision will be part of the contract and submit the completed form with his/her bid. Failure to submit the form or failure to indicate contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment.

Types of Steel Products. An adjustment will be made for fluctuations in the cost of steel used in the manufacture of the following items:

Metal Piling (excluding temporary sheet piling)
Structural Steel
Reinforcing Steel

Other steel materials such as dowel bars, tie bars, mesh reinforcement, guardrail, steel traffic signal and light poles, towers and mast arms, metal railings (excluding wire fence), and frames and grates will be subject to a steel cost adjustment when the pay items they are used in has a contract value of \$10,000 or greater.

Documentation. Sufficient documentation shall be furnished to the Engineer to verify the following:

- (a) The dates and quantity of steel, in lb (kg), shipped from the mill to the fabricator.
- (b) The quantity of steel, in lb (kg), incorporated into the various items of work covered by this special provision. The Department reserves the right to verify submitted quantities.

Method of Adjustment. Steel cost adjustments will be computed as follows:

$$SCA = Q \times D$$

Where: SCA = steel cost adjustment, in dollars
Q = quantity of steel incorporated into the work, in lb (kg)
D = price factor, in dollars per lb (kg)

$$D = MPI_M - MPI_L$$

Where: MPI_M = The Materials Cost Index for steel as published by the Engineering News-Record for the month the steel is shipped from the mill. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

MPI_L = The Materials Cost Index for steel as published by the Engineering News-Record for the month prior to the letting. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

The unit weights (masses) of steel that will be used to calculate the steel cost adjustment for the various items are shown in the attached table.

No steel cost adjustment will be made for any products manufactured from steel having a mill shipping date prior to the letting date.

If the Contractor fails to provide the required documentation, the method of adjustment will be calculated as described above; however, the MPI_M will be based on the date the steel arrives at the job site. In this case, an adjustment will only be made when there is a decrease in steel costs.

Basis of Payment. Steel cost adjustments may be positive or negative but will only be made when there is a difference between the MPI_L and MPI_M in excess of five percent, as calculated by:

$$\text{Percent Difference} = \{(MPI_L - MPI_M) \div MPI_L\} \times 100$$

Steel cost adjustments will be calculated by the Engineer and will be paid or deducted when all other contract requirements for the items of work are satisfied. Adjustments will only be made for fluctuations in the cost of the steel as described herein. No adjustment will be made for changes in the cost of manufacturing, fabrication, shipping, storage, etc.

The adjustments shall not apply during contract time subject to liquidated damages for completion of the entire contract.

Attachment

Item	Unit Mass (Weight)
Metal Piling (excluding temporary sheet piling)	
Furnishing Metal Pile Shells 12 in. (305 mm), 0.179 in. (3.80 mm) wall thickness	23 lb/ft (34 kg/m)
Furnishing Metal Pile Shells 12 in. (305 mm), 0.250 in. (6.35 mm) wall thickness	32 lb/ft (48 kg/m)
Furnishing Metal Pile Shells 14 in. (356 mm), 0.250 in. (6.35 mm) wall thickness	37 lb/ft (55 kg/m)
Other piling	See plans
Structural Steel	See plans for weights (masses)
Reinforcing Steel	See plans for weights (masses)
Dowel Bars and Tie Bars	6 lb (3 kg) each
Mesh Reinforcement	63 lb/100 sq ft (310 kg/sq m)
Guardrail	
Steel Plate Beam Guardrail, Type A w/steel posts	20 lb/ft (30 kg/m)
Steel Plate Beam Guardrail, Type B w/steel posts	30 lb/ft (45 kg/m)
Steel Plate Beam Guardrail, Types A and B w/wood posts	8 lb/ft (12 kg/m)
Steel Plate Beam Guardrail, Type 2	305 lb (140 kg) each
Steel Plate Beam Guardrail, Type 6	1260 lb (570 kg) each
Traffic Barrier Terminal, Type 1 Special (Tangent)	730 lb (330 kg) each
Traffic Barrier Terminal, Type 1 Special (Flared)	410 lb (185 kg) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms	
Traffic Signal Post	11 lb/ft (16 kg/m)
Light Pole, Tenon Mount and Twin Mount, 30 - 40 ft (9 - 12 m)	14 lb/ft (21 kg/m)
Light Pole, Tenon Mount and Twin Mount, 45 - 55 ft (13.5 - 16.5 m)	21 lb/ft (31 kg/m)
Light Pole w/Mast Arm, 30 - 50 ft (9 - 15.2 m)	13 lb/ft (19 kg/m)
Light Pole w/Mast Arm, 55 - 60 ft (16.5 - 18 m)	19 lb/ft (28 kg/m)
Light Tower w/Luminaire Mount, 80 - 110 ft (24 - 33.5 m)	31 lb/ft (46 kg/m)
Light Tower w/Luminaire Mount, 120 - 140 ft (36.5 - 42.5 m)	65 lb/ft (97 kg/m)
Light Tower w/Luminaire Mount, 150 - 160 ft (45.5 - 48.5 m)	80 lb/ft (119 kg/m)
Metal Railings (excluding wire fence)	
Steel Railing, Type SM	64 lb/ft (95 kg/m)
Steel Railing, Type S-1	39 lb/ft (58 kg/m)
Steel Railing, Type T-1	53 lb/ft (79 kg/m)
Steel Bridge Rail	52 lb/ft (77 kg/m)
Frames and Grates	
Frame	250 lb (115 kg)
Lids and Grates	150 lb (70 kg)

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

OPTION FOR STEEL COST ADJUSTMENT

The bidder shall submit this completed form with his/her bid. Failure to submit the form or properly complete contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment. After award, this form, when submitted shall become part of the contract.

Contract No.: _____

Company Name: _____

Contractor's Option:

Is your company opting to include this special provision as part of the contract plans for the following items of work?

Metal Piling	Yes	<input type="checkbox"/>
Structural Steel	Yes	<input type="checkbox"/>
Reinforcing Steel	Yes	<input type="checkbox"/>
Dowel Bars, Tie Bars and Mesh Reinforcement	Yes	<input type="checkbox"/>
Guardrail	Yes	<input type="checkbox"/>
Steel Traffic Signal and Light Poles, Towers and Mast Arms	Yes	<input type="checkbox"/>
Metal Railings (excluding wire fence)	Yes	<input type="checkbox"/>
Frames and Grates	Yes	<input type="checkbox"/>

Signature: _____ **Date:** _____

STORM WATER POLLUTION PREVENTION PLAN



Storm Water Pollution Prevention Plan

Route	<u>FAP 338</u>	Marked Rte.	<u>Illinois Route 59</u>
Section	<u>Various (See Item I.B)</u>	Project No.	<u>Various (See Item I.B)</u>
County	<u>DuPage</u>	Contract No.	<u>Various (See Item I.B)</u>

This plan has been prepared to comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) Permit No. ILR10 (Permit ILR10), issued by the Illinois Environmental Protection Agency (IEPA) for storm water discharges from construction site activities.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Diane O'Keefe
 Print Name
Director, District One Engineer
 Title
Illinois Department of Transportation
 Agency

Signature
3-21-12
 Date

I. Site Description:

A. Provide a description of the project location (include latitude and longitude):

The project consists of six construction contracts for the proposed improvements of 3.50 miles of Illinois Route 59 and reconstruction of the intersecting cross streets from New York Street / Aurora Avenue to Ferry Road. The project is located in the City of Naperville and City of Aurora in DuPage County. The approximate latitude and longitude for the beginning and ending project limits are 41° 45' 35" N / 88° 12' 21" W and 41° 48' 35" N / 88° 12' 13" W, respectively.

B. Provide a description of the construction activity which is the subject of this plan:

Advance Work - Tree Removal
 Section 2011-037-DTR
 Project No. C-91-540-11
 Contract No. 60P43

Work in this contract includes removal of all existing trees in conflict with the proposed roadway improvement on Illinois Route 59 from New York Street / Aurora Avenue to Ferry Road. Tree removal will also occur on the following side roads: New Your Street, Aurora Avenue, Liberty Street, Jefferson Avenue, Meridian Parkway, Glacier Park Avenue, North Aurora Road, Bruce Lane, Brookdale Road and Diehl Road.

Advance Work - Pump Station 47 Replacement
 Section 2011-035-I
 Project No. C-91-538-11
 Contract No. 60P41

Work in this contract includes advance work to remove and reconstruct Pump Station 47 at the B.N.S.F. Railroad underpass and construction of one retaining wall on Illinois Route 59 south of North Aurora Road.

Advance Work - Retaining Walls

Section 2011-036-I
Project No. C-91-539-11
Contract No. 60P42

Work in this contract includes advance work to construct five retaining walls for the proposed improvement on Illinois Route 59 from New York Street / Aurora Avenue to Diehl Road. Two retaining walls to be constructed are located on the east side of Illinois Route 59 between New York Street / Aurora Avenue and Liberty Street / Jefferson Avenue. Two retaining walls to be constructed are located at the B.N.S.F. Railroad underpass on Illinois Route 59. The fifth wall retaining wall to be constructed in this contract is located north of Brookdale Road on the east side of IL Route 59.

Roadway Reconstruction (New York St. / Aurora Ave. to North Aurora Road)

Section (112 & 113) WRS-7
Project No. C-91-064-12
Contract No. 60R30

Construction for this contract will include the reconstruction of Illinois Route 59 from New York Street / Aurora Avenue to North Aurora Road. Side road reconstruction includes New York Street, Aurora Avenue, Liberty Street, Jefferson Street, Glacier Park Avenue, Meridian Parkway and North Aurora Road. Additional activities will include storm sewer, drainage structures, combination concrete curb and gutter, pavement marking, signing, landscaping, traffic signal modernization and all incidental and collateral work necessary to complete the contract.

Roadway Reconstruction (North Aurora Road to Diehl Road)

Section (112 & 113) WRS-6
Project No. C-91-065-12
Contract No. 60R31

Construction for this contract will include the reconstruction of Illinois Route 59 from North Aurora Road to Diehl Road. Side road reconstruction includes Brookdale Avenue and Diehl Road. Additional activities will include storm sewer, drainage structures, combination concrete curb and gutter, pavement marking, signing, landscaping, traffic signal modernization and all incidental and collateral work necessary to complete the contract.

Roadway and Interchange Reconstruction

Section (112 & 113) WRS-5
Project No. C-91-014-10
Contract No. 60I31

Construction for this contract will include the reconstruction of Illinois Route 59 from Diehl Road and Ferry Road, and the replacement of the existing I-88 and Illinois Route 59 interchange with a Diverging Diamond Interchange (DDI). Additional activities will include storm sewer, drainage structures, combination concrete curb and gutter, pavement marking, signing, landscaping, traffic signal modernization and all incidental and collateral work necessary to complete the contract.

- C. Provide the estimated duration of this project:

The estimated duration of all construction contracts associated with this project is 24 to 36 months.

- D. The total area of the construction site is estimated to be 149.57 acres.

The total area of the site estimated to be disturbed by excavation, grading or other activities is 149.57 acres.

- E. The following is a weighted average of the runoff coefficient for this project before and after construction activities are completed:

The weighted average run off coefficient for this project is 0.56 prior to construction.

The weighted average run off coefficient for this project is 0.66 following construction.

F. List all soils found within project boundaries. Include map unit name, slope information, and erosivity:

Eleven soil types are located within the project area of the Illinois Route 59 Improvement Project, which are listed below. A soils map provided by the United States Department of Agriculture (USDA) is attached.

Drummer silty clay loam (152A) – A poorly drained soil with moderate permeability. This soil has a slight susceptibility to water and wind erosion with slopes that are between zero and two percent.

Varna silty clay loam (223B) – A moderately well drained soil with moderately slow permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between two and four percent.

Peotone silty clay loam (330A) – A very poorly drained soil with moderately slow permeability. This soil has a slight susceptibility to water and wind erosion with slopes that are between zero and two percent.

Waupecan silt loam (369B) – A well-drained soil with moderate permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between two and four percent.

Mundelein silt loam (442A) – A somewhat poorly drained soil with moderately slow permeability. This soil has a slight susceptibility to water and wind erosion with slopes that are between zero and two percent.

Barrington silt loam (443B) – A moderately well drained soil with moderate permeability. This soil has a slight susceptibility to water and wind erosion with slopes that are between two and four percent.

Ozaukee silt loam (530C2) – A moderately well drained soil with moderate permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between four and six percent.

Markham silt loam (531B) – A moderately well drained soil with moderately slow permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between two and four percent slope.

Graymont silt loam (541B) – A moderately well drained soil with slow permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between two and five percent.

Chenoa silty clay loam (614A) – A somewhat poorly drained soil with slow permeability. This soil has a slight susceptibility to water and wind erosion with slopes that are between zero and two percent.

Orthents, loamy, undulating (802B) – A well-drained soil with moderately slow permeability. This soil is susceptible to water erosion and slightly susceptible to wind erosion with slopes that are between one and six percent.

G. Provide an aerial extent of wetland acreage at the site:

There are eight wetland sites and one Waters of the US within the ESR project limits that total an area of 2.97 acres. The following is a list of sites and their areas.

Site No.	General Location	Type	Acres
1	West side of IL 59 north of Ferry Road	Wet Meadow	0.04
2	Adjacent to outside of Ramp C	Wet Shrubland	0.27
4	Infield area adjacent to Ramp D	Marsh	1.13
5	Approximately 250 feet west of IL 59 on the south side of Diehl Road	Marsh	0.01
7	Approximately 550 feet east of IL 59 on the south side of LaSalle Avenue	Wet Meadow	0.44
9	Approximately 400 feet east of IL 59 between Brookdale Road and LaSalle Avenue	Marsh	0.04
16	Adjacent to the east side of IL 59, north of Ramp B Terminus	Marsh	0.34
17	North side of Ramp B east of IL 59	Wet Meadow	0.02
20	Adjacent to the north side of I-88, west of Ramp C	Wet Meadow	0.38
21	Adjacent to the south side of I-88, west of Ramp D	Wetland Pond	0.03
W1	South of the BNSF Railroad and north of Meridian Lakes Drive on both sides of IL 59	Waters of the US	0.27

The widening of IL Route 59 from four to six lanes with a 30' median and the construction of the diverging diamond interchange necessitates the impacts to three of the above wetland sites. Wetlands sites 4, 5, 16 and W1 are expected to be partially impacted for a total area of 0.64 acres.

- H. Provide a description of potentially erosive areas associated with this project:

Potentially high erosive areas located within the project limits include the following:

- Areas of embankment steeper than 1V:3H adjacent to the Diverging Diamond Interchange (Interstate 88 and IL Route 59)
- Areas of embankment associated with proposed retaining walls and earth berm
- Earth disturbing activity adjacent to flowing water including tree removal and clearing near Sta. 3958+50
- Areas of storm sewer installation near the proposed pump station

- I. The following is a description of soil disturbing activities by stages, their locations, and their erosive factors (e.g. steepness of slopes, length of slopes, etc.):

Advance Work - Tree Removal

Tree removal will take place adjacent to IL Route 59 on the east and west sides and on the side roads. This work will be limited to daytime and off-road operations with intermittent off-peak period lane closures. Clearing, grubbing and tree removal throughout the project will be subject to erosivity until temporary or permanent soil stabilization measures are established.

Advance Work - Pump Station 47 Replacement

Work in this contract includes the storm sewer, drainage structures, earthwork and proposed pump station will take place adjacent to IL Route 59 on the west side at the B.N.S.F. RR underpass. This work will be limited to daytime and off-road operations with intermittent off-peak period lane closures. Existing steep slopes (2:1) will be disturbed during construction of the pump station and retaining wall.

Advance Work - Retaining Walls

Work in this contract includes the construction of proposed retaining walls, structure excavation, concrete operations and grading will take place adjacent to IL Route 59 in five various locations. This work will be limited to daytime and off-road operations with intermittent off-peak period lane closures.

Roadway Reconstruction (New York St. / Aurora Ave. to North Aurora Road)

Roadway Reconstruction (North Aurora Road to Diehl Road)

Roadway and Interchange Reconstruction

Construction activities will include temporary pavement placement, existing raised median removal, installation of storm sewer and drainage structures, concrete curb and gutter, concrete pavement and corner islands, construction of proposed concrete and landscaped medians. Detailed staging plans for these contracts are currently being developed. See contract plans for these contracts for detailed soil disturbing activities and locations. The diverging diamond interchange construction will involve many steep slopes (2:1) adjacent to the proposed ramps and structures carrying Illinois Route 59 over Interstate 88. Proposed embankments placed throughout the project will be subject to erosion until temporary or permanent soil stabilization measures have been placed. In areas where foreslopes are steeper than 3:1, and as indicated on the plans, soil shall be stabilized with erosion control blanket or mulching.

- J. See the erosion control plans and/or drainage plans for this contract for information regarding drainage patterns, approximate slopes anticipated before and after major grading activities, locations where vehicles enter or exit the site and controls to prevent offsite sediment tracking (to be added after contractor identifies locations), areas of soil disturbance, the location of major structural and non-structural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters (including wetlands) and locations where storm water is discharged to surface water including wetlands.

- K. Identify who owns the drainage system (municipality or agency) this project will drain into:

The drainage system for Illinois Route 59 within the project limits outfalls to Waubensee Creek and Ferry Creek Tributary. Waubensee Creek and Ferry Creek Tributary are under the jurisdiction of the US Army Corps of Engineers. Some parts of the drainage system discharge to the City of Naperville and City of Aurora municipal separate storm sewer systems. The drainage system at the IL Route 59 and I-88 interchange flows into the Illinois Tollway ditch system.

- L. The following is a list of receiving water(s) and the ultimate receiving water(s) for this site. The location of the receiving waters can be found on the erosion and sediment control plans:

Waubansee Creek ultimately discharges to the Fox River
Illinois Tollway Ditch discharges to Ferry Creek which ultimately discharges to West Branch Dupage River
Ferry Creek Tributary discharges to Ferry Creek which ultimately discharges to West Branch Dupage River

The receiving waters are not listed as Biologically Significant Streams nor are they listed on the 303d list for sediment/siltation, turbidity or total suspended solids. However, it should be noted that downstream sections of the West Branch DuPage River are impaired for sediment/siltation.

- M. Describe areas of the site that are to be protected or remain undisturbed. These areas may include steep slopes, highly erodible soils, streams, stream buffers, specimen trees, natural vegetation, nature preserves, etc.

Where the wetlands listed in Item I.G are adjacent to construction activities, no intrusion fencing shall be placed at the wetland boundaries prior to the start of construction to discourage intrusion into the non-impacted wetlands. Other areas which are to be protected and/or remain undisturbed are Waubansee Creek, Ferry Creek Tributary and Illinois Tollway ditches.

- N. The following sensitive environmental resources are associated with this project, and may have the potential to be impacted by the proposed development:

- Floodplain
- Wetland Riparian
- Threatened and Endangered Species
- Historic Preservation
- 303(d) Listed receiving waters for suspended solids, turbidity, or siltation
- Receiving waters with Total Maximum Daily Load (TMDL) for sediment, total suspended solids, turbidity or siltation
- Applicable Federal, Tribal, State or Local Programs
- Other – McDonald Grove County Forest Preserve
(located downstream along the Ferry Creek and the unnamed tributary to Ferry Creek)

1. 303(d) Listed receiving waters (fill out this section if checked above):

- a. The name(s) of the listed water body, and identification of all pollutants causing impairment:
- b. Provide a description of how erosion and sediment control practices will prevent a discharge of sediment resulting from a storm event equal to or greater than a twenty-five (25) year, twenty-four (24) hour rainfall event:
- c. Provide a description of the location(s) of direct discharge from the project site to the 303(d) water body:
- d. Provide a description of the location(s) of any dewatering discharges to the MS4 and/or water body:

2. TMDL (fill out this section if checked above)

- a. The name(s) of the listed water body:
- b. Provide a description of the erosion and sediment control strategy that will be incorporated into the site design that is consistent with the assumptions and requirements of the TMDL:

- c. If a specific numeric waste load allocation has been established that would apply to the project's discharges, provide a description of the necessary steps to meet that allocation:

O. The following pollutants of concern will be associated with this construction project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Soil Sediment | <input checked="" type="checkbox"/> Petroleum (gas, diesel, oil, kerosene, hydraulic oil / fluids) |
| <input checked="" type="checkbox"/> Concrete | <input type="checkbox"/> Antifreeze / Coolants |
| <input checked="" type="checkbox"/> Concrete Truck Waste | <input checked="" type="checkbox"/> Waste water from cleaning construction equipment |
| <input checked="" type="checkbox"/> Concrete Curing Compounds | <input checked="" type="checkbox"/> Other (specify) Organic / Landscape Material |
| <input checked="" type="checkbox"/> Solid Waste Debris | <input checked="" type="checkbox"/> Other (specify) Tree Debris |
| <input checked="" type="checkbox"/> Paints | <input checked="" type="checkbox"/> Other (specify) Hot Mix Asphalt |
| <input checked="" type="checkbox"/> Solvents | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Fertilizers / Pesticides | <input type="checkbox"/> Other (specify) |

II. Controls:

This section of the plan addresses the controls that will be implemented for each of the major construction activities described in I.I. above and for all use areas, borrow sites, and waste sites. For each measure discussed, the Contractor will be responsible for its implementation as indicated. The Contractor shall provide to the Resident Engineer a plan for the implementation of the measures indicated. The Contractor, and subcontractors, will notify the Resident Engineer of any proposed changes, maintenance, or modifications to keep construction activities compliant with the Permit ILR10. Each such Contractor has signed the required certification on forms which are attached to, and are a part of, this plan:

A. Erosion and Sediment Controls

1. **Stabilized Practices:** Provided below is a description of interim and permanent stabilization practices, including site specific scheduling of the implementation of the practices. Site plans will ensure that existing vegetation is preserved where attainable and disturbed portions of the site will be stabilized. Stabilization practices may include but are not limited to: temporary seeding, permanent seeding, mulching, geotextiles, sodding, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. Except as provided below in II(A)(1)(a) and II(A)(3), stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than seven (7) days after the construction activity in that portion of the site has temporarily or permanently ceases on all disturbed portions of the site where construction will not occur for a period of fourteen (14) or more calendar days.

Where the initiation of stabilization measures by the seventh day after construction activity temporarily or permanently ceases is precluded by snow cover, stabilization measures shall be initiated as soon as practicable thereafter.

The following stabilization practices will be used for this project:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Preservation of Mature Vegetation | <input checked="" type="checkbox"/> Erosion Control Blanket / Mulching |
| <input checked="" type="checkbox"/> Vegetated Buffer Strips | <input checked="" type="checkbox"/> Sodding |
| <input checked="" type="checkbox"/> Protection of Trees | <input checked="" type="checkbox"/> Geotextiles |
| <input checked="" type="checkbox"/> Temporary Erosion Control Seeding | <input checked="" type="checkbox"/> Other (specify) Dust Control |
| <input checked="" type="checkbox"/> Temporary Turf (Seeding, Class 7) | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Temporary Mulching | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Permanent Seeding | <input type="checkbox"/> Other (specify) |

Describe how the stabilization practices listed above will be utilized during construction:

Mature vegetation which lines the existing ditches will be preserved and maintained where possible. The existing ditches outside the project limits will filter and convey runoff from the construction site before it reaches the outlet.

Temporary Erosion Control Seeding: Temporary seeding will be treated following the IDOT Standard Specifications for Road and Bridge Construction. The seed mixture will depend on the time of year it is applied. Winter wheat mix shall replace spring oats mix for temporary seed applied after July 31 and before November 15. All areas disturbed by construction will be stabilized within seven days of Temporary Erosion Control Seeding.

Erosion Control Blankets: Erosion control blankets will be installed over all temporary seed areas to protect from erosion and allow seeds to germinate. Specifically, erosion control blanket and seeding will be placed over fill slopes (3H:1V and steeper) and in temporary and permanent ditches.

Temporary Tree Protection: Shall consist of the following items: temporary fencing, tree trunk protection, tree root pruning and tree pruning as shown on the plans or as directed by the Engineer in accordance with Article 201.06 of the IDOT Standard Specifications for Road and Bridge Construction.

Geotextile fabrics shall be used to separate, reinforce, filter, protect and drain the proposed aggregate subgrades at the locations indicated on the plans.

Temporary mulching will be applied in disturbed areas on the project after September 30th or in the winter months when seeds will not germinate to provide protection until the following spring. Compost (Mulch Method 4) is to be utilized for temporary stabilization when temporary seed will not germinate, for example during midsummer drought or January thaw.

Permanent seeding shall be applied in accordance with the IDOT Standard Specifications for Road and Bridge Construction. As shown on the erosion control plans for the mainline roadway and interchange reconstruction contracts (60R30, 60R31 and 60I31), permanent stabilization in one stage shall be completed prior to beginning work in the subsequent stage. Seed will be placed as shown on the plans from April 1 to June 15 and August 1 to November 1 after the final grade is reached and no further soil disturbance is expected for at least a year. Within 24 hours from the time seeding has been performed, the seeded area shall be given a covering of mulch by methods as indicated on the plans. Under no circumstances shall the contractor prolong final grading and shaping so that the entire project can be permanently seeded at one time.

Dust control measures will be implemented in accordance with Article 107.36 of the *IDOT Standard Specifications for Road and Bridge Construction*.

Describe how the stabilization practices listed above will be utilized after construction activities have been completed:

Permanent Stabilization: All areas disturbed by construction activities will be stabilized with permanent seeding or sodding immediately following the finished grading. Erosion control blankets will be installed over seeded areas to protect from rill and gully erosion and to allow the seed to germinate properly.

2. **Structural Practices:** Provided below is a description of structural practices that will be implemented, to the degree attainable, to divert flows from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Such practices may include but are not limited to: perimeter erosion barrier, earth dikes, drainage swales, sediment traps, ditch checks, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins. The installation of these devices may be subject to Section 404 of the Clean Water Act.

The following structural practices will be used for this project:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Perimeter Erosion Barrier | <input type="checkbox"/> Rock Outlet Protection |
| <input checked="" type="checkbox"/> Temporary Ditch Check | <input checked="" type="checkbox"/> Riprap |
| <input checked="" type="checkbox"/> Storm Drain Inlet Protection | <input type="checkbox"/> Gabions |
| <input checked="" type="checkbox"/> Sediment Trap | <input type="checkbox"/> Slope Mattress |
| <input type="checkbox"/> Temporary Pipe Slope Drain | <input checked="" type="checkbox"/> Retaining Walls |
| <input type="checkbox"/> Temporary Sediment Basin | <input type="checkbox"/> Slope Walls |
| <input type="checkbox"/> Temporary Stream Crossing | <input type="checkbox"/> Concrete Revetment Mats |
| <input checked="" type="checkbox"/> Stabilized Construction Exits | <input type="checkbox"/> Level Spreaders |
| <input type="checkbox"/> Turf Reinforcement Mats | <input checked="" type="checkbox"/> Other (In-Stream Work Plan) |
| <input type="checkbox"/> Permanent Check Dams | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Permanent Sediment Basin | <input type="checkbox"/> Other (specify) |
| <input type="checkbox"/> Aggregate Ditch | <input type="checkbox"/> Other (specify) |
| <input checked="" type="checkbox"/> Paved Ditch | <input type="checkbox"/> Other (specify) |

Describe how the structural practices listed above will be utilized during construction:

In-Stream Work Plan: Contract 60R30 requires an US Army Corps of Engineers (ACOE) 404 permit. The permit issued to the Department does not cover the in-stream work by the Contractor. Therefore, after award, the Contractor will need to submit the work plan to IDOT's resident engineer for acceptance. The acceptable plan must be submitted to the ACOE prior to starting work. The ACOE will not be providing an approval, unless stated otherwise in the permit, and in-stream work can commence at the Contractor's discretion after the ACOE has been copied on the work plan acceptable to the Department. Guidelines on acceptable in-stream work can be found on the ACOE 404 approval letter in the Special Provisions.

Perimeter Erosion Barrier: Sediment control silt fence will be placed adjacent to areas of construction limits in areas where the ground slopes away from the project site to intercept waterborne silt and prevent it from leaving the project site. In locations where there is concentrated flow, temporary ditch checks should be used as perimeter erosion barrier.

Temporary Ditch checks will be placed in swales where runoff velocity is high or as directed by the Engineer in order to prevent downstream erosion. Temporary ditch checks will be constructed with urethane foam and/or geotextile ditch checks so that elevation of the toe in accordance with IDOT Standard 280001. For flat ditches the distance between successive ditch checks shall not exceed 400 feet.

Storm Drain Inlet Protection: Sediment filters will be placed in all inlets, catch basins and manholes during construction and will be maintained throughout the entire contract and will be cleaned regularly. Pipe and inlet protection will be in accordance with IDOT Standard 280001. Sediment filters will be cleaned on a regular basis as indicated in the special provisions. Straw bales will not be allowed for inlet and pipe protection; a combination of temporary ditch checks, temporary seed and erosion control blanket can be utilized for inlet and pipe protection.

Sediment Trap: See Attachment A - IDOT Guidance for the Construction of Temporary Sediment Traps.

Describe how the structural practices listed above will be utilized after construction activities have been completed:

Stone riprap will be utilized as protection at the discharge end of all culvert end sections to prevent downstream scouring and erosion.

Retaining walls: The project will have 4,969 feet of retaining soldier pile walls and 2,420 feet of cast-in-place walls to minimize wetland impacts and to maintain acceptable slopes to prevent erosion of adjacent soils to the roadway.

3. **Storm Water Management:** Provided below is a description of measures that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed. The installation of these devices may be subject to Section 404 of the Clean Water Act.
- a. Such practices may include but are not limited to: storm water detention structures (including wet ponds), storm water retention structures, flow attenuation by use of open vegetated swales and natural depressions, infiltration of runoff on site, and sequential systems (which combine several practices).

The practices selected for implementation were determined on the basis of the technical guidance in Chapter 41 (Construction Site Storm Water Pollution Control) of the IDOT Bureau of Design and Environment Manual. If practices other than those discussed in Chapter 41 are selected for implementation or if practices are applied to situations different from those covered in Chapter 41, the technical basis for such decisions will be explained below.
 - b. Velocity dissipation devices will be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g. maintenance of hydrologic conditions such as the hydroperiod and hydrodynamics present prior to the initiation of construction activities).

Description of storm water management controls:

Storm water detention is being utilized for the proposed storm sewer outlets at the Waubensee Creek near the B.N.S.F. Railroad underpass. The Waubensee Creek is identified as a non-sensitive outlet because of none flooding history at this location. However, due to the history of flooding at the B.N.S.F. viaduct, detention was provided at this location to alleviate the problem.

The proposed storm sewer for the project will be oversized to provide in-line detention and controlled with restrictor manholes prior to release into the Waubensee Creek.

Restrictor controls on the outflow from the detention pond in the interchange infield prior to discharging water into the Tollway drainage ditch on the south side of I-88 will be installed.

Landscaped medians are being provided as a permanent BMP to help decrease the amount of new impervious surface.

All these permanent BMP systems are to remain in place during and after construction.

4. **Approved State or Local Laws:** The management practices, controls and provisions contained in this plan will be in accordance with IDOT specifications. Procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials shall be described or incorporated by reference in the space provided below. Requirements specified in sediment and erosion site plans, site permits, storm water management site plans or site permits approved by local officials that are applicable to protecting surface water resources are, upon submittal of an NOI, to be authorized to discharge under the Permit ILR10 incorporated by reference and are enforceable under this permit even if they are not specifically included in the plan.

Description of procedures and requirements specified in applicable sediment and erosion site plans or storm water management plans approved by local officials:

All management practices, controls, and other provisions provided in this plan are in accordance with the current edition of the IDOT Standard Specifications for Bridge and Road Construction, IDOT Supplemental Specifications and Recurring Special Provisions and the Illinois Tollway Erosion and Sediment Control, Landscape Design Criteria.

5. **Contractor Required Submittals:** Prior to conducting any professional services at the site covered by this plan, the Contractor and each subcontractor responsible for compliance with the permit shall submit to the Resident Engineer a Contractor Certification Statement, BDE 2342a.
- a. The Contractor shall provide a construction schedule containing an adequate level of detail to show major activities with implementation of pollution prevention BMPs, including the following items:
- Approximate duration of the project, including each stage of the project
 - Rainy season, dry season, and winter shutdown dates
 - Temporary stabilization measures to be employed by contract phases
 - Mobilization timeframe
 - Mass clearing and grubbing/roadside clearing dates
 - Deployment of Erosion Control Practices
 - Deployment of Sediment Control Practices (including stabilized construction entrances/exits)
 - Deployment of Construction Site Management Practices (including concrete washout facilities, chemical storage, refueling locations, etc.)
 - Paving, saw-cutting, and any other pavement related operations
 - Major planned stockpiling operations
 - Timeframe for other significant long-term operations or activities that may plan non-storm water discharges such as dewatering, grinding, etc.
 - Permanent stabilization activities for each area of the project
- b. The Contractor and each subcontractor shall provide, as an attachment to their signed Contractor Certification Statement, a discussion of how they will comply with the requirements of the permit in regard to the following items and provide a graphical representation showing location and type of BMPs to be used when applicable:
- Vehicle Entrances and Exits – Identify type and location of stabilized construction entrances and

exits to be used and how they will be maintained.

- Material Delivery, Storage and Use – Discuss where and how materials including chemicals, concrete curing compounds, petroleum products, etc. will be stored for this project.
- Stockpile Management – Discuss what BMPs will be used to prevent pollution of storm water from stockpiles.
- Waste Disposal – Discuss methods of waste disposal that will be used for this project.
- Spill Prevention and Control – Discuss steps that will be taken in the event of a material spill (chemicals, concrete curing compounds, petroleum, etc.)
- Concrete Residuals and Washout Wastes – Discuss the location and type of concrete washout facilities to be used on this project and how they will be signed and maintained.
- Litter Management – Discuss how litter will be maintained for this project (education of employees, number of dumpsters, frequency of dumpster pick-up, etc.).
- Vehicle and Equipment Fueling – Identify equipment fueling locations for this project and what BMPs will be used to ensure containment and spill prevention.
- Vehicle and Equipment Cleaning and Maintenance – Identify where equipment cleaning and maintenance locations for this project and what BMPs will be used to ensure containment and spill prevention.
- Additional measures indicated in the plan.

III. Maintenance:

When requested by the Contractor, the Resident Engineer will provide general maintenance guides to the Contractor for the practices associated with this project. The following additional procedures will be used to maintain, in good and effective operating conditions, the vegetation, erosion and sediment control measures and other protective measures identified in this plan. It will be the Contractor's responsibility to attain maintenance guidelines for any manufactured BMPs which are to be installed and maintained per manufacture's specifications.

Construction equipment shall be stored and fueled only at designated locations. All necessary measures shall be taken to contain any fuel or pollution runoff in compliance with environmental law and EPA Water Quality Regulations. Leaking equipment or supplies shall be immediately repaired or removed from the site. On a weekly basis, the Engineer shall inspect the project to determine that erosion control efforts are in place, effective, and whether any further measure is needed. Sediment collected during construction by the various temporary erosion control systems shall be disposed on site on a regular basis as directed by the Resident Engineer according to Article 202.03 of the *IDOT Standard Specification for Road and Bridge Construction*. All erosion and sediment control measures will be checked weekly and after each significant rainfall (1/2 inch or greater in a 24-hour period). During the winter months, all measures will be checked after each significant snowmelt.

The following items will be checked:

- Perimeter Erosion Barrier
- Temporary Ditch Check
- Storm Drain Inlet Protection
- Stabilized Construction Entrance/Exit
- Temporary Erosion Control Seeding
- Temporary Mulch
- Erosion Control Blanket
- Inlet and Pipe Protection
- Sediment Traps
- Temporary Ditch Checks
- Temporary Sediment Basins
- Permanent Seeding

Items shall be checked for structural integrity, sediment accumulation and functionality. Any damage or undermining shall be repaired immediately. Accumulated sediment shall be removed and properly disposed of in accordance with Article 202.03 of the *IDOT Standard Specifications for Road and Bridge Construction*. Stone at the sediment traps and riprap aprons shall be replaced due to washout. All erodible bare earth areas with temporary seeding will be inspected on a weekly basis and reseeded as necessary. Perimeter erosion barrier will be maintained at low lying areas throughout the length of the contracts; deteriorated fabrics shall be replaced, wire connections restored and fabric properly buried. All slope, berm or outlet erosion shall be repaired immediately following significant rainfall events. Sediment traps, sediment basins and sediment filter bags will be cleaned once silt fills 50% of their capacity. All maintenance measures will be carried out as specified in the current version of the *IDOT Standard Specifications for Road and Bridge Construction*.

All maintenance of the erosion control systems will be the responsibility of the contractor. All erosion and control devices need to be inspected several weeks prior to the anticipated beginning of the winter season to allow for clean out and restoration of the various devices. The inspection should determine whether:

- Sediment basins and sediment traps are in place and cleaned out
- Perimeter erosion barrier has been inspected, deteriorating fabric replaced, wire connection restored and fabric properly buried
- Ditch checks have been inspected, cleaned and replaced if necessary
- Riprap has been renewed with supplemental rock if necessary
- Erosion control blanket is in place and functioning properly
- Temporary mulching and/or temporary seeding has been applied where necessary
- Culvert and bridge sites are properly protected

The contractor understands his obligations for maintenance and/or repairs and that equipment and personnel will be available during the winter months to maintain the project site.

IV. Inspections:

Qualified personnel shall inspect disturbed areas of the construction site which have not yet been finally stabilized, structural control measures, and locations where vehicles and equipment enter and exit the site using IDOT Storm Water Pollution Prevention Plan Erosion Control Inspection Report (BC 2259). Such inspections shall be conducted at least once every seven (7) calendar days and within twenty-four (24) hours of the end of a storm that is 0.5 inch or greater or equivalent snowfall.

If any violation of the provisions of this plan is identified during the conduct of the construction work covered by this plan, the Resident Engineer shall notify the appropriate IEPA Field Operations Section office by email at: epa.swnoncomp@illinois.gov, telephone or fax within twenty-four (24) hours of the incident. The Resident Engineer shall then complete and submit an "Incidence of Non-Compliance" (ION) report for the identified violation within five (5) days of the incident. The Resident Engineer shall use forms provided by IEPA and shall include specific information on the cause of noncompliance, actions which were taken to prevent any further causes of noncompliance, and a statement detailing any environmental impact which may have resulted from the noncompliance. All reports of non-compliance shall be signed by a responsible authority in accordance with Part VI. G of the Permit ILR10.

The Incidence of Non-Compliance shall be mailed to the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attn: Compliance Assurance Section
1021 North Grand East
Post Office Box 19276
Springfield, Illinois 62794-9276

V. Failure to Comply:

Failure to comply with any provisions of this Storm Water Pollution Prevention Plan will result in the implementation of a National Pollutant Discharge Elimination System/Erosion and Sediment Control Deficiency Deduction against the Contractor and/or penalties under the Permit ILR10 which could be passed on to the Contractor.

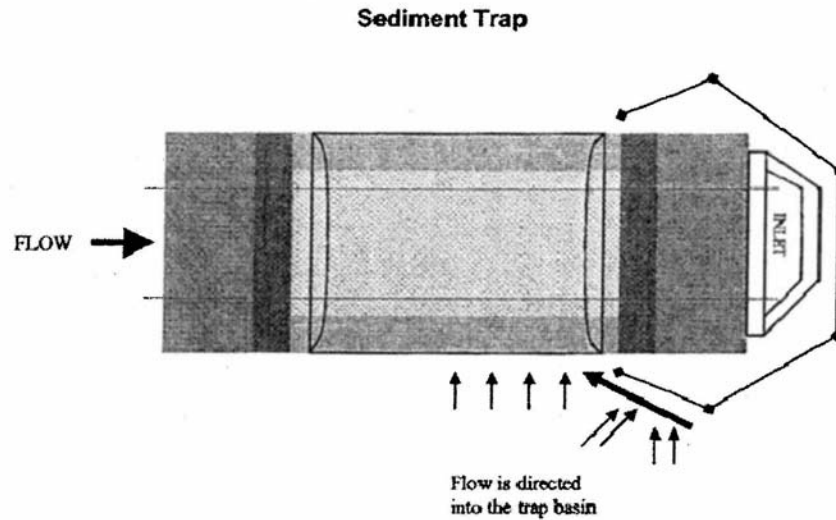
ATTACHMENT A

IDOT GUIDANCE FOR THE CONSTRUCTION OF TEMPORARY SEDIMENT TRAPS



Construction of a Sediment Trap
A Best Management Practice
Used for Jobsite Outfall Protection

This guide documents the implementation and use of the new preferred method of jobsite outfall protection. Silt fence is not an effective protection measure, because it is not permeable enough for a major outfall. A sediment trap is only effective with a suitable quantity of water in it. For this reason, it is encouraged that sediment traps be used to protect outfalls with a drainage area greater than 4,500 square feet (~.1 Acres) and less than 216,000 square feet (~5 Acres). Above 216,000 square feet, a sediment basin should be used to drain the area, or a diversion should be constructed to divert clean water from upstream around the construction site. On most IDOT projects, there isn't enough room on state right of way for a sediment basin, so a diversion is generally the solution for large drainage areas. In locations with drainage areas between .1 and 5 acres, sediment traps should be constructed on all current and new construction projects where practical, effective immediately. Remember, this is simply a new configuration of old pay items, so nothing should need to be added to the contract. For permanent sediment traps being constructed, contact Rick Wanner in the District One headquarters, Bureau of Maintenance office for evaluation and to ensure that maintenance is informed of the trap's existence.



LEGEND

- Ditch Check (Stone, Triangular Silt Dike, Excelsior Roll)
- Silt Fence
- Water's path into the trap
- Trap basin to allow sediment to settle
- Erosion Control Blanket and seeding (on side slope)
- Seeding only
- Exterior flow protection (Protecting against shear stress)

PURPOSE:

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under stagnant conditions, allowing sediment to settle out before the runoff is discharged. Sediment traps are formed by excavation of a small, shallow, long basin in a low drainage area, with a ditch check on the upstream and downstream side of the trap basin. The sediment trap is an effective ditch outfall or inlet/pipe protection system for drainage areas no greater than 216,000 sq. ft. (~5 acres) and no less than 4,500 square feet (~.1 acres).

IMPLEMENTATION:

- Construct prior to wet season and construction activities.
- Locate where sediment-laden runoff enters a storm drain or watercourse.
- Sediment traps are never to be located in live streams.
- Access to the sediment trap must be available for maintenance purposes.
- Consider whether the trap is needed as a long term or a temporary practice. Use permanent (stone) or temporary (excelsior rolls, triangular silt dikes) ditch checks accordingly.

DESIGN:

- Sediment traps generally release a slow flow that may be directed into a culvert, a sewer inlet or may simply be released to another sediment trap if there is a large drainage area.
- Sediment traps must have silt fence surrounding the acceptor to ensure water does not flow into the pipe unfiltered unless the acceptor is a ditch, in which case, no additional silt fence is needed. This silt fence should be positioned such that the water may still flow from the sides of the trap into the trap basin, and if possible, the silt fence should direct water into the trap basin, on the upstream side of the second ditch check.
- A ditch check must be located on both the upstream and downstream ends of the holding trap basin. These ditch checks may be triangular silt dikes or excelsior rolls for temporary sediment traps, or stone for permanent sediment traps. The ditch check on the downstream side of the trap must be contained within the silt fence if the acceptor is a culvert. Otherwise, for outlets, the ditch check must be located on the downstream side of the perimeter barrier.
- Temporary sediment traps should be built with the timeframe of the construction job in mind, or a single construction season. Temporary traps should be constructed using either triangular silt dikes or excelsior rolls.
- If the sediment trap is to remain functional as a permanent water quality feature, it should be constructed using stone ditch checks. Permanent sediment traps must be constructed in locations out of the sub-grade of the road, and out of the clear zone. Ditch checks in permanent sediment traps must have a 2:1 slope or flatter on both the upstream and the downstream side of the ditch check.
- A sediment trap can also be a semi-permanent feature. If the ditch checks are made of excelsior rolls, they will function for a while, but will eventually break down. This allows for the construction of a trap that will remain in place after construction, but will not permanently remain in place. This may allow for establishment of vegetation as the primary filtration method in place of the ditch check without blocking water unnaturally or permanently.
- The top of ditch checks are to be at least 1-1/2' higher than the bottom of the holding trap basin, and should be no less than 1' higher than the water's normal flowing height. Also, ditch checks should be spaced such that the bottom of the upstream ditch check is no higher than the top of the downstream ditch check. This will depend on the slope of the ditch.

- The holding trap basin should be excavated so that the cross-section looks like a 'U' (instead of a 'V'). This U-shaped ditch discourages erosion in the middle crook of the ditch and increases the capacity of the trap.
- The trap basin shall have a capacity of no less than 3600 cubic feet per acre of drainage area. This is enough space to hold 1 inch of water per acre. See Figure 1 for standard dimensions. If the drainage area is less than 4,500 sq. ft. (.1 acre), consider using an inlet filter or another BMP in place of the sediment trap.
- Under no circumstance shall a sediment trap or series of sediment traps cover a total drainage area of more than 5 acres. If this is the case, or an appropriate amount of land is available, a sediment basin should be constructed in place of a sediment trap.
- Stabilize any exposed soil in the sediment trap that could be subject to erosion from the flow of water, including the trap basin. A Turf Reinforcement Mat and permanent seeding works well for long term installations, but temporary seeding and/or an erosion control blanket will suffice as a temporary measure.
- An armored overflow must be constructed.
- Regardless of the type of acceptor (with the sole exception of a ditch), leave approximately 5 feet between the final ditch check and the acceptor. This allows the water flow to settle, which lowers the risk of disturbing sediment that may be in the acceptor. This gap should be protected against the effects of shear stress from the flowing water.
- On particularly steep slopes, it may be most effective to place multiple smaller sediment traps in rapid succession to cover the drainage area. In this case, it would be most cost-efficient to allow sediment traps to share ditch checks.
- Shear stress can cause sediment to be picked up by flowing water. Attention should be paid to the shear stress to ensure that the soil in the ditch before and after the sediment trap does not get eroded. These areas must be protected. See the Shear Stress page (6) for formulas and more information.

PLANS AND SPECIFICATIONS:

- The plans and specifications for sediment traps will show the following requirements:
 - Location of the sediment trap(s).
 - Size of the trap basin including width, length, and depth.
 - Minimum cross section of embankment.
 - Minimum profile through spillway.
 - Location of emergency spillway, if used.
 - Graduation and quality of stone.
 - The installation, inspection, and maintenance schedules with the responsible party identified.

INSPECTION/MAINTENANCE:

- Sediment traps are to be inspected by the resident engineer and contractor every 7 calendar days and after a storm event of ½" or greater (including snowfall) on a temporary basis. On a permanent basis, traps should be checked at least once every 2 years.
- The trap should be cleaned of silt when the trap becomes 50% filled. The material removed must be disposed of in accordance with good housekeeping practices, incorporated into the fill material, or disposed of in accordance with IEPA regulations.
- Inspect the outlet for erosion and any needed stabilization.
- Inspect the outlet for any sediment discharge and discolored water.
- If sediment is discharged or other pollutants are identified at the discharge point, other BMPs, such as sand filters, may be required to filter pollutants.
- Note that the first ditch check is primarily used to slow the water, while the second is primarily used to catch remaining sediment. Inspection of the first ditch check, therefore, is primarily a structural inspection, while the second is primarily a check for sediment clogging.

NOTES ON THE DIMENSIONS OF THE TRAP:

The volume of the trap may be calculated using the following formula (only applies on shallow slopes of 5% or less):

$$\text{Volume} = (\text{Depth of the trap}) \times (\text{Length between ditch checks}) \times (\text{Width of the ditch})$$

SEDIMENT TRAP DIMENSION MATRIX					
Depth	Length	Width	Capacity (cu. ft.)	Drainage Area Max. (sq. ft.)	Drainage Area Max. (acres)
1-1/2'	125'	10'	1,875	22,500	.52
1-1/2'	100'	10'	1,500	18,000	.417
1-1/2'	75'	10'	1,125	13,500	.3125
1-1/2'	50'	10'	750	9,000	.21
1-1/2'	25'	10'	375	4,500	.1
2'	100'	10'	2,000	24,000	.55
2'	80'	10'	1,600	19,000	.44
2'	60'	10'	1,200	14,500	.33
2'	40'	10'	800	9,600	.22
2'	30'	10'	600	7,250	.17
2'	25'	10'	500	6,000	.14

Figure 1

For reference, 1 Acre ~ 43200 sq. ft.

Shear Stress

STRAIGHT SECTIONS OF DITCHES

$$\tau_d = \gamma(dS)$$

where

τ_d = maximum shear stress, lb/ft² (Pa)
 γ = unit weight of water, 62.4 lb/ft³ (9810 N/m³)
 d = maximum depth of flow, ft (m)
 S = average bed slope or energy slope, ft/ft (m/m)

BENDS IN DITCHES

Flow around a channel bend imposes higher shear stresses on the channel boundaries. The maximum shear stress in a bend is a function of the radius of curvature and the bottom width of the channel and is given by:

$$\tau_b = K_b \tau_d$$

where

τ_b = maximum shear stress in a bend, lb/ft² (Pa)
 $K_b = 2.38 - 0.206 \left(\frac{R_c}{B} \right) + 0.0073 \left(\frac{R_c}{B} \right)^2$

where

K_b = bend coefficient - function of R_c/B
 R_c = radius to centerline of channel, ft (m)
 B = bottom width of channel, ft (m)

To determine which BMP to use to protect the ditch, calculate the Shear Stress and compare to the following values:

- < 3 psf (147 Pa) → Erosion Control Blanket and Seeding
- < 8 psf (392 Pa) → Turf Reinforcement Mat and Seeding
- > 8 psf (392 Pa) → Stone lining

RELEVANT PAY ITEMS:

- EARTH EXCAVATION
- PERIMETER EROSION BARRIER
- Stone size IDOT RR-4
- ROCKFILL IDOT CA-1
- TEMPORARY DITCH CHECKS
- TEMPORARY EROSION CONTROL SEEDING or SEEDING, CLASS 2A
- TEMPORARY EROSION CONTROL BLANKET



Contractor Certification Statement

Prior to conducting any professional services at the site covered by this contract, the Contractor and every subcontractor must complete and return to the Resident Engineer the following certification. A separate certification must be submitted by each firm. Attach to this certification all items required by Section II.5 of the Storm Water Pollution Prevention Plan (SWPPP) which will be handled by the Contractor/subcontractor completing this form.

Route	FAP 338	Marked Rte.	Illinois Route 59
Section	2011-035-I	Project No.	C-91-538-11
County	DuPage	Contract No.	60P41

This certification statement is a part of the SWPPP for the project described above, in accordance with the General NPDES Permit No. ILR10 issued by the Illinois Environmental Protection Agency.

I certify under penalty of law that I understand the terms of the Permit No. ILR 10 that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

In addition, I have read and understand all of the information and requirements stated in the SWPPP for the above mentioned project; I have received copies of all appropriate maintenance procedures; and, I have provided all documentation required to be in compliance with the Permit ILR10 and SWPPP and will provide timely updates to these documents as necessary.

- Contractor
- Sub-Contractor

Print Name	_____	Signature	_____
Title	_____	Date	_____
Name of Firm	_____	Telephone	_____
Street Address	_____		
	City/State/ZIP		

Items which this Contractor/subcontractor will be responsible for as required in Section II.5. of the SWPPP:

PROJECT LABOR AGREEMENT - QUARTERLY EMPLOYMENT REPORT

Public Act 97-0199 requires the Department to submit quarterly reports regarding the number of minorities and females employed under Project Labor Agreements. To assist in this reporting effort, the Contractor shall provide a quarterly workforce participation report for all minority and female employees working under the project labor agreement of this contract. The data shall be reported on Construction Form BC 820, Project Labor Agreement (PLA) Workforce Participation Quarterly Reporting Form available on the Department's website <http://www.dot.il.gov/const/conforms.html>.

The report shall be submitted no later than the 15th of the month following the end of each quarter (i.e. April 15 for the January – March reporting period). The form shall be emailed to DOT.PLA.Reporting@illinois.gov or faxed to (217) 524-4922.

Any costs associated with complying with this provision shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

Illinois Department of Transportation
PROJECT LABOR AGREEMENT

This Project Labor Agreement (“PLA”) is entered into this _____ day of _____, by and between the Illinois Department of Transportation (“IDOT” or “Department”) in its proprietary capacity, and each relevant Illinois AFL-CIO Building Trades Council made signatory hereto by the Illinois AFL-CIO Statewide Project Labor Agreement Committee on behalf of itself and each of its affiliated members (individually and collectively, the “Union”). This PLA shall apply to Construction Work (as defined herein) to be performed by IDOT’s Prime Contractor and each of its relevant subcontractors of whatever tier (“Subcontractor” or “Subcontractors”) on Project Name (hereinafter, the “Project”).

ARTICLE 1 - INTENT AND PURPOSES

- 1.1. This PLA is entered into in furtherance of Illinois Executive Order No. 2010-03 and P.A. 097-0199. It is mutually understood and agreed that the terms and conditions of this PLA are intended to promote the public interest in obtaining timely and economical completion of the Project by encouraging productive and efficient construction operations; by establishing a spirit of harmony and cooperation among the parties; and by providing for peaceful and prompt settlement of any and all labor grievances or jurisdictional disputes of any kind without strikes, lockouts, slowdowns, delays or other disruptions to the prosecution of the work.
- 1.2. As a condition of the award of the contract for performance of work on the Project, IDOT's Prime Contractor and each of its Subcontractors shall be required to sign a “Contractor Letter of Assent”, in the form attached hereto as Exhibit A, prior to commencing Construction Work on the Project. Each Union affiliate and separate local representing workers engaged in Construction Work on the Project in accordance with this PLA are bound to this agreement by the Illinois AFL-CIO Statewide Project Labor Agreement Committee which is the central committee established with full authority to negotiate and sign PLAs with the State on behalf of all respective crafts. Upon their signing the Letter of Assent, the Prime Contractor, each Subcontractor, and the individual Unions shall thereafter be deemed a party to this PLA. No party signatory to this PLA shall, contract or subcontract, nor permit any other person, firm, company or entity to contract or subcontract for the performance of Construction Work for the Project to any person, firm, company or entity that does not agree in writing to become bound by the terms of this PLA prior to commencing such work.
- 1.3. It is understood that the Prime Contractor(s) and each Subcontractor will be considered and accepted by the Unions as separate employers for the purposes of collective bargaining, and it is further agreed that the employees working under this PLA shall constitute a bargaining unit separate and distinct from all others. The Parties hereto also agree that this PLA shall be applicable solely with respect to this Project, and shall have no bearing on the interpretation of any other collective bargaining agreement or as to the recognition of any bargaining unit other than for the specific purposes of this Project.
- 1.4. In the event of a variance or conflict, whether explicit or implicit, between the terms and conditions of this PLA and the provisions of any other applicable national, area, or local collective bargaining agreement, the terms and conditions of this PLA shall supersede and control.

For any work performed under the NTL Articles of Agreement, the National Stack/Chimney Agreement, the National Cooling Tower Agreement, the National Agreement of the International Union of Elevator Constructors, and for any instrument calibration work and loop checking performed under the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, the preceding sentence shall apply only with respect to Articles I, II, V, VI, and VII.

- 1.5. Subject to the provisions of paragraph 1.4 of this Article, it is the parties' intent to respect the provisions of any other collective bargaining agreements that may now or hereafter pertain, whether between the Prime Contractor and one or more of the Unions or between a Subcontractor and one or more of the Unions. Accordingly, except and to the extent of any contrary provision set forth in this PLA, the Prime Contractor and each of its Subcontractors agrees to be bound and abide by the terms of the following in order of precedence: (a) the applicable collective bargaining agreement between the Prime Contractor and one or more of the Unions made signatory hereto; (b) the applicable collective bargaining agreement between a Subcontractor and one or more of the Unions made signatory hereto; or (c) the current applicable area collective bargaining agreement for the relevant Union that is the agreement certified by the Illinois Department of Labor for purposes of establishing the Prevailing Wage applicable to the Project. The Union will provide copies of the applicable collective bargaining agreements pursuant to part (c) of the preceding sentence to the Prime Contractor. Assignments by the Contractors amongst the trades shall be consistent with area practices; in the event of unresolved disagreements as to the propriety of such assignments, the provisions of Article VI shall apply.
- 1.6. Subject to the limitations of paragraphs 1.4 and 1.5 of this Article, the terms of each applicable collective bargaining agreement as determined in accordance with paragraph 1.5 are incorporated herein by reference, and the terms of this PLA shall be deemed incorporated into such other applicable collective bargaining agreements only for purposes of their application to the Project.
- 1.7. To the extent necessary to comply with the requirements of any fringe benefit fund to which the Prime Contractor or Subcontractor is required to contribute under the terms of an applicable collective bargaining agreement pursuant to the preceding paragraph, the Prime Contractor or Subcontractor shall execute all "Participation Agreements" as may be reasonably required by the Union to accomplish such purpose; provided, however, that such Participation Agreements shall, when applicable to the Prime Contractor or Subcontractor solely as a result of this PLA, be amended as reasonably necessary to reflect such fact. Upon written notice from any applicable fringe benefit fund, IDOT will withhold from the Prime Contractor payment of any delinquencies arising from this Project.
- 1.8. In the event that the applicable collective bargaining agreement between a Prime Contractor and the Union or between the Subcontractor and the Union expires prior to the completion of this Project, the expired applicable contract's terms will be maintained until a new applicable collective bargaining agreement is ratified. The wages and fringe benefits included in any new applicable collective bargaining agreement will apply on and after the effective date of the newly negotiated collective bargaining agreement, except to the extent wage and fringe benefit retroactivity is specifically agreed upon by the relevant bargaining parties.

ARTICLE II – APPLICABILITY, RECOGNITION, AND COMMITMENTS

- 2.1 The term Construction Work as used herein shall include all “construction, prosecution, completion, or repair” work performed by a “laborer or mechanic” at the “site of the work” for the purpose of “building” the specific structures and improvements that constitute the Project. Terms appearing within quotation marks in the preceding sentence shall have the meaning ascribed to them pursuant to 29 CFR Part 5.
- 2.2 By executing the Letters of Assent, Prime Contractor and each of its Subcontractors recognizes the Unions signatory to this PLA as the sole and exclusive bargaining representatives for their craft employees employed on the jobsite for this Project. Unions who are signatory to this PLA will have recognition on the Project for their craft.
- 2.3 The Prime Contractor and each of its Subcontractors retains and shall be permitted to exercise full and exclusive authority and responsibility for the management of its operations, except as expressly limited by the terms of this PLA or by the terms and conditions of the applicable collective bargaining agreement.
- 2.4 Except to the extent contrary to an express provision of the relevant collective bargaining agreement, equipment or materials used in the Project may be pre-assembled or pre-fabricated, and there shall be no refusal by the Union to handle, transport, install, or connect such equipment or materials. Equipment or materials delivered to the job-site will be unloaded and handled promptly without regard to potential jurisdictional disputes; any such disputes shall be handled in accordance with the provisions of this PLA.
- 2.5 Unions commit to furnishing qualified and skilled craft persons as required by the Prime Contractor and its Subcontractors in fulfillment of their obligations to complete the Project. In order to promote the long-term development of a skilled and knowledgeable work force, the parties are encouraged to utilize apprentices to the maximum extent permitted by the applicable collective bargaining agreement.
- 2.6 The parties are mutually committed to promoting a safe working environment for all personnel at the job site. It shall be the responsibility of each employer to which this PLA applies to provide and maintain safe working conditions for its employees, and to comply with all applicable federal, state, and local health and safety laws and regulations.
- 2.7 The use or furnishing of alcohol or drugs and the conduct of any other illegal activity at the job-site is strictly prohibited. The parties shall take every practical measure consistent with the terms of applicable collective bargaining agreements to ensure that the job-site is free of alcohol and drugs.
- 2.8 All parties to this PLA agree that they shall not discriminate against any employee based on race, creed, color, national origin, union activity, age, or gender as required by all applicable federal, state, and local laws.
- 2.9 The Parties hereto agree that engineering consultants and materials testing employees, to the extent subject to the terms of this PLA, shall be fully expected to objectively and responsibly perform their duties and obligations owed to the Department without regard to the potential union affiliation of such employees or of other employees on the Project.

ARTICLE III - ADMINISTRATION OF AGREEMENT

- 3.1 In order to assure that all parties have a clear understanding of the PLA and to promote harmony, a post-award pre-job conference will be held among the Prime Contractor, all Subcontractors and Union representatives prior to the start of any Construction Work on the Project. No later than the conclusion of such pre-job conference, the parties shall, among other matters, provide to one another contact information for their respective representatives (including name, address, phone number, facsimile number, e-mail). Nothing herein shall be construed to limit the right of the Department to discuss or explain the purpose and intent of this PLA with prospective bidders or other interested parties prior to or following its award of the job.
- 3.2 Representatives of the Prime Contractor and the Unions shall meet as often as reasonably necessary following award until completion of the Project to assure the effective implementation of this PLA.
- 3.3 Not less than once per month, Prime Contractor and all Subcontractors shall make available in writing to the Unions a Project status report that shall include, though not necessarily be limited to, planned activities for the next 30 day period and estimated numbers of employees by craft required for the next 30 day period. The purpose of this Project status report is to promote effective workforce planning and to facilitate resolution of any potential jurisdictional or other problems.
- 3.4 Not later than the earlier of (a) five business days following the pre-job conference, or (b) commencement of Construction Work, the Unions and Prime Contractor (on behalf of itself and all its subcontractors of whatever tier) shall confer and jointly designate a slate of three (3) permanent arbitrators (each a "Permanent Arbitrator") for the purpose of hearing disputes pursuant to Articles V and VII of this PLA. The slate of Permanent Arbitrators shall be selected from among the following individuals: Thomas F. Gibbons, Robert Perkovich, Byron Yaffee, and Glenn A. Zipp. In the event that the Unions and Prime Contractor are not able to agree on a full slate of three Permanent Arbitrators, the Department, after consultation with the Unions and Prime Contractor, shall designate such additional Permanent Arbitrators as may be necessary to establish the full slate. A single Permanent Arbitrator shall be selected from the slate of three on a rotating basis to adjudicate each arbitrable matter as it arises. In the event a Permanent Arbitrator is not available to adjudicate a particular matter in the order of rotation, the arbitration assignment shall pass to the next available Permanent Arbitrator.

ARTICLE IV - HOURS OF WORK AND GENERAL CONDITIONS

- 4.1 The standard work day for Construction Work on the Project shall be an established consecutive eight (8) hour period between the hours of 7:00 a.m. and 5:00 p.m. with one-half hour designated as unpaid period for lunch. The standard work week shall be five (5) consecutive days of work commencing on Monday. Starting time shall be established at the pre-job conference, and shall be applicable to all craft employees on the Project unless otherwise expressly agreed in writing. In the event Project site or other job conditions dictate a change in the established starting time and/or a staggered lunch period for portions of the Project or for specific crafts, the Prime Contractor, relevant Subcontractors and business managers of the specific crafts involved shall confer and mutually agree to such changes as appropriate.

If proposed work schedule changes cannot be mutually agreed upon between the parties, the hours fixed at the time of the pre-job meeting shall prevail.

- 4.2 Shift work may be established and directed by the Prime Contractor or relevant Subcontractor as reasonably necessary or appropriate to fulfill the terms of its contract with the Department. If used, shift hours, rates and conditions shall be as provided in the applicable collective bargaining agreement.
- 4.3 The parties agree that chronic and/or unexcused absenteeism is undesirable and must be controlled in accordance with procedures established by the applicable collective bargaining agreement. Any employee disciplined for absenteeism in accordance with such procedures shall be suspended from all work on the Project for not less than the maximum period permitted under the applicable collective bargaining agreement.
- 4.4 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, employment begins and ends at the Project site; employees shall be at their place of work at the starting time; and employees shall remain at their place of work until quitting time.
- 4.5 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, there shall be no limit on production by workmen, no restrictions on the full use of tools or equipment, and no restrictions on efficient use of manpower or techniques of construction other than as may be required by safety regulations.
- 4.6 The parties recognize that specialized or unusual equipment may be installed on the Project. In such cases, the Union recognizes the right of the Prime Contractor or Subcontractor to involve the equipment supplier or vendor's personnel in supervising the setting up of the equipment, making modifications and final alignment, and performing similar activities that may be reasonably necessary prior to and during the start-up procedure in order to protect factory warranties. The Prime Contractor or Subcontractor shall notify the Union representatives in advance of any work at the job-site by such vendor personnel in order to promote a harmonious relationship between the equipment vendor's personnel and other Project employees.
- 4.7 For the purpose of promoting full and effective implementation of this PLA, authorized Union representatives shall have access to the Project job-site during scheduled work hours. Such access shall be conditioned upon adherence to all reasonable visitor and security rules of general applicability that may be established for the Project site at the pre-job conference or from time to time thereafter.

ARTICLE V - GRIEVANCE AND ARBITRATION PROCEDURES

- 5.1 Except as provided in Articles VI or VII, it is specifically agreed among the parties that any grievance or dispute arising out of the interpretation or application of this PLA shall be settled by means of the expedited arbitration process set forth in Paragraph 5.2 below. No such grievance or dispute shall be recognized unless called to the attention of the Prime Contractor and relevant Subcontractor by the Union or to the Union by the Prime Contractor or relevant Subcontractor within five (5) working days after the alleged violation was committed or discovered by the grieving party.

- 5.2 Grievances shall be settled according to the following procedure:
- 5.2.A. Step 1. The dispute shall be referred to the Steward of the craft union involved and a representative of the Prime Contractor and relevant Subcontractor at the job-site.
 - 5.2.B. Step 2. In the event that the Steward and the contractors' representatives at the job-site cannot reach agreement within two (2) working days after a meeting is arranged and held, the matter shall be referred to the Union Business Manager and to executive representatives of the Prime Contractor and relevant Subcontractor.
 - 5.2.C. Step 3. In the event the dispute is not resolved within five (5) working days after completion of Step 2, the relevant parties shall request a Permanent Arbitrator as determined in accordance with paragraph 3.4 of this PLA, who shall, within ten (10) working days, hear the grievance and make a written decision. Such decisions shall be final and binding on all parties. The parties shall each pay the expense of their own representative. The expense of the Permanent Arbitrator shall be divided equally between (1) the Prime Contractor and/or relevant Subcontractor, and (2) the involved Union.
- 5.3 Any failure of a party to comply fully with such final and binding decision of the Permanent Arbitrator may result in removal of the non-complying party from the site, in a holdback from the Prime Contractor or Subcontractor of any amounts awarded, or in such other relief as the Department may reasonably determine is necessary to promote final resolution of the dispute.
- 5.4 In the event any dispute or grievance should arise, the parties expressly agree that it shall be resolved without occurrence of any strike, work stoppage, slow-down or other prohibited activities as provided in Article VII of this PLA. Individuals or parties violating this section shall be subject to immediate discharge or other discipline.

ARTICLE VI - JURISDICTIONAL DISPUTES

- 6.1 As used in this Agreement, the term "jurisdictional dispute" shall be defined as any dispute, difference or disagreement involving the assignment of particular work to one class or craft of employees rather than to a different class or craft of employees, regardless of that Contractor's contractual relationship to any other employer, contractor, or organization on the site.
- 6.2 It is agreed by and between the parties to this Agreement that any and all jurisdictional disputes shall be resolved in the following manner; each of the steps hereinafter listed shall be initiated by the parties in sequence as set forth:
- (a) Negotiation by and between the Local Business Representative of the disputing Union and Employer shall take place within two (2) business days. Business days are defined as Monday through Friday excluding contract holidays. Such negotiations shall be pursued until it is apparent that the dispute cannot be resolved at the local level.

- (b) The International Representatives of the disputing Union shall meet or confer and attempt to resolve said dispute. This meeting shall take place within two (2) business days. Business days are defined as Monday through Friday excluding contract holidays.
- (c) The parties to the Jurisdictional Dispute shall submit the dispute directly to an Arbitrator after complying with paragraph (2b) above. The parties shall meet with the Arbitrator within three (3) business days. Business days are defined as Monday through Friday excluding contract holidays. An Arbitrator will be selected based on availability from the slate of permanent Arbitrators. The Arbitrator's bench decision will be given the day of the hearing and will be final and legally binding on this project only. The Arbitrator's bench decision will be implemented without delay. The cost of Arbitration will be shared equally by the disputing parties. Any party to the dispute can require that a "long form" written decision be provided from the Arbitrator, however the cost of the "long form" written decision will be the responsibility of the party making the request.

Notes:

- A jurisdictional dispute may be submitted based upon a pre-job assignment.
 - If any party to the jurisdictional disputes does not fully comply with the steps and time limits with each step, then the party in non-compliance will lose by "automatic default".
 - Time limits at any step can be extended if all parties to the jurisdictional dispute mutually agree in writing.
 - All parties to a jurisdictional dispute can mutually agree to waive the time limits in steps (a) and (b) and proceed directly to an expedited arbitration hearing.
- (d) In rendering his decision, the Arbitrator shall determine:
- (1) First whether a previous agreement of record or applicable agreement, including a disclaimer agreement, between the National or International Unions to the dispute governs;
 - (2) Only if the Arbitrator finds that the dispute is not covered by an appropriate or applicable agreement of record or agreement between the crafts to the dispute, he shall then consider whether there is a previous decision of record governing the case;
 - (3) If the Arbitrator finds that a previous decision of record governs the case, the Arbitrator shall apply the decision of record in rendering his decision except under the following circumstances. After notice to the other parties to the dispute prior to the hearing that it intends to challenge the decision of record, if a trade challenging the decision of record is able to demonstrate that the recognized and established prevailing practice in the locality of the work has been contrary to the applicable decision of record, and that historically in that locality the work in dispute has not been performed by the other craft or crafts, the Arbitrator may rely on such prevailing practice rather than the decision of record.

If the craft relying on the decision of record demonstrates that it has performed the work in dispute in the locality of the job, then the Arbitrator shall apply the decision of record in rendering his decision. If the Arbitrator finds that a craft has improperly obtained the prevailing practice in the locality through raiding, the undercutting of wagers or by the use of vertical agreements, the Arbitrator shall rely on the decision of record rather than the prevailing practice in the locality.

- (4) If no decision of record is applicable, the Arbitrator shall then consider the established trade practice in the industry and prevailing practice in the locality; and
- (5) Only if none of the above criteria is found to exist, the Arbitrator shall then consider that because efficiency, cost or continuity and good management are essential to the well being of the industry, the interest of the consumer or the past practice of the employer shall not be ignored.

The Arbitrator shall set forth the basis for his decision and shall explain his findings regarding the applicability of the above criteria. If lower-ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the job in dispute.

- (6) Agreements of record are applicable only to the party's signatory to such agreements. Decisions of record are applicable to all trades.
 - (7) The Arbitrator is not authorized to award back pay or any other damages for a mis-assignment of work. Nor may any party bring an independent action for back pay or any other damages, based upon a decision of an Arbitrator.
- 6.3 The signatory parties to this Agreement agree that jurisdictional disputes cannot and shall not interfere with the efficient and continuous operations required for the successful application of this Agreement. In the event a dispute arises, the Contractor's assignment shall be followed until the dispute is resolved.
 - 6.4 Equipment or material delivered to the job site will be unloaded promptly without regard to jurisdictional disputes which will be handled as per the provisions of this Agreement. The Contractor will supply the Union with delivery schedules, allowing as much time as possible to insure the appropriate crafts will be available to unload the materials or equipment.
 - 6.5 All signatory affiliates agree that upon request, a representative shall be assigned without delay to attempt a settlement in the event of a question on assignments.

ARTICLE VII - WORK STOPPAGES AND LOCKOUTS

- 7.1 During the term of this PLA, no Union or any of its members, officers, stewards, employees, agents or representatives shall instigate, support, sanction, maintain, or participate in any strike, picketing, walkout, work stoppage, slow down or other activity that interferes with the routine and timely prosecution of work at the Project site or at any other contractor's or supplier's facility that is necessary to performance of work at the Project site. Hand billing at the Project site during the designated lunch period and before commencement or following conclusion of the established standard workday shall not, in itself, be deemed an activity that interferes with the routine and timely prosecution of work on the Project.
- 7.2 Should any activity prohibited by paragraph 7.1 of this Article occur, the Union shall undertake all steps reasonably necessary to promptly end such prohibited activities. No Union complying with its obligations under this Article shall be liable for acts of employees for which it has no responsibility or for the unauthorized acts of employees it represents. Any employee who participates in or encourages any activity prohibited by paragraph 7.1 shall be immediately suspended from all work on the Project for a period equal to the greater of (a) 60 days; or (b) the maximum disciplinary period allowed under the applicable collective bargaining agreement for engaging in comparable unauthorized or prohibited activity.
- 7.3 During the term of this PLA, the Prime Contractor and its Subcontractors shall not engage in any lockout at the Project site of employees covered by this Agreement.
- 7.4 Upon notification of violations of this Article, the principal officer or officers of the local area Building and Construction Trades Council, and the Illinois AFL-CIO Statewide Project Labor Agreement Committee as appropriate, will immediately instruct, order and use their best efforts to cause the affiliated union or unions to cease any violations of this Article. A Trades Council and the Committee otherwise in compliance with the obligations under this paragraph shall not be liable for unauthorized acts of its affiliates.
- 7.5 In the event that activities in violation of this Article are not immediately halted through the efforts of the parties, any aggrieved party may invoke the special arbitration provisions set forth in paragraph 7.6 of this Article.
- 7.6 Upon written notice to the other involved parties by the most expeditious means available, any aggrieved party may institute the following special arbitration procedure when a breach of this Article is alleged:
- 7.6.A The party invoking this procedure shall notify the individual designated as the Permanent Arbitrator pursuant to Article III of the nature of the alleged violation; such notice shall be by the most expeditious means possible. The initiating party may also furnish such additional factual information as may be reasonably necessary for the Permanent Arbitrator to understand the relevant circumstances. Copies of any written materials provided to the arbitrator shall also be contemporaneously provided by the most expeditious means possible to the party alleged to be in violation and to all other involved parties.

7.6.B Upon receipt of said notice the Permanent Arbitrator shall set and hold a hearing within twenty-four (24) hours if it is contended the violation is ongoing, but not before twenty-four (24) hours after the written notice to all parties involved as required above.

7.6.C The Permanent Arbitrator shall notify the parties by facsimile or any other effective written means, of the place and time chosen by the Permanent Arbitrator for this hearing. Said hearing shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of an Award by the Permanent Arbitrator.

7.6.D The sole issue at the hearing shall be whether a violation of this Article has, in fact, occurred. An Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the Award. The Permanent Arbitrator may order cessation of the violation of this Article, and such Award shall be served on all parties by hand or registered mail upon issuance.

7.6.E Such Award may be enforced by any court of competent jurisdiction upon the filing of the Award and such other relevant documents as may be required. Facsimile or other hardcopy written notice of the filing of such enforcement proceedings shall be given to the other relevant parties. In a proceeding to obtain a temporary order enforcing the Permanent Arbitrator's Award as issued under this Article, all parties waive the right to a hearing and agree that such proceedings may be ex parte. Such agreement does not waive any party's right to participate in a hearing for a final order of enforcement. The Court's order or orders enforcing the Permanent Arbitrator's Award shall be served on all parties by hand or by delivery to their last known address or by registered mail.

7.7 Individuals found to have violated the provisions of this Article are subject to immediate termination. In addition, IDOT reserves the right to terminate this PLA as to any party found to have violated the provisions of this Article.

7.8 Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance therewith are hereby waived by parties to whom they accrue.

7.9 The fees and expenses of the Permanent Arbitrator shall be borne by the party or parties found in violation, or in the event no violation is found, such fees and expenses shall be borne by the moving party.

ARTICLE VIII – MISCELLANEOUS

8.1 If any Article or provision of this PLA shall be declared invalid, inoperative or unenforceable by operation of law or by final non-appealable order of any tribunal of competent jurisdiction, such provision shall be deemed severed or limited, but only to the extent required to render the remaining provisions of this PLA enforceable consistent with the intent of the parties.

The remainder of this PLA or the application of such Article or provision to persons or circumstances other than those as to which it has been held invalid, inoperative or unenforceable shall not be affected thereby.

- 8.2 The term of this PLA shall commence as of and from the date of the notice of award to the Prime Contractor and shall end upon final acceptance by IDOT of all work on the Project by the parties hereto.
- 8.3 This PLA may not be changed or modified except by the subsequent written agreement of the parties. All parties represent that they have the full legal authority to enter into this PLA. This PLA may be executed by the parties in one or more counterparts.
- 8.4 Any liability arising out of this PLA shall be several and not joint. IDOT shall not be liable to any person or other party for any violation of this PLA by any other party, and no Contractor or Union shall be liable for any violation of this PLA by any other Contractor or Union.
- 8.5 The failure or refusal of a party to exercise its rights hereunder in one or more instances shall not be deemed a waiver of any such rights in respect of a separate instance of the same or similar nature.

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Execution Page

Illinois Department of Transportation

William R. Frey, Interim Director of Highways

Matthew R. Hughes, Director - Finance & Administration

Ellen Schanzle-Haskins, Chief Counsel

Ann L. Schneider, Secretary

(Date)

Illinois AFL-CIO Statewide Project Labor Agreement Committee, representing the local unions listed below:

(Date)

List Union Locals:

**** RETURN WITH BID ****

Exhibit A – Contractor Letter of Assent

(Date)

To All Parties:

In accordance with the terms and conditions of the contract for Construction Work on [], this Letter of Assent hereby confirms that the undersigned Prime Contractor or Subcontractor agrees to be bound by the terms and conditions of the Project Labor Agreement established and entered into by the Illinois Department of Transportation in connection with said Project.

It is the understanding and intent of the undersigned party that this Project Labor Agreement shall pertain only to the identified Project. In the event it is necessary for the undersigned party to become signatory to a collective bargaining agreement to which it is not otherwise a party in order that it may lawfully make certain required contributions to applicable fringe benefit funds, the undersigned party hereby expressly conditions its acceptance of and limits its participation in such collective bargaining agreement to its work on the Project.

(Authorized Company Officer)

(Company)

**** RETURN WITH BID ****

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

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ATTACHMENTS

- A. Employment Preference for Appalachian Contracts
(included in Appalachian contracts only)

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

- Section I, paragraph 2;
- Section IV, paragraphs 1, 2, 3, 4 and 7;
- Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6 and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. Selection of Labor: During the performance of this contract, the contractor shall not:

- a. Discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or
- b. Employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60 (and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

- a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
- b. The contractor will accept as his operating policy the following statement: "It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job-training."

2. EEO Officer: The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for an must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

- a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
- b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
- c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.
- d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.
- e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

- a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employees referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish which such identified sources procedures whereby minority group applicants may be referred

to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women

for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or quailifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

- (1)** The number of minority and non-minority group members and women employed in each work classification on the project;
- (2)** The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;
- (3)** The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and
- (4)** The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the

contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred

during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the question, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as

appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any cost reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and

individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which cases such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers:

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV. 2. Any worker listed on a payroll at a helper wage rate, who is not a helper under a approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. Apprentices and Trainees (Programs of the U.S. DOT):

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. Withholding:

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainee's and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take

such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. Overtime Requirements:

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. Violation:

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages:

The SHA shall; upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

- a.** Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.
- b.** The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of

contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

- c.** Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for submitting payroll copies of all subcontractors.
- d.** Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
 - (1)** that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;
 - (2)** that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;
 - (3)** that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of worked performed, as specified in the applicable wage determination incorporated into the contract.
- e.** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.
- f.** The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S. C. 1001 and 31 U.S.C. 231.
- g.** The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such

actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all federal-aid contracts on the national highway system, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:

- a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.
 - b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.
 - c. Furnish, upon the completion of the contract, to the SHA resident engineer on /Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.
2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractors' own organization (23 CFR 635).

- a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.
- b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S. C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more).

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 *et seq.*, as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 *et seq.*, as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. Instructions for Certification - Primary Covered Transactions:

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in

this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded from Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

- a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from

- covered transactions by any Federal department or agency;
- b.** Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - c.** Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and
 - d.** Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

- a.** By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b.** The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c.** The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d.** The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- e.** The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f.** The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- g.** A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not

- required to, check the Nonprocurement List.
- h.** Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealing.
- i.** Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility And Voluntary Exclusion-Lower Tier Covered Transactions:

- 1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- 2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

- 1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
 - a.** No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
 - b.** If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not

more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**MINIMUM WAGES FOR FEDERAL AND FEDERALLY
ASSISTED CONSTRUCTION CONTRACTS**

This project is funded, in part, with Federal-aid funds and, as such, is subject to the provisions of the Davis-Bacon Act of March 3, 1931, as amended (46 Sta. 1494, as amended, 40 U.S.C. 276a) and of other Federal statutes referred to in a 29 CFR Part 1, Appendix A, as well as such additional statutes as may from time to time be enacted containing provisions for the payment of wages determined to be prevailing by the Secretary of Labor in accordance with the Davis-Bacon Act and pursuant to the provisions of 29 CFR Part 1. The prevailing rates and fringe benefits shown in the General Wage Determination Decisions issued by the U.S. Department of Labor shall, in accordance with the provisions of the foregoing statutes, constitute the minimum wages payable on Federal and federally assisted construction projects to laborers and mechanics of the specified classes engaged on contract work of the character and in the localities described therein.

General Wage Determination Decisions, modifications and supersedes decisions thereto are to be used in accordance with the provisions of 29 CFR Parts 1 and 5. Accordingly, the applicable decision, together with any modifications issued, must be made a part of every contract for performance of the described work within the geographic area indicated as required by an applicable DBRA Federal prevailing wage law and 29 CFR Part 5. The wage rates and fringe benefits contained in the General Wage Determination Decision shall be the minimum paid by contractors and subcontractors to laborers and mechanics.

NOTICE

The most current **General Wage Determination Decisions** (wage rates) are available on the IDOT web site. They are located on the Letting and Bidding page at <http://www.dot.state.il.us/desenv/delett.html>.

In addition, ten (10) days prior to the letting, the applicable Federal wage rates will be e-mailed to subscribers. It is recommended that all contractors subscribe to the Federal Wage Rates List or the Contractor's Packet through IDOT's subscription service.

PLEASE NOTE: if you have already subscribed to the Contractor's Packet you will automatically receive the Federal Wage Rates.

The instructions for subscribing are at <http://www.dot.state.il.us/desenv/subsc.html>.

If you have any questions concerning the wage rates, please contact IDOT's Chief Contract Official at 217-782-7806.