5

Letting November 8, 2024

Notice to Bidders, Specifications and Proposal

Contract No. 62B66
LAKE County
Section (125S-1)I-4
Route FAP 346
Project NHPP-CIUX(634)
District 1 Construction Funds

Prepared by	F
Checked by	

(Printed by authority of the State of Illinois)

Illinois Department of Transportation

NOTICE TO BIDDERS

1. **TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 12:00 p.m. November 8, 2024 at which time the bids will be publicly opened from the iCX SecureVault.

2. **DESCRIPTION OF WORK**. The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

   Contract No. 62B66
   LAKE County
   Section (125S-1)I-4
   Project NHPP-CIUX(634)
   Route FAP 346
   District 1 Construction Funds

The project consists of decommissioning of existing Pump Station 37 located in the IL 176 over US 41 bridge abutment (SN 049-0131), and construction of the new pump station in the northeast quadrant of the US 41 and IL 176 intersection with a new outfall pipe to the Skokie River.

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 re-advertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Omer Osman,
Secretary

FAP Route 346 (US 41)
Project NHPP-CIUX(634)
Section (125S-1)I-4
Lake County
Contract No. 62B66

INDEX
FOR
SUPPLEMENTAL SPECIFICATIONS
AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2024

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 1-1-22) (Revised 1-1-24)

SUPPLEMENTAL SPECIFICATIONS

FAP Route 346 (US 41)
Project NHPP-CIUX(634)
Section (125S-1)I-4
Lake County
Contract No. 62B66

RECURRING SPECIAL PROVISIONS

The following RECURRING SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

TABLE OF CONTENTS

STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2022, the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways," and 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 Route 346 (US 41), Project NHPP-CIUX(634), Section (125S-1)I-4, Lake County, Contract No. 62B66 and in case of conflict with any part or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

FAP Route 346 (US 41)
Project NHPP-CIUX(634)
Section (125S-1)I-4
Lake County
Contract No. 62B66

LOCATION OF IMPROVEMENT

The Project is located at the northeast quadrant of US-41 (Skokie Highway) at IL-176 (Rockland Road) intersection in Unincorporated Shields Township and Village of Lake Bluff, Illinois, Lake County.

DESCRIPTION OF IMPROVEMENT

This improvement shall consist of construction of a new pump station with new outfall pipe to the Skokie River, intercepting the existing inlet piping located in US-41, new electric service, new fiber optic communications, de-commissioning of the existing pump station located in the bridge abutment, and salvaging existing pump station equipment to the Department. The project includes but is not limited to supply of new material, transportation, labor, installation, testing and commissioning.

BUILD AMERICA, BUY AMERICA ACT (BABA) PROVISIONS

In addition to Section 106 – Control of Materials of the Standard Specifications for Road and Bridge Construction requirements for all iron and steel materials to be domestically manufactured or produced and manufactured, this Contract shall be compliant with BABA and 23 U.S.C 313 / 23 CFR 635.410 requiring manufactured products and construction materials used in the project be produced in the United States.

To be produced in the United States, a manufactured product must be manufactured in the United States and have the cost of components of the product that are mined, produced, or manufactured in the United States be greater than 55 percent of the total cost of all components of the manufactured product. The Contractor will be responsible for submitting a statement of compliance with each shop drawing submittal.

BABA requirements do not apply for a De Minimis portion of the project, meaning a cumulative total of no more than 5 percent of the total cost of the iron, steel, manufactured products, and construction materials, up to a maximum of $1 million. The Contractor will be responsible for tracking De Minimis for the duration of the project and submitting monthly reports.

MAINTENANCE OF ROADWAYS
Effective: September 30, 1985
Revised: November 1, 1996

Beginning on the date that work begins on this project, the Contractor shall assume responsibility for normal maintenance of all existing roadways within the limits of the improvement. This normal maintenance shall include all repair work deemed necessary by the Engineer, but shall not include snow removal operations. Traffic control and protection for maintenance of roadways will be provided by the Contractor as required by the Engineer.

If items of work have not been provided in the contract, or otherwise specified for payment, such items, including the accompanying traffic control and protection required by the Engineer, will be paid for in accordance with Article 109.04 of the Standard Specifications.

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, **May 14, 2027** plus 10 working days 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. Under extenuating circumstances the Engineer may direct that certain items of work, not affecting the safe opening of the roadway to traffic or operation of the pump station, may be completed within the working days allowed for clean up work and punch list items. Temporary lane closures or interruption to the pump station operation 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.

STAGING AND SEQUENCE OF CONSTRUCTION

Construction Staging: The Contractor shall be responsible for and include all work for implementing and maintaining construction staging as may be required and as described in the Contract Documents and indicated on the Drawings to maintain all existing pumping capabilities throughout the proposed work under this Contract and to complete all construction by the completion date specified in the Contract Document and as approved by the Engineer.

The Contractor shall confine its construction operations within the limits of work indicated on the Drawings. In the event the Contractor requires additional area or areas for its construction operations, it shall be responsible for leasing such additional area or areas. No additional payment will be made for leasing additional area or areas. This expense shall be deemed as included in prices in the Contract.

The Contractor shall obtain all permits, easements or other requirements and shall pay all fees, rent or other expense for easements for access to the work area or for storage of materials, equipment or construction operations. The contractor shall submit shop drawings or proposed access plan for such additional areas, as it may require, to the Engineer for approval before commencing construction. No separate measurements or payment will be made for providing, maintaining and restoring any areas used for access or other construction operations.

In general, the work described herein and on the Drawings shall not be considered as all inclusive and will not be listed in order but only to give a brief description of the work required and which shall be executed concurrently under this Contract.

The Contractor shall prepare and submit to the Engineer for approval its proposed sequence of operations for the relocation of the Pump Station. The submittal shall include all details and descriptions for the work under this Contract including, but not limited to, maintenance of electric service to existing pump station; maintenance of existing pumps and pumping capacity as specified in the Contract Documents; protection of existing and new equipment during all relocation work; demolition sequence; reconstruction sequence; the proposed construction schedule indicating critical path the Contractor proposes to pursue on all work under this Contract; and all matters relating to this Contract. The submittal shall be a form acceptable to the Department and shall be subject to approval by the Department.

Overnight work is not allowed. Contractor shall prepare plan avoiding work between the hours of 6pm and 6am.

FAILURE TO COMPLETE THE WORK ON TIME

Should the Contractor fail to complete the work on or before the specified completion date or within such extended time as may be allowed, the Contractor shall be liable to the Department in the amount as defined in Section 108.09 of the Standard Specifications, not as a penalty but as liquidated damages, for each calendar day or a portion thereof, of overrun in the Contract time or such extended time as may have been allowed.

A calendar day is every day on the calendar and starts at 12:00 midnight and ends at the following 12:00 midnight, twenty-four hours later.

STATUS OF UTILITIES (DISTRICT 1)
Effective: June 1, 2016
Revised: January 1, 2020

Utility companies and/or municipal owners located within the construction limits of this project have provided the following information regarding their facilities and the proposed improvements. The tables below contain a description of specific conflicts to be resolved and/or facilities which will require some action on the part of the Department's contractor to proceed with work. Each table entry includes an identification of the action necessary and, if applicable, the estimated duration required for the resolution.

UTILITIES TO BE ADJUSTED

Conflicts noted below have been identified by following the suggested staging plan included in the contract. The company has been notified of all conflicts and will be required to obtain the necessary permits to complete their work; in some instances, resolution will be a function of the construction staging. The responsible agency must relocate, or complete new installations as noted below; this work has been deemed necessary to be complete for the Department's contractor to then work in the stage under which the item has been listed.

Pre-Stage

STAGE / LOCATION	TYPE	DESCRIPTION	RESPONSIBLE AGENCY	DURATION OF TIME
IL 176 Sta. 124+45, 42.3' RT	Water Main	Proposed 36" dia. jacked storm sewer crosses water main	Village of Lake Bluff	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 129+70, 38.4' RT Sta. 130+83, 38.4' RT	Sanitary Sewer	Proposed 36" dia. jacked storm sewer crosses existing sanitary sewers	North Shore Water Reclamation District (NSWRD)	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 121+18 to Sta. 131+00, 36.7' RT to 46.4' RT	Underground Fiber Optic Cable	Proposed jacking pit, open cut trench and jacked 36" dia. storm sewer is in conflict / under fiber optic cable	Windstream	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 130+30, 38' RT	Utility Handhole	Proposed open cut trench for 36" dia. storm sewer passes thru handhole	Windstream	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 132+00 to Sta. 136+43, 45' RT to 40' RT	Underground Fiber Optic Cable	Proposed open cut trench for 36" dia. storm sewer is in conflict with fiber optic cable	Windstream	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 132+16 to Sta. 133+53, 40' RT to 45' RT	Underground Fiber Optic Cable	Proposed open cut trench for 36" dia. storm sewer is in conflict with fiber optic cable	Windstream	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 130+44,	Underground Telephone Cable	Proposed open cut trench for 36"	Commonwealth Edison	To be relocated prior to construction of proposed

38’ RT		dia. storm sewer crosses telephone cable		discharge pipe. (Relocated)
IL 176 Sta. 131+46 to Sta. 137+22, 34’ RT to 41’ RT	Underground Electric Cable	Proposed open cut trench for 36”/42” dia. storm sewer adjacent to/crosses electric cable	Commonwealth Edison	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 131+87, 38’ RT	Guy Anchor	Proposed open cut trench for 36” dia. storm sewer passes thru guy anchor	Commonwealth Edison	To be relocated prior to construction of proposed discharge pipe.
IL 176 Sta. 132+71, 40’ RT	Utility Pole	Proposed open cut trench for 36” dia. storm sewer passes thru utility pole	Commonwealth Edison	To be relocated prior to construction of proposed discharge pipe.
IL 176 Sta. 132+23, 38.6’ RT	Water Main	Proposed open cut trench for 36” dia. storm sewer crosses water main	Central Lake County Joint Action Water Agency (CLCJAWA)	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 134+18 to Sta. 137+22, 39.2’ RT	Underground Gas Line	Proposed open cut trench for 36” dia. storm sewer crosses gas line	North Shore Gas	To be relocated prior to construction of proposed discharge pipe. (Relocated)
IL 176 Sta. 131+87, 30.8’ RT	Utility Pole	Proposed open cut trench for 36” dia. storm sewer passes thru utility pole	Joint Commonwealth Edison, Comcast, AT&T	To be relocated prior to construction of proposed discharge pipe.
IL 176 Sta. 131+87, 30.8’ RT	Underground Telephone Cable	Proposed open cut trench for 36” dia. storm sewer crosses telephone cable	AT&T buried cable	To be relocated prior to construction of proposed discharge pipe.

Pre-Stage: _____ Days Total Installation

The following contact information is what was used during the preparation of the plans as provided by the Agency/Company responsible for resolution of the conflict.

Agency/Company Responsible to Resolve Conflict	Name of contact	Phone	E-mail address
CLCJAWA	Bill Soucie	847.582.9215	soucie@clcjawa.com
	Grant Wollert	847.980.8950	gwollert@clcjawa.com
ComEd	Inam Sharif	847.816.5541	Inamullah.sharif@comed.com
	Vince Mazzaferro	779.231.1027	vincent.mazzaferrope@comed.com
North Shore Gas	Jay Hammer	847.954.8250	jay.hammer@northshoregasdelivery.org
Village of Lake Bluff	Jeff Hansen	847.283.6884	jhansen@lakebluff.org
Windstream	Deven Barnhill	815.715.2287	Deven.barnhill@windstream.com

UTILITIES TO BE WATCHED AND PROTECTED

The areas of concern noted below have been identified by following the suggested staging plan included for the contract. The information provided is not a comprehensive list of all remaining utilities, but those which during coordination were identified as ones which might require the Department's contractor to take into consideration when making the determination of the means and methods that would be required to construct the proposed improvement. In some instances, the contractor will be responsible to notify the owner in advance of the work to take place so necessary staffing on the owner's part can be secured.

Pre-Stage

STAGE / LOCATION	TYPE	DESCRIPTION	OWNER
IL 176 Sta. 132+23, 38.6' RT	Underground Water Line	Proposed open cut trench for 36" dia. storm sewer crosses 8" or 10" water line	Village of Lake Bluff
IL 176 Sta. 124+13, 43' RT Sta. 127+93, 44' RT	Underground Gas Main	Proposed 36" dia. jacked storm sewer crosses gas main	North Shore Gas
IL 176 Sta. 127+90, 40' RT	Underground Gas Main	Approximately 30" of clearance from relocated gas main and jacking pit for outfall pipe	North Shore Gas
IL 176 Sta. 128+60, 41.4' RT	4" Steel Pipe (Underground Fiber Optic Cable)	Proposed 36" dia. jacked storm sewer crosses fiber optic cable	AT&T Transmission
IL 176 Sta. 129+12, 40' RT	Underground Fiber Optic Cable	Proposed 36" dia. jacked storm sewer crosses fiber optic cable. Exploratory excavation (pothole) is required to pothole the cable in the presence of the Engineer and Sprint.	Sprint
IL 176 Sta. 129+16, 39.8' RT	Retired Underground Fiber Optic Cable	Proposed 36" dia. jacked storm sewer crosses fiber optic cable	AT&T, Teleport Communication America, LLC
IL 176 Sta. 129+24, 39.6' RT	Underground Fiber Optic Cable	Proposed 36" dia. jacked storm sewer crosses fiber optic cable	Centurylink / Lumen
IL 176 Sta. 129+70, 38.4'	Sanitary Sewer	Jacking pit at Sta. 129+70 close proximity to forcemain	North Shore Water Reclamation District (NSWRD)
IL 176 STA 131+75, 29' RT & STA 133+50, 44' RT	Utility Pole	Joint (ComEd and AT&T) poles at Sta. 131+75 & Sta. 133+50	AT&T, Commonwealth Edison
IL 176 STA 124+75, 75' RT - 59' LT	Aerial line and Utility pole	Joint (ComEd and AT&T) poles at Sta. 124+75 & AT&T Aerial cable across the road	AT&T, Commonwealth Edison

The following contact information is what was used during the preparation of the plans as provided by the owner of the facility.

Agency/Company Responsible to Resolve Conflict	Name of contact	Phone	E-mail address
AT&T Distribution	Hector Garcia	630.573.5465	Hg2929@att.com
AT&T Teleport Communications America, LLC	Tamara Booker Jason Sterneberg	614.208.8689 708.240.9085	th3913@att.com jsterenberg@networkconnex.com
AT&T Transmission	Vanessa Ross Rich Myers	217.814.2314 630.215.7567	vf2021@att.com rcm5@sbcglobal.net
Centurylink / Lumen	Ben Pacocha	847.954.8250	Ben.pacocha@lumen.com
CLCJAWA	Bill Soucie	847.582.9215	soucie@clcjawa.com
	Grant Wollert	847.980.8950	gwollert@clcjawa.com
ComEd	Inam Sharif	847.816.5541	Inamullah.sharif@comed.com
	Vince Mazzaferro	779.231.1027	vincent.mazzaferrope@comed.com
North Shore Gas	Jay Hammer	847.954.8250	jay.hammer@northshoregasdelivery.org
NSWRD	Nicholas Wolf	847.623.6060	niwolf@northshorewrd.org
Sprint / T-Mobile	Stephen T. Hughes	513.459.5796	steven.hughes1$@T-Mobile.com
Village of Lake Bluff	Jeff Hansen	847.283.6884	jhansen@lakebluff.org
Windstream	Deven Barnhill	815.715.2287	Deven.barnhill@windstream.com

The above represents the best information available to the Department and is included for the convenience of the bidder. The days required for conflict resolution should be considered in the bid as this information has also been factored into the timeline identified for the project when setting the completion date. The applicable portions of the Standard Specifications for Road and Bridge Construction shall apply.

Estimated duration of time provided above for the first conflicts identified will begin on the date of the executed contract regardless of the status of the utility relocations. The responsible agencies will be working toward resolving subsequent conflicts in conjunction with contractor activities in the number of days noted.

The estimated relocation duration must be part of the progress schedule submitted by the contractor. A utility kickoff meeting will be scheduled between the Department, the Department's contractor and the utility companies when necessary. The Department's contractor is responsible for contacting J.U.L.I.E. prior to all excavation work.

EXISTING UTILITIES

The Contractor shall familiarize themselves 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 their expense in a manner acceptable to the Engineer.

The Contractor shall notify all utility owners of their 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.

CONSTRUCTION LAYOUT SPECIAL FOR RESURFACING WITH ADA AND STAND ALONE ADA (D1)

Effective: January 1, 2017
Revised: April 17, 2017

Description. This work shall consist of furnishing and placing construction layout stakes for the construction of ADA Ramps shown in the plans. The Contractor shall furnish and place stakes marking the locations and elevations of points indicated in the plans for ADA Ramp Construction.

The Contractor shall locate all reference points as shown on the plans and listed herein. Any additional control points required will be identified in the field by the Contractor and all field notes will be kept in the office of the Resident Engineer.

The Contractor shall provide field forces, equipment, and material to set all additional stakes for this project, which are needed to establish offset stakes, reference points, and any other horizontal and vertical controls necessary to secure a correct layout for the work.

Layout stakes shall be set to assure conformance to the ADA Ramp design shown on the plans and shall meet the approval of the Engineer.

The Contractor shall be responsible for having the finished work conform to the lines, grades, elevations, and dimensions called for in the plans. Any inspection or checking of the Contractor's layout by the Engineer and the acceptance of all or any part of it shall not relieve the Contractor of his/her responsibility to secure the proper dimensions, grades, and elevations of the work. The Contractor shall exercise care in the preservation of stakes and bench marks and shall have them reset when any are damaged, lost, displaced, removed or otherwise obliterated.

Responsibility of the Department.

The Department will make random checks of the Contractor's staking to determine if the work is in conformance with the plans. When the Contractor's work will tie into work that is being or will be done by others, checks will be made to determine if the work is in conformance with the proposed overall grade and horizontal alignment.

Where the Contractor, in setting construction stakes, discovers discrepancies, the Department will check to determine their nature and make whatever revisions are necessary to the plans. Any additional restaking required by the Engineer will be the responsibility of the Contractor. The additional restaking done by the Contractor will be paid for according to Article 109.04 of the Standard Specifications.

The Department will be responsible for the accuracy of the initial reference points shown in the plans.

It is not the responsibility of the Department, except as provided herein, to check the correctness of the Contractor's stakes. Any apparent errors will be immediately called to the Contractor's attention and the Contractor will be required to make the necessary correction before the stakes are used for construction purposes. The Contractor shall provide the Engineer a copy of any field notes and layout diagrams produced during the course of the project.

Responsibility of the Contractor.

The Contractor shall establish from the given survey points and contract plan information, all the control points or reference points necessary to layout the ADA Ramp elements. The Contractor shall furnish and place the layout stakes. The Contractor shall notify the Engineer when the stakes are complete and available for review and approval by the Engineer at least 3 working days in advance of the actual construction.

Field notes shall be kept in standard survey field notebooks and those books shall become the property of the Department at the completion of the project. All notes shall be neat, orderly, and in accepted form.

Measurement and Payment. This work will be paid for at the contract lump sum price for CONSTRUCTION LAYOUT (SPECIAL).

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:
701006 Off-Road Operations, 2L, 2W, 15' (4.5m) to 24" (600mm) from Pavement Edge
701101 Off-Road Operations, Multilane, 15' (4.5m) to 24" (600mm) from Pavement Edge
701106 Off-Road Operations, Multilane, More than 15’ (4.5M) Away
701301 Lane Closure, 2L, 2W, Short Time Operations
701311 Lane Closure, 2L, 2W, Moving Operations – Day Only
701421 Lane Closure, Multilane, Day Operations Only, for Speeds ≥ 45 MPH to 55 MPH
701423 Lane Closure, Multilane, with Barrier, for Speeds ≥ 45 MPH to 55 MPH
701426 Lane Closure, Multilane, Intermittent or Moving Operation, for Speeds ≥ 45 MPH
701501 Urban Lane Closure, 2L, 2W, Undivided
701502 Urban Lane Closure, 2L, 2W, with Bidirectional Left Turn Lane
701701 Urban Lane Closure, Multilane Intersection
701901 Traffic Control Devices
704001 Temporary Concrete Barrier
720011 Metal Posts for Signs, Markers & Delineators
780001 Typical Pavement Markings
782006 Guardrail and Barrier Wall Reflector Mounting Details

DETAILS:
TC-10 Traffic Control and Protection for Side Roads, Intersections, and Driveways
TC-11 Raised Reflective Pavement Markers (Snow Plow Resistant)
TC-13 District One Typical Pavement Markings
TC-22 Arterial Road Information Sign
TC-26 Driveway Entrance Signing

SPECIAL PROVISIONS:
Maintenance of Roadways
Public Convenience and Safety (District-1)
Raised Reflective Pavement Marker reflector Removal
Raised Reflective Pavement Marker Reflector Replacement
Traffic Control and Protection (Arterials)
Temporary Information Signing
Traffic Control For Work Zone Areas
Keeping Arterial Roadways Open to Traffic (Lane Closures Only)
Temporary Traffic Signal Timing
Short Term and Temporary Pavement Markings (BDE)
Vehicle and Equipment Warning Lights (BDE)
Work Zone Traffic Control Devices (BDE)

TRAFFIC CONTROL AND PROTECTION (ARTERIALS) 3/01/2011
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.

TRAFFIC SIGNAL PAINTING
Effective: May 22, 2002
Revised: November 1, 2023
817.02TS

The cable shall meet the requirements of Section 817 of the Standard Specifications, except for the following:

Add the following to Article 817.03 of the Standard Specifications:

> "In order to trace the fiber optic cable after installation, the tracer cable shall be installed in the same conduit as the fiber optic cable in locations shown on the plans. The tracer cable shall be continuous, extended into the controller cabinet and terminated on a barrier type terminal strip mounted on the side wall of the controller cabinet. The barrier type terminal strip and tracer cable shall be clearly marked and identified. All tracer cable splices shall be kept to a minimum and shall incorporate maximum lengths of cable supplied by the manufacturer. The tracer cable will be allowed to be spliced at handholes only. The tracer cable splice shall use a Western Union Splice soldered with resin core flux and shall be soldered using a soldering iron. Blow torches or other devices which oxidize copper cable shall not be allowed for soldering operations. All exposed surfaces of the solder shall be smooth. The splice shall be covered with a black shrink tube meeting UL 224 guidelines, Type V and rated 600V, minimum length 4 in. (100 mm) and with a minimum 1 in. (25 mm) coverage over the XLP insulation, underwater grade."

Revise Article 817.05 of the Standard Specifications to read:

> "Basis of Payment. The tracer cable shall be paid for separately as ELECTRIC CABLE IN CONDUIT, TRACER, NO. 14 1C per foot (meter), which price shall include all associated labor and material for installation."

PUBLIC CONVENIENCE AND SAFETY (DISTRICT 1)
Effective: May 1, 2012
Revised: July 15, 2012

Add the following to the end of the fourth paragraph of Article 107.09:

> "If the holiday is on a Saturday or Sunday, and is legally observed on a Friday or Monday, the length of Holiday Period for Monday or Friday shall apply."

Add the following sentence after the Holiday Period table in the fourth paragraph of Article 107.09:

> "The Length of Holiday Period for Thanksgiving shall be from 5:00 AM the Wednesday prior to 11:59 PM the Sunday After"

Delete the fifth paragraph of Article 107.09 of the Standard Specifications:

> "On weekends, excluding holidays, roadways with Average Daily Traffic of 25,000 or greater, all lanes shall be open to traffic from 3:00 P.M. Friday to midnight Sunday except where structure construction or major rehabilitation makes it impractical."

PRE-BID SITE INSPECTION OF PUMP STATION

The proposed Pump Station No. 37 site and existing Pump Station No. 37 can be visited upon request. Contractor's shall contact the Department project management. Information listed on drawing cover sheet.

CONTRACTOR COOPERATION

The attention of the Contractor is directed to the fact that other contracts are or may be in force that adjoins the limits of this project. 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.

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.

AGGREGATE SURFACE COURSE FOR TEMPORARY ACCESS
Effective: April 1, 2001
Revised: January 2, 2007

Revise Article 402.10 of the Standard Specifications to read:

"**402.10 For Temporary Access.** The contractor shall construct and maintain aggregate surface course for temporary access to private entrances, commercial entrances and roads according to Article 402.07 and as directed by the Engineer.

The aggregate surface course shall be constructed to the dimensions and grades specified below, except as modified by the plans or as directed by the Engineer.

(a) Private Entrance. The minimum width shall be 12 ft (3.6 m). The minimum compacted thickness shall be 6 in. (150 mm). The maximum grade shall be eight percent, except as required to match the existing grade.

(b) Commercial Entrance. The minimum width shall be 24 ft (7.2 m). The minimum compacted thickness shall be 9 in. (230 mm). The maximum grade shall be six percent, except as required to match the existing grade.

(c) Road. The minimum width shall be 24 ft (7.2 m). The minimum compacted thickness shall be 9 in. (230 mm). The grade and elevation shall be the same as the removed pavement, except as required to meet the grade of any new pavement constructed.

Maintaining the temporary access shall include relocating and/or regrading the aggregate surface coarse for any operation that may disturb or remove the temporary access. The same type and gradation of material used to construct the temporary access shall be used to maintain it.

When use of the temporary access is discontinued, the aggregate shall be removed and utilized in the permanent construction or disposed of according to Article 202.03."

Add the following to Article 402.12 of the Standard Specifications:

"Aggregate surface course for temporary access will be measured for payment as each for every private entrance, commercial entrance or road constructed for the purpose of temporary access. If a residential drive, commercial entrance, or road is to be constructed under multiple stages, the aggregate needed to construct the second or subsequent stages will not be measured for payment but shall be included in the cost per each of the type specified."

Revise the second paragraph of Article 402.13 of the Standard Specifications to read:

"Aggregate surface course for temporary access will be paid for at the contract unit price per each for TEMPORARY ACCESS (PRIVATE ENTRANCE), TEMPORARY ACCESS (COMMERCIAL ENTRANCE) or TEMPORARY ACCESS (ROAD).

Partial payment of the each amount bid for temporary access, of the type specified, will be paid according to the following schedule:

(a) Upon construction of the temporary access, sixty percent of the contract unit price per each, of the type constructed, will be paid.

(b) Subject to the approval of the Engineer for the adequate maintenance and removal of the temporary access, the remaining forty percent of the pay item will be paid upon the permanent removal of the temporary access."

STORM SEWER ADJACENT TO OR CROSSING WATER MAIN 1/01/2007
Effective: February 1, 1996
Revised: January 1, 2007

This work consists of constructing storm sewer adjacent to or crossing a water main, at the locations shown on the plans. The material and installation requirements shall be according to the latest edition of the "Standard Specifications for Water and Sewer Main Construction in Illinois", and the applicable portions of Section 550 of the Standard Specifications; which may include concrete collars and encasing pipe with seals if required.

Pipe materials shall meet the requirements of Sections 40 and 41-2.01 of the "Standard Specifications for Water and Sewer Main Construction in Illinois", except PVC pipe will not be allowed. Ductile-Iron pipe shall meet the minimum requirements for Thickness Class 50.

Encasing of standard type storm sewer, according to the details for "Water and Sewer Separation Requirements (Vertical Separation)" in the "STANDARD DRAWINGS" Division of the "Standard Specifications for Water and Sewer Main Construction in Illinois", may be used for storm sewers crossing water mains.

Basis of Payment: This work will be paid according to Article 550.10 of the Standard Specifications, except the pay item shall be STORM SEWER (WATER MAIN REQUIREMENTS), of the diameter specified.

ADJUSTMENTS AND RECONSTRUCTIONS
Effective: March 15, 2011

Revise the first paragraph of Article 602.04 to read:

"602.04 Concrete. Cast-in-place concrete for structures shall be constructed of Class SI concrete according to the applicable portions of Section 503. Cast-in-place concrete for pavement patching around adjustments and reconstructions shall be constructed of Class PP-1 concrete, unless otherwise noted in the plans, according to the applicable portions of Section 1020."

Revise the third, fourth and fifth sentences of the second paragraph of Article 602.11(c) to read:

"Castings shall be set to the finished pavement elevation so that no subsequent adjustment will be necessary, and the space around the casting shall be filled with Class PP-1 concrete, unless otherwise noted in the plans, to the elevation of the surface of the base course or binder course. HMA surface or binder course material shall not be allowed. The pavement may be opened to traffic according to Article 701.17(e)(3)b."

Revise Article 603.05 to read:

"**603.05 Replacement of Existing Flexible Pavement.** After the castings have been adjusted, the surrounding space shall be filled with Class PP-1 concrete, unless otherwise noted in the plans, to the elevation of the surface of the base course or binder course. HMA surface or binder course material shall not be allowed. The pavement may be opened to traffic according to Article 701.17(e)(3)b."

Revise Article 603.06 to read:

"**603.06 Replacement of Existing Rigid Pavement.** After the castings have been adjusted, the pavement and HMA that was removed, shall be replaced with Class PP-1 concrete, unless otherwise noted in the plans, not less than 9 in. (225 mm) thick. The pavement may be opened to traffic according to Article 701.17(e)(3)b.

The surface of the Class PP concrete shall be constructed flush with the adjacent surface."

Revise the first sentence of Article 603.07 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."

COFFERDAM (TYPE 1) (IN-STREAM/WETLAND WORK) (DISTRICT 1)

Effective: January 1, 2019
Revised: August 15, 2022

Description. This work shall be performed in accordance with Section 502.06 of the Standard Specifications for Road and Bridge Construction, except as herein modified. The work shall consist of the preparation of an in-stream/wetland work plan and the installation, maintenance, removal and disposal of the temporary cofferdam(s) to isolate the work area from water within regulated wetlands and Waters of the U.S. (WOUS) in accordance with the authorized U.S. Army Corps of Engineers (USACE) Section 404 Permit and the General Conditions of the current Nationwide Permit Program.

Materials. Materials shall be in accordance with the USACE Section 404 Permit and General Conditions of the current Nationwide Permit Program.

Construction Requirements. Construction shall be in accordance with Article 502.06(a) of the Standard Specifications for Road and Bridge Construction and in accordance with the authorized USACE Section 404 Permit**.** For Cofferdam - Type 1, it is anticipated the design will be based on the flow requirement as shown in the plans and per the General Conditions of the current Nationwide Permit Program.

The Contractor shall be responsible for diverting the water flow from the construction area using a method meeting the approval of the Engineer and in accordance with the authorized USACE Section 404 Permit and General Conditions of the current Nationwide Permit Program.

This project requires a USACE Section 404 Permit prior to the start of work. All conditions of the Section 404 Permit must be followed. As a condition of the Section 404 Permit, the Contractor will be required to submit an In-Stream/Wetland Work Plan to the Department for approval. The USACE defines and determines in-stream/wetland work within the WOUS.

Guidelines on acceptable In-Stream/Wetland work techniques can be found on the USACE website**:** https://www.lrc.usace.army.mil/Missions/Regulatory/Illinois/IL-Nationwide-Permits/

Method of Measurement. This work will be measured for payment in units of Each where Each is defined as a plan detailed stage of bridge, culvert or other construction for which a temporary in-stream cofferdam(s) is required. If staged construction is not detailed/specified on the plans, this work will be measured as a total of One Each.

Basis of Payment. This work will be paid for at the contract unit price per each for COFFERDAM (TYPE 1) (IN-STREAM/WETLAND WORK).

EMBANKMENT II (DISTRICT 1)
Effective: March 1, 2011
Revised: November 1, 2013

Description. This work shall be according to Section 205 of the Standard Specifications except for the following.

Material. Reclaimed asphalt shall not be used within the ground water table or as a fill if ground water is present. The RAP used shall be according to the current Bureau of Materials and Physical Research Policy Memorandum, "Reclaimed Asphalt Pavement (RAP) for Aggregate Applications". Gradation deleterious count shall not exceed 10% of total RAP and 5% of other by total weight.

CONSTRUCTION REQUIREMENTS

Samples. Embankment material shall be sampled and tested before use. The contractor shall identify embankment sources, and provide equipment as the Engineer requires, for the collection of samples from those sources. Samples will be furnished to the Geotechnical Engineer a minimum of three weeks prior to use in order that laboratory tests for compaction can be performed. Embankment material placement cannot begin until tests are completed.

Placing Material. In addition to Article 202.03, broken concrete, reclaimed asphalt with no expansive aggregate, or uncontaminated dirt and sand generated from construction or demolition activities shall be placed in 6 inches (150 mm) lifts and disked with the underlying lift until a uniform homogenous material is formed. This process also applies to the overlaying lifts. The disk must have a minimum blade diameter of 24 inches (600 mm).

When embankments are to be constructed on hillsides or existing slopes that are steeper than 3H:1V, steps shall be keyed into the existing slope by stepping and benching as shown in the plans or as directed by the Engineer.

Compaction. Soils classification for moisture content control will be determined by the Soils Inspector using visual field examination techniques and the IDH Textural Classification Chart.

When tested for density in place each lift shall have a maximum moisture content as follows.

a) A maximum of 110 percent of the optimum moisture for all forms of clay soils.

b) A maximum of 105 percent of the optimum moisture for all forms of clay loam soils.

Stability. The requirement for embankment stability in Article 205.04 will be measured with a Dynamic Cone Penetrometer (DCP) according to the test method in the IDOT Geotechnical Manual. The penetration rate must be equal or less than 1.5 inches (38 mm) per blow.

Basis of Payment. This work will not be paid separately but will be considered as included in the various items of excavation.

FRICTION AGGREGATE (DISTRICT 1)

Effective: January 1, 2011
Revised: December 1, 2021

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	Allowed Alone or in Combination [5/]: Gravel Crushed Gravel Carbonate Crushed Stone Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag Crushed Concrete
HMA Low ESAL	Stabilized Subbase or Shoulders	Allowed Alone or in Combination [5/]: 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-19.0 or IL-19.0L SMA Binder	Allowed Alone or in Combination [5/ 6/]: Crushed Gravel Carbonate Crushed Stone[2/] Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Concrete[3/]

<table>
<tr><th>Use</th><th>Mixture</th><th colspan="2">Aggregates Allowed</th></tr>
<tr><td>HMA
High ESAL
Low ESAL</td><td>C Surface and Binder
IL-9.5
IL-9.5FG
or IL-9.5L</td><td colspan="2"><u>Allowed Alone or in Combination</u> [5/]:

Crushed Gravel
Carbonate Crushed Stone[2/]
Crystalline Crushed Stone
Crushed Sandstone
Crushed Slag (ACBF)
Crushed Steel Slag[4/]
Crushed Concrete[3/]</td></tr>
<tr><td rowspan="5">HMA
High ESAL</td><td rowspan="5">D Surface and Binder
IL-9.5
or IL-9.5FG</td><td colspan="2"><u>Allowed Alone or in Combination</u> [5/]:

Crushed Gravel
Carbonate Crushed Stone (other than Limestone)[2/]
Crystalline Crushed Stone
Crushed Sandstone
Crushed Slag (ACBF)
Crushed Steel Slag[4/]</td></tr>
<tr><td colspan="2"><u>Other Combinations Allowed:</u></td></tr>
<tr><td>Up to...</td><td>With...</td></tr>
<tr><td>25% Limestone</td><td>Dolomite</td></tr>
<tr><td>50% Limestone</td><td>Any Mixture D aggregate other than Dolomite</td></tr>
<tr><td>75% Limestone</td><td>Crushed Slag (ACBF) or Crushed Sandstone</td></tr>
<tr><td rowspan="5">HMA
High ESAL</td><td rowspan="5">E Surface
IL-9.5

SMA
Ndesign 80
Surface</td><td colspan="2"><u>Allowed Alone or in Combination</u> [5/ 6/]:

Crushed Gravel
Crystalline Crushed Stone
Crushed Sandstone
Crushed Slag (ACBF)
Crushed Steel Slag

No Limestone.</td></tr>
<tr><td colspan="2"><u>Other Combinations Allowed:</u></td></tr>
<tr><td>Up to...</td><td>With...</td></tr>
<tr><td>50% Dolomite[2/]</td><td>Any Mixture E aggregate</td></tr>
</table>

Use	Mixture	Aggregates Allowed	
		75% Dolomite[2/]	Crushed Sandstone, Crushed Slag (ACBF), Crushed Steel Slag, or Crystalline Crushed Stone
		75% Crushed Gravel[2/]	Crushed Sandstone, Crystalline Crushed Stone, Crushed Slag (ACBF), or Crushed Steel Slag
HMA High ESAL	F Surface IL-9.5 SMA Ndesign 80 Surface	<u>Allowed Alone or in Combination</u> [5/ 6/]: Crystalline Crushed Stone Crushed Sandstone Crushed Slag (ACBF) Crushed Steel Slag No Limestone.	
		<u>Other Combinations Allowed</u>:	
		Up to...	*With...*
		50% Crushed Gravel[2/] or Dolomite[2/]	Crushed Sandstone, Crushed Slag (ACBF), Crushed Steel Slag, or Crystalline Crushed Stone

1/ Crushed steel slag allowed in shoulder surface only.
2/ Carbonate crushed stone (limestone) and/or crushed gravel shall not be used in SMA Ndesign 80.
3/ Crushed concrete will not be permitted in SMA mixes.
4/ Crushed steel slag shall not be used as binder.
5/ When combinations of aggregates are used, the blend percent measurements shall be by volume."
6/ Combining different types of aggregate will not be permitted in SMA Ndesign 80."

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (PROJECT SPECIFIC)

Description. This work shall consist of the removal and disposal of regulated substances according to Section 669 of the Standard Specifications as revised below.

Contract Specific Sites. The excavated soil and groundwater within the areas listed below shall be managed as either "uncontaminated soil", hazardous waste, special waste or non-special waste. For stationing, the lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit, whichever is less.

Soil Disposal Analysis. When the waste material requires sampling for landfill disposal acceptance, the Contractor shall secure a written list of the specific analytical parameters and analytical methods required by the landfill The Contractor shall collect and analyze the required number of samples for the parameters required by the landfill using the appropriate analytical procedures. A copy of the required parameters and analytical methods (from landfill email or on landfill letterhead) shall be provided as Attachment 4A of the BDE 2733 (Regulated Substances Final Construction Report). The price shall include all sampling materials and effort necessary for collection and management of the samples, including transportation of samples from the job site to the laboratory. The Contractor shall be responsible for determining the specific disposal facilities to be utilized; and collect and analyze any samples required for disposal facility acceptance using a NELAP certified analytical laboratory registered with the State of Illinois.

Site 1896V3-42: ROW, 0-100 blocks of N. Skokie Highway, Lake Bluff and Unincorporated Shields Township, Lake County

- Station 120+00 to Station 120+35 (IL 176), 0 to 20 feet RT and 0 to 35 feet LT. This material meets the criteria of Article 669.05(a)(1) and shall be managed in accordance to Article 669.05. Contaminants of concern sampling parameter: Manganese.
- Station 120+00 to Station 120+35 (IL 176), 35 to 80 feet LT. This material meets the criteria of Article 669.05(a)(2) and shall be managed in accordance to Article 669.05. Contaminants of concern sampling parameter: Manganese.

Site 1896V3-43: Rockland Plaza, 11-21 N. Skokie Highway, Lake Bluff and Unincorporated Shields Township, Lake County

- Station 120+35 to Station 121+80 (CL IL176), 0 to 80 feet LT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.
- Station 120+35 to Station 120+95 (CL IL176), 80 to 125 feet LT. This material meets the criteria of and shall be managed in accordance to Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.
- Station 120+95 to Station 121+35 (CL IL176), 80 to 125 feet LT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameter: Manganese.
- Station 121+35 to Station 121+90 (CL IL176), 80 to 125 feet LT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.

Site 1896V3-57: Mariani Landscape, 300 Rockland Road, Lake Bluff, Lake County

- Station 132+55 to Station 132+90 (CL IL176), 0 to 120 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameter: Manganese.
- Station 132+90 to Station 133+90 (CL IL176), 0 to 120 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.
- Station 133+90 to Station 134+90 (CL IL176), 0 to 110 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic, Lead, and Manganese.
- Station 135+85 to Station 136+70 (CL IL176), 0 to 110 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Arsenic, and Manganese.
- Station 136+70 to Station 137+50 (CL IL176), 0 to 110 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.

Site 1896V3-58: Commonwealth Edison Transformer Yard, 675 Rockland Road, Lake Bluff, Cook County

- Station 128+75 to Station 129+85 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Arsenic, and Manganese.
- Station 129+85 to Station 130+85 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameter: Manganese.
- Station 130+85 to Station 131+90 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Arsenic, and Manganese.
- Station 131+90 to Station 132+55 (CL IL176), 0 to 80 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(1). Contaminants of concern sampling parameter: Manganese.

Site 1896V3-59: Knauz Corporate Headquarters and Hyundai, 775 Rockland Road, Lake Bluff, Cook County

- Station 124+70 to Station 127+65 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameters: Arsenic, and Manganese.
- Station 127+65 to Station 128+75 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(5). Contaminants of concern sampling parameters: Arsenic, and Manganese.

At the Knauz Corporate Headquarters and Hyundai Dealership property, Arsenic was detected at concentrations exceeding the TACO Tier 1 soil remediation objectives for the Construction Worker exposure route in soil boring 1896V2-59-B04, from the sample interval 0 to 7 feet deep, as noted in the Final Preliminary Site Investigation Report for this project, submitted July 24, 2024 by Andrews Engineering, Inc. Procedures shall be implemented to protect site workers and observers from hazards encountered during construction activities in locations containing contaminated materials, pursuant to Article 669 of the Standard Specifications for Road and Bridge Construction manual.

Engineered Barrier. An engineered barrier shall be installed in storm sewer trenches to limit the exposure and control the migration of contamination from the contaminated soil that remains within the trench excavation. It shall be placed beneath the trench backfill material at the following locations:

- Station 127+65 to Station 128+75 (CL IL 176), 35 feet RT to 55 feet RT at a depth from 0 to 7 feet bgs (Knauz Corporate Headquarters and Hyundai Dealership, PESA Site 1896V3-59) – non-special waste. Contaminants of concern sampling parameter: Arsenic.

The engineered barrier shall consist of a geosynthetic clay liner system, geomembrane liner, or equivalent material as approved by the Engineer. A geosynthetic clay liner shall be composed of a bentonite clay liner approximately 0.25 inches thick. The engineered barrier shall have a permeability of less than 10^{-7} cm/sec. Installation of the geosynthetic clay liner system shall be in accordance with the manufacturer's recommendations except that all laps shall face down-slope.

The geomembrane liner shall have a minimum thickness of 30 mils. The geomembrane liner shall line the entire trench and installed in accordance with the manufacturer's recommendations.

No equipment will be allowed on the engineered barrier until it is covered by a minimum of 1 foot of backfill. Any damage to the engineered barrier caused by the Contractor shall be repaired at no additional expense to the Department in accordance with the manufacturer's recommendations and as directed by the Engineer.

Method of Measurement: The engineered barrier will be measured for payment in place and the area computed in square yards.

Basis of Payment: The engineered barrier will be paid for at the contract unit price per square yard for ENGINEERED BARRIER.

Site 1896V3-60: Knauz Mercedes Dealership, 409 Skokie Highway, Lake Bluff, Lake County

- Station 121+95 to Station 122+70 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 665.05(a)(2). Contaminants of concern sampling parameter: Manganese.
- Station 122+70 to Station 123+65 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 665.05(a)(5). Contaminants of concern sampling parameters: Arsenic, and Manganese.
- Station 123+65 to Station 124+70 (CL IL176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 665.05(a)(2). Contaminants of concern sampling parameter: Manganese.

Site 1896V3-61: IDOT Pump Station #37, 437 Skokie Highway, Lake Bluff, Lake County

- Station 120+35 to Station 121+95 (CL IL 176), 0 to 85 feet RT. This material meets the criteria of and shall be managed in accordance with Article 669.05(a)(2). Contaminants of concern sampling parameter: Manganese.

Work Zones

Three distinct OSHA HAZWOPER work zones (exclusion, decontamination, and support) shall apply to projects adjacent to or within sites with documented leaking underground storage tank (LUST) incidents, or sites under management in accordance with the requirements of the Site Remediation Program (SRP), Resource Conservation and Recovery Act (RCRA), or Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or as deemed necessary. For this project, the work zones apply for the following ISGS PESA Sites**:**
None

HOT-MIX ASPHALT – MIXTURE DESIGN VERIFICATION AND PRODUCTION (D1)

Effective: January 1, 2019
Revised: December 1, 2021

Add to Article 1030.05 (d)(3) of the Standard Specifications to read:

" During mixture design, prepared samples shall be submitted to the District laboratory by the Contractor for verification testing. The required testing, and number and size of prepared samples submitted, shall be according to the following tables.

High ESAL – Required Samples for Verification Testing	
Mixture	Hamburg Wheel and I-FIT Testing [1/ 2/]
Binder	total of 3 - 160 mm tall bricks
Surface	total of 4 - 160 mm tall bricks

Low ESAL – Required Samples for Verification Testing	
Mixture	I-FIT Testing [1/ 2/]
Binder	1 - 160 mm tall brick
Surface	2 - 160 mm tall bricks

1/ The compacted gyratory bricks for Hamburg wheel and I-FIT testing shall be 7.5 ± 0.5 percent air voids.

2/ If the Contractor does not possess the equipment to prepare the 160 mm tall brick(s), twice as many 115 mm tall compacted gyratory bricks will be acceptable.

Revise the fourth paragraph of Article 1030.10 of the Standard Specifications to read:

"When a test strip is not required, each HMA mixture shall still be sampled on the first day of production: I-FIT and Hamburg wheel testing for High ESAL; I-FIT testing for Low ESAL. Within two working days after sampling the mixture, the Contractor shall deliver gyratory cylinders to the District laboratory for Department verification testing. The High ESAL mixture test results shall meet the requirements of Articles 1030.05(d)(3) and 1030.05(d)(4). The Low ESAL mixture test results shall meet the requirements of Article 1030.05(d)(4). The required number and size of prepared samples submitted for the Hamburg wheel and I-FIT testing shall be according to the "High ESAL - Required Samples for Verification Testing" table in Article 1030.05(d)(3) above."

Add the following to the end of Article 1030.10 of the Standard Specifications to read:

"Mixture sampled during first day of production shall include approximately 60 lb (27 kg) of additional material for the Department to conduct Hamburg wheel testing and approximately 80 lb (36 kg) of additional material for the Department to conduct I-FIT testing. Within two working days after sampling, the Contractor shall deliver prepared samples to the District laboratory for verification testing. The required number and size of prepared samples submitted for the Hamburg wheel and I-FIT testing shall be according to the "High ESAL - Required Samples for Verification Testing" table in Article 1030.05(d)(3) above."

HMA BINDER AND SURFACE COURSE (DISTRICT 1) 12/01/2021
Effective: November 1, 2019
Revised: December 1, 2021

Revise Article 1004.03(c) to read:

"(c) Gradation. The coarse aggregate gradations shall be as listed in the following table.

Use	Size/Application	Gradation No.
Class A-1, A-2, & A-3	3/8 in. (10 mm) Seal	CA 16 or CA 20
Class A-1	1/2 in. (13 mm) Seal	CA 15
Class A-2 & A-3	Cover Coat	CA 14
HMA High ESAL	IL-19.0; Stabilized Subbase IL-19.0	CA 11 1/
	SMA 12.5 2/	CA 13 4/, CA 14, or CA 16
	SMA 9.5 2/	CA 13 3/4/ or CA 16 3/
	IL-9.5	CA 16, CM 13 4/
	IL-9.5FG	CA 16
HMA Low ESAL	IL-19.0L	CA 11 1/
	IL-9.5L	CA 16

1/ CA 16 or CA 13 may be blended with the CA 11.

2/ The coarse aggregates used shall be capable of being combined with the fine aggregates and mineral filler to meet the approved mix design and the mix requirements noted herein.

3/ The specified coarse aggregate gradations may be blended.

4/ CA 13 shall be 100 percent passing the 1/2 in. (12.5mm) sieve."

Revise Article 1004.03(e) of the Supplemental Specifications to read:

"(e) Absorption. For SMA the coarse aggregate shall also have water absorption ≤ 2.0 percent."

Revise the "High ESAL" portion of the table in Article 1030.01 to read:

"High ESAL	Binder Courses	IL-19.0, IL-9.5, IL-9.5FG, IL-4.75, SMA 12.5, Stabilized Subbase IL-19.0
	Surface Courses	IL-9.5, IL-9.5FG, SMA 12.5, SMA 9.5"

Revise Note 2. and add Note 6 to Article 1030.02 of the Standard Specifications to read:

"Item	Article/Section
(g) Performance Graded Asphalt Binder (Note 6)	1032
(h) Fibers (Note 2)	

Note 2. A stabilizing additive such as cellulose or mineral fiber shall be added to the SMA mixture according to Illinois Modified AASHTO M 325. The stabilizing additive shall meet the Fiber Quality Requirements listed in Illinois Modified AASHTO M 325. Prior to approval and use of fibers, the Contractor shall submit a notarized certification by the producer of these materials stating they meet these requirements. Reclaimed Asphalt Shingles (RAS) may be used in Stone Matrix Asphalt (SMA) mixtures designed with an SBA polymer modifier as a fiber additive if the mix design with RAS included meets AASHTO T305 requirements. The RAS shall be from a certified source that produces either Type I or Type 2. Material shall meet requirements noted herein and the actual dosage rate will be determined by the Engineer.

Note 6. The asphalt binder shall be an SBS PG 76-28 when the SMA is used on a full-depth asphalt pavement and SBS PG 76-22 when used as an overlay, except where modified herein. The asphalt binder shall be a SBS PG 76-22 for IL-4.75, except where modified herein.."

Revise table in Article 1030.05(a) of the Standard Specifications to read:

"MIXTURE COMPOSITION (% PASSING) [1/]												
Sieve Size	IL-19.0 mm		SMA 12.5		SMA 9.5		IL-9.5mm		IL-9.5FG		IL-4.75 mm	
	min	max	min	max	min	max	min	max	min	max	min	max
1 1/2 in (37.5 mm)												
1 in. (25 mm)		100										
3/4 in. (19 mm)	90	100		100								
1/2 in. (12.5 mm)	75	89	80	100		100		100		100		100
3/8 in. (9.5 mm)				65	90	100	90	100	90	100		100
#4 (4.75 mm)	40	60	20	30	36	50	34	69	60	75[6/]	90	100
#8 (2.36 mm)	20	42	16	24 [4/]	16	32[4/]	34 [5/]	52 [2/]	45	60[6/]	70	90
#16 (1.18 mm)	15	30					10	32	25	40	50	65
#30 (600 μm)			12	16	12	18			15	30		
#50 (300 μm)	6	15					4	15	8	15	15	30
#100 (150 μm)	4	9					3	10	6	10	10	18
#200 (75 μm)	3.0	6.0	7.0	9.0 [3/]	7.5	9.5 [3/]	4.0	6.0	4.0	6.5	7.0	9.0 [3/]
#635 (20 μm)			≤ 3.0		≤ 3.0							
Ratio Dust/Asphalt Binder		1.0		1.5		1.5		1.0		1.0		1.0

1/ Based on percent of total aggregate weight.

2/ The mixture composition shall not exceed 44 percent passing the #8 (2.36 mm) sieve for surface courses with Ndesign = 90.

3/ Additional minus No. 200 (0.075 mm) material required by the mix design shall be mineral filler, unless otherwise approved by the Engineer.

4/ When establishing the Adjusted Job Mix Formula (AJMF) the percent passing the #8 (2.36 mm) sieve shall not be adjusted above the percentage stated on the table.

5/ When establishing the Adjusted Job Mix Formula (AJMF) the percent passing the #8 (2.36 mm) sieve shall not be adjusted below 34 percent.
6/ When the mixture is used as a binder, the maximum shall be increased by 0.5 percent passing."

Revise Article 1030.05(b) of the Standard Specifications to read:

(b) Volumetric Requirements. The target value for the air voids of the HMA shall be 4.0 percent, for IL-4.75 and SMA mixtures it shall be 3.5 percent and for Stabilized Subbase it shall be 3.0 percent at the design number of gyrations. The voids in the mineral aggregate (VMA) and voids filled with asphalt binder (VFA) of the HMA design shall be based on the nominal maximum size of the aggregate in the mix and shall conform to the following requirements.

	Voids in the Mineral Aggregate (VMA), % Minimum for Ndesign				
Mix Design	30	50	70	80	90
IL-19.0		13.5	13.5		13.5
IL-9.5		15.0	15.0		
IL-9.5FG		15.0	15.0		
IL-4.75[1/]		18.5			
SMA-12.5[1/2/5/]				17.0[3/]/16.0[4/]	
SMA-9.5[1/2/5/]				17.0[3/]/16.0[4/]	
IL-19.0L	13.5				
IL-9.5L	15.0				

1/ Maximum draindown shall be 0.3 percent according to Illinois Modified AASHTO T 305.

2/ The draindown shall be determined at the JMF asphalt binder content at the mixing temperature plus 30°F.

3/ Applies when specific gravity of coarse aggregate is ≥ 2.760.

4/ Applies when specific gravity of coarse aggregate is < 2.760.

5/ For surface course, the coarse aggregate can be crushed steel slag, crystalline crushed stone or crushed sandstone. For binder course, coarse aggregate shall be crushed stone (dolomite), crushed gravel, crystalline crushed stone, or crushed sandstone"

Revise the last paragraph of Article 1102.01 (a) (5) of the Standard Specifications to read:

"IL-4.75 and Stone Matrix Asphalt (SMA) mixtures which contain aggregate having absorptions greater than or equal to 2.0 percent, or which contain steal slag sand, shall have minimum surge bin storage plus haul time of 1.5 hours."

Add after third sentence of Article 1030.09(b) to read:

"If the Contractor and Engineer agree the nuclear density test method is not appropriate for the mixture, cores shall be taken at random locations determined according to the QC/QA document "Determination of Random Density Test Site Locations". Core densities shall be determined using the Illinois Modified AASHTO T 166 or T 275 procedure."

Revise Table 1 and Note 4/ of Table 1 in Article 406.07(a) of the Standard Specifications to read:

	Breakdown/Intermediate Roller (one of the following)	Final Roller (one or more of the following)	Density Requirement
IL-9.5, IL-9.5FG, IL-19.0 1/	V_D, P , T_B, 3W, O_T, O_B	V_S, T_B, T_F, O_T	As specified in Section 1030
IL-4.75 and SMA 3/ 4/	T_B, 3W, O_T	T_F, 3W	As specified in Section 1030
Mixtures on Bridge Decks 2/	T_B	T_F	As specified in Articles 582.05 and 582.06.

"4/ The Contractor shall provide a minimum of two steel-wheeled tandem rollers (T_B), and/or three-wheel (3W) rollers for breakdown, except one of the (T_B) or (3W) rollers shall be 84 inches (2.14 m) wide and a weight of 315 pound per linear inch (PLI) (5.63 kg/mm) and one of the (T_B) or (3W) rollers can be substituted for an oscillatory roller (O_T). T_F rollers shall be a minimum of 280 lb/in. (50 N/mm). The 3W and T_B rollers shall be operated at a uniform speed not to exceed 3 mph (5 km/h), with the drive roll for T_B rollers nearest the paver and maintain an effective rolling distance of not more than 150 ft (45 m) behind the paver."

Add the following after the fourth paragraph of Article 406.13 (b):

"The plan quantities of SMA mixtures shall be adjusted using the actual approved binder and surface Mix Design's G_{mb}."

Revise first paragraph of Article 1030.10 of the Standard Specifications to read:

"A test strip of 300 ton (275 metric tons), except for SMA mixtures it will be 400 ton (363 metric ton), will be required for each mixture on each contract at the beginning of HMA production for each construction year according to the Manual of Test Procedures for Materials "Hot Mix Asphalt Test Strip Procedures". At the request of the Producer, the Engineer may waive the test strip if previous construction during the current construction year has demonstrated the constructability of the mix using Department test results."

Revise third paragraph of Article 1030.10 of the Standard Specifications to read:

"When a test strip is constructed, the Contractor shall collect and split the mixture according to the document "Hot-Mix Asphalt Test Strip Procedures". The Engineer, or a representative, shall deliver split sample to the District Laboratory for verification testing. The Contractor shall complete mixture tests stated in Article 1030.09(a). Mixture sampled shall include enough material for the Department to conduct mixture tests detailed in Article 1030.09(a) and in the document "Hot-Mix Asphalt Mixture Design Verification Procedure" Section 3.3. The mixture test results shall meet the requirements of Articles 1030.05(b) and 1030.05(d), except Hamburg wheel tests will only be conducted on High ESAL mixtures during production."

LIGHTWEIGHT CELLULAR CONCRETE FILL (DISTRICT 1
Effective: November 11, 2001
Revised: June 18, 2018

General: This work consists of providing lightweight cellular concrete fill (LCCF) at the locations(s) and according to the dimensions shown in the contract plans, and as directed by the Engineer.

Submittals: Within 45 calendar days prior to proposed installation, the Contractor shall submit the following:

(a) The name of the subcontractor providing and installing the light weight cellular fill. The Contractor shall present an organization chart including names, telephone numbers, current certifications and/ or titles, and roles and responsibilities of all those involved in the manufacturing and installation of the lightweight cellular fill.

(b) Manufacturer's specifications, catalog cuts, and other product data needed to demonstrate compliance with specified requirements. These shall include reports and test results from laboratories.

(c) The subcontractor installing the lightweight fill shall be certified in writing by the Manufacturer of the lightweight fill. The certified applicator shall be regularly engaged in the placement of lightweight fill of a similar nature including the completion of mass fills having a minimum of 13,000 cu yd (9,950 cu m) in the past five years.

(d) A description of the proposed installation procedure. The procedure shall address the following.

(1) Proposed construction sequence and schedule.

(2) Location of the equipment and batching areas.

(3) Type of equipment and tools to be used.

Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Portland Cement (Note 1)	1001
(b)	Water	1002
(c)	Fine Aggregate	1003
(d)	Concrete Admixtures	1021
(e)	Foaming Agent (Note 2)	

Note 1. Pozzolans and finely divided minerals will not be permitted.

Note 2. The foaming agent shall be according to ASTM C 869, and shall be listed on the Department's Approved/Qualified Product List of Foaming Agents for Cellular Concrete. The manufacturer shall provide an infrared spectrophotometer trace no more than five years old. When the infrared spectrophotometer trace is more than seven years old, a new one shall be provided.

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)	Mobile Portland Cement Concrete Plants	1103.04
(f)	Foam Generator (Notes 1 & 3)	
(g)	Mobile Site Batch Plant (Notes 2 & 3)	

Note 1. Foam generating equipment shall be calibrated daily to produce an accurate volume of foam.

Note 2. Mobile site batch plants shall be capable of mixing and pumping cellular concrete, and shall have a minimum 1 cu yd (0.76 cu m) capacity. Mobile site plants shall be calibrated before the start of the project, and then during the project as determined by the Engineer.

Note 3. Foam generators and mobile site batch plants shall be certified in writing by the manufacturer of the lightweight cellular concrete and approved by the Engineer.

Lightweight Cellular Concrete Classes. The four general classes of lightweight cellular concrete delineated by as-cast density and minimum compressive strength are given in Table 1. If the class of lightweight cellular concrete is not specified in the contract, the class to use shall be as directed by the Engineer.

Table 1. CLASSES OF LIGHTWEIGHT CELLULAR CONCRETE

Class	Maximum Lift Height ft (m)	As-Cast Density lb/cu ft (kg/cu m)	Minimum Compressive Strength Psi (kPa) Days	
			7	28
I	4 (1.2)	24 - 32 (384 - 513)	30 (205)	40 (275)
II	4 (1.2)	30 - 38 (481 - 609)	60 (415)	80 (550)
III	2.5 (0.76)	36 - 44 (577 - 705)	90 (620)	120 (825)
IV	2.5 (0.76)	44 - 52 (705 - 833)	115 (795)	150 (1035)

Other Lightweight Cellular Concrete Criteria. The lightweight cellular concrete shall be according to the following.

(a) Proportioning and Mix Design. For all Classes of lightweight cellular concrete, it shall be the Contractor's responsibility to determine the mix design material proportions and to proportion each batch. The Contractor shall provide the mix designs a minimum of 45 calendar days prior to production. The Engineer will verify the mix design submitted by the Contractor.

For a new mix design to be verified, the Engineer will require the Contractor to provide a trial batch at no cost to the Department. The trial batch shall be scheduled a minimum of 30 calendar days prior to anticipated use and shall be performed in the presence of the Engineer. A minimum of 1 cu yd (0.75 cu m) trial batch shall be produced and placed offsite. The trial batch shall be produced with the equipment, materials, and methods intended for construction. The trial batch will be evaluated and tested by the Contractor and Engineer via split samples for as-cast density and compressive strength according to the sampling and testing requirements specified herein. The lightweight cellular concrete will also be evaluated and tested by the Engineer according to Illinois Test Procedure 501, as applicable.

Verification of the mix design will include trial batch test results and other criteria as determined by the Engineer. The Contractor will be notified in writing of verification. Verification of a mix design shall in no manner be construed as acceptance of any mixture produced. Tests performed at the jobsite will determine if a mix design can meet specifications.

(b) Admixtures. Admixture use shall be according to Article 1020.05(b).

(c) Temperature. The air temperature at the time of placement and for 24 hours thereafter shall be a minimum of 35 °F (2 °C). The temperature of the lightweight cellular concrete at point of discharge shall be a minimum of 45 °F (7 °C) and a maximum of 95 °F (35 °C).

Curing. Curing may be required for applications with significant surface area exposed (least width dimension of minimum 80 ft (24 m)) to the elements if rapid drying conditions are expected during placement, as determined by the Engineer. When curing is required, each lift shall be cured with a method recommended by the manufacturer of the lightweight cellular concrete. If curing compound is used, it shall be compatible with other construction materials it may interact with, and shall not inhibit bond of subsequent lifts.

Quality Control Sampling and Testing by the Contractor. The Contractor shall sample and test the lightweight cellular concrete as follows:

(a) As-Cast Density. The first batch placed each day and a minimum rate of one per hour thereafter shall be sampled and tested as described for “experimental density of the concrete after pumping” according to ASTM C 796, except the hose length shall be that used for jobsite placement. The as-cast density shall be the average of at least two tests. Additional tests shall be done if adjustments are made to the materials. These tests shall be documented.

If the average as-cast density is outside the specified tolerance from Table 1, the Contractor shall reject the batch or make an adjustment to the mix before placement. Adjustments to the mix shall be accomplished by either increasing or decreasing the foam only.

(b) Compressive Strength. First batch placed each day and every 200 cu yd (155 cu m) thereafter shall be sampled according to ASTM C 495, except that samples shall not be oven dried at any time before testing. The minimum number of batches sampled per day shall be two. Eight 3 in. x 6 in. (75 mm x 150 mm) cylindrical test specimens shall be molded from each sample.

A compressive strength test is defined as the average of four cylinder breaks. For each sample, tests shall be conducted at 7 and 28 days.

Quality Assurance Sampling and Testing by the Engineer. The Engineer will sample and test the lightweight cellular concrete for quality assurance on independent 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. Any failing strength test 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 for placement or acceptance will be as follows:

(a) As-Cast Density. One independent or split sample test for the first batch placed each day and as determined by the Engineer thereafter.

(b) Compressive Strength. One independent or split sample for the first batch placed each day and as determined by the Engineer thereafter.

Comparing Test Results. Differences between the Engineer's and the Contractor's split sample test results will be considered reasonable if within the following limits.

Test Parameter	Acceptable Limits of Precision
Compressive Strength	5 psi (34.5 kPa)
Density	1 lb/cu ft (16 kg/cu m)

Action shall be taken when either the Engineer's or the Contractor's test results are not within specification limits for strength or density. Action may include, but is not limited to, the Contractor being required to replace or repair test equipment as determined by the Engineer.

Placed material that fails in compressive strength will be considered unacceptable.

Acceptance by the Engineer. Final acceptance will be based on the Standard Specifications and the following:

(a) Validation of Contractor quality control 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.

(b) 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 lightweight cellular concrete. The decision will be determined according to (a) or (b).

Installation. Prior to installation, the ground surface shall be cleared of organic top soils, debris, sharp objects, and trees. Tree stumps shall be either removed or cut to the level of the ground surface. All wheel tracks or ruts in excess of 3 in. (75 mm) in depth shall be graded smooth or otherwise filled with soil to provide a reasonable smooth surface.

If a geotechnical fabric for ground stabilization or geomembrane is specified in conjunction with the LCCF, it shall be furnished and installed as specified elsewhere in the Contract and shall be in place prior to placing the LCCF.

The lightweight cellular concrete fill shall be placed according to the approved installation procedures provided by the manufacturer.

There shall be no standing water in the area to be filled. If necessary, dewatering shall be continuous during the time the lightweight cellular concrete fill is constructed. Lightweight cellular concrete fill shall not be placed during or when periods of precipitation are expected unless placed in an enclosed, covered area and the ground water is diverted away from the LCCF.

If any items are to be encased in the fill, the items shall be set to the final location both horizontally and vertically prior to installation of the LCCF.

Mixing and placement of the LCCF shall be done as follows:

(a) After mixing, the materials shall be promptly placed in the final location.

(b) No mechanical vibration of the LCCF shall be permitted.

(c) The material shall be placed to prevent segregation. Intermediate lifts shall be placed horizontal while only the top lift shall be sloped to grade. The final surface elevation of the lightweight cellular concrete fill shall be within ±1.5 inches (±38 mm) of the plan elevation.

(d) Limit the area of placement to the volume that can be placed within 1 hour, up to the maximum lift height. Stagger placements such that the vertical joints are at least 10 ft (3 m) apart.

(e) The cellular concrete shall be placed with a hose. The discharge hose length shall not exceed 800 ft (244 m) in length. Discharge from the hose shall not be allowed to flow more than 30 ft (9 m) from where it is deposited to its final position.

(f) Heavy construction equipment or other unusual loading of the lightweight cellular concrete fill shall not be permitted.

(g) Construction activities on any recently placed lift will not be permitted until at least 12 hours has elapsed and a minimum compressive strength of 8 psi (50 kPa) has been achieved. However, if any work on the recently placed LCCF results in cracking or indentations of more than an 0.125 inch (3 mm), the contractor shall discontinue construction, revise their wait time, mix strength or equipment used and submit to the Engineer for approval.

(h) Sawing or ripping of the lightweight cellular concrete fill for utilities, drains or other conflicts will be by methods approved by the Engineer and lightweight cellular concrete fill Manufacturer.

Method of Measurement. Lightweight cellular fill shall be measured for payment in cubic yards (cubic meters) according to Article 202.07.

Basis of Payment. This work will be paid for at the contract unit price per cubic yards (cubic meter) for LIGHTWEIGHT CELLULAR CONCRETE FILL.

TEMPORARY PAVEMENT (DISTRICT 1)
Effective: March 1, 2003
Revised: April 10, 2008

Description. This work shall consist of constructing a temporary pavement at the locations shown on the plans or as directed by the engineer.

The contractor shall use either Portland cement concrete according to Sections 353 and 354 of the Standard Specifications or HMA according to Sections 355, 356, 406 of the Standard Specifications, and other applicable HMA special provisions as contained herein. The HMA mixtures to be used shall be specified in the plans. The thickness of the Temporary Pavement shall be as described in the plans. The contractor shall have the option of constructing either material type if both Portland cement concrete and HMA are shown in the plans.

Articles 355.08 and 406.11 of the Standard Specifications shall not apply.

The removal of the Temporary Pavement, if required, shall conform to Section 440 of the Standard Specification.

Method of Measurement. Temporary pavement will be measured in place and the area computed in square yards (square meters).

Basis of Payment. This work will be paid for at the contract unit price per square yard (square meter) for TEMPORARY PAVEMENT and TEMPORARY PAVEMENT (INTERSTATE).

Removal of temporary pavement will be paid for at the contract unit price per square yard (square meter) for PAVEMENT REMOVAL.

TEMPORARY INFORMATION SIGNING
Effective: November 13, 1996
Revised: January 29, 2020

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:

	Item	Article/Section
a.)	Sign Base (Note 1)	1090
b.)	Sign Face (Note 2)	1091
c.)	Sign Legends	1091
d.)	Sign Supports	1093
e.)	Overlay Panels (Note 3)	1090.02

Note 1. The Contractor may use 5/8 inch (16 mm) instead of 3/4 inch (19 mm) thick plywood.
Note 2. The sign face material shall be in accordance with the Department's Fabrication of Highway Signs Policy.
Note 3. 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 bridges, sign structures or sign panels shall be approved by the Engineer. Any damage to the existing signs and/or structures due to the Contractor's operations shall be repaired or signs replaced, as determined by the Engineer, at the Contractor's expense.

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.

KEEPING ARTERIAL ROADWAYS OPEN TO TRAFFIC (LANE CLOSURES ONLY)
Effective: January 22, 2003
Revised: August 10, 2017

The Contractor shall provide the necessary traffic control devices to warn the public and to delineate the work zone as required in these Special Provisions, the Standard Specifications, the State Standards, and the District Details.

Arterial lane closures shall be in accordance with the Standard Specifications, Highway Standards, District Details, and the direction of the Engineer. The Contractor shall request and gain approval from the Engineer seventy–two (72) hours in advance of all long-term (24 hrs. or longer) lane closures.

Arterial lane closures not shown in the staging plans will not be permitted during **peak traffic volume hours**.

Peak traffic volume hours are defined as weekdays (Monday through Friday) from 6:00 AM to 8:30 AM and 4:30 PM to 6:00 PM.

Private vehicles shall not be parked in the work zone. Contractor's equipment and/or vehicles shall not be parked on the shoulders or in the median during non-working hours. The parking of equipment and/or vehicles on State right-of-way will only be permitted at locations approved by the Engineer in accordance with Articles 701.08 and 701.11 of the Standard Specifications.

Should the Contractor fail to completely open and keep open all the traffic lanes to traffic in accordance with the limitations specified above, the Contractor shall be liable to the Department for the amount of:

One lane or ramp blocked = $1,500

Two lanes blocked = $3,000

Not as a penalty but as liquidated and ascertained damages for each and every 15 minute interval or a portion thereof that a lane is blocked outside the allowable time limitations. Such damages may be deducted by the Department from any monies due the Contractor. These damages shall apply during the contract time and during any extensions of the contract time.

TRAFFIC CONTROL FOR WORK ZONE AREAS
Effective: September 14, 1995
Revised: January 1, 2007

Work zone entry and exit openings shall be established daily by the Contractor with the approval of the Engineer. All vehicles including cars and pickup trucks shall exit the work zone at the exit openings. All trucks shall enter the work zone at the entry openings. These openings shall be signed in accordance with the details shown elsewhere in the plans and shall be under flagger control during working hours.

The Contractor shall plan his trucking operations into and out of the work zone as well as on to and off the expressway to maintain adequate merging distance. Merging distances to cross all lanes of traffic shall be no less than 1/2 mile. This distance is the length from where the trucks enter the expressway to where the trucks enter the work zone. It is also the length from where the trucks exit the work zone to where the trucks exit the expressway. The stopping of expressway traffic to allow trucks to change lanes and/or cross the expressway is prohibited.

Failure to comply with the above requirements will result in a Traffic Control Deficiency charge. The deficiency charge will be calculated as outlined in Article 105.03 of the Standard Specifications. The Contractor will be assessed this daily charge for each day a deficiency is documented by the Engineer.

TRAFFIC SIGNAL GENERAL REQUIREMENTS
Effective: May 22, 2002
Revised: March 1, 2024
800.01TS

These Traffic Signal Special Provisions and the "District One Standard Traffic Signal Design Details" supplement the requirements of the State of Illinois "Standard Specifications for Road and Bridge Construction." The intent of these Special Provisions is to prescribe the materials and construction methods commonly used for traffic signal installations.

All material furnished shall be new unless otherwise noted herein. Traffic signal construction and maintenance work shall be performed by personnel holding current International Municipal Signal Association (IMSA)/Illinois Public Service Institute (IPSI) Traffic Signal Technician Level II certification. A copy of the certification shall be immediately available upon request of the Engineer. The work to be done under the Contract consists of furnishing, installing, and maintaining all traffic signal work and items as specified in the plans and as specified herein in a manner acceptable and approved by the Engineer.

Definitions of Terms.
Add the following to Section 101 of the Standard Specifications:

101.56 Manufacturer. Company that sells a particular type of product directly to the Contractor or the Vendor.

101.57 Vendor. Company that supplies, represents, and provides technical support for IDOT District One approved traffic signal controllers and other related equipment. The Vendor shall be located within IDOT District One and shall:

(1) Be full service with on-site facilities to assemble, test and troubleshoot traffic signal controllers and cabinet assemblies.

(2) Maintain an inventory of IDOT District One approved controllers and cabinets.

(3) Be staffed with permanent sales and technical personnel able to provide traffic signal controller and cabinet expertise and support.

(4) Have technical staff that hold current IMSA/IPSI Traffic Signal Technician Level III certification and shall attend traffic signal turn-ons as well as cabinet and/or controller modifications.

Submittals.
Revise Article 801.05 of the Standard Specifications to read:

"All material approval requests shall be submitted electronically following District guidelines unless directed otherwise by the Engineer. Submittal requirements shall include, but not limited to the following:

(1) All material approval requests shall be made prior to or no later than the date of the preconstruction meeting. A list of major traffic signal items can be found in Article 801.05. Material or equipment which is similar or identical shall be the product of the same manufacturer, unless necessary for system continuity. Traffic signal materials and equipment shall bear the U.L. label whenever such labeling is available.

(2) Product data and shop drawings shall be assembled by pay item. Only the top sheet of each pay item submittal will be stamped by the Department with the review status, except shop drawings for mast arm pole assemblies and the like will be stamped with the review status on each sheet.

(3) Original manufacturer published product data and shop drawing sheets with legible dimensions and details shall be submitted for review.

(4) When hard copy submittals are necessary, four (4) complete copies of the manufacturer's descriptive literatures and technical data for the traffic signal materials shall be submitted. For hard copy or electronic submittals, the descriptive literature and technical data shall be adequate for determining whether the materials meet the requirements of the plans and specifications. If the literature contains more than one item, the Contractor shall indicate which item or items will be furnished.

(5) When hard copy submittals are necessary for structural elements, four (4) complete copies of the shop drawings for the mast arm assemblies and poles, and the combination mast arm assemblies and poles showing, in detail, the fabrication thereof and the certified mill analyses of the materials used in the fabrication, anchor rods, and reinforcing materials shall be submitted.

(6) Partial or incomplete submittals will be returned without review.

(7) Certain non-standard mast arm poles and special structural elements will require additional review from IDOT's Central Office. Examples include ornamental/decorative, non-standard length mast arm pole assemblies and monotube structures.

(8) The Contract number or Permit number, project location/limits, and corresponding pay code number must be on each sheet of correspondence, material approval, and mast arm poles and assemblies drawings.

(9) Where certifications and/or warranties are specified, the information submitted for approval shall include certifications and warranties. Certifications involving inspections and/or tests of material shall be complete with all test data, dates, and times.

(10) After the Engineer reviews the submittals for conformance with the design concept of the project, the Engineer will stamp the drawings indicating their status as 'Approved', 'Approved-As-Noted', 'Disapproved', or 'Incomplete'. Since the Engineer's review is for conformance with the design concept only, it is the Contractor's responsibility to coordinate the various items into a working system as specified. The Contractor shall not be relieved from responsibility for errors or omissions in the shop, working, layout drawings, or other documents by the Department's approval thereof. The Contractor must still be in full compliance with Contract and specification requirements.

(11) The Contractor shall secure approved materials in a timely manner to assure construction schedules are not delayed.

(12) All submitted items reviewed and marked 'APPROVED AS NOTED', 'DISAPPROVED', or 'INCOMPLETE' are to be resubmitted in their entirety, unless otherwise indicated within the submittal comments, with a disposition of previous comments to verify Contract compliance at no additional cost to the Contract.

(13) 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 to the Engineer. In general, substitutions will not be acceptable. Requests for substitutions must demonstrate that the proposed substitution is superior to the material or equipment required by the Contract Documents. No exceptions, deviations or substitutions will be permitted without the approval of the Engineer.

(14) The Contractor shall not order major equipment such as mast arm assemblies prior to Engineer approval of the Contractor marked proposed traffic signal equipment locations to assure proper placement of Contract required traffic signal displays, push buttons and other facilities. Field adjustments may require changes in proposed mast arm length and other coordination.

(15) Revised cabinet wiring diagrams shall be submitted whenever any wiring modifications are made to the traffic signal cabinet."

Marking Proposed Locations.
Revise "Marking Proposed Locations for Highway Lighting System" of Article 801.09 to read "Marking Proposed Locations for Highway Lighting System and Traffic Signals."

Add the following to Article 801.09 of the Standard Specifications:

"It shall be the Contractor's responsibility to verify all dimensions and conditions existing in the field prior to ordering materials and beginning construction. This shall include locating the mast arm foundations and verifying the mast arms lengths."

Inspection of Electrical Systems.
Add the following to Article 801.10 of the Standard Specifications:

(c) All cabinets, including temporary traffic signal cabinets, shall be assembled by an approved Vendor in District One. The Department reserves the right to request any controller and cabinet to be tested at the Vendor's facility prior to field installation at no extra cost to the Contract.

Maintenance and Responsibility of Traffic Signal and Flashing Beacon Installations.
Replace Article 801.11(b) of the Standard Specifications to read:

(b) Traffic Signals and Flashing Beacons. The Contractor shall be responsible for maintaining the traffic signal/flashing beacon installation in proper operating condition.

(1) General.

a. The Contractor must notify the Area Traffic Signal Maintenance and Operations Engineer of their intent to begin any physical construction work on the Contract or any portion thereof. This notification must be made a minimum of seven (7) working days prior to the start of construction to allow sufficient time for inspection of the existing traffic signal installation(s) and transfer of maintenance to the Contractor. The Department will attempt to fulfill the Contractor's inspection date request(s); however, workload and other conditions may prevent the Department from accommodating specific dates or times. The Contractor shall not be entitled to any other compensation if the requested inspection date(s) cannot be scheduled by the Department.

b. Full maintenance responsibility shall start upon the successful completion of a maintenance transfer inspection, or as directed by the Engineer. If the Contractor begins any physical work on the Contract or any portion thereof prior to a traffic signal inspection, maintenance of the traffic signal installation(s) will be transferred to the Contractor without an inspection. The Contractor will become responsible for repairing or replacing all equipment that is not operating properly or is damaged at the time of transfer at no cost to the owner of the traffic signal equipment. Final repairs or replacement of damaged equipment must meet the approval of the Engineer prior to or at the time of final inspection, otherwise the traffic signal installation will not be accepted.

c. All traffic signals within the limits of the Contract or those which have the item "MAINTENANCE OF EXISTING TRAFFIC SIGNAL INSTALLATION," "TEMPORARY TRAFFIC SIGNAL INSTALLATION", "TEMPORARY BRIDGE TRAFFIC SIGNAL INSTALLATION", "TEMPORARY PORTABLE BRIDGE TRAFFIC SIGNAL INSTALLATION", and/or "MAINTENANCE OF EXISTING FLASHING BEACON INSTALLATION" shall become the full responsibility of the Contractor. Maintenance responsibility shall end upon issuance of final acceptance by the Engineer.

d. The Contractor shall have electricians with IMSA/IPSI Traffic Signal Technician Level II certification on staff to provide signal maintenance. A copy of the certification shall be immediately available upon request by the Engineer.

e. This item shall include maintenance of all traffic signal equipment and other connected and related equipment such as flashing beacons, emergency vehicle preemption (EVP) equipment, master controllers, network switches, uninterruptable power supply (UPS) and batteries, pan-tilt-zoom (PTZ) cameras, vehicle detection, handholes, lighted signs, telephone service installations, cellular modems, radios, communication cables, and other traffic signal equipment. All conduit and related equipment to adjacent intersections shall be maintained to the far back handhole, or as directed by the Engineer. If adjacent intersections are part of Contract work, then maintenance of all conduit and related equipment shall be included in this item.

f. Regional transit, County, and other agencies may also have equipment connected to existing traffic signal or peripheral equipment such as network switches and transit signal priority (TSP, SCP, and BRT) servers, radios, and other devices, where maintenance shall be coordinated with the owner.

g. Maintenance shall not include automatic traffic enforcement equipment such as red light enforcement cameras, detectors, or peripheral equipment. This equipment is operated and maintained by others and shall be deactivated while on Contractor maintenance.

h. The energy charges for the operation of the traffic signal installation shall be paid for by the Contractor.

(2) Maintenance.

a. The Contractor shall inspect all traffic signal equipment and appurtenances every two (2) weeks to ensure they are functioning properly. Signal heads shall be properly adjusted, including plumb, and tightly mounted. All controller cabinets, signal posts, and controller pedestals shall be tight on their foundations and in alignment. Deficient equipment shall be repaired or replaced as necessary. The Contractor shall check signal system communications and phone lines to assure proper operation. This item includes, as routine maintenance, all portions of EVP equipment. The Contractor shall always maintain enough materials and equipment in stock to provide effective temporary and permanent repairs. The Contractor shall supply a detailed maintenance log monthly that includes dates, locations, names of electricians performing the required checks and inspections, and any other information requested by the Engineer. The Contractor shall attend any additional inspections as requested by the Engineer. The Contractor shall check the controllers, relays, and detectors after receiving complaints or calls to ascertain that they are functioning properly and make all necessary repairs and replacement.

b. The Contractor is advised that the existing and/or temporary traffic signal installation must remain in operation during all construction stages, except for the most essential down time. Any shutdown of the traffic signal installation which exceeds fifteen (15) minutes must have prior approval from the Engineer. Approval to shut down the traffic signal installation will only be granted during the period extending from 9:00 a.m. to 3:00 p.m. on weekdays. Shutdowns shall not be allowed during inclement weather or holiday periods.

c. The Contractor shall provide immediate corrective action when any part(s) of the signal fail to function properly. Two far side heads facing each approach shall be considered the minimum acceptable signal operation pending permanent repairs. When repairs at a signalized intersection require that the controller be disconnected or otherwise removed from normal operation, and power is available, the Contractor shall place the traffic signal installation in flashing operation. The signals shall flash RED for all directions unless a different indication has been specified by the Engineer. The Contractor shall install cones on all lane lines at the stop bar on each approach, R1-1 (36 in. minimum) “STOP” signs at the stop bar on each approach on the right side and on raised medians (where applicable), and black on fluorescent orange “SIGNALS OUT AHEAD” warning signs followed by fluorescent orange W3-1 symbolic stop ahead warning signs on all approaches to the intersection.

d. Temporary replacement of a damaged or knocked down mast arm pole assembly shall require construction of a full or partial span wire signal installation or other method approved by the Engineer to assure signal heads are located overhead and over traveled pavement. Temporary replacement of mast arm mount signals with post mount signals is not permitted.

e. The Contractor shall provide the Engineer with two (2) 24-hour telephone numbers for the maintenance of the traffic signal installation and for emergency calls by the Engineer.

f. Traffic signal equipment which is lost, damaged, or not returned to the Department for any reason shall be replaced with new equipment meeting the requirements of the Standard Specifications and these special provisions.

g. The Contractor shall be fully responsible for the safe and efficient operation of the traffic signals and other equipment noted herein. The Contractor shall respond to all emergency calls from the Department or others within one (1) hour after notification and provide immediate corrective action. When equipment has been damaged or becomes faulty beyond repair, the Contractor shall replace it with new equipment meeting current District One traffic signal specifications. The cost of furnishing and installing the replaced equipment shall be borne by the Contractor at no additional cost to the Contract. The Contractor may institute action to recover damages from a responsible third party. If at any time the Contractor fails to perform all work as specified herein to keep the traffic signal installation in proper operating condition, or if the Engineer cannot contact the Contractor's designated personnel, the Engineer shall have the Department's Electrical Maintenance Contractor perform the maintenance work. The Contractor shall be responsible for all of the Department's Electrical Maintenance Contractor's costs and liquidated damages of $1,000 per day per occurrence. The Department's Electrical Maintenance Contractor shall bill the Contractor for the total cost of the work. The Contractor shall pay this bill within thirty (30) days of the date of receipt of the invoice or the cost of such work will be deducted from the amount due the Contractor. The Contractor shall allow the Electrical Maintenance Contractor to inspect the traffic signal installation that has been transferred to the Contractor for maintenance. Final replacement of damaged equipment must meet the approval of the Engineer prior to or at the time of final inspection, otherwise the traffic signal installation will not be accepted. Cable splices outside the controller cabinet shall not be allowed. The Department may inspect any signalizing device on the Department's highway system at any time without notification. The Contractor shall not install padlocks on traffic signal cabinets or otherwise restrict the Department's access to the cabinet or controller.

h. Any proposed activity in the vicinity of a highway-rail grade crossing must adhere to the guidelines set forth in the current edition of the Manual on Uniform Traffic Control Devices (MUTCD) regarding work in temporary traffic control zones in the vicinity of highway-rail grade crossings which states that lane restrictions, flagging, or other operations shall not create conditions where vehicles can be queued across the railroad tracks. If the queuing of vehicles across the tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the crossing to prevent vehicles from stopping on the tracks, even if automatic warning devices are in place.

i. The Contractor shall be responsible to clear snow, ice, dirt, debris, vegetation, temporary fence, or other condition that obstructs visibility of any traffic signal display or access to traffic signal equipment.

j. The Contractor shall maintain the traffic signal in normal operation during any loss of utility or battery backup power. Temporary power to the traffic signal must meet applicable NEC and OSHA guidelines and may include portable generators and/or replacement batteries. Temporary power shall not be paid for separately but shall be included in the Contract.

(3) Basis of Payment. This work will be paid for at the Contract unit price per each for MAINTENANCE OF EXISTING TRAFFIC SIGNAL INSTALLATION, TEMPORARY TRAFFIC SIGNAL INSTALLATION, TEMPORARY BRIDGE TRAFFIC SIGNAL INSTALLATION, or TEMPORARY PORTABLE BRIDGE TRAFFIC SIGNAL INSTALLATION. Each location will be paid for separately. Maintenance of a flashing beacon shall be paid for at the Contract unit price for MAINTENANCE OF EXISTING FLASHING BEACON INSTALLATION. Each flashing beacon will be paid for separately.

Damage to Traffic Signal System.
Add the following to Article 801.12(b) of the Standard Specifications:

"Any traffic signal control equipment that is damaged and non-repairable or not operating properly from any cause shall be replaced with new equipment meeting current District One traffic signal specifications and provided by the Contractor at no additional cost to the Contract and/or owner of the traffic signal system, all as approved by the Engineer. Final replacement of damaged equipment must meet the approval of the Engineer prior to or at the time of final inspection. Repair or replace any equipment damaged within the time shown in the table below:

ITEM	RESPONSE TIME	SERVICE RESTORATION	PERMANENT REPAIR (calendar days)
Cabinet	1 hour	24 hours	21 days
Controllers and Peripheral Equipment	1 hour	4 hours	21 days
System Detector Loop	1 hour	N/A	7 days
All Other Detectors	1 hour	N/A	21 days
Signal Head and Lenses	1 hour	4 hours	7 days
Aviation Red Beacon	1 hour	4 hours	7 days
Mast Arm Assembly and Pole	1 hour	4 hours	7 days
Traffic Signal Post	1 hour	4 hours	7 days
Cable and Conduit	1 hour	4 hours	7 days
Interconnect and Telemetry	1 hour	4 hours	7 days
Graffiti Removal	N/A	N/A	7 days
Misalignment of Signal Heads	1 hour	4 hours	4 hours
Closed Loop Monitoring System	1 hour	24 hours	14 days
Post and Poles Plumb Vertically	N/A	N/A	21 days
Controller, Post & Pole Foundations	N/A	N/A	21 days
Complaints, Calls, Controller or System Alarms, Timing, Phasing, Programming	1 hour	4 hours	N/A
Patrol Truck Deficiencies	N/A	24 hours	24 hours
Signal Heads Visibility	1 day	2 days	14 days

Temporary replacement of a damaged or knocked down mast arm pole assembly shall require construction of a full or partial span wire signal installation or other method approved by the Engineer to assure signal heads are located overhead and over traveled pavement. Temporary replacement of mast arm mount signals with post mount signals will not be permitted.

Replacement of any equipment for any reason shall be reported to the Area Traffic Signal Maintenance and Operations Engineer in writing within 24 hours. Permanent and temporary replacement of the controller and/or cabinet shall require inspection and testing by the Vendor.

Automatic Traffic Enforcement equipment, such as red light enforcement cameras, detectors, and peripheral equipment, that is damaged or not operating properly from any cause, shall be the responsibility of the municipality or the automatic traffic enforcement company per Permit agreement."

Traffic Signal Inspection (TURN-ON).
Revise Article 801.15(b) of the Standard Specifications to read:

"Turn-on. It is the intent to have all electric work completed and equipment field tested by the Contractor and/or Vendor prior to the Department's "turn-on" field inspection. If in the event the Engineer determines work is not complete and the inspection will require more than two (2) hours to complete, the inspection shall be canceled, and the Contractor will be required to reschedule at another date. The maintenance of the traffic signals will not be accepted until all punch list work is corrected and re-inspected.

When the Contractor requests a turn-on and inspection of the completed traffic signal installation(s), the request must be made to the Area Traffic Signal Maintenance and Operations Engineer a minimum of seven (7) working days prior to the time of the requested inspection. The Department will attempt to fulfill the Contractor's turn-on and inspection date request(s); however, workload and other conditions may prevent the Department from accommodating specific dates or times. The Contractor shall not be entitled to any other compensation if the requested turn-on and inspection date(s) cannot be scheduled by the Department. The Department will not grant a field inspection until written or electronic notification is provided from the Contractor that the equipment has been field tested and the intersection is operating according to Contract requirements. The Contractor must invite local fire department personnel to the turn-on when emergency vehicle preemption (EVP) is included in the project. When the Contract includes the item RE-OPTIMIZE TRAFFIC SIGNAL SYSTEM, OPTIMIZE TRAFFIC SIGNAL SYSTEM, and/or TEMPORARY TRAFFIC SIGNAL TIMING, the Contractor must notify the SCAT Consultant of the turn-on/detour implementation schedule, as well as stage changes and phase changes during construction.

The Contractor must have all traffic signal work completed and the electrical service installation connected by the utility company prior to requesting an inspection and turn-on of the traffic signal installation. The Contractor shall be responsible to provide a police officer to assist with traffic control at the time of testing.

The Contractor shall provide a representative from the Vendor who is knowledgeable of the cabinet design and controller functions to attend the traffic signal inspection for both permanent and temporary traffic signal turn-ons.

Upon demonstration that the signals are operating and all work is completed in accordance with the Contract and to the satisfaction of the Engineer, the Engineer will then allow the signals to be placed in continuous operation. The signals shall continue to be maintained by the Contractor until final acceptance.

The Department requires the following Final Project Documentation from the Contractor at traffic signal turn-ons in electronic format in addition to hard copies where noted. An electronic media device shall be submitted with separate folders corresponding to each numbered title below. The electronic media device shall be labeled with date, project location, company, and Contract or Permit number. Electronic record drawings and material approvals shall be submitted prior to traffic signal turn-on for review by the Department as described in the Record Drawings section herein.

Final Project Documentation:

(1) Record Drawings. Electronically produced signal plans of record with field revisions marked in red. Two (2) hard copies of 11 in. x 17 in. record drawings shall also be provided.

(2) Field Testing. Written notification from the Contractor and the Vendor of satisfactory field testing with corresponding material performance measurements, such as for detector loops and fiber optic systems (see Article 801.13).

(3) Material Approvals. Material approval documentation.

(4) Manuals. Operation and service manuals of the signal controller and associated control equipment.

(5) Cabinet Wiring Diagram and Cable Logs. Five (5) hard copies of 11 in. x 17 in. cabinet wiring diagrams shall be provided along with electronic PDF and DGN files of the cabinet wiring diagram. Five (5) hard copies of the cable logs and electronic Excel files shall be provided with cable #, number of conductors and spares, connected device/signal head and intersection location.

(6) Warrantees and Guarantees. All manufacturer and Contractor warrantees and guarantees required by Article 801.14.

(7) GPS Coordinates. GPS coordinates of traffic signal equipment as described in the Record Drawings section herein.

Acceptance of the traffic signal equipment by the Department shall be based upon inspection results at the traffic signal “turn-on”, completeness of the required documentation, and successful operation during a minimum 72 hour “burn-in” period following activation of traffic signal equipment. If approved, traffic signal acceptance shall be verbal at the final inspection followed by written correspondence from the Engineer. The Contractor shall be responsible for all traffic signal equipment and associated maintenance thereof until Departmental acceptance is granted.

All equipment and/or parts to keep the traffic signal installation operating shall be furnished by the Contractor. No spare traffic signal equipment is available from the Department.

All punch list work shall be completed within two (2) weeks after the turn-on. The Contractor shall notify the Area Traffic Signal Maintenance and Operations Engineer to schedule an inspection of all punch list work. Failure to meet these time constraints shall result in liquidated damage charges of $500 per month per incident.

All cost of work and materials required to comply with the requirements herein shall be included in the pay item bid prices, under which the subject materials and signal equipment are paid, and no additional compensation will be allowed. Materials and signal equipment not complying with the requirements herein shall be subject to removal and disposal at the Contractor's expense."

Record Drawings.

The requirements listed for Electrical Installation shall apply for Traffic Signal Installations in Article 801.16. Revise the second and third paragraphs of Article 801.16 of the Standard Specifications to read:

"When the work is complete, and seven (7) days before the request for a final inspection, electronic Contract drawings, stamped "RECORD DRAWINGS", shall be submitted to the Engineer for review and approval and shall be stamped with the date and the signature of the Contractor's supervising Engineer or electrician. The record drawings shall be submitted in PDF format. If the Contract consists of multiple intersections, each intersection shall be saved as an individual PDF file with TS# and location name in its file name.

In addition to the record drawings, copies of the final material approvals which have been Approved or Approved as Noted shall be submitted in PDF format. The PDF files shall clearly indicate the pay item either by filename or PDF Table of Contents referencing the respective pay item number for multi-item PDF files. Specific part or model numbers of items which have been selected shall be clearly visible.

The Contractor shall provide two (2) 11 in. x 17 in. hard copies of electronically produced final record drawings to be kept inside each traffic signal cabinet within project limits."

Add the following to Article 801.16 of the Standard Specifications:

"In addition to the specified record drawings, the Contactor shall record GPS coordinates of the following traffic signal components being installed, modified or being affected in other ways by the Contract:

- All Mast Arm Poles and Posts
- Traffic Signal Wood Poles
- Railroad Bungalow
- UPS
- Handholes
- Controller Cabinets
- Communication Cabinets
- Electric Service Disconnect locations
- CCTV/PTZ Camera installations

Datum to be used shall be North American 1983.

Data shall be provided in electronic format and shall be in .csv format. Latitude and Longitude shall be in decimal degrees with a minimum of 6 decimal places. Each coordinate shall have the following information:

- File shall be named: TSXXX_YY-MM-DD.csv (i.e. TS22157_24-01-01.csv)
- Each intersection shall have its own file
- Row 1 should have the location name (i.e. IL 31 @ Klausen)
- Row 2 is blank
- Row 3 is the headers for the columns
- Row 4 starts the data
- Column A (Date) – should be in the following format: MM/DD/YYYY
- Column B (Item) – as shown in the table below
- Column C (Description) – as shown in the table below
- Column D and E (GPS Data) – should be in decimal form

Examples:

Date	Item	Description	Latitude	Longitude
01/01/2024	MP (Mast Arm Pole)	NEQ, NB, Dual, Combination Pole	41.580493	-87.793378
01/01/2024	HH (Handhole)	Heavy Duty, Fiber, Intersection, Double	41.558532	-87.792571
01/01/2024	ES (Electrical Service)	Ground mount, Pole mount	41.765532	-87.543571
01/01/2024	CC (Controller Cabinet)		41.602248	-87.794053
01/01/2024	PTZ (PTZ)	NEQ extension pole	41.593434	-87.769876
01/01/2024	POST (Post)		41.651848	-87.762053
01/01/2024	MCC (Master Controller Cabinet)		41.584593	-87.793378
01/01/2024	COMC (Communication Cabinet)		41.584600	-87.793432
01/01/2024	BBS (Battery Backup System)		41.558532	-87.792571

Data collection can be made as construction progresses or can be collected after all items are installed. If the data is unacceptable, the Contractor shall make corrections to the data collection equipment and/or process and resubmit the data for review and approval as specified.

Data shall have a minimum 1 ft accuracy after post processing."

Restoration of Work Area.
Add the following article to Section 801 of the Standard Specifications:

"**801.17 Restoration of Work Area.** Restoration of the traffic signal work area shall be included in the related pay items such as foundation, conduit, handhole, underground raceways, detector loop installation or replacement, etc. All roadway surfaces such as shoulders, medians, sidewalks, pavement, etc. shall be replaced in kind. All damage to mowed lawns shall be replaced with an approved sod, and all damage to unmowed fields shall be seeded. All brick pavers disturbed in the work area shall be restored to their original configuration as directed by the Engineer. All damaged brick pavers shall be replaced with a comparable material approved by the Engineer.

Exposed holes created from removal or relocation of traffic signal equipment shall be sealed using a zinc-plated fender washer with toggle bolt.

Restoration of the work area shall be included in the Contract without any extra compensation allowed to the Contractor.

Removal, Disposal, and Salvage of Existing Traffic Signal Equipment.
The removal, disposal, and/or salvage of existing traffic signal equipment shall become the property of the Contractor and disposed of by the Contractor outside the State's right-of-way, unless otherwise noted. No additional compensation shall be provided to the Contractor for removal, disposal or salvage expense for the work in the Contract."

Bagging Signal Heads.
Light tan colored traffic and pedestrian signal reusable covers shall be used to cover dark/un-energized signal sections, visors, and retroreflective backplates. Covers shall be made of outdoor fabric with urethane coating for repelling water, have elastic fully sewn around the cover ends for a tight fit over the visor, and have a minimum of two (2) straps with buckles to secure the cover to the backplate. A center mesh strip allows viewing without removal for signal status testing purposes. Covers shall include a message indicating the signal is not in service. Pedestrian pushbuttons that are not in service shall be covered with a durable material such as described above or burlap that is secured in a weather-resistant manner. The entire housing, including the pedestrian sign, shall also be covered on the front side.

Turn-on of New Traffic Signal Installations.
The following only applies to new traffic signals at previously unsignalized locations.

The signal responsibility shall begin at the start of signal construction and shall end upon issuance of final acceptance by the Engineer. New traffic signal heads and indications may not be installed more than two (2) weeks (14 calendar days) prior to the scheduled turn-on of the traffic signal to avoid motorist confusion caused by the presence of new signal heads, even if properly covered. Unenergized signal indications shall be bagged until one (1) hour prior to the scheduled turn-on per the Bagging Signal Heads section above.

New stop bars and crosswalks on approaches that did not previously have stop control shall NOT be installed until the day of the traffic signal turn-on.

A Portable Changeable Message Sign (PCMS) must be placed two (2) weeks prior to the scheduled new traffic signal turn-on for all approaches to the intersection with the following messages:

NEW TRAFFIC SIGNAL	STARTING MMM ##

where “MMM” and “##” are the 3-character month abbreviation and day of the scheduled turn-on, respectively.

On the day of the turn-on, change messages to read:

NEW SIGNAL AHEAD	BE PREPARED TO STOP

The PCMS must remain in place for two (2) weeks following the day of the turn-on.

Conflicting Stop signs shall be removed immediately at the time of the traffic signal turn-on.

Locating Underground Facilities.
Revise Section 803 to the Standard Specifications to read:

> “IDOT traffic signal facilities are not part of any of the one-call locating service such as J.U.L.I.E or Digger. If the Contract requires the maintenance services of an Electrical Contractor, the Contractor shall be responsible at their own expense for locating all existing IDOT electrical facilities, including but not limited to interconnect conduit and handholes, prior to performing any work. A maintenance transfer is required prior to any locating work. If this Contract does not require the maintenance services of an Electrical Contractor, the Contractor may request one free locate for existing IDOT electrical facilities from the District One Electrical Maintenance Contractor prior to the start of any work. Additional requests will be at the expense of the Contractor. The location of underground traffic facilities does not relieve the Contractor of their responsibility to repair any facilities damaged during construction at their expense.
>
> The exact location of all utilities shall be field verified by the Contractor before the installation of any components of the traffic signal system. For locations of utilities, locally owned equipment, and leased enforcement camera system facilities, the local Counties or Municipalities may need to be contacted: in the City of Chicago contact Digger at (312) 744-7000, and for all other locations contact J.U.L.I.E. at 1-800-892-0123 or 811.

The Contractor shall take whatever precautions to protect the electric cable or electric conductors in conduit from damage during location and construction operations. If the wiring is damaged, the Contractor shall replace the entire length of cable or conductors in conduit, in a manner satisfactory to the Engineer. Splicing below grade will not be permitted.

In the event the repairs are not made by the Contractor, the Contractor shall reimburse the Department for such repairs within sixty (60) days of receiving written notification of said damage. Otherwise, the cost of such repairs will be deducted from monies due or which will become due the Contractor under the terms of the Contract."

Grounding of Traffic Signal Systems

Revise Section 806 of the Standard Specifications to read:

"All traffic signal systems, equipment and appurtenances shall be properly grounded in strict conformance with the NEC. This work shall be in accordance with IDOT's District One Traffic Signal Design Details.

The grounding electrode system shall include a ground rod installed with each traffic signal controller concrete foundation and all mast arm and post concrete foundations. An additional ground rod will be required at locations were measured resistance exceeds 25 ohms. Ground rods are included in the applicable concrete foundation or service installation pay item and will not be paid for separately.

Testing shall be according to Article 801.13 (a) (4) and (5).

(a) The grounded conductor (neutral conductor) shall be white color coded. This conductor shall be bonded to the equipment grounding conductor only at the Electric Service Installation. All power cables shall include one neutral conductor of the same size.

(b) The equipment grounding conductor shall be green color coded. The following is in addition to Article 801.04 of the Standard Specifications:

(1) Equipment grounding conductors shall be bonded to the grounded conductor (neutral conductor) only at the Electric Service Installation. The equipment grounding conductor is paid for separately and shall be continuous. The Earth shall not be used as the equipment grounding conductor.

(2) Equipment grounding conductor*s* shall be bonded, using a UL Listed grounding connector, to all traffic signal mast arm poles, traffic signal posts, pedestrian posts, pull boxes, handhole frames and covers, conduits, and other metallic enclosures throughout the traffic signal wiring system, except where noted herein. Bonding shall be made with a splice and pigtail connection, using a sized compression type copper sleeve, sealant tape, and heat-shrinkable cap. A UL listed electrical joint compound shall be applied to all conductors' terminations, connector threads and contact points. Conduit grounding bushings shall be installed at all conduit terminations, including spare or empty conduits and conduit protruding from handhole walls.

(3) All metallic and non-metallic raceways, including spare or empty raceways, shall have a continuous equipment grounding conductor, except raceways containing only detector loop lead-in circuits, circuits under 50 V and/or fiber optic cable will not be required to include an equipment grounding conductor.

(4) Individual conductor splices in handholes shall be soldered and sealed with heat shrink. When necessary to maintain effective equipment grounding, a full cable heat shrink shall be provided over individual conductor heat shrinks.

(c) The grounding electrode conductor shall be similar to the equipment grounding conductor in color coding (green) and size. The grounding electrode conductor is used to connect the ground rod to the equipment grounding conductor and is bonded to ground rods via exothermic welding, UL listed pressure connectors, and UL listed clamps."

RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REPLACEMENT

Effective: August 1, 2023
Revised:

Description: This work shall be completed in accordance with Section 781 of the Standard Specifications for Road and Bridge Construction. This work shall consist of reinstallation of reflectors into the raised pavement marker castings upon completion of staging in which the markers were in conflict with temporary lane usage.

Basis of Payment: This work will be measured for payment at the contract unit price per each for RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REPLACEMENT. Payment shall be full compensation for materials, labor and equipment required to complete this work.

UNDERGROUND RACEWAYS
Effective: May 22, 2002
Revised: March 1, 2024
810.02TS

Revise Article 810.04 of the Standard Specifications to read:

> "Installation. All underground conduits shall have a minimum depth of 30 in. (700 mm) below the finished grade and shall be installed to avoid existing and proposed utilities within the project limits."

Add the following to Article 810.04 of the Standard Specifications:

> "All metal conduit installed underground shall be Rigid Steel Conduit unless otherwise indicated on the plans."
>
> All raceways which extend outside of a structure or duct bank but are not terminated in a cabinet, junction box, pull box, handhole, post, pole, or pedestal shall extend a minimum of 1 ft (300 mm) or the length shown on the plans beyond the structure or duct bank. The end of this extension shall be capped and sealed with a cap designed for the conduit to be capped.
>
> The ends of rigid metal conduit to be capped shall be threaded, the threads protected with full galvanizing, and capped with a threaded galvanized steel cap.
>
> The ends of rigid nonmetallic conduit and coilable nonmetallic conduit shall be capped with a rigid PVC cap of not less than 1/8 in. (3 mm) thick. The cap shall be sealed to the conduit using a room-temperature-vulcanizing (RTV) sealant compatible with the material of both the cap and the conduit. A washer or similar metal ring shall be glued to the inside center of the cap with epoxy, and the pull cord shall be tied to this ring."

ROD AND CLEAN EXISTING CONDUIT (DISTRICT 1) 7/01/2015
Effective: January 1, 2015
Revised: July 1, 2015
810.03TS

Description.
This work shall consist of inserting a duct rod or electrical fish rod or tape of sufficient length and rigidity into an electrical conduit opening in one electrical handhole, and pushing the said rod through the conduit to emerge at the next or subsequent handhole in the conduit system at the location(s) shown on the plans. The duct rod may be inserted and removed by any standard construction method which causes no damage to the conduit. The size of the conduit may vary, but there shall be no differentiation in cost for the size of the conduit.

The conduit which is to be rodded and cleaned may exist with various amounts of standing water in the handholes to drain the conduit and to afford compatible working conditions for the installation of the duct rods and/or cables. Pumping of handholes shall be included with the work of rodding and cleaning of the conduit.

Any handhole which, in the opinion of the Engineer contains excessive debris, dirt or other materials to the extent that conduit rodding and cleaning is not feasible, shall be cleaned at the Engineer's order and payment approval as a separate pay item.

Prior to removal of the duct rod, a duct cleaning attachment such as a properly sized wire brush or cleaning mandrel shall be attached to the duct rod, which by removal of the duct rod shall be pulled through the conduit to remove sand, grit, or other light obstructions from the duct to provide a clean, clear passage for the installation of cable. Whenever the installation of cables is not performed as an adjunct to or immediately following the cleaning of the duct, a light weight pulling line such as a 1/8" polyethylene line or conduit measuring tape shall be placed and shall remain in the conduit to facilitate future work. When great difficulty of either inserting the duct rod or removal of the cleaning mandrel is encountered, the duct may require further cleaning by use of a compressed air gun, or a low pressure water hose. In the case of a broken conduit, the conduit must be excavated and repaired. The existence and location of breaks in the conduit may be determined by rodding, but the excavation and repair work required will be paid for separately.

This work shall be measured per lineal foot for each conduit cleaned. Measurements shall be made from point to point horizontally. No vertical rises shall count in the measurement.

Basis of Payment.
This work shall be paid for at the contract unit price per lineal foot for ROD AND CLEAN EXISTING CONDUIT for the installation of new electric cables in existing conduits. Such price shall include the furnishing of all necessary tools, equipment, and materials required to prepare a conduit for the installation of cable.

HANDHOLES
Effective: January 01, 2002
Revised: November 1, 2023
814.01TS

Description.
Add the following to Section 814 of the Standard Specifications:

All conduits shall enter the handhole at a depth of 30 in. (762 mm) except for the conduits for detector loops when the handhole is less than 5 ft (1.52 m) from the detector loop. All conduit ends should be sealed with a waterproof sealant to prevent the entrance of contaminants into the handhole.

Steel cable hooks shall be epoxy coated and must meet the specifications set forth in 1006.10. Hooks shall be a minimum of 5/8 in. (16 mm) diameter with 90-degree bend and extend into the handhole at least 6 in. (152 mm). Hooks shall be placed a minimum of 12 in. (305 mm) below the lid or lower if additional space is required.

Precast round handholes shall not be used unless called out on the plans.

The cover of the handhole frame shall be labeled “Traffic Signals" with legible raised letters. Only handholes serving IDOT traffic signal equipment shall have this label. Handhole covers for Red Light Running Cameras shall be labeled “RLRC”.

Revise the third paragraph of Article 814.03 of the Standard Specifications to read:

> “Handholes shall be constructed as shown on the plans and shall be cast-in-place or precast concrete units. Heavy duty handholes shall be either cast-in-place or precast concrete units.”

Revise Article 814.03(c) of the Standard Specifications to read:

> “Precast Concrete. Precast concrete handholes shall be fabricated according to Article 1042.17. Where a handhole is contiguous to a sidewalk, preformed joint filler of 1/2 in. (13 mm) thickness shall be placed between the handhole and the sidewalk.”

Add the following to Section 814 of the Standard Specifications:

Cast-In-Place Handholes.
All cast-in-place handholes shall be concrete with minimum inside dimensions of 21-1/2 in. (546 mm). Frames and lid openings shall match this dimension.

For grounding purposes, the handhole frame shall have provisions for a 7/16 in. (11 mm) diameter stainless steel bolt cast into the frame. The covers shall have a stainless steel threaded stint extended from the eye hook assembly for the purpose of attaching the grounding conductor to the handhole cover.

The minimum wall thickness for heavy duty hand holes shall be 1 ft (305mm).

Precast Round Handholes.
All precast handholes shall be concrete with an inside diameter of 30 in. (762mm). Frames and covers shall have a minimum opening of 26 in. (660mm) and no larger than the inside diameter of the handhole.

For grounding purposes, the handhole frame shall have provisions for a 7/16 in. (11 mm) diameter stainless steel bolt cast into the frame. For the purpose of attaching the grounding conductor to the handhole cover, the covers shall either have a 7/16 in. (11 mm) diameter stainless steel bolt cast into the cover or a stainless steel threaded stint extended from an eye hook assembly. A hole may be drilled for the bolt if one cannot be cast into the frame or cover. The head of the bolt shall be flush or lower than the top surface of the cover.

The minimum wall thickness for precast heavy duty hand holes shall be 6 in. (152 mm).

Precast round handholes shall be only produced by an approved precast vendor.

FIBER OPTIC TRACER CABLE
Effective: May 22, 2002
Revised: November 1, 2023
817.02TS

The cable shall meet the requirements of Section 817 of the Standard Specifications, except for the following:

Add the following to Article 817.03 of the Standard Specifications:

> "In order to trace the fiber optic cable after installation, the tracer cable shall be installed in the same conduit as the fiber optic cable in locations shown on the plans. The tracer cable shall be continuous, extended into the controller cabinet and terminated on a barrier type terminal strip mounted on the side wall of the controller cabinet. The barrier type terminal strip and tracer cable shall be clearly marked and identified. All tracer cable splices shall be kept to a minimum and shall incorporate maximum lengths of cable supplied by the manufacturer. The tracer cable will be allowed to be spliced at handholes only. The tracer cable splice shall use a Western Union Splice soldered with resin core flux and shall be soldered using a soldering iron. Blow torches or other devices which oxidize copper cable shall not be allowed for soldering operations. All exposed surfaces of the solder shall be smooth. The splice shall be covered with a black shrink tube meeting UL 224 guidelines, Type V and rated 600V, minimum length 4 in. (100 mm) and with a minimum 1 in. (25 mm) coverage over the XLP insulation, underwater grade."

Revise Article 817.05 of the Standard Specifications to read:

> "Basis of Payment. The tracer cable shall be paid for separately as ELECTRIC CABLE IN CONDUIT, TRACER, NO. 14 1C per foot (meter), which price shall include all associated labor and material for installation."

FIBER OPTIC CABLE (DISTRICT 1) 7/01/2015
Effective: May 22, 2002
Revised: July 1, 2015
871.01TS

Add the following to Article 871.01 of the Standard Specifications:

The Fiber Optic cable shall be installed in conduit or as specified on the plans.

Add the following to Article 871.02 of the Standard Specifications:

The control cabinet distribution enclosure shall be 24 Port Fiber Wall Enclosure, unless otherwise indicated on plans. The fiber optic cable shall provide twelve fibers per tube for the amount of fibers called for in the Fiber Optic Cable pay item in the Contract. Fiber Optic cable may be gel filled or have an approved water blocking tape.

Add the following to Article 871.04 of the Standard Specifications:

A minimum of six multimode fibers from each cable shall be terminated with approved mechanical connectors at the distribution enclosure. Fibers not being used shall be labeled “spare." Fibers not attached to the distribution enclosure shall be capped. A minimum of 13.0 feet (4m) of extra cable length shall be provided for controller cabinets. The controller cabinet extra cable length shall be stored as directed by the Engineer.

Add the following to Article 871.06 of the Standard Specifications:

The distribution enclosure and all connectors will be included in the cost of the fiber optic cable.

Testing shall be in accordance with Article 801.13(d). Electronic files of OTDR signature traces shall be provided in the Final project documentation with certification from the Contractor that attenuation of each fiber does not exceed 3.5 dB/km nominal at 850nm for multimode fiber and 0.4 bd/km nominal at 1300nm for single mode fiber.

ELECTRIC CABLE (DISTRICT 1) 7/01/2015
Effective: May 22, 2002
Revised: July 1, 2015
873.01TS

Delete “or stranded, and No. 12 or” from the last sentence of Article 1076.04 (a) of the Standard Specifications.

Add the following to the Article 1076.04(d) of the Standard Specifications:

Service cable may be single or multiple conductor cable.

TEMPORARY AERIAL FIBER OPTIC CABLE, NO. 62.5/125, MM 12F, MS12F

Description. This work shall consist of furnishing and installing all accessories required and an aerial fiber optic cable No. 62.5/125, MM12F, SM12F on span wire mounted between temporary wood poles. The cable shall meet the requirements of Article 871.02 of the Standard Specifications, except that it shall be installed aerially. The cable shall be installed as shown on the plans and as directed by the Engineer. A temporary splice between the temporary cable and the permanent cable shall be provided in the handhole the permanent cable is pulled back to.

Method of Measurement. This work will be measured for payment per foot of fiber optic cable installed.

Basis of Payment. This work will be paid for at the contract unit price per foot for TEMPORARY AERIAL FIBER OPTIC CABLE, NO. 62.5/125, MM12F, SM12F. Removal of the cable will be paid for separately.

ELECTRIC CABLE AERIAL SUSPENDED, NO. 20 3 C, TWISTED, SHIELDED

This work shall consist of furnishing and installing lead-in cable for light detectors installed at existing and/or proposed traffic signal installations as part of an emergency vehicle priority system. The work includes installing No. 20 3C electric cable aerial suspended. The electric cable shall be twisted, shielded, and have (3) stranded conductors, colored blue, orange, and yellow with a stranded tinned copper drain wire. The cable shall meet the requirements of the vendor of the Emergency Vehicle Priority System Equipment.

Basis of Payment.
This work will be paid for at the contract unit price per foot for ELECTRIC CABLE AERIAL SUSPENDED, NO 20 3C, TWISTED, SHIELDED, which price shall be payment in full for furnishing, installing and making all electrical connections necessary for proper operations.

COAXIAL CABLE AERIAL SUSPENDED

Description. This work shall consist of furnishing and installing a temporary aerial suspended coaxial cable from the traffic signal cabinet to the associated field device as shown on the plans.

Materials. The coaxial cable shall be an RG-6/U Type low loss digital coaxial cable. The cable shall be a 75-ohm coaxial cable with 18 AWG solid 0.040” bare copper conductor, tinned copper braided shield (95% min), and black polyvinyl chloride jacket. The nominal outside diameter shall be 0.274 inches. The cable shall be rated suitable for outdoor use by the manufacturer.

General. The work shall be performed according to the applicable portions of Section 873 of the Standard Specifications, the details shown on the plans and the following:

Crimp-on BNC plug connectors with 75-ohm resistance shall be used at both the PTZ camera and traffic signal cabinet ends of the temporary coaxial cable. The Contractor shall use a hand crimping tool recommended by the plug connector manufacturer to perform the termination.

No splices shall be allowed in the temporary coaxial cable between the PTZ camera and the traffic signal cabinet.

Basis of Payment. This work will be paid for at the contract unit price per foot for COAXIAL CABLE AERIAL SUSPENDED.

ELECTRIC TRACER CABLE AERIAL SUSPENDED

The cable shall meet the requirements of Section 873 of the Standard Specifications, except for the following:

Add the following to Article 871.04 of the Standard Specifications:

In order to trace the electric cable after installation, the tracer cable shall be installed adjacent to the electric cable in locations noted on the plans. The tracer cable shall be continuous, extended into the controller cabinet and terminated on a barrier type terminal strip mounted on the side wall of the controller cabinet. The barrier type terminal strip and tracer cable shall be clearly marked and identified. All tracer cable splices shall be kept to a minimum and shall incorporate maximum lengths of cable supplied by the manufacturer. The tracer cable will be allowed to be spliced at handholes only. The tracer cable splice shall use a Western Union Splice soldered with resin core flux and shall be soldered using a soldering iron. Blow torches or other devices which oxidize copper cable shall not be allowed for soldering operations. All exposed surfaces of the solder shall be smooth. The splice shall be covered with a black shrink tube meeting UL 224 guidelines, Type V and rated 600V, minimum length 4 inches (100 mm) and with a minimum 1 inch (25 mm) coverage over the XLP insulation, underwater grade.

Add the following to Article 873.06 of the Standard Specifications:

Basis of Payment. The tracer cable will be paid for separately as ELECTRIC CABLE AERIAL SUSPENDED, TRACER, NO. 14 1C per foot.

TEMPORARY TRAFFIC SIGNAL TIMING
Effective: May 22, 2002
Revised: March 1, 2024
890.02TS

Description.
This work shall consist of developing and maintaining appropriate traffic signal timings for the specified intersection for the duration of the temporary signalized condition, as well as impact to existing traffic signal timings caused by detours or other temporary conditions.

All timings and adjustments necessary for this work shall be performed by an approved Consultant who has previous experience in optimizing Traffic Signal Systems for District One of the Illinois Department of Transportation. The Contractor shall contact the Traffic Signal Engineer for a listing of approved Consultants.

The following tasks are associated with TEMPORARY TRAFFIC SIGNAL TIMING:

(a) Consultant shall attend temporary traffic signal inspection (turn-on) and/or detour meeting and conduct on-site implementation of the traffic signal timings.

(b) Consultant shall be responsible for making fine-tuning adjustments to the timings in the field to alleviate observed adverse operating conditions and to enhance operations.

(c) Consultant shall provide monthly observation of traffic signal operations in the field.

(d) Consultant shall provide on-site consultation and adjust timings as necessary for construction stage changes, temporary traffic signal phase changes, and any other conditions affecting timing and phasing, including lane closures, detours, and other construction activities.

(e) Consultant shall make timing adjustments and prepare comment responses as directed by the Area Traffic Signal Maintenance and Operations Engineer.

(f) Return original timing plan once construction is complete.

Basis of Payment.
The work shall be paid for at the Contract unit price each for TEMPORARY TRAFFIC SIGNAL TIMING, which price shall be payment in full for performing all work described herein per intersection. When the temporary traffic signal installation is turned on and/or detour implemented, 50 percent of the bid price will be paid. The remaining 50 percent of the bid price will be paid following the removal of the temporary traffic signal installation and/or detour.

REMOVE AND REINSTALL FIBER OPTIC CABLE IN CONDUIT

Description. This work shall consist of pulling an existing fiber optic cable from a conduit and subsequently reinstalling the cable in a new conduit. The conduit run shall be cleaned and swabbed prior to reinstalling the cable.

Method of Measurement. Removal and reinstallation of existing fiber optic cable will be measured for payment in place in feet. If two or more cables in a conduit are to be removed and reinstalled, each cable will be measured separately for payment.

Basis of Payment. This work will be paid for at the contract unit price per foot for REMOVE AND REINSTALL FIBER OPTIC CABLE IN CONDUIT as shown on the plans. Payment shall not be made until the cable is reinstalled, spliced and tested in compliance with the fiber optic cable special provisions.

REMOVE EXISTING FLARED END SECTION

Description.
This work shall consist of removing flared end sections at the locations shown in the plans or where directed by the Engineer. The work shall be performed in accordance with the applicable portions of Section 501 of the Standard Specifications

Method of Measurement: This work will be measured for payment in units of each.

Basis of Payment: This work will be paid for at the contract unit price per each for REMOVE EXISTING FLARED END SECTION, which payment shall constitute full compensation for all labor, equipment, tools and incidentals necessary to complete the work as specified.

PLANTING WOODY PLANTS

This work shall consist of planting woody plants as specified in Section 253 of the Standard Specifications with the following revisions:

This work shall consist of planting woody plants as specified in Section 253 of the Standard Specifications with the following revisions:

Delete Article 253.03 Planting Time and substitute the following:

Spring Planting. This work shall be performed between March 15th and May 31st except that evergreen planting shall be performed between March 15th and April 30th in the northern zone.

Add the following to Article 253.03 (a) (2) and (b):

All plants shall be obtained from Illinois Nurserymen's Association or appropriate state chapter nurseries. All trees and shrubs shall be dug prior to leafing out (bud break) in the spring or when plants have gone dormant in the fall, except for the following species which are only to be dug prior to leafing out in the spring:

- Red Maple (Acer rubra)
- Alder (alnus spp.)
- Buckeye (Aesculus spp.)
- Birch (Betulus spp.)
- American Hornbeam (Carpinus caroliana)
- Hickory (Carya spp.)
- Eastern Redbud (Cercis spp.)
- American Yellowwood (Cladrastis kentuckea spp.)
- Corylus (Filbert spp.)
- Hawthorn (Crataegus spp.)
- Walnut (Juglans spp.)
- Sweetgum (Liquidambar spp.)
- Tuliptree (Liriodendron spp.)
- Dawn Redwood (Metasequoia spp.)
- Black Tupelo (Nyssa sylvatica)
- American Hophornbeam (Ostraya virginiana)
- Planetree (Platanus spp.)
- Poplar (Populus spp.)
- Cherry (Prunus spp.)
- Oak (Quercus spp.)
- Willow (Salix spp.)
- Sassafras (Sassafras albidum)
- Baldcypress (Taxodium distichum)
- Broadleaf Evergreens (all)
- Vines (all)

Fall Planting. This work shall be performed between October 1 and November 30 except that evergreen planting shall be performed between August 15 and October 15.
Planting dates are dependent on species of plant material and weather. Planting might begin or end prior or after above dates as approved by the Engineer. Do not plant when soil is muddy or during frost.

Delete Article 253.17 Basis of Payment and substitute the following:

This work will be paid for at the contract unit price per each for TREES, SHRUBS, or VINES, of the species, root type, and plant size specified, and per unit for SEEDLINGS. The unit price shall include the cost of all materials, equipment, labor, plant care, removal, disposal, and incidentals required to complete the work as specified herein and to the satisfaction of the Engineer. Payment will be made according to the following schedule:

(a) Initial Payment. Upon completion of planting, mulching, wrapping, and bracing, 75 percent of the pay item(s) will be paid.

(b) Final Payment. Upon inspection and acceptance of the plant material, or upon execution of a third-party bond, the remaining 25 percent of the pay item(s) will be paid."

WASHOUT BASIN

Description. This work shall consist of construction and maintaining a washout basin for concrete trucks and other construction vehicles per the details shown on the plans.

Method of Measurement. This work will be measured for payment at the contract lump sum price for WASHOUT BASIN which price shall include general maintenance and removal of all construction debris, restoration of the site upon completion, and all incidentals required to complete this item of work.

Basis of Payment. This work will be paid for at the contract lump sum price for WASHOUT BASIN.

TEMPORARY WOOD POLE, 40 FT., CLASS 4

Description. This item shall consist of furnishing, installing and removing a temporary wood pole, as specified herein and all hardware and accessories required for the intended temporary use of the pole.

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

Item	Article/Section
Wood Pole	1069.04

CONSTRUCTION REQUIREMENTS

Installation. Installation shall be as described in Article 830.03.

Wood poles may be used poles as approved by the Engineer as described in Article 830.04. The wood pole shall remain the property of the Contractor and shall be removed when directed by the Engineer.

The void caused by the removal of the wood pole shall be backfilled according to Article 841.02.

Method of Measurement. Wood poles will be counted as, each installed.

Basis of Payment. This item will be paid at the contract unit price per each for TEMPORARY WOOD POLE, of the length and class indicated.

TEMPORARY FENCE (SPECIAL)

Description. This work shall consist of constructing a temporary fence at the locations shown on the plans or as directed by the Engineer. This fence is intended to be placed along the north side of the North Shore Bike Path thru the full length of the construction zone to separate pedestrians from construction activities. Upon completion of the work activities in the bike path area, the Temporary Fence (Special) shall be removed as part of this item.

Materials. The materials for the temporary fence shall be in accordance with Article 201.05(a) of the Standard Specifications except the fence shall be supported by metal fence posts spaced five (5) feet apart on center.

Method of Measurement. This work will be measured for payment in feet in place along the top of the temporary fence.

Basis of Payment. This work will be paid for at the contract unit price per foot for TEMPORARY FENCE (SPECIAL).

EXPLORATION TRENCH (SPECIAL)

This work shall consist of constructing trenches for the purpose of locating existing utilities that cross the proposed jacked-in-place storm sewer and as directed by the Engineer. The trench shall not be less than 52" (inches) in depth, measured from the existing ground elevation. The width and depth of the trench shall be sufficient to allow proper investigation of the entire trench and existing underground utility.

The Contractor shall notify the Engineer and utility owner of the location, elevation (top of pipe), material and size verification of the existing utilities.

After the information has been obtained, the jacked pipe has cleared the utility, and pictures taken, the exploration trench shall be backfilled with gradation CA 6 stone to a minimum height of one-foot above the utility, the cost of which shall be included in the item of EXPLORATION TRENCH, SPECIAL, then the excavated material shall be used to back fill the trench.

Method of Measurement. The exploration trench will be measured for payment in feet of trench excavated.

Basis of Payment. This work will be paid for at the contract unit price per foot for EXPLORATION TRENCH, SPECIAL, regardless of the depth required, and no extra compensation will be allowed for any delays, inconveniences, or damages sustained by the Contractor in performing the work. This price shall include all costs for furnishing labor, materials, and equipment necessary to construct this item.

PARKING LOT PAVEMENT REMOVAL

Description. This work consists of the removal and satisfactory disposal of existing parking lot pavement at locations shown on the plans, as directed by the Engineer, and in accordance with Section 440 of the Standard Specifications.

Parking lot pavement to be removed under this item is an HMA pavement on an aggregate base.

Method of Measurement. This work will be measured for payment in place per square yard.

Basis of Payment. This work will be paid for at the contract unit price per square yard for PARKING LOT PAVEMENT REMOVAL.

CLASS D PATCHES (SPECIAL)

Effective: July 24, 2020

Description. This work shall consist of all labor, materials and equipment necessary to construct Class D Patches at the locations shown on the plans and/ or locations determined by the Resident Engineer in the field. The work shall be performed according to Section 442 of the Standard Specifications, except as modified herein.

Delete Note 2 from Article 442.02 of the Standard Specification and replace with the following:

"Note 2. The mixture composition of the HMA used shall be binder course and surface course as specified in the Hot-Mix Asphalt Mixtures Requirements table in the plans."

Basis of Payment. This work shall be paid for at the contract unit price per square yard of CLASS D PATCHES, of the type and thickness specified, (SPECIAL).

CHAIN LINK FENCE REMOVAL

Description. This work consists of the removal and satisfactory disposal of existing chain link fence at the locations shown on the plans or as directed by the Engineer. This work shall be performed in accordance with the applicable portions of Section 201 of the Standard Specifications and as herein specified.

General. Chain Link Fence Removal shall include removal and disposal of all associated posts, fence fabric, fittings, appurtenances, attachments and concrete foundations. Any holes created by removal of the foundations shall be filled with clean earth fill to eliminate any hazard to the public and shall be included in the cost of CHAIN LINK FENCE REMOVAL.

The Contractor shall notify the property owner in writing at least 15 calendar days in advance of the chain link fence removal.

Method of Measurement. This work will be measured for payment in feet along the top of the fence.

Basis of Payment. This work will be paid for at the contract unit price per foot for CHAIN LINK FENCE REMOVAL.

ENGINEER'S FIELD OFFICE TYPE A (SPECIAL) (D1)
Effective: December 1, 2011
Revised: May 1, 2013

Revise the first paragraph of Article 670.02 to read:

670.02 Engineer's Field Office Type A (Special). Type A (Special) field offices shall have a ceiling height of not less than 7 feet and a floor space of not less than 3000 square feet with a minimum of two separate offices. The office shall also have a separate storage room capable of being locked for the storage of the nuclear measuring devices. The office shall be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the Engineer.

Revise the first sentence of the second paragraph of Article 670.02 to read:

An electronic security system that will respond to any breach of exterior doors and windows with an on-site alarm shall be provided.

Revise the last sentence of the third paragraph of Article 670.02 to read:

Adequate all-weather parking space shall be available to accommodate a minimum of twelve vehicles.

Revise the fifth paragraph of Article 670.02 to read:

Sanitary facilities shall include hot and cold potable running water, lavatory and toilet as an integral part of the office where available. Solid waste disposal consisting of seven waste baskets and an outside trash container of sufficient size to accommodate a weekly provided pick-up service. A weekly cleaning service for the office shall be provided.

Revise subparagraph (a) of Article 670.02 to read:

(a) Twelve desks with minimum working surface 42 inch x 30 inch each and twelve non-folding chairs with upholstered seats and backs.

Revise the first sentence of subparagraph (c) of Article 670.02 to read:

(c) Two four-post drafting tables with minimum top size of 37-½ inch x 48 inch.

Revise subparagraph (d) of Article 670.02 to read:

(d) Eight free standing four-drawer legal size file cabinets with lock and an underwriters' laboratories insulated file device 350 degrees one hour rating.

Revise subparagraph (e) of Article 670.02 to read:

(e) Twenty folding chairs and two conference tables with minimum top size of 44 inch x 96 inch.

Revise subparagraph (h) of Article 670.02 to read:

(h) Three electric desk type tape printing calculator and two pocket scientific notation calculators with a 1000 hour battery life or with a portable recharger.

Revise subparagraph (i)(2) of Article 670.02 to read:

(i)(2) Telephones lines. Five separate telephone lines including one line for the fax machine, and two lines for the exclusive use of the Engineer. All telephone lines shall include long distance service and all labor and materials necessary to install the phone lines at the locations directed by the Engineer. The TELCOM company shall configure ROLL/HUNT features as specified by the engineer.

Revise subparagraph (j) of Article 670.02 to read:

(j) Two plain paper network multi-function printer/copier/scanner machines capable of reproducing prints up to 11 inch x 17 inch within automatic feed tray capable of sorting 30 sheets of paper. Letter size and 11 inch x 17 inch paper shall be provided. The contractor shall provide the multi-function machines with IT support for setup and maintenance.

Revise subparagraph (k) of Article 670.02 to read:

(k) One plain paper fax machine including maintenance and supplies.

Revise subparagraph (l) of Article 670.02 to read:

(l) Six four-line telephones, with touch tone, where available, and two digital answering machines, for exclusive use by the Engineer.

Revise subparagraph (m) of Article 670.02 to read:

(m) One electric water cooler dispenser including water service.

Add the following subparagraphs to Article 670.02:

(s) One 4 foot x 6 foot chalkboard or dry erase board.

(t) One 4 foot x 6 foot framed cork board.

Add the following to Article 670.07 Basis of Payment.

The building or buildings, fully equipped, will be paid for at the contract unit price per calendar month or fraction thereof for ENGINEER'S FIELD OFFICE, TYPE A (SPECIAL).

REMOVE SIGN (SPECIAL)

Description. This work shall consist of the removal, salvage and delivery of the existing sign and foundation to the Village of Lake Bluff as noted on the plans.

Construction Requirements. The sign and precast concrete foundation shall be completely removed, salvaged, and backfilled. The salvaged sign and foundation shall be returned and delivered to the Village of Lake Bluff Public Works Department. Contact the department at (847)-234-0774 to make arrangements to deliver the sign and foundation.

Measurement and Payment. Removal of the sign and foundation, backfilling the excavated foundation hole and delivering the sign and foundation to the Lake Bluff Public Works Department will be paid for at the contract unit price per EACH as REMOVE SIGN (SPECIAL).

RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL

Effective: August 1, 2023
Revised:

Description: This work shall be completed in accordance with Section 783 of the Standard Specifications for Road and Bridge Construction. This work shall consist of removing the reflector unit from existing raised reflector pavement markers that will remain in place at the end of construction activities. Existing reflectors that conflict with revised traffic patterns shall be removed immediately to facilitate a change in lane assignment. If darkness or inclement weather prohibits the removal operations, such operation shall be resumed the next morning of when weather permits.

The base casting shall remain in place in areas where no pavement rehabilitation is required, therefore only the reflector shall be removed. Debris from the removal operations shall be removed from the pavement prior to opening the roadway to traffic.

Basis of Payment: This work will be measured for payment at the contract unit price per each for RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL. Payment shall be full compensation for materials, labor and equipment required to complete this work.

CONDUIT SPLICE

Description. This work shall conform to applicable portions of Section 810 of the Standard Specifications and shall consist of connecting a new section of conduit to an existing conduit in place. The Contractor, at the splice location, shall make a clean cut of the existing conduit, provide the necessary splicing sleeves or unions and complete the splice by affixing a water proof tape or other sealer around the splice location.

Materials. The conduit splice material must match the material type of the existing and new conduits so the completed union will not be subject to corrosion due to dissimilar material types. All wires and cables must be able to be pulled unobstructed through the splice location.

Basis of Payment. This work will be paid for at the contract unit price per each for CONDUIT SPLICE.

REMOVE AERIAL CABLE

Description. This work shall consist of the disconnection and removal of aerial cable from existing temporary wood poles and all associated apparatus and connections.

Removal. Removal shall include the removal of aerial cables and associated apparatus and connections from temporary poles. This removal shall include removal of all temporary wiring and connections to the associated traffic signal interconnect and Lake County Traffic Management System (PASSAGE). All aerial cable shall become property of the Contractor and shall be removed from the site.

Method of Measurement. Removal of existing aerial cable will be measured for payment in feet. If two or more cables hung aerially or in a conduit are to be removed, each cable will not be measured for payment separately, but as one payment. The length measured shall be between the splice points at each end of the longest cable removed.

Basis of Payment. Removal of aerial cable will be paid for at the contract unit price per foot for REMOVE AERIAL CABLE.

STABILIZED CONSTRUCTION ENTRANCE

This work shall be done in accordance with the applicable portions of Section 281 of the Standard Specifications and shall include the furnishing, installing, maintaining and removing of the STABILIZED CONSTRUCTION ENTRANCE at locations and per the details shown on the plans.

Coarse Aggregate and geotextile fabric for the STABILIZED CONSTRUCTION ENTRANCE, must meet the requirements of the IDOT Standard Specifications, the requirements of the Illinois Urban Manual Material Specification 592 and as detailed on the plans, unless otherwise directed by the Engineer.

Basis of Payment. This work will be paid for at the contract unit price per SQUARE YARD measured in place for STABILIZED CONSTRUCTION ENTRANCE.

STEEL CASINGS

Description. This work shall consist of constructing steel casings of the inside diameter specified, at the locations shown on the plans or as directed by the Engineer. This work shall be performed in accordance with the applicable portions of Sections 202, 550, 552 and 1006 of the Standard Specifications, except as modified herein.

General Requirements. Steel casings shall be constructed in accordance with Article 1006.18. The casing pipe is to have a wall thickness of 11/16-inch (0.6875) and be uncoated steel conforming to ASTM A-53. The casing pipe shall be jacked in place. All joints between individual steel casing pieces shall be watertight upon completion prior to inserting the storm sewer thru the casing.

All annular space between the steel casings and drainage pipes is to be filled with grout to support the carrier pipe and provide long-term stability. The grout shall consist of portland cement (portland cement and fly ash) and/or additives. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM 403, and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM C 495 or C 109. The grout mix shall have sufficient density to prevent floating of the pipe. The apparent viscosity shall not exceed 35 seconds in accordance with ASTM C 939.

Trenches resulting from the installation of steel casings shall be backfilled according to the applicable requirements of Article 550.07. Granular trench backfill will be provided from the bottom of the trench to the existing ground elevation minus one (1) foot.

Disposal of unsuitable material shall be according to Article 202.03.

Method of Measurement. Steel casings will be measured for payment in place in feet.

Basis of Payment. This work will be paid for at the contract unit price per foot for STEEL CASINGS of the inside diameter specified.

Pipeline spacers and annular grout will also be included in the unit cost of this item.

Trench backfill meeting the requirements of Article 208 will be paid for separately.

TRACK MONITORING

Description

This work shall consist of providing pre-construction, during construction, and post-construction track surveys and daily monitoring of the Union Pacific Railroad (UPRR) track for vertical and horizontal potential displacements during operations associated with the jacking of the 48-inch steel casing pipe underneath the railroad corridor and track, and the installation of the proposed 36-inch storm sewer pipe. These operations include, but are not limited to:

1. Installation and removal of the Temporary Soil Retention System
2. Excavation of jacking and receiving pits
3. Jacking of steel casing pipe
4. Insertion of storm sewer pipe into casing pipe
5. Backfilling and restoration of jacking and receiving pits
6. Documenting all conditions photographically

The Contractor shall submit a track monitoring plan to the Engineer a minimum of forty five (45) calendar days prior to start of any work within the UPRR right of way for the Engineer's and the UPRR's review and approval. The purpose of the track monitoring plan is to ensure that there will be no horizontal and/or vertical displacement of railroad track due to proposed work within railroad right of way. The track monitoring plan shall be in compliance with the description of the work described below.

The Contractor will not be allowed to begin work within the Union Pacific Railroad right of way until written approval of the Contractor's track monitoring plan is received from the UPRR and the Supervising Engineer.

Track monitoring Tolerance, ground monitoring, targets, monitoring plan, contingency plans, shoring design, excavation safety should be as per the most current track and ground monitoring guidelines from UPRR.

https://www.up.com/cs/groups/public/@uprr/@realestate/documents/up_pdf_nativedocs/pdf_up_track_ground_monitor.pdf

Pre-Construction:

A pre-construction track survey and inspection shall be performed prior to the start of any construction operations taking place which shall consist of the following and or directed by the Engineer:

- The Contractor will establish an existing track alignment for each set of rails extending 1,000 feet along the track in both directions from the centerline of the proposed pipe.
- The survey shots will be taken every 50 feet along the top of all existing rails.
- The survey shots shall be taken at the centerline of the jacked pipe and at five (5), ten (10), fifteen (15) and twenty (20) feet along the rail on both sides of the jacked pipe centerline.
- The survey shall be taken for a period of fourteen (14) consecutive calendar days prior to the start of the jacking operation.
- The survey shall be coordinated with the Engineer and the UPRR (Casey J. Moore, (402) 544-8553) at least fourteen (14) calendar days prior to any activity that precedes construction.
- The pre-construction track survey shall be documented and tabulated for weekly submittal to the Engineer and the UPRR (Casey J. Moore, (402) 544-8553) for review.
- The Contractor shall submit the specialty subs Contractor's name, contact and location for any track repair or track work, for approval by UPRR a minimum of forty-five (45) days prior to work.
- Normal and temporary vertical track deflections caused by the passage of a train should be noted and established prior to construction.

During Construction:

Daily monitoring shall consist of the Contractor surveying the same points taken during the pre-construction track survey, taking horizontal and vertical measurements. Daily monitoring shall only occur from the date the Contractor begins work through the date the Contractor completes work within the UPRR ROW.

Track conditions shall be documented and tabulated for weekly submittal to the Engineer and the UPRR (Casey J. Moore, (402) 544-8553) for review.

Post-Construction:

The Contractor shall complete a post-construction track survey and inspection after completion of the operation. The post-construction track survey shall consist of the Contractor surveying the same points taken during the pre-construction track survey, taking horizontal and vertical measurements, for a period of fourteen (14) consecutive calendar days.

The post-construction track survey shall be documented and tabulated for weekly submittal to the Engineer and the UPRR (Casey J. Moore, (402) 544-8553) for review.

Track Monitoring Values:

Threshold value is equal to 1/8 inch permanent vertical or horizontal deflection.
Shutdown value is equal to ¼ inch permanent vertical or horizontal deflection.

Deflection Limits:

The top of rail shall not permanently deflect more than ¼ inch vertical or horizontal. This is not an “allowable” deflection. All estimated deflection should be eliminated to the greatest extent possible prior to construction.

During construction, if any measurements exceed ¼” of the pre-construction track survey, the Contractor must discontinue construction operations immediately and notify the Engineer and UPRR to evaluate the track condition.

The Contractor shall perform any restorative work at his/her own expense prior to resuming construction operations. If track repairs are required, the Contractor shall use a qualified specialty contractor experienced in UPRR track work and approved by UPRR in advance to perform corrective track repairs to the satisfaction of UPRR, and the Engineer. These repairs can include, but are not limited to elevation adjustments, realignment, replacement of track units or hardware or other work to restore the existing tracks to pre-construction conditions and shall be performed at no additional cost to the Department or UPRR.

During post construction track monitoring, if any measurements exceed ¼” of the pre-construction track survey, the Contractor must immediately notify the Engineer and UPRR who will jointly investigate the cause of the displacement. If it is determined that the deflection in the vertical or horizontal deflection exceeds ¼” and caused by contractor’s work operations then the Contractor shall perform any restorative work at his/her expense.

If track repairs are required, the Contractor shall use a qualified specialty contractor experienced in UPRR track work and approved by UPRR in advance to perform corrective track repairs to the satisfaction of UPRR, and the Engineer. These repairs can include, but are not limited to elevation adjustments, realignment, replacement of track units or hardware or other work to restore the existing tracks to pre-construction conditions and shall be performed at no additional cost to the Department or UPRR.

Targets:

Track monitoring shall not require track access other than to place the track monitoring targets. Monitoring targets should be placed such that monitoring is possible when a train is present. However, monitoring during the passing of a train is not required. Adhesive backed reflective targets should be attached to the side of the rail temporarily. Targets should be removed once monitoring phase is complete.

Ground Monitoring:

The Contractor shall provide the means and methods for monitoring the ground settlement and submit a ground monitoring plan minimum of forth five (45) days prior to the start of work operation within the railroad ROW for Engineer's and the UPRR’s review and approval.

Contractor Contingency Plan:

The Contractor shall provide Contractor Contingency Plan(s), that anticipates reaching the threshold and shutdown values, for all work operations causing vertical or horizontal track displacements of the pre-construction track survey. The Contractor Contingency Plans shall provide means and methods, with options, if necessary, to complete the work operations in a manner that will not cause the above described excessive vertical or horizontal track displacements. Once the threshold value is met, the Contractor should anticipate the need to implement each Contractor Contingency Plan with the required materials, equipment, and personnel. The contractor shall determine the appropriate Contractor Contingency Plan(s) to be utilized and shall immediately discuss this plan with, and receive approval confirmation from, the Railroad or authorized Railroad representative. If the above-described shutdown value is met, all project work shall stop, and the chosen Contractor Contingency Plan shall commence. The Railroad may choose to allow and/or require the immediate implementation of specific approved Contractor Contingency Plans, submitted by the Contractor, once the above-described excessive track displacement occurs.

Basis of Payment. This work will be paid for at the contract unit price per Calendar Day for TRACK MONITORING, regardless of how many data points or setups are performed that day.

RAILROAD PROTECTIVE LIABILITY INSURANCE (BDE)

Effective: December 1, 1986
Revised: January 1, 2022

Description. Railroad Protective Liability and Property Damage Liability Insurance shall be carried according to Article 107.11 of the Standard Specifications. A separate policy is required for each railroad unless otherwise noted.

NAMED INSURED & ADDRESS	NUMBER & SPEED OF PASSENGER TRAINS	NUMBER & SPEED OF FREIGHT TRAINS
Union Pacific Railroad Company Finance/Insurance Mail Stop 1870 1400 Douglas St. Omaha, NE 68179	0 trains/day	7 trains/day @ 50 mph

Class 1 RR (Y or N): Y
DOT/AAR No.: 176 819R
RR Mile Post: 31.27
RR Division: GREAT LAKES
RR Sub-Division: MILWAUKEE SUB

For Freight/Passenger Information Contact: Dave LaPlante Phone: 402-544-8563
For Insurance Information Contact: Connie Prokupek Phone: 402-544-2215

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.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 1A - SUMMARY OF WORK

1. GENERAL:

1.1 Description: General

1.1.1 The work under this Contract for the construction of Pump Station 37 shall include all labor, materials, tools, equipment and incidentals and for performing all work required for the construction of a new pump station for a complete operational facility, as included in all Contract Documents and shall be as measured and paid for as described hereinafter. The requirements of Division 1, General Requirements, shall apply to all Pump Station Work.

1.1.2 Any pay items that are not otherwise described in this Division or in the Special Provisions for Civil and Drainage shall be in accordance with the Standard Specifications. The following Sections of the Standard Specifications required in the Contract.

1.1.2.1	Tree Removal	Section 201
1.1.2.2	Earth Excavation	Section 202
1.1.2.3	Trench Backfill	Section 208
1.1.2.4	Topsoil and Compost	Section 211
1.1.2.5	Seeding	Section 250
1.1.2.6	Mulch	Section 251
1.1.2.7	Perimeter Erosion Control	Section 280
1.1.2.8	Riprap	Section 281
1.1.2.9	Aggregate Base Course	Section 351
1.1.2.10	Aggregate Surface Course Section 402	
1.1.2.11	Hot-Mix Asphalt Binder and Surface Course Section 406	
1.1.2.12	Bituminous Materials (Tack Coat)	Section 406
1.1.2.13	Portland Cement Concrete Sidewalk Section 424	
1.1.2.14	Removal of Existing Pavement Appurtenances	Section 440
1.1.2.15	Excavation for Structures	Section 502
1.1.2.16	Concrete Structures Section 503	
1.1.2.17	Reinforcement Bars Section 508	
1.1.2.18	Piling	Section 512
1.1.2.19	Storm Sewer	Section 550
1.1.2.20	Storm Sewer Removal and Installation	Section 551

1.1.2.21	Storm Sewer Jacked in Place	Section 552
1.1.2.22	Manholes	Section 602
1.1.2.23	Concrete Curb and Gutter	Section 606
1.1.2.24	Removal and Disposal of Regulated Substances	Section 669
1.1.2.25	Engineer's Field Office and Laboratory	Section 670
1.1.2.26	Mobilization	Section 671
1.1.2.27	Work Zone, Traffic Control and Protection, Signing, and Pavement Marking	Section 701
1.1.2.28	Work Zone Pavement Marking	Section 703
1.1.2.29	Temporary Concrete Barrier	Section 704
1.1.2.30	Pavement Stripping	Section 780
1.1.2.31	Raised Reflective Pavement Markers	Section 781
1.1.2.32	Prismatic Reflectors	Section 782
1.1.2.33	Handhole	Section 814
1.1.2.34	Fiber Optic Cable	Section 871

1.1.3 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 will 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, Site Work; Section 3B, Grout; Division 4, Masonry; Division 5, Metals, Division 6, Carpentry; Division 7, Thermal and Moisture Protection; Division 8, Doors and Windows; Division 9A, Painting; and Division 10, Specialties. The Pump Station General Work shall include, but not be limited to, the following and shall be paid under pay item PUMP STATION GENERAL WORK:

(a) Site work as indicated on the Drawings and as specified in Section 2A, Site Work.

(b) All grout as indicated on the Drawings and as specified in Section 3B, Grout.

(d) All unit masonry work consisting of concrete block work, glass block work and faced brickwork as indicated on the Drawings and as specified in Section 4A, Unit Masonry.

(e) All miscellaneous metal work as indicated on the Drawings and as specified in Division 5, Metals.

(f) All carpentry work as indicated on the Drawings and as specified in Section 6A, Rough Carpentry.

(g) All roofing work as indicated on the Drawings and as specified in Section 7A, Elastomeric Sheet Roofing- Fully Adhered/Ballasted Cover.

(h) All sheet metal work as indicated on the Drawings and as specified in Section 7B, Sheet Metal Flashing and Trim.

(i) All sealant work as indicated on the Drawings and as specified in Section 7C, Joint Sealers.

(j) All board insulation work as indicated on the Drawings and as specified in Section 7D, Board Insulation.

(k) All doors and hardware as indicated on the Drawings and as specified in Division 8, Doors and Windows.

(l) All painting as indicated on the Drawings and as specified in Section 9A, Painting.

(m) The station identification plate, shop desk, bulletin board, staff gauges, first aid kit, fire extinguishers, electric clock, metal shelf and trash can as indicated on the Drawings and as specified in Section 10A, Specialties.

(n) Fiberglass railing and other components as specified in Section 10B, Fiberglass Reinforced Plastic Products and Fabrications

1.1.4 Work related to aggregate subgrade improvement, 12” shall be paid for under pay item AGGREGATE SUBGRADE IMPROVEMENT 12” at the contract unit price per square yard and shall be in accordance with Standard Specifications and the special provision listed under the section “Special Provisions for Civil and Drainage”.

1.1.5 Work related to concrete shall be paid for under pay item CONCRETE STRUCTURES at the contract unit price per cubic yard and shall be in accordance with Section 3A, Cast-In-Place Concrete.

1.1.6 Work related to reinforcing shall be paid for under pay item REINFORCED BARS, EPOXY COATED at the contract unit price per pound and shall be in accordance Section 3A, Cast-In-Place Concrete.

1.1.7 Work related to washout basin shall be paid for under pay item WASHOUT BASIN at the contract unit price per lump sum and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”.

1.1.8 Work related to road and clean existing conduit shall be paid for under pay item ROD AND CLEAN EXISTING CONDUIT at the contract unit price per foot and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.9 Work related to bike path removal shall be paid for under pay item BIKE PATH REMOVAL at the contract unit price per square yard and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”.

1.1.10 Work related to the sliding gate shall be paid for under pay item SLIDE GATE at the contract unit price per each and shall be as specified in Section 2B, Chain Link Fence and Gate.

1.1.11 Work related to pavement marking removal shall be paid for under pay item PAVEMENT MARKING REMOVAL – WATER BLASTING at the contract unit price per square foot and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”.

1.1.12 Work related to pavement removal for parking lot shall be paid for under pay item PARKING LOT PAVEMENT REMOVAL at the contract unit price per square yard and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”.

1.1.13 Work related to lightweight cellular concrete fill shall be paid for under pay item LIGHTWEIGHT CELLULAR CONCRETE FILL at the contract unit price per cubic yard and shall be as specified in Section 2C, Demolition.

1.1.14 Work related to demolition of the existing pump station shall be paid for under pay item DEMOLITION OF EXISTING PUMP STATION at the contract unit price per lump sum and shall be as specified in Section 2C, Demolition.

1.1.15 Work related to fence special shall be paid for under pay item CHAIN LINK FENCE (Special) at the contract unit price per foot as specified in Section 2B, Chain Link Fence and Gate.

1.1.16 Work related to fence removal shall be paid for under pay item CHAIN LINK FENCE REMOVAL at the contract unit price per foot and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”..

1.1.17 Work related to fence shall be paid for under pay item CHAIN LINK FENCE, 8’ (Special) at the contract unit price per foot and shall be as specified in Section 2B, Chain Link Fence and Gate.

1.1.18 Work related to man gate shall be paid for under pay item CHAIN LINK GATES (Special) at the contract unit price per each and shall be as specified in Section 2B, Chain Link Fence and Gate.

1.1.19 Work related to traffic control and protection shall be paid for under pay item TRAFFIC CONTROL AND PROTECTION, (SPECIAL) at the contract unit lump sum price and shall be in accordance with the special provision listed under the section “Special provisions for Civil and Drainage”.

1.1.20 Work related to raised reflective pavement marker removal shall be paid for under pay item RAISED REFLECTIVE PAVEMENT MARKER, REFLECTOR REMOVAL at the contract unit price per each and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.21 Work related to Class D patches shall be paid for under pay item CLASS D PATCHES, TYPE IV, 12 INCH (SPECIAL) at the contract unit price per square yard and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.22 Work related to temporary information signing shall be paid for under pay item TEMPORARY INFORMATION SIGNING at the contract unit price per square foot and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.23 Work related to bollards shall be paid for under pay item BOLLARDS at the contract unit price per each and shall be as specified in Section 2A, Site Work.

1.1.24 Work related to stabilized construction entrance shall be paid for under pay item STABILIZED CONSTRUCTION ENTRANCE at the contract lump sum price and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.25 Work related to construction layout shall be paid for under pay item CONSTRUCTION LAYOUT at the contract lump sum unit price and shall be in accordance with the recurring special provisions.

1.1.26 Work related railroad protective liability insurance shall be paid for under pay item RAILROAD PROTECTIVE LIABILITY INSURANCE at the contract lump sum price and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.27 Work related with 36” type 3 storm sewers of water main quality shall be paid for under pay item STORM SEWERS, TYPE 3, WATER MAIN QUALITY PIPE, 36" at the contract unit price per foot and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.28 Work related with 48” steel casing shall be paid for under pay item STEEL CASING 48" at the contract unit price per foot and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.1.29 Work related to conduits directionally drilled shall be paid for under pay item ELECTRICAL CONDUIT, HDD Method at the contract unit price per foot and shall be as specified in Section 2A, Site Work.

1.1.30 Work related with braced excavation shall be paid for under pay item BRACED EXCAVATION at the contract unit price per cubic yard and shall be as specified in Section 2A, Site Work.

1.2 Description: Mechanical

1.2.1 The requirements of Division 1, General Requirements, shall apply to all Pump Station Mechanical Work.

1.2.2 The Pump Station Mechanical Work shall be as shown on the Drawings and as specified and include, but not be limited to, furnishing and installing the following and shall be paid for at the contract lump sum under pay item PUMP STATION MECHANICAL WORK:

(a) Piping and appurtenances as indicated on the Drawings and as specified in all Contract Documents.

(b) Gates and valves with all appurtenances.

(c) Flow recirculation system including, but not limited to, stainless steel slide gate, piping, and all appurtenances.

(d) Miscellaneous mechanical items consisting of cable support, pavement flooded float alarm box, float stilling well and pump dolly.

1.2.3 The heating and ventilation system shall be paid for at the contract lump sum under pay item HEATING AND VENTILATION and shall be in accordance with Section 15E, Ventilation.

1.2.4 The storm water main pumps shall be paid for at the contract unit price per each under pay item MAIN PUMPS and shall be in accordance with Section 15D, Pumping Equipment.

1.2.5 The storm water low flow pump shall be paid for at the contract unit price per each under pay item LOW FLOW PUMP and shall be in accordance with Section 15D, Pumping Equipment.

1.2.6 Complete spare main pump assembly shall be paid for at the contract unit price per each under pay item COMPLETE SPARE MAIN PUMP ASSEMBLY and shall be in accordance with Section 15D, Pumping Equipment.

1.2.7 Complete spare low flow pump assembly shall be paid for at the contract unit price per each under pay item COMPLETE SPARE LOW FLOW PUMP ASSEMBLY and shall be in accordance with Section 15D, Pumping Equipment.

1.3 Description: Electrical

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

1.3.2 The pump Station Electrical Work shall include, but not be limited to, furnishing and installing the following and shall be paid for at the contract lump sum under pay item PUMP STATION ELECTRICAL WORK:

(a) Disconnect switches and motor starters.

(b) Electrical Power System Studies.

(c) Lighting fixtures, lighting panel board, lighting transformer and wiring devices.

(d) Power, lighting, control and signal wires and cables.

(e) Conduit and raceway system.

(f) Lightning protection.

(g) Ultrasonic and hydrostatic level system. Float type level sensing control system.

(h) Branch wiring and conduit for main pumps, low flow pumps, unit heaters, slide gate actuators, ventilation system, SCADA panel and other electrical equipment as shown on the Drawings.

(i) Testing.

1.3.3 Packaged engine generator systems shall be paid for at the contract lump sum under pay item PUMP STATION PACKAGED ENGINE GENERATOR SYSTEMS and shall be in accordance with Section 16E, Packaged Engine Generator Systems.

1.3.4 Motor control center with misc. controls, breaker and automatic transfer switch shall be paid for at the contract lump sum under pay item PUMP STATION MOTOR CONTROL CENTER and shall be in accordance with Section 16F, Motor Control Center.

1.3.5 Supervisory, Control and Data Acquisition (SCADA) equipment and programming shall be paid for at the contract lump sum under pay item PUMP STATION SCADA EQUIPMENT and shall be in accordance with Section 16D, Supervisory Control and Data Acquisition (SCADA) Equipment. Systems Integrator shall be in accordance with Section 16D.

1.3.6 Electric service connection shall consist of charges of the electric utility for both the temporary service during construction (for construction trailers as well as relocation of existing pump station feed to avoid the jacking pit) and permanent electrical service and shall be paid for at the contract lump sum under pay item ELECTRICAL SERVICE CONNECTION and shall be in accordance with Section 16A, General Electrical Provisions.

1.3.7 Electric service installation shall be paid for at the contract unit price per each under pay item ELECTRIC SERVICE INSTALLATION and shall be in accordance with Section 16A, General Electrical Provisions.

1.3.8 Telephone service installation and connection shall be paid for at the contract lump sum under pay item TELEPHONE SERVICE INSTALLATION AND CONNECTION and shall be in accordance with Section 16A, General Electrical Provisions.

1.3.9 AEGIS panel shall be paid for at the contract lump sum under pay item AEGIS PANEL and shall be in accordance with Section 16H, Major Electrical Equipment.

1.3.10 Fire detection panel shall be paid for at the contract lump sum under pay item FIRE DETECTION PANEL and shall be in accordance with Section 16H, Major Electrical Equipment.

1.3.11 Gas detection panel shall be paid for under pay item GAS DETECTION PANEL at the contract lump sum and shall be as specified in Section 16D, Major Electrical Equipment.

1.3.12 FIBER OPTIC CABLE IN CONDUIT, NO. 62.5/125, 6F shall be paid for at the contract unit price per foot as specified in Standard Specifications and in Division 16, Electrical.

1.4 Scope of Work

1.4.1 It is the intent of the Contract Documents and referenced Standard Specifications, to define the work required for the construction of the new Pump Station 37 and to maintain operations of the existing pump station facility during construction. No portion of the work required to provide a coordinated complete installation shall be omitted even though not expressly specified or indicated.

1.4.2 These Contract Specifications for work on Pump Station 37 are presented as various listed Divisions. In general, these Divisions address the requirements for work items which are listed as pay items and as described under the various Divisions.

1.5 Existing Pump Station Maintenance during Construction

1.5.1 Transfer of maintenance to the Contractor will occur at the pre-inspection meeting. From the day of transferring the maintenance of the existing pump station to the Contractor until the day of final acceptance by the Engineer, the Contractor shall be fully responsible for maintenance of the existing Pump Station 37. Maintenance shall be in full compliance with the District 1 Electrical Maintenance Contract, Contract 62A12 from September 2015 letting or the most recent contract from the date of BID.

1.5.2 If the project is not complete, the existing pump station shall remain in operation except as noted in the schedule and constrains section.

1.5.3 Once the new pump station is commissioned to the satisfaction of the Engineer, the existing pump station shall be abandoned and the wet well filled. The Contractor shall transfer maintenance of the new Pump Station 37 to the Department at the day of final inspection by the Engineer.

1.5.4 The Contractor shall transfer the maintenance of the new Pump Station 37 to the Department at the day of final acceptance by the Engineer and Department Electrical Maintenance. The Contractor shall be responsible for maintaining the equipment installed in the new Pump Station 37 in accordance with the equipment manufacturer's written instructions and maintenance recommendations. The Contractor shall be responsible for maintaining the new Pump Station 37 including but not limited to, removal of silt and debris from wet well, remove of debris from screen and exercising of generator until maintenance has been transferred to the Department. Contractor shall clean wet well and screen at intervals not to exceed three months. The wet well shall be cleaned and free of debris at the final acceptance day.

1.5.5 Prior to the starting of work, the Contractor shall notify the Engineer and arrange for a pre-construction inspection. At the pre-construction inspection, the facility and its equipment shall be examined and defective or missing items shall be repaired by the Department's Electrical Maintenance Contractor or shall otherwise be noted. A record of inspection shall be furnished to the Engineer.

1.5.6 Emergency Service Requirements:

The Contractor shall be responsible for providing 24-hour, 7 days a week emergency response to existing pumping station alarms. Upon notification of a pump station alarm, the Contractor shall dispatch emergency service personnel to the station immediately and shall arrive at the station within one (1) hour of the receipt of the alarm. All necessary emergency repairs required to restore the pump station to its normal operating condition shall be done by the Contractor immediately. Emergency service personnel shall remain at the station to monitor the situation until the alarm(s) are cleared or otherwise notified by the Department.

(a) The IDOT COMCENTER shall be immediately notified by the Contractor whenever an "Entry Alarm" or "Pavement Flooded Alarm" are received, the IDOT COMCENTER shall be notified with the following information: number of pumps running, water depth in wet well, depth of water on pavement and if the drainage inlets are clogged.

(b) Failure to respond or meet the emergency service requirements of a pumping station alarm, the Contractor shall be liable to the Department in the amount paid to other subcontractors hired by the Department to perform the necessary alarm response.

1.5.7 Routine Maintenance Requirements:

Ongoing maintenance activities are required to maintain the existing Pump Station #37 for proper roadway drainage. Routine maintenance inspections of all equipment shall be conducted by the Contractor. Routine maintenance items shall be done at intervals and as outlined in the District 1 Electrical Maintenance Contract, Article 15.0 "Routine Patrol Requirements".

(a) Failure to meet the routine maintenance requirements of the pumping station, the Contractor shall be liable to the Department in the amount paid to other subcontractors hired by the Department to perform the necessary routing maintenance.

1.5.8 The Contractor shall ensure that two sets of construction lock and entry keys for all construction facilities are provided to the Engineer.

1.5.9 Snow plowing of the facility shall be provided no more than two working days after a snow fall of one (1) inch or more.

1.5.10 Should it become necessary to perform maintenance work beyond the scope of the Contract or routine maintenance/patrol, as outlined in the Electrical Maintenance Contract, the Contractor shall be reimbursed per Article 109.04 (B) and 109.05.

1.5.11 This work shall be paid for at the Contract unit price per month under the pay item MAINTENANCE OF EXISTING PUMP STATION DURING CONSTRUCTION as specified in Division 1, General Requirements. No additional monthly payment shall be paid to Contractor beyond contractual date due to the contractor’s inability to complete the relocation of the pump station in a timely manner and as stipulated in the contract documents.

1.6 Continuous Operation

1.6.1 The existing Pump Station 37 shall remain in continuous operation during construction. Brief shut-down periods may be permitted to facilitate construction needs when approved by the Engineer. The Contractor shall submit, to the Engineer, all requests for a brief shut-down indicating detailed written description of all particulars such as date, time of day, length of shut-down and all related details. The work required to meet this requirement shall be included at no additional cost to the Department. The Contractor is responsible for maintaining the full existing pump station capacity at all times until transferring the maintenance of the new pump station to the Department.

1.6.2 Continuous operation may require that some of the existing electrical equipment be disconnected, relocated and reconnected as temporary systems.

1.6.3 Continuous operation may require temporary pumping arrangements. Existing station specified firm pumping capacity 6,000 gpm shall be maintained. All necessary temporary pumping provisions and arrangements shall be made to maintain the above specified pumping capacity of the pumping station. There are (2) existing 3,000 gpm main pumps.

1.6.4 This 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.

1.7 Protection of Drainage Facilities during Construction

1.7.1 Unless otherwise noted in the Contract Drawings, the existing drainage facilities shall remain in use during the period of the new pump station construction.

1.7.2 Locations of existing drainage structures and sewers as indicated on the Contract Drawings are approximate. Prior to commencing work, the Contractor, at his own expense, shall determine the exact location of the existing structures which are within the proposed construction site.

1.7.3 All drainage structures are to be kept free from any debris resulting from construction operations. All work and material 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 expense and no extra compensation will be allowed.

1.8 Submittals

1.8.1 Except as specified elsewhere herein, materials and equipment shall be in conformance with the requirements of Section 106 of the Standard Specifications.

1.8.2 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.

1.8.3 All equipment, products and materials incorporated in the work shall be submitted for approval.

1.8.4 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 be complied with for each indicated type of submittal. Procedures concerning items such as 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.

1.8.5 Work-Related Submittals

(a) Substitution or "Or Equal" Items include material or equipment Contractor requests Engineer to approve, 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.

(b) 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.

(c) 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.

(d) 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.

(e) Miscellaneous Submittals are work-related submittals that do not fit in the previous categories, such as 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.

1.8.6 The contractor shall thoroughly review submittal and ensure that the submittal complete and meets contract documents. Any shop drawing submitted more than two times requires the contractor to be charged for all costs incurred by the Department.

1.8.7 Contractor shall deliver submittals for review, pickup reviewed submittals and distribute as directed by the Engineer.

1.8.8 Scheduling

(a) A preliminary schedule of shop drawings and samples submittals shall be submitted for approval, in duplicate.

(b) Each submittal shall be prepared and transmitted to Engineer sufficiently in advance of scheduled performance of related work and other applicable activities.

(c) 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.

1.8.9 Each submittal shall be accompanied by a transmittal containing the following information:

(a) Contractor's Name
(b) Supplier's Name
(c) Manufacturer's Name
(d) Date of submittal and dates of previous submittals containing the same material
(e) Project Route/Name
(f) Section
(g) Submittal and transmittal number
(h) Contract identification
(i) Identification of equipment and material with equipment identification numbers, motor numbers, and Specification section number Variations from Contract Documents and any limitations which may impact the Work Drawing sheet and detail number as appropriate
(j) Variations from Contract Documents and any limitations which may impact the Work.
(k) 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.
(l) The resubmittal shall be complete in all respect and shall supersede earlier submittal in entirety and should not require referring to earlier multiple piece meal submittals.
(m) Each submittal shall be dedicated for each subject. The different subjects and or systems associated with different engineering disciplines shall not be combined or mixed up together in one package of submittal.

1.8.10 Exceptions, Deviations, and Substitutions

(a) 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.

(b) Data for items to be submitted for review as substitution shall be collected into one submittal for each item of material or equipment.

(c) 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.

1.8.11 Shop Drawings

(a) 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 which 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.

(b) The catalog cuts shall be highlighted identifying all selected options and project specific details. Generic catalog cuts shall be unacceptable.

(c) Any deviation hidden in the submittals shall be unacceptable. The deviations if any shall be highlighted and contractor shall provide cost analysis justifying equal or better product. The Engineer shall be the sole authority for the acceptance or rejection without any justification.

(d) List all shop drawings that are required for each discipline.

(e) Each major equipment submittal shall have a detailed bill of material list.

(f) The following information shall be included on each drawing or page:

1) Submittal date and revision dates.
2) Project name, division number and descriptions.
3) Detailed specifications section number and page number.
4) Identification of equipment, product or material.
5) Name of Contractor and Subcontractor.
6) Name of Supplier and Manufacturer.
7) Relation to adjacent structure or material.
8) Field dimensions, clearly identified.
9) Standards or Industry Specification references.
10) Identification of deviations from the Contract Documents.
11) Contractor's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
12) Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.

(g) An 8-inch by 3-inch blank space shall be provided for Contractor and Engineer stamps.

(h) Five (5) submittal copies shall be submitted to the Engineer for review.

(i) 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.

(j) Shop drawing submittal shall include pump control schematics, SCADA panel drawings, and detailed control system descriptions for auto/manual controls and operation and monitoring of main and low flow pumps from the SCADA Panel and from the float control mode and also remote monitoring system descriptions.

1.8.12 Product Data

(a) 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 identify not applicable and project specific information.

(b) 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.

(c) Submittal shall be final when returned by Engineer marked "Approved".

(d) Five submittal copies shall be submitted to the Engineer.

(e) 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.

1.8.13 Samples

(a) 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.

(b) 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.

(c) Each sample shall include generic description, source or product name and manufacturer, limitations, and compliance with standards.

(d) 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, texture.

(e) 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, 1 set will be returned.

(f) 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.

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

1.8.15 Miscellaneous Submittals

(a) Inspection and Test Reports

1) Inspection and factory test reports shall be submitted for pumps, SCADA panel, generator and MCC.

(b) Submittals for detailed factory and field test procedures for pumps. Submittals for detailed field test procedures for SCADA, generator and MCC.

(c) Warranties, Maintenance Agreements, and Workmanship Bonds

1) Refer to Specification sections and section Warranties of this Division for specific requirements. Submittal is final when returned by Engineer marked "Approved" or "Approved as Noted".

2) 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.

(d) Certifications

1) Refer to Specification sections for specific requirements on submittal of certifications. Five 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".

2) 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.

3) 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) There should be a section in the report analyzing results and test data that meets the requirements of the contract and also list the items that fall short of contract requirements with conclusive remarks for acceptance/rejection of the equipment.

(d) Tools

1) Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units shall be submitted.

2) 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.

3) 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.

1.8.16 Contractor's Stamp

(a) 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.

(b) 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.

1.8.17 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.

1.8.18 Unless required elsewhere, submittals shall be distributed to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.8.19 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.

1.8.20 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.

1.8.21 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. The complete re-submittal shall be required for the "Approved as Noted" until the submittal attain "Approved" status, unless the reviewer's remarks indicate "Re-submittal is not required" which shall only be exercised for minor comments.

1.8.22 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.

1.8.23 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.

1.8.24 Coordination

(a) 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.

(b) 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.

1.8.25 Unless otherwise indicated, warranties 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.

1.9. Re-submittal Preparation

1.9.1 Re-submittal Preparation shall comply with the requirements described in subsection 1.8, Submittal, of this section. In addition, it shall be identified on the transmittal form that the submittal is a resubmission. Re-submittal shall have previous comments and detailed point by point response to each previous comments.

1.9.2 Any corrections or changes in submittals required by Engineer's notations shall be made on returned submittal.

1.9.3 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.

1.9.4 Variations or revisions from previously reviewed submittal, other than those called for by Engineer, shall be identified on transmittal form.

1.10 Record Drawings

1.10.1 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.

1.10.2 At completion of the Contract and before final payment is made, four (4) sets of clearly legible 11”x 17” bond media Contract Drawings reflecting all changes made during construction shall be delivered to the Engineer. The drawings shall each be stamped "Record Drawings", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's representative.

1.10.3 Record Drawings shall reflect the actual field installed equipment, locations, nameplates, electrical control logic, conduit locations with corresponding labeling, and wiring changes etc. Any deletions of the design drawings shall cross reference to the replaced drawings.

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

1.10.5 The record drawings shall be submitted in PDF format on CDROM as well as hardcopy for review and approval. In addition to the record drawings, copies of the final catalog cuts which have been Approved or Approved as Noted shall be submitted in PDF format along with the record drawings. The PDF files shall clearly indicate either by filename or PDF table of contents the respective pay item number. Specific part or model numbers of items which have been selected shall be clearly visible.

1.10.6 In addition to the specified record drawings, the Contactor shall record GPS coordinates of the following electrical components:

- Last light pole on each circuit
- Handholes
- Conduit crossings
- Controllers
- Buildings
- Structures with electrical connections, i.e. DMS, lighted signs.
- Electric Service locations”

1.11 Warranties

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

1.11.2 Prior to final payment, the original and one copy of all bonds, warranties, 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 Engineer.

1.11.3 The warranties shall include parts and labor and shall begin from the date of final acceptance.

1.12 Operation and Maintenance Manuals

1.12.1 Five (5) copies of an Operation and Maintenance Manual shall be furnished to the Engineer for all equipment and associated control systems furnished and installed for review and approval. Four hard copies of approved O&M manuals and four scanned O&M Manuals CD’s shall be submitted for Engineer’s use.

1.12.2 The contractor shall submit four manuals for engineer, Department O&M and Department engineer's independent review when construction is at 75% complete stage. Based on the consolidated review comments and compliance, the contractor shall organize and compile required number of sets of O&M manuals and resubmit for review and approval along with point to point response to the previous comments. If it is determined by the Engineer that the manuals does not contain required details and are not revised per the previous comments, then all manuals shall be returned back to the contractor for corrective action until the manuals are approved by the Engineer.

1.12.3 The manual shall consist of the following and shall be prepared and arranged subject wise and chronological order as follows:

(a) Table of Contents broken down per discipline.
(b) A section of a pump station data sheet (see sample form at end of section.
(c) A section of an equipment data summary (see sample form at end of section) for each item of equipment.
(d) A section of an equipment preventive maintenance data summary (see sample form at end of section) for each item of equipment.
(e) 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.
(f) Approved power systems study including list of electrical relay settings and control, alarm contact, an timer settings with applicable ranges.
(g) Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.
(h) One valve schedule giving valve number and location for each valve installed.
(i) All O&M Manual material and catalog pages shall be on 8-1/2 inch by 11 inch commercially printed or typed forms or an acceptable alternative format.
(j) Comprehensive equipment technical data sheets for pumps , motors, equipment within switchgear, MCC, switchgear, transformers, breakers, valves, SCADA and control panel.
(k) Details of equipment nameplates and technical ratings.
(l) Detailed summary of quantities and bill of material with technical descriptions for major equipment such as MCC, switchgear, SCADA, and control panels, etc.

(m) The manuals shall contain catalog cuts highlighting features and selected options of the equipment.
(n) Legible 11 inch x 17 inch shop drawing and each shop drawing shall have “Record” stamp, signatures and date.
(o) The catalog cuts of each device/equipment shall have engineer’s “Approved” stamp, signature and date.
(p) The manual shall include shop drawings of SCADA, control panels, MCC, switchgear, front and internal views, internal wiring and field interconnection termination details/terminal schedules.
(q) The manual shall have CAD produced contract drawings having changes identified by red ink and contract documents shall have “Record” stamp, signature and date.
(r) The manual shall include all approved pump factory witness test reports with corresponding data and records from the pump field tests.
(s) The manual shall include control schematic shop drawings for pumps and discharge/recirculation gate valves.
(t) Mechanical and HVAC equipment schedules.
(u) The manual shall include floor and roof hatch product data and shop drawings including roofing product data, glass and glazing and doors product data, and specialty items product data including but not limited to fiberglass handrails and ladders product data, HVAC louver and grilles product data. Provide associated shop drawings with the product data.
(v) The manual shall contain a section for detailed system description of sequence of pump operations during rising and falling wet well water level through SCADA primary and backup level controls, float mode control, manual and auto operation of various level systems, remote monitoring of pump station signals and communications method.
(w) All documents shall be legible.
(x) The manual shall include shop drawings having engineer’s approved stamp, signature and date.
(y) The manual shall include section for field test reports for all major equipment including the MCC, generator, grounding system, SCADA, and all other monitoring and control equipment.
(z) Four copies of Record Drawings shall be submitted to the Engineer for review.
(aa) Successful bidder will be provided with MicroStation drawings upon receipt of acceptable release.

1.12.4 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. 11”x17” reduced size legible 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.

1.12.5 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.

1.12.6 The O&M Manuals must be submitted and must be acceptable to the Engineer prior to equipment start-up. Substantial completion is not achieved until O&M Manuals are approved by the Engineer.

Pump Station # 37 Data Sheet

Location: Describe Location and Address

Telephone:
Voice & AEGIS Phone #:

Main Pumps: Total 2 @ 3,000 GPM
Standby Pump: 1@3,000 GPM
Pump: Describe complete model # and manufacturer's name
Motor: Describe complete model #, motor HP, amps, voltage and manufacturer's name

Low Flow Pumps: 1@ 800 GPM.
Pump: Describe complete model # and manufacturer's name
Motor: Describe complete model #, motor HP, amps, voltage and manufacturer's name

Pump Station Capacity: 6,000 GPM

Pit Type: Wet Pit

Outlet: 36" and 42" Diameter Sewer

Electrical Service:
1) Normal Power: Describe amps, cable and conduit size

2) Emergency Power: Describe amps, cable and conduit size

Generator: Describe complete model # and manufacturer's name, and technical rating

MCC:
1) MCC: Describe tech ratings, model # and manufacturer's name

Pump Station #37 Control Elevations

Pumping Operation Ranges With Rising Water			
SCADA Function	Level Above Sump Pit Floor	Level EL.	Float Function
	(FT)	(EL)	
High Water Alarm	14.36	657.11	High Water Alarm
No Function	11.25	654.00	Start Main Pump 3 (If 1 or 2 has failed)
Start Lag Main Pump	10.25	653.00	Start Main Pump 2
Start Lead Main pump and Stop Low Flow Pump	9.25	652.00	Start Main Pump 1 Stop Low Flow Pump
Start Low Flow Pump	5.75	648.50	Start Low Flow Pump
Pavement Flood Alarm	20.47	663.22	Pavement Flood Alarm

Pumping Operation Ranges With Falling Water			
SCADA Function	Level Above Sump Pit Floor	Level EL.	Float Function
	(FT)	(EL)	
Stop Main Pumps & Start Low Flow Pump	7.75	650.50	Stop main pumps and Start Low Flow Pump
Stop Low Flow Pump	4.25	647.00	Stop Low Flow Pump
Low Water Alarm	3.75	646.50	Low Water Alarm

Maps, Photos, and Driving Directions

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

STORMWATER PUMP STATION NO. 37

Operation and Maintenance Manual

Equipment Data Summary

Equipment Name: Specification

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:

Operation and Maintenance Manual

Preventive Maintenance Summary

Equipment Name: Location

Manufacturer

Name:

Address:

Telephone:

Model No.: Serial No.:

Maintenance Task	Lubricant/Part	D W M Q S A A

NOTES:

1.12.7 Binders shall be labeled Volume 1 of X, 2 of X, and so on, where more than one binder is required. The table of contents for the entire set, identified by volume number, shall be included in each binder.

1.13 Storage of Equipment and Materials

1.13.1 All materials and equipment shall be protected from wear and damage both before and after delivery to the job site.

1.13.2 Unless specifically permitted by the Engineer, all equipment such as pumps, fans, electrical apparatus, valve operators, SCADA equipment, and the like shall be stored indoors out of exposure to the weather. Items having electrical parts, such as motors, electronic panels, and the like, shall be kept in heated storage, at a temperature to prohibit the accumulation of condensation on the equipment. Where equipment is provided with integral space/strip heaters, (such as the motor control center), these heaters shall be energized as soon as the equipment is present at the job site and they shall remain energized from temporary circuits until final permanent energization is attained.

1.13.3 Unless otherwise specifically permitted by these specifications or as allowed by the Engineer, all materials for use on the project shall be stored indoors out of exposure to the weather. Such materials would include ductwork, doors and frames, louvers, grating, slate roofing, building hardware, windows and glass block, wire and cable, conduit, and piping. Certain materials such as building steel, exterior hatch covers, fencing, and the like which will be applied exposed to the weather, may be stored outdoors in a safe manner as approved. Note the specified requirements for the storage of building masonry in Section 4A.

1.14 Protection of the Work

1.14.1 All work shall be protected from damage by vandals, the weather, or other sources until final acceptance by the Engineer. Such protection shall include temporary fencing or other barriers, if necessary, to restrict access to the work. Open pits, doors, hatches, etc. shall be covered, closed and locked. No additional compensation will be granted and no additional time will be allowed due to delays caused by failure to adequately protect the work from damage. In addition, the Contractor shall make the worksite safe at the end of each work day, leaving no attractive nuisance hazards and no open electrical boxes and the like.

1.14.2 Clean-Up and Public Safety

The work site shall be maintained in a clean condition, free of hazards to the work force and the public, all in conformance with the requirements of Article 107 of the Standard Specifications. Special care shall be taken to see 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 have their cover in place and shall be locked when possible, during off-work hours.

1.15 Standards of Workmanship

1.15.1 All work shall be performed to the highest standard of each respective trade. The work shall demonstrate all due care and attention so that all specified requirements are met and that the end product is a first-rate installation.

1.15.2 The Contractor shall comply with the requirements of Sections 105 and 108 of the Standard Specifications, and any Supplements thereto shall, in addition, comply with the requirements for control of work specified herein.

1.16 Quality Control

1.16.1 Submittals

All submittals, including the following, shall be provided as specified in this Section.

Authoritative evidence in the form of Certificates of Manufacture shall be furnished to the Engineer to show that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Copies of the results of physical tests that have been made directly on the product or on similar products of the manufacturer shall be included where necessary.

1.16.2 At all times during the progress of the Work and until the date of final completion, afford the Engineer every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the Contractor of any obligations to perform proper and satisfactory work as specified. Work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, shall be replaced with satisfactory work at no additional cost to the Department. Finished or unfinished work found not to be in strict accordance with the Contract shall be replaced as directed even though such work may have been previously approved and payment made therefore.

1.16.3 Failure or neglect on the part of the Engineer to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the Engineer at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

1.16.4 Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or IEEE, except as may otherwise be stated herein.

1.16.5 Personnel shall be provided to assist the Engineer in performing the following periodic observation and associated services.

(a) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe sub-grade soils and foundations.

(b) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by Engineer.

(c) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.

1.16.6 When specified in Divisions 2 through 16 of the Contract Documents, an independent laboratory testing facility shall be provided to perform required testing. The laboratory shall be qualified as having performed previous satisfactory work. Prior to use, such qualifications shall be submitted to the Engineer for approval.

1.16.7 Cooperate with the Engineer and laboratory testing representatives. At least fifteen (15) working days notice shall be given prior to when specified testing is required. Labor and materials, and necessary facilities shall be provided by the Contractor at the site as required by the Engineer and the testing laboratory.

1.16.8 Equipment test procedures shall be coordinated and demonstrated as specified in the Contract Documents or as otherwise required during the formal tests.

1.16.9 Where transcripts or certified test reports are required by the Contract Documents, the following requirements shall be met:

For all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents, submit and obtain approval of the Engineer before delivery of materials or equipment. All testing shall be performed in an approved independent laboratory or the manufacturer's laboratory. Reports of shop equipment tests shall be submitted for approval within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.

1.16.10 At the option of the Engineer, or where not otherwise specified, a notarized Certificate of Compliance shall be submitted for approval. The Certificates may be in the form of a letter stating the following:

(a) Manufacturer has performed all required tests
(b) Materials to be supplied meet all test requirements
(c) Tests were performed not more than one year prior to submittal of the certificate
(d) Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified
(e) Identification of the materials

1.16.11 Except as expressly provided elsewhere herein, all the costs of shop and field tests of equipment and other tests specifically called for in the Contract Documents shall be included in the Contract Price.

1.16.12 Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Engineer for compliance. The Owner shall be reimbursed for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

1.16.13 The Contractor shall coordinate work such that inspections are not required outside of the hours of 7:00 a.m. and 5:00 a.m. Monday-Friday, non-holiday.

1.16.14 The Contractor shall provide transportation and reasonable expenses including lodging and meals to and from all factory pump testing for two Engineer representatives. The Contractor shall notify the Engineer of a scheduled test date two months prior to said date and shall arrange an exact suitable date not less than two weeks prior to the test.

1.16.15 As soon as conditions permit, all labor and materials and services to perform preliminary field tests of all equipment shall be furnished as provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, all changes, adjustments and replacements required shall be made prior to the acceptance tests.

1.16.16 Upon completion of the Work and prior to final payment, all equipment, piping and appliances installed under this Contract shall be subjected to specified acceptance tests to demonstrate compliance with the Contract Documents.

1.16.17 All labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests shall be furnished by the Contractor.

1.16.18 Field tests shall be conducted in the presence of the Engineer. The field tests shall demonstrate that under all conditions of operation each equipment item:

(a) Has not been damaged by transportation or installation
(b) Has been properly installed
(c) Has no mechanical defects
(d) Is in proper alignment
(e) Has been properly connected
(f) Is free of overheating of any parts
(g) Is free of all objectionable vibration
(h) Is free of overloading of any parts
(i) Operates as intended

1.16.19 Each pump and generator shall be operated for a minimum of 30 minutes continuous service.

1.16.20 If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, such deficiencies shall be promptly corrected. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet warranty or specified requirements, the Engineer, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the Contractor to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.17 Cutting and Patching

1.17.1 No structural members shall be removed, cut or otherwise modified without approval and any such work shall be done in a manner as directed by the Engineer.

1.17.2 Cutting of concrete slabs, walls and members shall be performed without over-cutting at corners or elsewhere.

1.17.3 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.

1.17.4 All cutting, fitting or patching of the Work that may be required to make the several parts thereof join shall be provided in accordance with the Contract Documents. Restoration shall be performed by competent workmen skilled in the trade.

1.17.5 All cutting and patching required to install improperly timed work or to remove samples of installed materials for testing shall be provided.

1.17.6 Except when the cutting or removal of existing construction is specified or indicated, any cutting or demolition which may affect the structural stability of the Work or existing facilities shall not be undertaken without the Engineer's concurrence.

1.17.7 Shoring, bracing, supports, and protective devices necessary to safeguard all work during cutting and patching operations shall be provided.

1.17.8 All materials shall be cut and removed to the extent shown or as required to complete the Work. Materials shall be removed in a careful manner with no damage to adjacent facilities. Materials which are not salvageable from the site shall be removed.

1.17.9 All work affected by demolition, cutting operations, and equipment removal shall be patched, repaired or restored with new materials or with salvaged materials acceptable to the Engineer to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished. Affected surfaces shall match adjacent surfaces and provide uniform appearance. Unnecessary gaps, holes, openings and depressions shall be filled with suitable patching material.

1.18 Definition of Terms

1.18.1 Abbreviations

Wherever the following abbreviations are used in these Special Provisions or on the Plans, 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

ASME American Society of Mechanical Engineers

ASTM American Society for Testing and Materials

AWG American Wire Gauge

ICEA Insulated Power Cable Engineers Association

IEEE Institute of Electrical and Electronic Engineers

IES Illuminating Engineering Society of North America

IBC International Building Code

NEC National Electrical Code

NEMA National Electrical Manufacturer's Association

NESC National Electrical Safety Code

NETA ATS International Electrical Testing Agency, Acceptance Testing Specifications

UL Underwriter's Laboratories

ACI American Concrete Institute

FM Factory Mutual

SSPC Steel Structures Painting Council

HI Hydraulic Institute Standard

NFPA 72 National fire Alarm and Signaling Code

NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities

OSHA Confined Space Regulations and Electrical Systems Code Regulations

IDOT Drainage Manuals

IDOT General Guidelines for Pump Station Design

IDOT Bureau of Design and Environment BDE Manuals

Illinois Professional Engineering Practice Act

1.18.2 Standard Specifications

Where used in these Special Provisions, this term shall mean the latest "Standard Specifications for Road and Bridge Construction, Adopted April 1, 2016", published by the Illinois Department of Transportation.

1.18.3 Specifications

Where used in these Special Provisions, this term shall mean the complete body of specifications, including the Standard Specifications, these Special Provisions, and referenced specifications and standards. See also latest IDOT “Standard Specifications for Road and Bridge Construction” for definition of terms.

1.18.4 Supplements

Where used in these Special Provisions, this term shall mean the latest "Supplemental Specifications and Recurring Special Provisions" published by the Illinois Department of Transportation.

1.18.5 Contract Documents

The complete body of agreements, specifications and drawings which define the contract work.

1.18.6 Provide

Where used in these Special Provisions, this term shall mean "furnish and install, complete functional, including any required connection and testing".

1.19 Referenced Specifications and Standards

1.19.1 The referenced specifications and standards shall be latest version and are incorporated, by reference, in these Special Provisions and shall apply to the work as though fully written herein:

(a) *STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION,* a publication of the Illinois Department of Transportation.

(b) *SUPPLEMENTAL SPECIFICATIONS AND RECURRING SPECIAL PROVISIONS,* a publication of the Illinois Department of Transportation.

(c) NATIONAL ELECTRICAL SAFETY CODE, a publication of American National Standards Institute.

(d) SAFETY CODE, a publication of the Illinois Department of Transportation.

(e) *AMERICAN NATIONAL STANDARD PRACTICE FOR ROADWAY LIGHTING, ANSI/IES RP-8,* published by Illuminating Engineering Society, approved by National Standards Institute.

(f) *ELECTRICAL MAINTENANCE CONTRACT,* State of Illinois. Department of Transportation, Division of Highways, District 1.

1.20 Schedule of Values, Payment and Invoices

1.20.1 A Schedule of Values and invoices shall be submitted as payment basis for each pay item of Pump Station General Work, Pump Station Electrical Work, and Pump Station Mechanical Work.

1.20.2 The Contractor shall submit a Schedule of Values, as specified herein, at least fifteen (15) days prior to submitting the first payment estimate and shall provide information as requested to substantiate the prices included in the Schedule of Values.

1.20.3 The Schedule of Values shall be approved by the Engineer prior to any project payments.

1.20.4 Complete Schedule of Values

(a) The Schedule of Values shall be typewritten on 8-1/2 inch by 11 inch paper in a format approved by the Engineer.

(b) The Schedule of Values shall be used to determine the value of work completed for payment purposes. After review by the Engineer, the Contractor shall revise and resubmit the Schedule of Values as required.

(c) The Schedule of Values shall have each pay item further itemized by Specification Division as listed in the Specification index.

(d) For the item Pump Station General Work, Pump Station Electrical Work and Pump Station Mechanical Work, each pay item which has an installed value of over $10,000, a list of the costs for the major products or operations shall be indicated under each pay item. Round off figures to the nearest ten (10) dollars. The "value" for each pay item listed shall be the supplied, installed and operational start-up cost incurred to the Contractor for that pay item (overhead and profit included). The sum total of all pay items in the Schedule shall be equal to the payment reflecting total contract value.

1.20.5 Unit Price for Change Order

(a) If there is no bid unit prices for change order, Article 109.04 of the Standard Specifications will be used for the change order.

1.21 Start-Up

1.21.1 Items to be checked on start-up include, but not limited to, the following:

(a) Field test procedures shall be approved by the Engineer prior to field testing. Pump Station shall be operational for a minimum of 30 days prior to final acceptance within which cumulative major component remains active without down time, consisting of the pumps, influent slide gate, HVAC system and electrical system. Control system down time shall not exceed 4 hours, see Section 16D.
(b) Demonstration of back-up float controls.
(c) Gas detection calibration kit shall be always stored on site.
(d) Demonstration of generator and transfer switch operation and maintenance.
(e) Check pump operation in manual, bump and auto mode.
(f) Check alarm operation SCADA and AEGIS system and verify at remote location (EMC contractor’s facility, District 1, and IDOT TSC).

(g) SCADA panel operation
(h) Network Equipment Rack operation
(i) Level system operation
(j) Fire alarm system operation
(k) HVAC system operation
(l) Discharge slide gate and recirculation valve operation

1.21.2 The contractor shall prepare to demonstrate operation and maintenance procedures for all equipment installed.

1.22 Method of Measurement

1.22.1 Progress payments will be accordance with Section 109 of the Standard Specifications.

1.22.2 Mechanical equipment specified under Section 15D and electrical equipment specified under Sections 16D, 16E, 16F will be considered 80% complete once substantially complete and corresponding O&M Manuals have been approved by the Engineer for each corresponding pay item. Substantial completion is defined as the time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of the Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. Equipment will not be considered 100% complete for each corresponding pay item until the Final Acceptance by the Engineer, all incomplete works (punch lists) have been addressed, spare parts have been delivered, Record Drawings have been approved, and all outstanding issues have been completed to the satisfaction of the Engineer.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 2 - SITE WORK

SECTION 2A - SITE WORK

1. GENERAL:

1.1 Description

1.1.1 This Section shall include all work required for the furnishing and completing all site work as indicated on the Contract Drawings and as specified herein.

1.1.2 The work included under this Section shall include, but not be limited to, the following:

(a) Site clearing
(b) Braced Excavation (braced support system for excavation)
(c) Bollards
(d) Conduits directionally drilled (Electrical Conduit HDD Method)
(e) Sewer
(f) Steel Casing

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.3 Warranty

1.3.1 Provide warranty under provisions of Section 1A.

1.4 Submittals

1.4.1 Submit product data under provisions of Section 1A.

1.5 Braced Excavation General Requirements

1.5.1 This work shall consist of furnishing all labor, equipment, and materials necessary to install, maintain and remove a braced support system for excavation to protect the adjacent roadway during the construction of the pump station, retaining wall modifications, and piping installations as shown on the plans and as specified herein.

1.5.2 The design of the braced support system for excavation is the responsibility of the Contractor. The Contractor shall submit drawings and design for the braced excavation to the Engineer for approval. The braced excavation design and drawings shall be signed and sealed by an Illinois licensed Structural Engineer, Submitted and reviewed prior to the start of any work. The Engineer's review shall not relieve the Contractor from the sole responsibility of the structural integrity of the braced excavation system.

1.5.3 The braced support system for excavation shall be capable of restraining earth pressures and surcharges imposed by construction equipment, trucks and vehicular traffic on the adjacent roadway. The braced excavation shall include all sheeting, walers, struts, and bracing, backfill, coarse aggregate base, material, dewatering, concrete fill hardware and all appurtenant and collateral materials and work required to construct the structure and protect the adjacent roadway where the braced excavation is utilized.

1.5.4 It shall be the Contractor's responsibility to verify all existing conditions, including geotechnical conditions, utilities, and access to the site prior to construction or ordering of materials.

1.5.5 All materials, equipment and construction methods shall be in accordance with the requirements of Section 502 and 512 of the Standard Specifications except as herein modified.

1.5.6 At the option of the Contractor, the materials may be new or used. If used, the materials shall be in good condition and acceptable to the Engineer. The Contractor shall provide all temporary or permanent materials required for the proper execution of the work on this Item.

1.5.7 The excavation for the work of installing structures S-13, S-14, and S-15 is located at the sag of the roadway, which might be filled with water during heavy rain storms. Protect the new pump station from any water intrusion during the construction of Structure S-13, S-14, and S-15, and the jacking of pipe P-14.

1.6 Basis of Payment

1.6.1 Site clearing shall be included for payment under the Item, PUMP STATION GENERAL WORK.

1.6.2 This work will be paid for at the contract unit price per cubic yard for BRACED EXCAVATION. The price shall be payment in full for all work, equipment, and materials necessary for designing, installing, maintaining, removing the braced excavation support system and all necessary excavation for structure as shown on the plans and as specified herein. This work will be measured for payment as a computed volume in cubic yards as described in Section 502 of the Standard specifications.

1.6.3 ComEd transformer foundation consists of gravel fill and base course shall be included for payment under the Item, PUMP STATION GENERAL WORK. Concrete and reinforcement bars required shall be paid under separate pay items.

1.6.4 Conduits to be directionally drilled as shown on the contract plans shall be paid per contract unit price per foot for ELECTRICAL CONDUIT, HDD METHOD in accordance with this Section.

1.6.5 Bollards as shown on the contract plans shall be paid per contract unit price each for BOLLARDS in accordance with this Section.

1.6.6 Sewer and manholes shall be paid for per contract unit price in accordance with Section 550 and Section 602 of the Standard Specifications.

1.6.7 Work related with 48” steel casing shall be paid for under pay item STEEL CASING 48" at the contract unit price per foot and shall be in accordance with the special provision listed under the section for “Special provisions for Civil and Drainage”.

1.6.8 All remaining site work as specified herein or as required shall be included in the contract lump sum price for the Item, PUMP STATION, GENERAL WORK.

1.6.9 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.2 Bollards

2.2.1 Provide bollards as detailed on Drawings and herein. Provide 6” diameter standard steel pipe per ASTM A53, Type E or S, Grade B filled with 3,500 psi concrete. Paint with 2 coats of safety yellow per system specified in Section 9A.

2.3 Directional Drilling

2.3.1 This work shall be in accordance with the “Standard Specifications for Water and Sewer Main Construction in Illinois” and the detail(s) provided in the plans, except as modified herein.

2.3.2 This work shall consist of providing 2-5", 1-2" and 1-1" electrical conduits by using Horizontal Directional Drilling (HDD) method. The Contractor performing the HDD shall have five (5) years' experience installing HDD pressure piping systems and shall be able to provide work history of completed projects. Contractor shall coordinate the work listed in this section with the electric utility and Section 16A – 3.4 of the special provisions.

2.3.3 Exploration and determination of location of existing utilities shall be performed as necessary. It is contractor's responsibility to verify on the jobsite, the exact locations and elevations of existing utilities and sewer services before commencing with any installation/drilling work and coordinate with the Engineer any changes to the proposed layout and/or elevation. Existing utility exploration work shall be considered included in Electrical Conduit – HDD Method" unit price item and will not be paid separately.

2.3.4 Certa-Lok C900/RJ restrained joint PVC Pipe, or approved equal, shall be used for this project.

3. EXECUTION:

3.1 Site Clearing

3.1.1 Unless otherwise specifically indicated, this work shall consist of clearing, grubbing, removal and disposal off site of the tree branches, stumps and construction debris within the project site.

3.2 Sewer

3.2.1 Outfall sewer shall be installed and constructed in accordance with Section 550 of the Standard Specifications.

3.3 Pump Station Outfall Sewer to be installed in a Casing Pipe

3.3.1 The boring and jacking operations shall be done simultaneously, with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add on sections of casing pipe shall be full-ring welded to the preceding length, developing watertight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the pipe casing, 12" minimum brick and mortar shall be used to seal each end.

3.3.2 Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the casing pipe to preclude formation of voids outside of the pipe shell.

3.3.3 The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion, if not in the hole, shall be replaced. However, if inserted, the encasement pipe shall be abandoned in place, grouted full, and suitably plugged, and an alternate installation made.

3.3.4 Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimension necessary to perform the operation. Said excavations shall be adequately barricaded, sheeted, braced and dewatered as required.

3.3.5 Bored and jacked installation shall have a bore hole essentially the same as the outside diameter of the casing pipe. Grout any voids that develop. Also grout around the casing pipe when the bore hole diameter is greater than the outside diameter of the pipe by more than 1 inch.

3.4 Directional Drilling Construction Requirements

3.4.1 The work specified in this section consists of furnishing and installing new PVC pipes using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall consist of the complete furnishing and installation of conduit, with appropriate retaining joints and tracer wires, directionally bored and placed as herein specified and/or determined by the engineer. This work shall be constructed in accordance with all applicable sections of the IDOT “Standard Specifications for Road and Bridge Construction”, OSHA, all Local Codes and Ordinances and as specified herein.

3.4.2 Drilling fluid shall be composed of a carrier fluid (water) and drilling fluid additives (bentonite and/or polymers). Bentonite is a naturally occurring clay mineral (montmorillinite) that forms a mud when mixed with water.

3.4.3 All drilling fluids and loose cuttings shall be contained; no fluids shall be allowed to enter any unapproved areas, storm and sanitary sewers systems or natural waterways. The Contractor at all times shall be in compliance with NPDES requirement and permitting. Upon completion of the directional drill project, all excess drilling fluid and material shall be removed by the Contractor.

3.4.4 Directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system.

3.4.5 All utility supports, pit excavation, dewatering, sheeting, bracing, shoring, and other materials necessary for the complete installation of the directional bore shall be of sufficient strength to support the loads that are imposed on them.

3.4.6 If boring operations cause surface disruptions or damage to existing pavement, sidewalks, driveways, lawns, or any other surface appurtenances, the contractor shall halt operations and adjust procedures to ensure damage is not caused to surface appurtenances.

3.4.7 Any surface disruption or damage to existing pavement created by the directional bore shall be the contractor's responsibility to repair. All cost associated to repair surface disruptions shall be the contractors to incur.

3.4.8 Backfilling and compaction of trench backfill, excavation of material, dewatering, removal and disposal of any material and disturbed area restoration with topsoil and sod shall be considered included in "Electrical Conduit – HDD Method" unit price item.

END OF THIS SECTION

SECTION 2B – CHAIN LINK FENCE AND GATE

1. GENERAL:

1.1 Description

1.1.1 This Section shall include all work required for the furnishing and completing all fence and gate work. In addition to the work specified herein, work shall be in accordance with the details shown on the plans and the applicable portions of Section 664 of the Standard Specifications except as specified herein.

1.1.2 Refer to Division 1 for additional requirements.

1.2 Basis of Payment

1.2.3 Work related to sliding gate shall be paid for under the pay item SLIDE GATE for at the contract unit price per each.

1.2.1 Work related to fence special shall be paid for under the pay item CHAIN LINK FENCE (SPECIAL) at the contract unit price per linear foot.

1.2.2 Work related to fence shall be paid for under the pay item CHAIN LINK FENCE, 8’ (SPECIAL) at the contract unit price per linear foot.

1.2.4 Work related to man gate and barb wire fence overhang shall be paid for under the pay item CHAIN LINK GATES (SPECIAL) at the contract unit price per each.

2. PRODUCTS:

2.1 In addition to the work specified herein, work shall be in accordance with the details shown on the plans and the applicable portions of Section 664 of the Standard Specifications except as specified herein.

2.2 Barbed Wire

2.2.1 Barbed wire supporting arms shall meet the requirements of ASTM F626. Metal and finish shall match the framework, with provision for anchorage to posts and attaching the rows of barbed wire and coil of barbed tape to each arm. Support arms shall be either attached to posts and be capable of withstanding 250 pound downward pull at outmost end, except as otherwise required. Provide a single 45-degree arm for three stands of barbed wire, one for each post.

2.2.2 Steel barbed wire shall be ASTM A121, Chain Link Fence Grade, Class 3 coating, three stands 0.099 inch minimum diameter (12-1/2 gage) steel wire with 0.080 minimum diameter (14 gage), four-point barbs spaced at 5 inches maximum centers. Ends of barbs shall be cut on bias.

2.3 Horizontal Slide Gates

2.3.1 Type II Cantilever Slide Gate, Class 1 or 2 in complying with ASTM F 1184.

2.3.2 Hardware:

(a) Latches shall permit operation from both sides of gate and have integral eye openings for padlocking with the padlock accessible from both sides of gate.

3. EXECUTION:

3.1 Execution shall be in accordance with the details shown on the plans and the applicable portions of Section 664 of the Standard Specifications.

END OF THIS SECTION

SECTION 2C - DEMOLITION

1. GENERAL:

1.1 Description

1.1.1 The extent and location of the Demolition work for the exiting pump station shall be as specified herein and as shown on Plan Sheets R-1 and R-2 and on Civil Demolition Plan Stage I and Civil Demolition Plan Stage II. The work consists of the removal of equipment, filling of the wet pit and sewers with lightweight cellular concrete material, and initiating and completing cancellation / termination of service and billing for the electric and telephone systems at the existing pump station. Contractor shall transport the salvageable items to Department facility as part of the scope of demolition, and as directed by the Engineer with no additional cost to the Department.

1.1.2 Demolition shall not commence, nor shall the existing pump station be decommissioned until written authorization has been obtained from the Engineer to proceed.

1.2 Job Conditions

1.2.1 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.

1.3 Related Sections

1.3.1 None.

1.4 Submittal

1.4.1 Submit under provisions of Section 1A.

1.4.2 Shop drawings: Indicate demolition and removal sequence.

1.5 Basis of Payment

1.5.1 Payment

(a) This work will be paid for at the contract lump sum unit price for DEMOLITION OF EXISTING PUMP STATION, which price shall be payment in full for complete removal of the building as specified herein and as indicated on the drawing. The lump sum unit price for this work shall represent the cost of demolition. Any salvage value shall be reflected in the contract unit price for this item.

(b) The work as required for filling of the wet pit with lightweight cellular concrete fill shall be paid for at the contract unit price per cubic yard for LIGHTWEIGHT CELLULAR CONCRETE FILL.

2. PRODUCTS:

2.1 Material for backfilling the wet pit shall be lightweight cellular concrete fill according to District 1 Special Provisions.

3. EXECUTION:

3.1 Demolition

3.1.1 The work consists of the removal of equipment including pumps and motors, fabricated metal, bowls, impellers, suction piping and discharge piping, bubbler system, heating and ventilation equipment, and electrical equipment and controls from the existing pump station building and all incidental and collateral work necessary to complete the removal of the building in a manner approved by the Engineer.

(a) Mechanical equipment: Pumps and motors, fabricated metal, bowls, impellers, suction and discharge piping, and bubbler system.
(b) Electrical equipment.
(c) HVAC equipment.
(d) Structural grating.

3.1.2 The work also consists of filling of the wet pit with lightweight cellular concrete fill material according to District 1 Special Provisions.

3.1.3 The work also consists of initiating and completing cancellation / termination of service and billing for the electric and telephone services at the existing pump station.

3.1.4 The contractor shall maintain the existing Pump Station during construction as specified under Section 1, General Requirements. All demolition shall be subject to approval of the Engineer.

3.1.5 The Contractor shall protect adjacent materials, equipment, areas and related construction during all demolition operations from all dirt, dust, debris or damage of any kind.

3.1.6 The demolition operations shall be coordinated with the Contractor's proposed sequence of construction and maintenance of pumping of storm water at the Pump Station.

3.3 Disposal

3.3.1 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. Salvageable items include:
(a) Manhole frames and lids
(b) Pumps and motors
(c) Piping
(d) Fittings
(e) Valves
(f) Bubbler system

3.2.2 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.

END OF THIS SECTION

SECTION 2D – HELICAL PIERS

1. GENERAL:

1.1 Section Includes:

1.1.1 Design of and furnishing helical screw anchor piers.

1.1.2 Demolition shall not commence, nor shall the existing pump station be decommissioned until written authorization has been obtained from the Engineer to proceed.

1.2 Related Sections

1.3.1 None.

1.3 References

All reference standards shall be the latest edition.

1.3.1 ASTM: American Society for Testing and Materials

1.3.2 AWS: American Welding Society

1.3.3 SAE: Society of Automotive Engineers

1.4 Submittals

1.4.1 Shop Drawings:

(a) Profiles and product components, including anchorage and accessories.
(b) Stamped by a Structural Engineer registered in the State of Illinois.

1.4.2 Product Data:

(a) Manufacturer's product data for specified products.
(b) Manufacturer's installation instructions.

1.4.3 Test Results:

(a) Certified test reports showing compliance with specified characteristics and physical properties.
(b) Load test results.

1.4.4 Miscellaneous Submittals:

(a) Evidence of certification or experience qualifications for manufacturer and/or installer, when requested by Engineer.
(b) Project record documents for installed materials.
   a. Name of Contractor.
   b. Project name.
   c. Date.
   d. Pier location/number.
   e. Equipment description.
   f. Number and size of helices.
   g. Pier dimensions, length, and dia.
   h. Ground elevation.
   i. Final tip elevation.
   j. Effective length left in-place.
   k. Pier deviation from plan location.
   l. Installation angle from horizontal.
   m. Torque installation records.
   n. Torque monitoring calibration data.
   o. Notes on unusual phenomena.

1.5 Quality Assurance

1.5.1 Qualifications:

(a) Piers shall be installed by Contractor or Subcontractor specializing in particular type of pier to be provided, and at least 3 years experience placing piers in type of soil conditions that may be encountered and shall have participated in construction of 5 or more jobs of similar scope and magnitude using same method of construction as specified herein.
(b) Installer shall be certified by pier manufacturer.
(c) Engineer reserves the right to require written documentation of above.

1.5.2 Preinstallation Meetings:

(a) Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.5.3 Testing:

(a) Testing shall be provided by Contractor in accordance with Division 1 and this Section.

(b) Duties of testing laboratory shall be to monitor installation of piers and to monitor testing of piers to be load tested.

1.6 Basis of Payment

1.6.1 Payment

(c) This work will be paid for at the contract unit price per each for HELICAL GROUND ANCHORS which shall be payment in full for work described herein.

(d) Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Manufacturer

2.1.1 Firms specializing in particular type of pier to be provided and services normally associated with the industry for at least 3 years.

2.1.2 Manufacturers may be required to submit written evidence showing experience, qualifications, and ability to perform Work.

2.2 Materials

2.2.1 Screw Anchor Plates: ASTM A36, ASTM A572, ASTM A656, ASTM A935 or ASTM A936, minimum ½ inch thick.

2.2.2 Screw Anchor Shaft: Round-cornered square steel bar meeting dimensional and workmanship requirements of ASTM A29, minimum 1 3/4 inch square.

2.2.3 Couplers: Cast steel conforming to ASTM A958 Grade 90/60.

2.2.4 Bolts: SAE J429, Grade 5.

2.3 Fabrication

2.3.1 Conform to approved shop drawings.

2.3.2 Welds shall conform to requirements of AWS D1.1.

2.3.3 Hot-dip galvanize after fabrication. Conforming to ASTM A123.

2.4 Equipment

2.4.1 Equipment used to install piers shall be specifically designed for installation of piers of this type and shall be approved by pier manufacturer.

3. EXECUTION:

3.1 Preliminary Work

3.1.1 Do not install piers until earthwork in area in which piers are to be installed has been completed, as follows:

(a) Earth excavation shall be completed to bottom of foundation.
(b) Fills shall be constructed and compacted to elevation of grade indicated.

3.2 Installation

3.2.1 Comply with manufacturer's product data, including product technical bulletins.

3.2.2 Locate piers where shown on drawings or as indicated by Engineer.

3.2.3 Provide installation torque units, rotary type, forward and reverse capability, electric or hydraulic powered. Capable of positioning the screw anchor at the designed angle. Minimum drive equipment rating to equal or exceed the maximum torque rating of the specified screw anchor. Provide torque monitoring device as part of the installing unit or as a separate in-line device.

3.2.4 Position screw anchor as indicated. Establish proper angular alignment at the start of installation.

3.2.5 Connect the installation unit to the anchor with manufacturer's adapters. Provide safe and secure connection to screw anchors and extensions. Apply sufficient downward pressure to advance anchor. Install in a smooth and continuous manner, rate of anchor rotation five to twenty revolutions per minute.

3.2.6 Monitor torque applied by the installing unit during the entire installation, and record values achieved on each screw anchor. Remove encountered obstructions or relocate screw anchor and adjacent anchors as required.

3.2.7 Provide extension material to obtain indicated depth, couple with bolts provided as part of extension; torque to specified load. Install to minimum depth indicated. Provide minimum specified grout cover above the top helix. Obtain written permission from Engineer before proceeding if indicated depth or minimum torque cannot be obtained.

3.2.8 Connect pier to the existing footing, use metal brackets designed by manufacturer.

3.3 Depth and Tolerances

3.3.1 Screw anchors that reach maximum torque rating before reaching minimum indicated depth shall be subject to the following:

(a) Terminate at depth obtained with written approval of Engineer.
(b) Replace screw anchor with smaller and/or fewer helices, installed 3 feet minimum beyond termination of original screw anchor.

3.4 Test Piers

3.4.1 Construct test piers using same equipment to be used for construction actual construction piers.

3.4.2 Provide one initial load test to verify compression capacity of piers. Engineer will indicate location of test piers.

3.4.3 Install test piers under conditions similar to those existing for permanent piers. Excavate to elevation of bottom of footing before installing test piers.

3.4.4 Test piers shall not be used as production piers.

3.5 Field Quality Control

3.5.1 Monitor torque applied by the installing unites during entire installation.

3.5.2 Initial Load Tests:

(a) Materials and equipment for testing, testing procedures, and recordkeeping shall be provided in accordance with ASTM D1143 as outlined and modified herein.
(b) Test pier by loading in accordance with ASTM D1143, to 200% of design load.

3.5.3 Check Load Tests:

(a) Throughout course of Work, Engineer may select piers to be load tested and check of uplift capacity.
   a. Perform check load testing same as specified for initial load testing.
   b. Piers that satisfactorily pass check load testing may remain for use in Work.

3.5.4 Install pier within maximum tolerances:

(a) Location: 3 inches from location indicated.
(b) Plumbness: Maintain 1 inch in 10 feet from vertical or maximum of 4 inches, measures when pier is above ground.
(c) Final pier top elevation shall be within 1 in of Drawing top elevation.

3.5.5 Damaged piers and piers installed outside required tolerances will not be accepted. Piers rejected after installation may be abandoned and cut-off and additional piers installed to replace rejected units.

3.6 Protection: Protect installed product from damage during construction.

END OF THIS SECTION

SECTION 2E – TIEBACK ANCHORS

1. GENERAL:

1.1 Section Includes:

1.1.1 The Work specified in this Section consists of designing, furnishing, drilling, installing, testing and maintaining tieback anchors to support existing retaining wall. Provide tieback system sufficient to prevent displacement of ground and damage to adjacent buildings, structures, pavement, and utilities.

1.3 Related Sections

1.3.1 Section 3B - Grout

1.4 Reference Standards

1.4.1 ASTM: American Society for Testing and Materials

1.4.2 PTI: Post Tensioning Institute – Recommendations for Prestressed Rock and Soil Anchors

1.5 Submittals

1.5.1 Shop Drawings: Indicate the following:

(a) Details, arrangement and method of assembly of the proposed system and sequence and schedule of construction.
(b) Proposed detailed installation procedures for tiebacks indicating grout type, proposed equipment used for drilling, installing, grouting, testing, and pretensioning tiebacks.
(c) Full excavation depth.
(d) Loads on each tieback anchor for various stages of excavation, bracing removal, tieback detensioning, and concrete placement.
(e) Anticipated elevation of soil/rock profile for each tieback anchor.
(f) Maximum design loads carried by tieback anchors, and proof load values.
(g) Criteria proposed for deformations under proof loads.
(h) Design calculations for varies stages of execution, concrete placement, tieback detensioning and bracing removal.
(i) Tieback anchor detensioning procedure.

(j) Details of proposed grout mix design including estimated setting time, strength procedures and recommended installation procedures.

(k) Manufacturer's information for equipment used to conduct performance and proof tests on tiebacks including:

a. Diagrams showing geometry of performance and proof test equipment relative to tieback end hardware, method of locking off specified pretension load and calibration data for system of jack and gauges.

b. Calibration conducted by a certified testing agency, for complete performance test and proof test assemblies, together as a unit. Calibrate assembly within one month before first performance test; present in form of plot of gauge pressure versus actual jack force. Calibrate suing independent testing laboratory in accordance with National Institute of Standards and Technology (NIST).

c. Diagram of Contractor's proposed test equipment setups for monitoring elongation of tiebacks during performance and proof tests.

d. Proposed test equipment set-ups to be completely independent of jack; include a micrometer dial gauge, capable of measuring tieback extension to nearest 0.001 inch, having two inches of travel and mounted on adjustable tripos or other device with flexible extension arms or a goose neck to permit rapid alignment of dial gauge axis with axis of tieback.

(l) Description of tieback monitoring technique during the service.

(m) Final documentation for each tieback – Include actual elevations of soil/rock profile, bottom elevation of tieback, difficulties in drilling hole, grout take, water/cement ratio and proof/performance test sheets used to record testing of tieback loads/movements. Show actual movement versus load, and relationship to minimum and maximum theoretical elongation envelopes in log.

1.5.2 Stamped by a Structural Engineer licensed in the State of Illinois.

1.6 Quality Assurance

1.6.1 Qualifications:

(a) Accomplish Work of this Section using a specialty subcontractor experienced in design, fabrication, drilling, installation, testing and maintenance of tieback anchor systems. Have supervisory engineer present during execution of this portion of work.

(b) Design and Calculations to be prepared, sealed, and signed by a Structural Engineer registered in the State of Illinois.

(c) Engineer reserves the right to require written documentation of above.

1.6.2 Testing:

(a) Testing shall be provided under provisions of Division 1 and this Section.

1.7 Basis of Payment

1.7.1 Payment

(a) This work will be paid for at the contract unit price per each for HELICAL GROUND ANCHORS which shall be payment in full for work described herein.

(b) Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Tiebacks

2.1.1 Tendons – Uncoated high-strength stress-relieved or low relaxation strand conforming to ASTM A416.

2.1.2 Rods – Uncoated high-strength stress-relieved steel bar conforming to ASTM A722.

2.2 Grout

2.2.1 As specified in Section 3B – Grout.

3. EXECUTION:

3.1 Installation

3.1.1 Install tieback system in accordance with accepted Shop Drawings. Install anchorage in soil/rock beyond no-load zone as indicated.

3.1.2 Free stressing length of each anchor – equal to or greater than the length as indicated on the Drawings.

3.2 Testing and Stressing of Tiebacks

3.2.1 Testing:

(a) Comply with PTI.
(b) Test 100 percent of anchors. Anchor tests provide a basis of acceptance of anchor.
(c) Testing is segregated into three categories with the following distribution of tests:
    a. Performance tests consisting of cyclic loading and elongation and creep measurements.
    b. Proof tests – Single cyclic load and measurement of elongation of tieback components.
    c. Lift-off tests – Measurement of load required to lift anchor head assembly from bearing plate to monitor post-construction anchor loads.
(d) Do not perform testing until grout has sufficiently cured.

3.2.2 Performance Tests: Carry out performance tests on minimum of one tieback.

3.2.3 Proof Tests: Carry out proof tests on all anchors not subject to performance testing.

3.2.4 Lift-Off Tests: Perform lift-off tests on all anchors.

3.2.5 Non-Performing Tiebacks: Where tiebacks are found to be non-performing according to design requirements, replace tieback or revise design appropriately to meet required tieback capacity.

END OF THIS SECTION

DIVISION 3 - CONCRETE

SECTION 3A - CAST-IN-PLACE CONCRETE BUILDING ITEMS, CLASS S1

1 GENERAL:

1.1 Description

1.1.1 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.

1.1.2 Unless otherwise indicated, concrete material and work shall be in conformance with the requirements of the Standard Specifications for Road and Bridge Construction, adopted April 1, 2016, a publication of the Illinois Department of Transportation. Refer to Division 1 for additional requirements.

1.2 Submittals

1.2.1 Submit under provisions of Section 1A and Standard Specifications.

1.3 Quality Assurance

1.3.1 Under provisions of Standard Specifications.

1.4 Basis of Payment

1.4.1 Measurement

(a) The work specified for concrete shall be measured as specified in Article 503.21 of the Standard Specifications.

1.4.2 Payment

(a) 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.

(b) 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.

(c) Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Concrete Form Work

2.1.1 Forms shall be of wood or metal, as required, and supplied in sufficient quantities so that work can be properly accomplished.

2.1.2 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.

2.1.3 Forms shall conform to the requirements of Section 503 "Concrete Structures" of the Standard Specifications.

2.2 Concrete Reinforcing

2.2.1 General

(a) All steel reinforcement bars shall be epoxy coated deformed bars.

(b) All steel reinforcement bars shall be deformed bars conforming to the requirements of ASTM A706, 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.

(c) 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).

2.3 Cast-In-Place Concrete

2.3.1 General

(a) Unless otherwise indicated, all regular concrete shall be Class SI with 14 days Compressive Strength of 3,500 psi in accordance with Section 1020 of the Standard Specifications.

(b) 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.

(c) Portland Cement, conforming to ASTM C150, and blended hydraulic cement, conforming to ASTM C595 may be used. Different cement types shall not be blended or interchanged.

(d) The coarse aggregate gradations for all regular concrete (Class SI) shall be CA7 or CA 11.

(e) 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.

(f) 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.

2.3.2 Fiber Reinforcement Concrete

(a) Fiber Reinforcement Manufacturers:

1) GCP Applied Technologies (W.R. Grace & Co).
2) Fibermesh Co.
3) Euclid Chemical Co.
4) Or approved equal.

(b) Dosage Rate: 1-1/2 lbs/cu yd min.

(c) Use in strict accordance with manufacturer's written recommendation and ASTM C94.

2.4 Waterstop

2.4.1 Virgin polyvinyl chloride (PVC) waterstop conforming to CRD C572, with hog rings or grommets at 12 to 18 in. oc.

2.4.2 Construction Joints: Dumbbell or serrated type, 6 in. wide by 3/8 in. thick, at center.

2.4.3 Provide prefabricated tees, crosses, and other configurations as required.

2.4.4 Gasket Type Waterstop: 1" by ¾" Waterstop-XP by CETCO, SikaSwell S-2 by Sika Corp, or approved equal.

2.5 Mechanical Splicer

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

3. EXECUTION:

3.1 Form

3.1.1 Form Installation

Form surfaces shall be smooth and free from any imperfections which would cause objectionable roughness on the finished surface of the concrete.

(a) 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.

(b) All necessary inserts in form work such as rods, bolts, anchorages, fillets, and other devices shall be installed as required.

(c) Forms shall not be treated with material that will adhere to or discolor the concrete.

(d) 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 substructure concrete until the concrete has developed sufficient strength to support safely the load thereon.

(e) For all exposed concrete edges a 3/4 inch chamfer strip shall be provided unless noted otherwise.

3.2 Concrete Reinforcing

3.2.1 Reinforcing Installation

(a) Placing and fastening of reinforcement shall be as per Article 508 of Standard Specifications.

(b) 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.

(c) 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.

(d) Mechanical connections shall develop at least 125 percent of the Specified Yield Strength of the bar in tension.

3.3 Cast-In-Place Concrete

3.3.1 Placing Concrete

(a) Concrete placement and consolidation shall comply with provisions of Section 503 of the Standard Specifications.

(b) 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.

(c) Temperature control for concrete placement shall comply with the provisions of Section 1020 of the Standard Specifications.

(d) Previously placed concrete surfaces that will be in contact with the new concrete shall be coated with an epoxy bonding agent, Sika Chemical Co. Sikadur Hi-Mod, or approved equal. Application shall be in strict conformity with the manufacturer's recommendations. 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.

(e) The concrete surface for Screen Chamber, Inlet Chamber, Wet Pit and Discharge Chamber bottom shall be screeded and wood floated.

(f) 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.

(g) 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..

(h) All concrete shall be cured for a minimum of 7 days in accordance with Section 1020.13, "Curing and Protection" of Portland Cement Concrete.

3.4 Embedded Items

3.4.1 Cast pipe and other embedded items into concrete as placement progresses. Do not provide blockouts.

3.4.2 Following restrictions shall be adhered to, unless otherwise noted.

(a) No duct, conduit, pipe, or fitting placed vertically shall be larger in cross-sectional area than 4% of column into which it is placed.
(b) Duct, conduit, pipe, and fittings, when placed within slabs or walls

1) Shall not be larger than 1/3 thickness of slab or wall.
2) Shall be placed within the middle 1/3 thickness of slab or wall where possible.
3) Shall not be placed closer than 3 outside diameter clear from each other when parallel.
4) Shall cross each other at right angles.

5) Shall be secured to prevent shifting or “floating” during concrete placement.
6) Multiple conduits shall not cross each other at the same location.
7) Except for conduits that must run up a column, keep conduits a minimum of 2 to 3 feet away from columns.
8) Where conditions require conduit to be tied to the inside face of the reinforcing mat, the conduit shall be galvanized steel or PVC, shall not be tied directly adjacent to a parallel reinforcement bar, and shall be placed 3 outside diameter clear away from the parallel reinforcement bar.

(c) Reinforcing steel shall be in place before embedded items placed and reinforcing cut or removed shall be replaced with additional reinforcing as indicated.
(d) Do not pass sleeves through columns without Engineer’s approval.

3.4.3 Do not place ducts, conduit, and pipes in slabs on grade unless noted otherwise. Place minimum 4 inches below slab.

3.4.4 Set items such as bolts, anchors, piping, and frames in concrete as shown.

3.4.5 Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift and come into contact during concrete placement. Contact between reinforcing steel and other metal, other than bare, coated, or plated carbon steel not permitted.

3.5 Repair of Surface defects

3.5.1 General:

(a) Prior to starting repair work, obtain Engineer’s approval of proposed repair techniques and materials.
(b) Method of repair shall not adversely affect the appearance of the finished structure.
(c) Develop repair techniques on portion of as-cast surface selected by Engineer. Surface of repair remaining exposed to view shall match color and texture of adjacent surfaces.
(d) Prepare surfaces, apply and install materials, and cure as recommended by material manufacturers.

3.5.2 Tie Holes: Fill plastic cone snap tie holes with Patching Mortar. Fill taper tie through-bolt form tie holes with Non-Shrink Grout.

3.5.3 Defective Areas:

(a) Remove honeycombing, stone pockets, spalls, and other defective concrete down to sound concrete. If chipping required, make edges perpendicular to surface. Do not feather edges.
(b) Fill defective area with Patching Mortar.

3.5.4 Leaks or Wet Spots:

(a) Inject, patch and repair areas where leaks or wet spots have occurred inside dry structures.
(b) Inject, patch and repair areas where leaks or wet spots have occurred.

3.6 Finishing Slabs and Flatwork

3.6.1 Slab Finishes:

DESCRIPTION	CONCRETE FINISH
Surfaces to Receive Grout or Topping	Float
Submerged and Buried Slabs	Float
Slabs with Floor Coverings	1 Troweling
Sealer Applied Floors and Slabs	3 Trowelings
Exterior Exposed Slabs	Float and Broom Finish
Exterior Stairs and Walks	Float and Broom Finish

3.6.2 After placement, screed concrete with straightedges, power strike-offs or vibrating screeds.

3.6.3 After screeding, bull float or darby surfaces to eliminate ridges and to fill in voids left by screeding.

3.6.4 Float:

(a) Use magnesium or aluminum hand floats or power floats with slip on float shoes.
(b) Float finish shall result in uniform smooth granular texture.

3.6.5 Trowel:

(a) Use steel trowels.
(b) Use power or hand troweling.
(c) Final troweling shall be by hand and continue until concrete surface consolidated to uniform, smooth, dense surface free of trowel marks and irregularities.

3.6.6 Broom Finish: Use fine, soft-bristled broom and broom at right angles to direction of traffic to give nonskid finish approved by Engineer.

3.6.7 Floor Sealer:

(a) Apply in accordance with manufacturer's written instructions.
(b) Apply first coat after final troweling, surface water glaze has dissipated, and when surface is hard enough to sustain foot traffic on same day as pour.
(c) When floor has been water cured, apply first coat after curing has been completed. Apply within one day of floor being dry enough for application.
(d) Apply second coat after Work completed and ready for occupancy.

3.6.8 For special coatings or finishes, see room finish schedule.

3.6.9 Tolerances:

(a) Concrete slabs shall be within 3/16 inch of 10 foot straightedge in all directions except where slabs are dished for drains. Deviations from elevation indicated shall not exceed 3/4 inch.
(b) Pitch floor to floor drains minimum 1/8 inch per foot or as shown. Pitch bottom of slab or beam to match top slope to maintain thickness or depth indicated. As an alternate, bottom of slab or beam may be placed level provided that min thickness or depth is maintained.

3.7 Finishing Formed Concrete

3.7.1 As-Formed Finish: Finish resulting directly from formwork for surfaces which will be hidden from view by earth, submergence in water, or subsequent construction.

(a) Repair surface defects as specified herein.
(b) Where joint marks or fins on submerged surfaces exceed 1/4 inch, grind smooth.

3.7.2 Smooth Finish: Interior concrete surfaces permanently exposed to view and concrete surfaces scheduled to be painted.

(a) Repair surface defects as specified herein.
(b) Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
(c) Dampen concrete and paint entire surface with Cement Grout. Work grout into surface with suitable float. When grout has set to where it will not be pulled out of holes or depressions, brush off surface with burlap or carpet.
(d) Prepare surface to be painted in accordance with Section 9A and paint manufacturer's recommendations.

3.7.3 Rubbed Finish: Exterior concrete surfaces permanently exposed to view extending to 6 inch below finished grade or liquid level.

(a) Repair surface defects as specified herein.
(b) Grind joint marks and fins smooth with adjacent surface. Remove stains and rinse.
(c) Apply heavy coat of Finishing Grout. After first coat has set, apply second coat. When second coat has set, float to uniform texture.
(d) Follow manufacturer's written recommendations.

3.8 Removal of Forming and Shoring

3.8.1 Do not remove forming or shoring until member supported has acquired sufficient strength to safely support own weight and any imposed loads. Forming shall remain in place for at least the minimum time recommended by ACI 347R. In addition, forming for horizontal members shall remain in place minimum 7 days. In no case shall forming for horizontal members be removed before concrete has reached 70% of specified design strength.

3.8.2 Reshore areas as required to carry additional imposed loads.

3.8.3 Removal of forms shall conform to Section 503.06 of the Standard Specifications.

END OF THIS SECTION

SECTION 3B - GROUT

1. GENERAL:

1.1 Section Includes

1.1.1 Grout for equipment bases.

1.1.2 Grout for pipe and conduit penetrations.

1.1.3 Grout for anchor bolts.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 5B – Bolts, Anchor Bolts, Concrete Anchors, and Concrete Inserts.

1.2.3 Section 15C – Piping and Appurtenances.

1.3 References

1.3.1 ASTM C109 - Compressive Strength of Hydraulic Cement Mortars (using 2" or 50 mm. Cube Specimens).

1.3.2 ASTM C150 - Portland Cement.

1.3.3 ASTM C191 - Time of Setting of Hydraulic Cement by Vicat Needle.

1.3.4 ASTM C827 - Early Volume Change of Cementitious Mixtures.

1.3.5 CRD-C-588 - Specifications for Non-Shrink Grout.

1.3.6 CRD-C-619 - Specification for Grout Fluidifier.

1.3.7 CRD-C-621 - Specification for Non-Shrink Grout.

1.4 Submittals

1.4.1 Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

1.4.2 Submit manufacturer's installation instructions under provisions of Division 1.

1.5 Tests

1.5.1 Testing of grout will be performed under provisions of Division 1.

1.6 Delivery, Storage and Handling

1.6.1 Grout materials from manufacturers shall be delivered in unopened containers.

1.6.2 Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

1.7 Environmental Requirements

1.7.1 Maintain materials and surrounding air temperatures to a minimum of 50°F prior to, during and 48 hours after completion of the Work.

1.7.2 If manufacturer's requirements are more stringent, such requirements shall govern.

1.8 Basis of Payment

1.8.1 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.

1.8.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Materials

2.1.1 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

2.2.1 Sikadur 42, Grout-Pak by Sika Chemical Company.

2.2.2 DP Epoxy Grout by Five Star Products, Inc.

2.2.3 Substitutions: Under provisions of Division 1.

2.3 Materials- Non-Shrink, Non-Metallic, Cementitious Grout

2.3.1 Pre-mixed, non-staining, cementitious grout requiring only the addition of water at the job site; conforming to the following:

(a) 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.

(b) Compressive Strength: A minimum 28-day compressive strength of 7,000 psi when tested in accordance with ASTM C109.

(c) Setting Time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C191.

(d) Composition: Shall not contain metallic particles, chlorides or expansive cement.

2.3.2 Manufacturers - Non-Shrink, Non-Metallic, Cementitious Grout

(a) Sika Grout 212 by Sika Chemical Company.

(b) SET Grout by BASF.

(c) Five Star Grout by Five Star Products, Inc.

(d) Substitutions: Under provisions of Division 1.

2.4 Materials - Cement-Sand Grout

2.4.1 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.

2.4.2 Cement: ASTM C150, Type I or Type II.

2.4.3 Sand: ASTM C33.

2.4.4 Water: Clean, fresh, potable water free from injurious amounts of vegetable matter and mineral salts.

3. EXECUTION:

3.1 Inspection

3.1.1 Examine conditions under which grout is to be installed and notify Engineer in writing of unsatisfactory conditions or deficiencies that have been corrected.

3.2 Installation

3.2.1 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.

3.2.2 Drypacking for vertical grouting behind vertical base plates.

3.2.3 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.

3.2.4 Placing grout shall conform to temperature and weather limitations in Section 3A.

3.2.5 Equipment Bases

(a) After shimming and 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.

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

3.3 Schedule

3.3.1 Non-Shrink, Non-Metallic Cementitious Grout: anchor bolts, equipment bases, pipe supports, pipe and conduit penetration, slide gate frame, and pipe thrust support structures.

3.3.2 Cement-Sand Grout: Pipe and conduit penetrations for non-water containing structure, and repair of exposed concrete.

END OF THIS SECTION

DIVISION 4 - MASONRY SYSTEM

SECTION 4A - UNIT MASONRY

1. GENERAL:

1.1 Description

1.1.1 The scope of work under this Division shall include the furnishing and installing of all masonry units including standard concrete masonry units (CMU), face brick, glazed CMU, solid glass block, bond beams, cast stone, limestone, cap stone, 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.

1.1.2 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.

1.1.3 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.

1.1.4 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.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 5A – Metal Fabrications.

1.2.3 Section 5B – Bolts, Anchor Bolts, Concrete Anchors, and Concrete Inserts.

1.2.4 Section 6A – Rough Carpentry.

1.2.5 Section 7A – Elastomeric Membrane Roofing

1.2.6 Section 7B - Sheet Metal Flashing and Trim.

1.2.7 Section 7C - Joint Sealers.

1.2.8 Section 7D - Board Insulation.

1.2.9 Section 8A – Stainless Steel Doors and Frames.

1.2.10 Section 8B - Door Hardware.

1.2.11 Section 9A - Painting

1.2.12 Section 10A – Specialties.

1.2.13 Divisions 11, 12, 13 & 15.

1.3. Reference Standards

1.3.1 This work is subject to the requirements of the applicable portions of the following standards:

General:

(a) ACI 530: Building Code Requirements for Concrete Masonry Structures.

(b) ACI 530.1: Specifications for Masonry Structures.

(c) IBC: International Building Code.

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 C595: Blended Hydraulic Cements

(i) ASTM C780: Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

(j) ASTM C1019: Method of Sampling and Testing Grout.

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).

Cast Stone:

(a) Cast Stone Institute Technical Manual and the Architectural Precast Assn.

1.4 Submittals

1.4.1 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:

(a) Glass Block.
(b) Glazed single face CMU block.
(c) Glazed double face CMU block.
(d) Brick unit with coating.
(e) Glazed Brick
(f) Concrete masonry unit.
(g) Limestone base and sill for all finish types indicated on drawings with coating.
(h) Cast stone coping

1.4.2 Field Constructed Mock-Up: Provide a 5'x5' mock-up for review at a critical location of the building. Mock-up shall include stone base (including all stone types as shown on drawings), partial face brick, and glass block. Mock-up may be used as part of final work once approved by Engineer/Architect for appearance.

(a) Obtain Engineer's/Architect's acceptance of materials, workmanship, and visual qualities before proceeding with work.

1.4.3 Material submittals shall include manufacturer's certification of compliance for the type and grade of masonry units supplied.

1.4.4 Include design mix, indicate proportion or property method used, required environmental conditions, and admixture limitations.

1.4.5 Submit test reports on mortar indicating conformance with ASTM C270.

1.4.6 Submit test reports on grout indicating conformance with ASTM C476 and C1019.

1.4.7 Submit manufacturer’s certificate indicating that products meet or exceed specified requirements.

1.5 Delivery and Storage

1.5.1 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.

1.5.2 Store cementitious materials off the ground and completely cover with a wind safe waterproof covering.

1.5.3 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.

1.5.4 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.

1.6 Environmental Requirements

1.6.1 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.

1.7 Mix Tests

1.7.1 Testing of Mortar Mix: In accordance with ASTM C780.

1.7.2 Test mortar mix for compressive strength, slump, consistency, mortar aggregate ratio, water content, air content and splitting tensile strength.

1.7.3 Testing of Grout Mix: In accordance with ASTM C1019.

1.8 Field Measurements

1.8.1 Verify that field measurements are as indicated on the Drawings.

1.9 Basis of Payment

1.9.1 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.

2. PRODUCTS:

2.1 Brick Units

2.1.1 Manufacturers:

(a) Belden.
(b) Darlington, a General Shale Company.
(c) Hanley Brick, a Glen-Gery Brick Company.
(d) Approved equal.

2.1.2 Brick masonry units shall be face brick in accordance with ASTM C216, Type FBS, Grade SW (severe weathering/exposure), and zero efflorescence.

2.1.3 Brick masonry units shall be modular size of 2-1/4”x3-5/8”x7-5/8”. Provide special solid brick units for corners, lintels, headers, bases and other special conditions as required.

2.1.4 Color shall be “Autumn Haze Colonial” as manufactured by Glen-Gery Corporation or approved equal with Smooth texture. 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.

2.1.5 Where indicated on drawings at medallion, provide glazed brick units same as face brick, as per indicated pattern.

(a) Conform to ASTM Standard Specification C 1405, Class: Exterior, Grade: S, Type: 1, Division: Solid (≤25% void)

2.2 Concrete Block (Standard and Glazed Type CMU)

2.2.1 Manufacturers:

(a) 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 following or approved equal.

1) The Spectra Group, Spectra glazed II CMU.
2) Trenwyth, Astra-glazed CMU.

2.2.3 Hollow normal weight concrete block units shall conform to ASTM C 90. (f'cmu=3,250 pounds per square inch minimum, f'm=2,500 pounds per square inch minimum).

2.2.4 Solid normal weight concrete block units shall conform to ASTM C 90.

2.2.5 Provide special units for 90 degree corners, bond beams, lintels, jambs, bullnose, wall base (cove-type), and other special conditions as required.

2.2.6 Glazed face block color shall be as follows (based on Trenwyth Astra-glazed CMU):

(a) Walls: Whitman White.

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.

2.2.7 Glazed face block shall be provided in (1) single glazed face and (2) double glazed face units at locations indicated on drawings.

2.3 Glass Block

2.3.1 Manufacturer - Subject to compliance with requirements, provide glass block by the following, or approved equal:

Seves Glass Block Inc: Vistabrick Stipple

2.3.2 The glass block shall be solid, colorless glass with manufacturer's standard coating factory-applied on edge surfaces. Sizes shall be 3 inch thick by 7-3/4 inch square actual size.

2.3.3 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.

2.3.4 Stainless Steel angles, shall have #4 finish and oriented as shown on drawings. Size retainer angles as needed to provide a minimum of 1” deep recess for glass blocks with provisions for lintel deflection and sealed throughout.

2.3.5 At sill, apply a coat of asphalt emulsion and top with mortar. Do not use retainer angles at sill. Asphalt emulsion shall be water based. Use Type S Mortar.

2.3.6 Recommend installing glass blocks prior to their corresponding lintel installation.

2.4 Mortar

2.4.1 Materials:

(a) Portland Cement: ASTM C150, Type I, gray color.
(b) Blended Cement: ASTM C595, Type IL
(c) Masonry Cement: Not permitted for use.
(d) Mortar Aggregate: ASTM C144, standard masonry type. Grading and color suitable for type of masonry, one source for entire project.
(e) Hydrated Lime: ASTM C207. Type S
(f) Quicklime: ASTM C5, non-hydraulic type.
(g) Grout Aggregate: ASTM C404
(h) Grout Fine Aggregate: Sand, 50 percent by volume.
(i) Water: Clean and potable.

2.4.2 Pre-Mix Mortar:

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-load bearing walls and partitions: ASTM C1142, Type RS with an average compressive strength of 1800 psi at 28 day strength.

2.4.3 Mortar Mixes:

(a) 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.
(b) Pointing Mortar: Mortar shall be Type N and shall conform to ASTM C270, using the Property Method.
(c) 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.
(d) Mortar shall be freshly prepared and uniformly mixed and shall be of spreadable, workable consistency.
(e) 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.
(f) The mortar ingredients shall be mixed in a batch mixer for not less than three minutes.
(g) The use of fire clay, rock dust, dirt and other deleterious materials is prohibited.
(h) Mortar Color: As selected by owner/architect to match masonry unit colors from manufacturer's standard colors during submittal review process.

2.5 Grout

2.5.1 Grout shall conform to ASTM C476 and shall have a minimum strength of 3,000 psi at 28 days.

2.5.2 Grout shall have proportions of 1 part Portland cement 0.10 parts hydrated lime and 3 parts sand by volume.

2.5.3 Bond Beams: Lintels: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.5.4 Engineered Masonry: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.5.5 Grout slump shall be between 8" and 11" when tested under ASTM C143 testing procedures at time of placement.

2.6 Cement

2.6.1 Cement shall be Type 1 Portland cement conforming to ASTM C150 or Type 1L blended hydraulic cement conforming to ASTM C595. Plastic cement shall not be used.

2.7 Lime

2.7.1 Hydrated lime shall conform to ASTM C207.

2.8 Aggregates

2.8.1 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.

2.8.2 Aggregate for mortar shall conform to ASTM C144.

2.8.3 Aggregate for grout shall conform to ASTM C404 Size No. 2.

2.9 Water

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

2.10 Reinforcing Steel

2.10.1 Steel reinforcement bars shall conform to the requirements of AASHTO M-53 Grade 60 Ksi, or ASTM A615 Grade 60 Ksi, uncoated, deformed billet bars and the applicable portions of the Standard Specifications.

2.10.2 Reinforcement shall be clean and free from loose rust, scale, dirt, and any coatings that reduce bond.

2.10.3 Mechanical splice anchors for reinforcing bars: submit product data and information for review.

2.11 Horizontal Joint Reinforcement and Metal Accessories

2.11.1 Wire for joint reinforcement shall be ladder or 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.

2.11.2 Manufacturer - Subject to compliance with requirements, provide horizontal joint reinforcement by one of the following, or an approved equal:

(a) "Dur-O-Wall" by Dayton Superior
(b) Blok-Lok, A Hohmann & Bernard Company
(c) H-B, Homan & Barnard, Inc.

2.11.3 Horizontal Joint Reinforcement and Metal Accessories shall be as follows:

(a) The width of the horizontal reinforcing shall be 2 inches less than the actual thickness of the wall or partition in which reinforcement will be installed. Splicing of horizontal reinforcing, including corner and partition reinforcing, shall be done by providing a 8-inch overlapping of side rods.
(b) Corners shall be reinforced with prefabricated corner ladder or truss type standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R. Intersection between walls and partitions shall be reinforced horizontally with prefabricated T-ladder or truss type, 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.
(c) Solid and hollow interior or exterior masonry walls shall be reinforced horizontally with truss or ladder type reinforcement 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

2.12.1 Rubberized asphalt sheet flashing with metal drip edge.

2.12.2 Sheet Flashing: Subject to compliance with requirements, provide one of the following or approved equal:

(a) "Perm-A-Barrier VP" as manufactured by W. R. Grace & Co.
(b) "Textroflash Flashing" as manufactured by Hohmann & Barnard, Inc.

2.12.3 Material requirements:

(a) 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.
(d) 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.
(e) Accessories: Primer, conditioner, adhesive, and mastic compatible with the sheet flashing as recommended by the sheet flashing manufacturer.

2.13 Accessories

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

(a) Cleaners for red and light colored brick not subject to metallic staining with mortar not subject to bleaching.

1. Sure Klean No. 600 Detergent; ProSoCo. Inc.
2. 202 New Masonry Detergent; Diedrich Technologies, Inc.
3. Approved equal.

(b) Cleaners for brick subject to metallic staining:

1. Sure Klean Vana Trol; ProSoCo. Inc.
2. 202V Vana-Stop; Diedrich Technologies, Inc.
3. Approved equal.

(c) Cleaners for glazed concrete masonry units

1) Cleaning solution as recommended by glazed block manufacturer. Submit cleaning solution and manufacturer's instructions and recommendations for review.

2.13.2 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:

(a) Mortar Trap by Hohmann & Barnard, Inc.
(b) MortarNet by Mortar Net Solutions.
(c) Approved equal.

2.13.3 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 (if required)

2.14.1 20 gauge galvanized dovetail foam filled anchor slots compatible with anchors.

2.14.2 16 gauge by 1 in. galvanized corrugated, dovetailed metal anchor straps.

2.14.3 Zinc coated in accordance with ASTM A153, Class B2.

2.15 Weep/Vent Products: Use one of the following, unless otherwise indicated:

2.15.1 Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.

2.15.2 Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

2.15.1 Available Products:

(a) Advanced Building Products Inc.; Mortar Maze Weep Vents.
(b) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
(c) Heckmann Building Products Inc.; No. 85 Cell Vent.
(d) Hohmann & Barnard, Inc.; Quadro-Vent.
(e) Wire-Bond; Cell Vent.
(f) Approved Equal.

2.16 Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to comply with painting Section in color approved by Authority to match that of mortar.

2.16.1 Available Products:

(a) Hohmann & Barnard, Inc.; #343W - Wilko Weep Hole.
(b) Or approved equal.

2.17 Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.

2.17.1 Hohmann & Barnard, Inc.; #343 Louvered Weep Hole.

(a) Williams Products, Inc.; Williams-Goodco Brick Vent.
(b) Wire-Bond; Louvered Weepholes.
(c) Approved Equal.

2.16 Limestone Sill and Base

2.16.1 Limestone shall be “Adair Dolomitic”, selected for uniformity of tone, well-seasoned and free from stain producing minerals. Stone shall have "Smooth, or Rock Face" surface finish as indicated on drawings, cut to profiles, sized and dressed in accordance with the approved shop drawings. Compressive strength shall be a minimum of 6,000 psi, conforming to ASTM C-170. Color shall be as selected by Owner.

2.17 Expansion Joints

2.17.1 Basis of design: subject to compliance with requirements, provide RS Series-Rubber Control Joint as manufactured by Hohman & Barnard, Inc. or approved equal:

(a) Extruded rubber material designed for masonry walls at control joints.

(b) Rubber material conforms to ASTM D2000 M2AA-805 (type rubber 654-06) with a durometer hardness of 80 (+ or - 5) when tested in conformance with ASTM D2240.

2.18 Cast Stone: Provide units with fine-grained texture and buff color resembling Indiana
Limestone.

2.18.1 Cast stone complying with ASTM C 1364 and the following:

(a) Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

(b) Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

(c) Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

(d) Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

(e) Admixtures: Use only admixtures specified or approved in writing by the Department.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
   i. Water Reducing Admixture: ASTM C 494, Type A.
   ii. Water Reducing, Retarding Admixture: ASTM C 494, Type D.
   iii. Water Reducing, Accelerating Admixture: ASTM C 494, Type E.

(f) Reinforcement: Deformed steel bars complying with ASTM A 615, Grade 60. Use epoxy-coated reinforcement.

1. Epoxy Coating: ASTM A775.
2. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240, ASTM A 276 or ASTM A 666, type 304.

2.18.2 Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

(a) Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

2.18.3 Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

(b) Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.

(c) Provide raised fillets at backs of sills and at ends indicated to be built into jambs.

(d) Provide drips on projecting elements unless otherwise indicated.

2.18.4 Fabrication Tolerances:

(a) Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
(b) Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of the unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.

(c) Warp, Bow and Twist: Not to exceed 1/360 of the length of the unit or 1/8 inch, whichever is greater.

(d) Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

2.18.4 Cure units as follows:

(a) Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.

(b) Keep units damp and continue curing to comply with one of the following:

(c) No fewer than five days at mean daily temperature of 70 deg F or above.

(d) No fewer than six days at mean daily temperature of 60 deg F or above.

(e) No fewer than seven days at mean daily temperature of 50 deg F or above.

1. No fewer than eight days at mean daily temperature of 45 deg F or above.

2.18.5 Acid etch units after curing to remove cement film from surfaces to be exposed to view.

2.19 For graffiti protection of masonry refer to section 9A.

3. EXECUTION:

3.1 General

3.1.1 Masonry work shall not be started when the horizontal and vertical alignment of the foundation is out of plumb or line one inch or more.

3.1.2 The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed before starting the masonry.

3.1.3 All masonry shall be laid true, level and plumb and in accordance with construction documents.

3.1.4 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.

3.1.5 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.

3.1.6 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.

3.1.7 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.

3.1.8 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.

3.1.9 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 have 3/8-inch nominal thickness.

3.1.10 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.

3.1.11 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.

3.1.12 All surfaces, including sills, ledges, finished concrete, etc., shall be protected from mortar droppings or other damage during construction.

3.1.13 Horizontal reinforcing shall be laid on the webs of bond beam units.

3.1.14 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.

3.1.15 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.

3.1.16 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.

3.1.17 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.

3.1.18 Grouting at bond beams over openings shall be done in one continuous operation.

3.1.19 All cells containing reinforcement, anchor bolts, inserts, etc. shall be grouted solid. Spaces around metal door frames and other built-in items shall be filled solid with grout.

3.1.20 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.

3.1.21 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.

3.1.22 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. Nonload-bearing partitions and interior walls shall be securely anchored to the construction above and in a manner that provides lateral stability.

3.1.23 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.

3.1.24 Surfaces of masonry not being worked on shall be properly protected at all times during construction operations. 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.

3.1.25 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

3.2.1 Do not permit mortar to drop or accumulate into cavity air space or to plug weep.

3.2.2 Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier sheet/adhesive.

3.3 Concrete Masonry Units

3.3.1 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 installation.

3.3.2 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.

3.3.3 Concrete masonry lintels shall be installed over all 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 1 course solid (8 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:

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

3.3.4 Grouted Components (general)

(a) Reinforce bond beam (where required and as indicated on drawings) with two (2) No. 5 bars, placed continuous bottom reinforcement.
(b) Reinforce other grouted components as shown on Contract Drawings.
(c) Lap splices minimum 48 bar diameters.
(d) Support and secure reinforcing bars from displacement. Maintain position within ½ inch of dimensioned position.
(e) Place and consolidate grout fill without displacing reinforcing.
(f) At bearing locations, fill masonry cores with grout for a minimum 16 inches either side of opening.

3.3.5 Control Joints:

(a) Do not continue horizontal joint reinforcement through control joints.
(b) Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
(c) Size control joint in accordance with Section 7C for sealant requirements.

3.3.6 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) Built-in items shall be 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 embed organic materials subject to deterioration such as untreated wood.

3.3.7 Tolerances

(a) Maximum variation from unit to adjacent unit: 1/32 inch.
(b) Maximum variation from plane of wall: 1/4 inch in 10 feet, and ½ inch in 20 feet or more.
(c) Maximum variation from plumb: 1/4 inch per story non-cumulative; ½ inch in two stories or more.
(d) Maximum variation from level coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; ½ inch in 30 feet.
(e) Maximum variation of joint thickness: 1/8 inch in 3 feet.
(f) Maximum variation from cross sectional thickness of walls: 1/4 inch.

3.3.8 Cutting and Fitting

(a) Cut and fit for chases, pipes, conduit, sleeves and other components. Coordinate with other Sections of work to provide correct size, shape, and location.
(b) Obtain Engineer's 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

3.4.1 Provide stainless steel angles for mounting glass block window frame in the direction as indicated on drawings for security purposes.

3.4.2 Glass block including reinforcing, expansion strips, coatings, anchors and sealants shall be installed in accordance with the manufacturer's recommendations.

3.4.3 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.

3.4.4 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:

3.5.1 Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing.

3.5.2 Install in accordance with manufacturer's recommendations to provide a continuous flashing system.

3.5.3 Provide end dam at each end of flashing to funnel water flow out of wall.

3.5.4 Turn up sheet flashing a minimum of 8 inches and fully adhere to substrate.

3.5.5 Fully adhere sheet flashing to top of metal drip edge and cut off sheet flashing ½ inch back from exterior face.

3.5.6 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

3.6.1 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.

3.6.2 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.

3.6.3 After mortar is thoroughly set and cured, remove large mortar particles by hand with wooden paddles and non-metallic scrape holes or chisels.

3.6.4 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 THIS SECTION

DIVISION 5 - METALS

SECTION 5A - METAL FABRICATIONS

1. GENERAL:

1.1 Section Includes

1.1.1 Provide miscellaneous metal work shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

(a) Lintels.
(b) Metal frames.
(c) Floor access hatches.
(d) Roof access hatches.
(e) Bar Screen.
(f) Miscellaneous items.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.
1.2.2 Section 4A - Unit Masonry System.
1.2.3 Section 5B - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts.
1.2.4 Section 9A - Painting.

1.3 References

All reference standards shall be the latest edition.

1.3.1 ASTM A36 - Structural Steel.

1.3.2 ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

1.3.3 ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.

1.3.4 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.3.5 ASTM A276, Type 316L - Stainless Steel.

1.3.6 ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

1.3.7 ASTM A325 - High Strength Bolts for Structural Steel Joints.

1.3.8 ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

1.3.9 ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.3.10 ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

1.3.11 ASTM A992 – Structural Steel Shapes.

1.3.12 AWS A2.0 - Standard Welding Symbols.

1.3.13 AWS D1.1 - Structural Welding Code.

1.3.14 AISI - Standard for Stainless Steel.

1.3.15 SSPC - Steel Structures Painting Council.

1.3.16 ANSI A14.3: Safety requirements for fixed ladders.

1.3.17 Specifications for Aluminum Structures, The Aluminum Association.

1.4 Submittals

1.4.1 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.4.2 Submit Product Data.

1.4.3 Shop drawings shall be approved prior to fabrication.

1.4.4 Indicate all revisions on resubmissions.

1.4.5 Provide supporting information confirming that required loads for access hatches are met.

1.4.6 Include provisions for separations of dissimilar metals.

1.5 Quality Assurance

1.5.1 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).

1.5.2 Conform to AISC and AA standards.

1.6 Field Measurements

1.6.1 Verify that field measurements are as indicated on shop drawings and in accordance with manufacturers' recommendations.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Materials

2.1.1 In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, and roughness.

2.1.2 Comply with following standards, as pertinent.

(a) Steel plates and shapes: ASTM A36 or A992.
(b) Square or rectangular tubing: ASTM A500, Grade B.
(c) Round tubing or pipe: ASTM A53, Type E or S, Grade B.
(d) Stainless Steel:

1) Exterior and submerged uses: AISI, Type 316.
2) Interior uses: AISI, Type 304 or Type 316.

(e) Aluminum shapes and plates: Alloy 6061-T6 or 6063-T6.
(f) Connection Bolts:

1) For steel members: ASTM F3125 Grade A325, galvanized.
2) For aluminum members: Stainless steel.

(g) Cast-in-place Anchor Bolts:

1) 1/2 in. min dia.
2) Nonsubmerged: ASTM F1554, Grade 36, galvanized.
3) Submerged: Stainless steel.

(h) Malleable Iron: ASTM A47.
(i) Cast Iron: ASTM A48, Class 35B.
(j) Ductile Iron: ASTM A536, Grade 65-45-12.
(k) Cast Aluminum: ASTM B26.

2.2 Fabrication

2.2.1 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.

2.2.2 Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.

2.2.3 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.

2.2.4 Weld shop connections and bolt or weld field connections.

2.2.5 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.

2.2.6 Connections shall consist of min two 3/4 in. dia bolts or welds developing min of 10,000 lbs capacity.

2.2.7 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.

(a) Do not coat ferrous metal surfaces embedded in concrete.
(b) Coating of cast iron or ductile iron floor access hatches and pressure relief valves not required.
(c) On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
(d) Coat aluminum surfaces in contact with concrete with bituminous coating. Under no circumstances shall aluminum contact dissimilar metal.

2.2.8 Galvanizing:

(a) Galvanize after fabrication.
(b) Galvanize by hot-dip process conforming to ASTM A123 and AHDGA specifications.

2.3 Finishes

2.3.1 Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.

2.3.2 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.

2.3.3 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.

2.3.4 Quality of galvanizing shall be rigidly controlled and it shall be understood that any defects as mentioned below shall be just grounds for rejection.

2.3.5 Galvanized steel shall have no bare spots unless small and suitable for patching, pimples showing excessive contamination, flux, ash inclusions, or blisters.

2.3.6 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.

2.3.7 Structural and miscellaneous metal Work shall be galvanized when located on the exterior and on the interior where so indicated and/or specified.

2.3.8 Prime paint items in accordance with finish coat requirements.

2.3.9 Repair all damage to field-primed surfaces.

2.4 Lintels

2.4.1 Provide steel lintels over openings in masonry walls as noted and wherever reinforced masonry or concrete lintels are not provided.

2.4.2 Fabricate lintels from structural steel shapes as detailed, selected for straightness of section, with minimum of 8 in bearing each side of opening.

2.4.3 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.

2.4.4 Hot-dip galvanize after fabrication.

2.5 Metal Frames

2.5.1 Provide door, hatch, grille, louver, and other frames fabricated from structural shapes or plates.

2.5.2 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.

2.5.3 Miter or cope and join members with continuous welds.

2.5.4 Provide temporary spreader bars to prevent springing frames out of shape prior to and during erection.

2.6 Floor Access Hatches

2.6.1 Prefabricated Standard Type: All materials exposed to the elements shall be corrosion resistant.

(a) Manufacturers: subject to compliance with requirements:

1) Bilco Type K or KD.
2) Halliday Type S1S or S2S.
3) Approved equal.

(b) Provide aluminum access hatches and frames with stainless steel hardware of size as shown on Drawings.
(c) Door leaves shall be 1/4 in. min aluminum diamond pattern plate with reinforcing on underside to withstand live load of 150 lbs/sq ft with max deflection of 1/150 span.
(d) Frames shall be 1/4 in. min thick with strap anchors around perimeter.
(e) Equip hatches with stainless steel hinges bolted to underside and pivot on torsion bars that counterbalance leaf for easy operation.
(f) Equip hatches with hold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
(g) Provide 316 stainless steel snap lock mounted on underside of leaf with removable topside handle and socket recessed in cover.
(h) Hardware shall be stainless steel throughout.
(i) Factory finish on aluminum surfaces shall be mill finish with bituminous coating applied to surfaces in contact with concrete.
(j) Manufacturer shall warranty in writing against defects in material and workmanship for 5 yrs.

2.6.2 Prefabricated Drainage Channel Type: All materials exposed to the elements shall be corrosion resistant.

(a) Manufacturers: subject to compliance with requirements:

1) Bilco Type J-AL or JD-AL.
2) Halliday Type W1S or W2S.
3) Approved equal.

(b) Provide aluminum access hatches and frames with stainless steel hardware of size as shown on Drawings.
(c) Door leaves shall be 1/4 in. min. aluminum diamond pattern plate with reinforcing on underside to withstand live load of 300 lbs/sq ft with max deflection of 1/150 span.
(d) Frame: Channel frame shall be extruded aluminum with bend down anchor tabs around the perimeter.
(e) Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to covers with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.
(f) Drain Coupling: Provide a 1-1/2” (38mm) drain coupling located in the right front corner of the channel frame.
(g) Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the covers when closing.
(h) Exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected.
(i) Hardware:
1) Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 1/4” diameter Type 316 stainless steel pin, shall be provided.
2) Covers shall be equipped with a hold open arm which automatically locks each cover in the open position.
3) A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of one cover.
4) Hardware: Shall be Type 316 stainless steel throughout.

(j) Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.
1) Dissimilar metals shall be separated by means of factory applied bituminous coating. Shop drawings shall indicate this requirement.

2.7 Roof Access Hatches

2.7.1 Prefabricated Double Leaf Scuttle Type D and Type S for single leaf: All materials exposed to the elements shall be corrosion resistant.

(a) Manufacturers: Bilco Type D, Type D, Nystrom RHE-D Series or Approved equal.
(b) Provide access hatches with integral curbs of the size noted.
(c) Door leaves shall be 3/16 in. aluminum plate with neatly welded 3 in. beaded flange.
(d) Curbs shall be 3/16 in. aluminum plate extended 1 in. beyond concrete curb support with integral 2 in. apron.
(e) Curbs shall be a minimum of 12 in. high above adjacent concrete curb.
(f) Curbs shall be equipped with integral 11 ga. aluminum cap flashing, welded at corners for water tightness.
(g) Door leaves and curbs shall be insulated with 1 in. rigid glass fiber insulation. Insulation shall be covered with 14 ga. aluminum plate.
(h) Equip hatches with heavy pintel hinges and compression springs in telescoping tubes.
(i) Equip hatches with hold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
(j) Provide snap lock mounted on underside of leaf with underside and topside handle.
(k) All hardware shall be stainless steel.
(l) Factory finish on aluminum surfaces shall be mill finish with bituminous coating applied to surfaces in contact with concrete.
(m) Manufacturer shall warranty in writing against defects in material and workmanship for 5 yrs.
(n) For single leaf roof hatches located near parapet walls, provide cover to open 87˚. Consult manufacturer for recommendations.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that field conditions are acceptable and are ready to receive Work.

3.1.2 Preparation

(a) Clean and strip primed steel items to bare metal where site welding is required.

(b) Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.1.3 Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

3.2.1 Install items plumb and level, accurately fitted, free from distortion or defects.

3.2.2 Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

3.2.3 Perform field welding in accordance with AWS D1.1.

3.2.4 Obtain Engineer approval prior to site cutting or making adjustments not scheduled.

3.2.5 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.

3.2.6 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.

3.2.7 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.

3.2.8 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.

3.2.9 Install hatches and manufactured items in accordance with manufacturer's instruction.

3.2.10 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.

3.2.11 Touch up damaged galvanizing with cold galvanizing compound.

3.2.12 Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

3.2.13 Test units for proper function and adjust until proper operation is achieved

3.2.14 Repair finishes damaged during installation.

3.2.15 Restore finishes so no evidence remains of corrective work.

3.3 Adjusting and Cleaning

3.3.1 Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF THIS SECTION

SECTION 5B - BOLTS, ANCHOR BOLTS, CONCRETE ANCHORS, AND CONCRETE INSERTS

1. GENERAL:

1.1 Section Includes

1.1.1 Furnishing and installing all bolts, anchors and inserts, anchor bolts, expansion anchors and concrete inserts for:

(a) Piping.
(b) Hangers and brackets.
(c) Equipment.
(d) Electrical, plumbing and HVAC work.
(e) Pump base.
(f) Miscellaneous fasteners.

1.2 Related Sections

1.2.1 Section 4A - Unit Masonry.
1.2.2 Section 5A - Metal Fabrication.
1.2.3 Section 15C - Piping and Appurtenances.

1.3 References

1.3.1 Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
1.3.2 ACI 349 - Appendix B - Code Requirements for Nuclear Safety Related Concrete Structures.
1.3.3 AISC - American Institute of Steel Construction, Structural Steel Detailing.
1.3.4 ANSI B1.1 - Screw Threads, Coarse Thread Series.
1.3.5 ANSI B18.2 - Square and Hex Bolts and Nuts.
1.3.6 ASTM A36 - Structural Steel.
1.3.7 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
1.3.8 ASTM A193 - Alloy-Steel & Stainless Steel Bolting Materials for High-Temperature Service.
1.3.9 ASTM A194 - Carbon & Alloy Steel Nuts for Bolts for High Pressure & High Temp. Service.
1.3.10 ASTM A242 - High Strength Low-Alloy Structural Steel.
1.3.11 ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
1.3.12 ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum tensile Strength.
1.3.13 ASTM A354 - Quenched & Tempered Alloy Steel Bolts, Studs & Other Externally Threaded Fasteners.
1.3.14 ASTM A563 - Carbon and Alloy Steel Nuts.

1.3.15 ASTM A588 - High Strength Low-Alloy Structural Steel With 50 KSI Minimum Yield Point.
1.3.16 ASTM B98 - Copper Silicon Alloy Rods, Bars, and Shapes.
1.3.17 AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

1.4 Submittals

1.4.1 Samples: Submit for approval the following:

(a) 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.

1.4.2 Shop Drawings: Submit for approval the following:

(a) Setting drawings and templates for location and installation of anchorage devices.
(b) Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

1.4.3 Contractor shall submit calculations stamped by a licensed structural engineer.

1.5 Quality Assurance

1.5.1 Bolts, anchor bolts, expansion anchors and concrete inserts shall conform to applicable Section 1006, METALS, of the Standard Specifications.

1.6 Basis of Payment

1.6.1 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.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Design Criteria

2.1.1 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.

2.1.2 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.

2.1.3 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.

2.1.4 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:

(a) 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.

(b) Shall satisfy all requirements and recommendations of ACI 349, Appendix B.

(c) Shall satisfy all minimum recommendations and requirements of Manufacturer.

(d) Allowances for vibration are not included in the safety factor specified above.

2.1.5 Determine design loads as follows:

(a) For equipment anchors, use the design load recommended by the manufacturer and approved by the Engineer.

(b) 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.

2.1.6 Anchors and inserts shall be located and sized so as not to impair the integrity of the supporting structure.

2.2 Materials

2.2.1 Bolts and Anchor Bolts:

(a) Galvanized Steel Bolts and Nuts:

1) Steel anchor bolts, studs, nuts and washers for interior installation shall be in conformity with the current ASTM Designation: F3125 "High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi", Grade A325, 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.

(b) Stainless Steel Bolts and Nuts:

1) 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 F593, Group 1 (AISI 304) (75 KSI Min. Tensile Strength)and ASTM F594, Group 1 or 2 (AISI 304), AISI 316 or approved equal.

2) For high strength applications, stainless steel bolts and nuts shall be in conformity with the current ASTM F593, Group 1(AISI 304) (Tensile Strength 100/125 KSI) and ASTM F594, Group 1 (AISI 304) or approved equal.

(c) Bronze Bolts and Nuts:

1) 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.

(d) Other types, if shown on drawings or specified under other Sections.

2.3 Pipe Joints

2.3.1 Galvanized Bolts and Nuts (For EXPOSED Piping Installations):

(a) Steel anchor bolts, flange bolts, studs and nuts shall be in conformity with the current ASTM A307 "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength", Grade B or approved equal.

(b) All steel bolts, studs and nuts, shall be hot-dip galvanized in accordance with ASTM A153.

(c) At joint harnesses and restrained harnesses connected to flange, the tie bolts and studs, flange bolts and nuts shall conform to ASTM A354 Grade BC or ASTM A193 Grade B7 115/125 KSI Min. Tensile Strength for 4" diameter and under. Lug and ring shall be ASTM A36 steel.

2.3.2 Stainless Steel Bolts and Nuts (Where Specified):

(a) Stainless steel flange bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) 75 KSI Min. Tensile Strength), Class 1 & ASTM A194, Grade 8 (AISI 304) or approved equal.

(b) Stainless steel bolts and nuts for harness flanges and connecting restrained harnesses to flange 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.

2.3.3 Corrosion resistant steel (CRS) (For BURIED Piping Installations):

(a) CRS anchor bolts, flange bolts, studs and nuts shall be "Cor-Ten" type steel in conformity with the material characteristics listed in Sec.11-8 of AWWA C111 "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings", and also in conformity with the ASTM: A242 "High Strength Low-Alloy Structural Steel" Type 1, A588 "High Strength Low-Alloy Structural Steel With 50 KSI Minimum Yield Point" Grade A, or approved equal.

(b) At buried mechanical joints, bolts and nuts shall be in conformity with all of AWWA C111 dimensions and requirements.

(c) Above specified bolts and nuts shall be tension tested for a minimum ultimate tensile stress of 65 ksi using testing procedures corresponding to ASTM A307 requirements, and shall be proof load tested based on 45 ksi stress to AWWA C111 standards.

(d) Bolt heads shall be marked with manufacturer, ASTM material designation/grade, and country where manufactured. Markings shall be raised or depressed.

(e) At buried joint harnesses and restrained harnesses connected to flange, the tie bolts and studs, flange bolts and nuts shall be "Cor-Ten" type steel in conformity with the current ASTM: A325, "Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength", Type 3.

(f) Bolt strength shall be adequate to provide compression needed for water tightness of the gasket material used.

2.4 Concrete Anchors

2.4.1 Wedge Anchors:

(a) Manufacturers:

1) Power-Stud+ SD1, SD2, SD4, or SD6 by Dewalt.
2) Kwik Bolt TZ or Kwok Bolt 1 by Hilti Corp.
3) Strong-Bolt 2 by Simpson Strong-Tie Co., Inc.

(b) Usage: In concrete:

1) 316 stainless steel.
2) Do not use when submerged or subjected to dynamic loads.

2.4.2 Expansion Anchors:

(a) Manufacturers:

1) Power-Bolt+ by Dewalt.
2) HSL-3 by Hilti Corp.
3) Liebig Anchor by Liebig.

(b) Usage: In concrete:

1) 316 stainless steel.
2) Do not use when submerged, in overhead applications, or subjected to dynamic loads.

2.4.3 Sleeve Anchors:

(a) Manufacturers:

1) Power-Bolt+ Heavy Duty Sleeve Anchor by Dewalt.
2) HLC-H Sleeve Anchor by Hilti Corp.
3) Sleeve-All Anchor by Simpson Strong-Tie Co., Inc.

(b) Usage: In concrete:

(1) 316 stainless steel.

2.4.4 Undercut Anchors:

(a) Manufacturers:

1) Atomic+ Undercut by Dewalt.
2) HDA by Hilti Corp.
3) Or Approved Equal

(b) Usage: In concrete, overhead applications, and for dynamic loads:

1) 316 stainless steel.
2) Do not use when submerged.

2.4.5 Adhesive Anchors(Concrete):

(a) Manufacturers:

1) HIT RE 500-V3 or HIT-HY 200 v3 Epoxy Adhesive Anchor by Hilti Corp.
2) Pure 110+ or AC200+ by Dewalt.
3) SET-3G, SET-XP or AT-XP Epoxy Adhesive System by Simpson Strong-Tie Co., Inc.

(b) Epoxy adhesive with 316 stainless steel stud assembly.
(c) Usage:

1) In concrete, submerged.
2) Do not use in overhead applications.

2.4.6 Adhesive Anchors (Masonry):

(a) Manufacturers:

1) HIT-HY 270 Adhesive Anchor by Hilti Corp.
2) AC100+ Gold by Dewalt.
3) SET-XP Adhesive System by Simpson Strong-Tie Co., Inc.

(b) Epoxy adhesive with 316 stainless steel stud assembly.
(c) Usage:

1) In masonry.
2) Grout masonry cores at anchor locations unless noted otherwise or approved by engineer.
3) Provide tube screen inserts for hollow masonry units or multi-wythe masonry.
4) Do not locate anchors in vertical mortar joints.

3. EXECUTION:

3.1 Inspection

3.1.1 Examine conditions under which bolts, anchors, or inserts are to be installed, and notify Engineer in writing of unsatisfactory conditions existing.

3.1.2 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

3.2.1 Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.

3.2.2 Torque anchor as specified by manufacturer recommendation. Do not cut reinforcing bars.

3.2.3 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.

3.2.4 Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller.

3.2.5 Expansion anchors shall not be used for larger pipe or supporting vibrating equipment unless otherwise shown or approved by the Engineer.

3.2.6 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:

(a)	Embedment depth in concrete	8 diameters
(b)	Anchor spacing on centers	10 diameters
(c)	Distance to edge of concrete	1.5 embedment
(d)	Distance to edge of concrete where anchor is loaded in direction of edge	2.5 embedment

3.2.7 Undercut Anchors shall be installed in accordance with manufacturer's instructions.

3.3 Cleaning

3.3.1 After embedding concrete is placed, remove protection and clean bolts and inserts.

END OF THIS SECTION

DIVISION 6 - CARPENTRY

SECTION 6A - ROUGH CARPENTRY

1. GENERAL:

1.1 Section Includes

1.1.1 Wood nailer at parapet.

1.1.2 Blocking at roof system.

1.1.3 Other miscellaneous wood blocking as required or as noted.

1.1.4 Shoring and temporary protection.

1.2 Related Sections

1.2.1 Section 7A - Elastomeric Membrane Roofing

1.3 References

1.3.1 ASTM A525 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-dip Process.

1.3.2 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3.3 Federal Specifications (FS):

(a) FF-B-575C - Bolts, Hexagon and Square.
(b) FF-N-105B - Nails, Brads, Staples, and Spikes.
(c) FF-N-836D - Nut, Square, Hexagon, Cap, Slotted, Castle.
(d) FF-S-111D - Screw, Wood.

1.4 Quality Assurance

1.4.1 Grading Rules:

(a) 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.

1. Northeastern Lumber Manufacturers Association, Inc. (NELMA).
2. Southern Pine Inspection Bureau (SPIB).
3. West Coast Lumber Inspection Bureau (WCLIB).
4. Western Wood Products Association (WWPA).
5. Redwood Inspection Service (RIS).

1.4.2 Grade Marks: Identify all lumber by official grade mark.

(a) 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.

1. S-Dry: Maximum 19 percent moisture content.
2. MC-5 or KD: Maximum 15 percent moisture content.
3. Dense.

1.5 Submittals

1.5.1 Submit under provisions of Division 1.

1.5.2 Rough Carpentry: Submit certification that lumber and connection material conforms to specified minimum grade.

1.6 Delivery, Storage, and Handling

1.6.1 Deliver, store, protect and handle products to site under provisions of Division 1 and in accordance with the manufacturer's instructions.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. MATERIALS:

2.1 Blocking, nailing, etc. shall be construction grade douglas fir, hem-fir, or No. 1 common southern pine.

2.2 Fasteners for wood nailers for roofing, 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.

2.3 Pressure treatment of wood 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, whether or not covered by other materials, shall be pressure treated.

2.5 Wood members in connection with roofing and flashing shall be pressure treated.

2.6 Lumber for temporary protection 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, 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.

3. EXECUTION:

3.1 Members 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 shall be liberally coated with a concentrated solution of preservative.

3.3 Delivery and Storage

3.3.1 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 THIS SECTION

DIVISION 7 – THERMAL MOISTURE PROTECTION

SECTION 7A - ELASTOMERIC MEMBRANE ROOFING

1. GENERAL:

1.1 Section Includes

1.1.1 Fully adhered elastomeric 60 mil sheet membrane roofing over insulation.

1.1.2 Roof insulation.

1.1.3 Flexible flashings and base flashings around all openings, penetrations and roof edge terminations as required by all trades.

1.1.4 Membrane terminations.

1.1.5 Rubber roof walkway pads (1/2" thick) for roof foot traffic surfacing.

1.2 Related Sections

1.2.1 Section 3A - Cast-in-Place Concrete.

1.2.2 Section 4A – Unit Masonry.

1.2.3 Section 6A - Rough Carpentry.

1.2.4 Section 7B - Sheet Metal Flashing and Trim.

1.2.5 Section 7C – Joint Sealers

1.2.6 Section 7D – Board Insulation

1.3 References

Insulation Board

1.3.1 ASTM C1289 – Faced Rigid Cellular Polyisocyanurate Insulating Board.

1.3.2 ASTM C1621 - Compressive Properties of Rigid Cellular Plastics.

1.3.3 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

Roofing Membrane and Roof Walkway Pad

1.3.4 ASTM D412 - Rubber Properties in Tension.

1.3.5 ASTM D746 - Brittleness Temperatures of plastics and Elastomers by Impact.

1.3.6 ASTM D624 - Rubber Property-Tear Resistance.

1.3.7 ASTM D822 - Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products.

1.3.8 ASTM D1004 - Initial Tear Resistance of Plastic Film and Sheeting.

1.3.9 ASTM D2240 - Rubber Property - Durometer Hardness.

1.3.10 ASTM E96 - Water Vapor Transmission of Materials.

1.3.11 NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.

1.3.12 ULI - Fire Hazard Classifications.

1.4 System Description

1.4.1 Elastomeric sheet membrane roof assembly to conform to UL requirements for a Class A rated assembly, and 1-90 requirements for wind uplift resistance according to FM Global.

1.5 Submittals

1.5.1 Procedures for submittals as specified in Division 1.

1.5.2 Shop Drawings:

(a) Roof Plan (use 1/4" = 1'-0"): Submit general roof plan showing tapered insulation plan, which includes all valleys, ridges, slopes, saddles and crickets, roof walkway pads, and general drainage pattern based on tapered insulation.
(b) Detail Drawings (use 1-1/2" = 1'-0"): Submit shop drawings detailing base flashings, roof edge termination flashings, reglets, membrane terminations, roof drains, roof projection flashings, roof hatch flashings.

1.5.3 Samples: Submit samples for the following items:

EPDM Membrane: 8"x10", 3 pieces.
Termination bars: 2 pieces.
Rigid insulation board: 8"x10", 3 pieces.
Rubber roof walkway pads: 8”x10”, 3 pieces

1.5.4 Product Data:

(a) Provide product data for sheet membrane, elastic flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of membrane.
(b) Rigid insulation board(s).
(c) Rubber roof walkway pad

1.5.5 Manufacturer's Installation Instructions: Provide manufacturer’s instructions for a fully adhered membrane roof system, and indicate special precautions required for seaming the membrane; include installation instructions for roofing rigid insulation board.

1.5.6 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5.7 Manufacturer's Field Reports: Submit under provisions of Division 1.

1.5.8 Reports: Indicate procedures followed, ambient temperatures, and wind velocity during application.

1.6 Quality Assurance

1.6.1 Perform Work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

1.6.2 Single Source Responsibility: EPDM Membrane and accessories shall be supplied from a single manufacturer.

1.7 Qualifications

1.7.1 Manufacturer: Company specializing in manufacturing the products specified in this section with ten years documented experience.

1.7.2 Applicator: Company specializing in performing the work of this section with ten years documented experience and approved by system manufacturer.

1.8 Regulatory Requirements

1.8.1 Conform to applicable code for roof assembly fire hazard requirements.

1.8.2 UL: Class A Fire Hazard Classification.

1.9 Delivery, Storage, and Handling

1.9.1 Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

1.9.2 Store products in weather protected environment, clear of ground and moisture.

1.9.3 Stand rolled materials on end.

1.10 Environmental Requirements

1.10.1 Do not apply roofing membrane during inclement weather or when air temperature is below 40 degrees F and in accordance with manufacturer's instructions.

1.10.2 Do not apply roofing membrane to damp or frozen deck surface.

1.10.3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 Coordination

1.11.1 Coordinate the work with installing associated flashing, roof curbs, etc. as the work of this section proceeds.

1.12 Warranty

1.12.1 Prior to acceptance of work, furnish manufacturer's standard written warranty which covers repairs required to maintain roof in watertight condition including:

(a) Premature deterioration of membrane.
(b) Premature deterioration of base flashing.
(c) Premature deterioration of the roof insulation, recover board, cants, curbs or blocking.
(d) Bare spots.
(e) Blisters.
(f) Fishmouths.
(g) Ridges.
(h) Splits.
(i) Buckles and wrinkles.

(j) Workmanship in application of roofing membrane.
(k) Workmanship in application of base flashings.
(l) Workmanship in application of insulation, recover board, cants, curbs or blocking.
(m) Slippage of roofing membrane.
(n) Slippage of base flashing.
(o) Leaks.
(p) Delamination of the insulation, recover board, felts or flashing.
(q) Improper installation of the system or any component of the system.

1.12.2 Provide 20 year warranty under provisions of Division 1 furnished by manufacturer.

1.12.3 Warranty: Cover damage to building resulting from failure to prevent penetration of water. The warranty shall require the manufacturer to provide for repairs or replacements, including all materials and labor, for failure of any materials or workmanship of the roof system at no expense to the Authority during the entire warranty period (No Dollar Limit).

1.12.4 Warranty shall be signed by the manufacturer of the roofing materials and include all components of the system including insulation and flashing. Warranty shall certify that the manufacturer's representative has inspected the installation of the roofing system and determines that it is complete, proper and as specified. The warranty shall fully cover all materials and installation of the roof system.

1.12.5 Manufacturer shall warranty membrane over insulation.

1.13 Basis of Payment

1.13.1 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.

1.13.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 Manufacturers – Subject to compliance with requirements, provide Rubbergard EPDM (fully adhered type) as manufactured by Firestone Building Products or approved equal:

2.1.1 Carlisle SynTec Systems: - Sure-Seal.

2.1.2 Firestone Building Products Co.: - Rubbergard EPDM.

2.2 Membrane System

2.2.1 Fully adhered 0.060 inch (60 mil) thick EPDM system.

2.2.2 Roofing system total R value (average): as required to achieve an average R-value of 24.0 ft^2*F*h/BTU.

2.3 Sheet Materials

2.3.1 Sheet: 60 mil thick EPDM membrane:

Properties	Test	Results
Tensile Test	ASTM D412	1300 psi
Elongation	ASTM D412	350%
Tear Strength	ASTM D624	175 psi
Water Absorption	ASTM D471	4%
Moisture Vapor-perms	ASTM E96	20
Low Temperature Brittleness	ASTM D746	-75 F
Resistance to Ozone	ASTM D1149	No cracks

2.3.2 Manufacturer's 5" wide (minimum), pressure sensitive, self-adhering EPDM seam cover and as recommended by Manufacturer.

2.4 Base and Flexible Flashing

2.4.1 Sheet: 60 mil thick EPDM; perm rating of 0.5 maximum; tensile strength of 1200 psi elasticity of 50 percent with full recovery without set; as manufactured by membrane manufacturer.

2.5 Vapor Retarder Materials

2.5.1 Fire Retardant Sheet Vapor Retarder: UL requirements; plastic sheet; manufactured by membrane manufacturer, including compatible fire retardant adhesive.

2.6 Accessories

2.6.1 Sealants: As recommended by membrane manufacturer and complying with Section 7C, Joint Sealants.

2.6.2 Reglet Strip Devices: 16 oz. Copper or as recommended by Manufacturer.

2.6.3 Roof Foot Traffic Surfacing: Rubber roof walkway pads:
(a) As recommended by roofing membrane manufacturer
(b) "Duo-Pad" roof traffic and vibration protection pads by W.R. Meadows, Inc.
(c) JM EPDM Peel and Stick Walkpads by John Manville.
(d) or approved equal.

2.6.4 Provide textured, solid rubber pad, adhered to roofing EPDM membrane with minimum 3 rows of 3" wide factory-applied tape.

(a) Thickness: 375mil thick
(b) Walkway Pad shall comply with ASTM D297 with water displacement of 1.06gm/cm, and ASTM D624 with tear resistance of 250lb/in.

2.7 Manufacturers - Roofing Insulation Materials: Subject to compliance with requirements, provide one of the following or approved equal:

2.7.1 Firestone Building Products Co.

2.7.2 Atlas Roofing Corporation.

2.7.3 Apache ISO Products, LLC.

2.8 Insulation Materials

2.8.1 Polyisocyanurate rigid insulation and polyisocyanurate insulation board with cellulosic fiber insulation board overlay (sandwich/composite construction); Flat and tapered board insulation, 1/4-inch/ft. taper, with the following characteristics:

Polyisocyanurate board:

(a) Board Density: (2.0 lb/cu ft).

(b) Thermal Resistance: R-value of minimum 6 per inch.

(c) Compressive Strength: 20 psi minimum per ASTM D1621.

(d) Water Absorption: In accordance with ASTM C2842, less than 1.5 percent by volume maximum.

(e) Board Edges: Ship lapped.

(f) Board Thickness: As required to achieve an average R-value of 24.0.

Overlay boards(s):

(a) 1/2" high density fiberboard: R-value of 1.39 per 2" per ASTM C208.

(b) Gypsum decking overlay (if req'd): R-value of 1.12 per 1" per ASTM C1177.

2.9.2 Protection Boards: All polyisocyanurate in contact with concrete roof deck and membrane roofing shall be overlaid (or composite sandwich construction) with 2" High Density fiberboard. Note: several manufacturers may require gypsum overlay when used with fully adhered.

(a) Basis of design subject to compliance with requirements, provide Isogard HD Cover Board as manufactured by Firestone Building Products or approved equal.

(b) High-density, closed-cell, polyisocyanurate board with a coated fiberglass facer on both sides designed for use as a cover board.

2.10 Adhesive Materials

2.10.1 Adhesive: Type recommended by insulation manufacturer for application that provides a fully adhered system.

2.11 Components and Accessories

2.11.1 Crickets & Saddles: Slope 1/4"/ft minimum.

2.11.2 Protective Boards: see item 2.9.2 above.

2.11.3 Underlayment: see items 2.9.2 & 2.10.1 above.

2.11.4 Wood Nailers: Coordinate and provide thickness of wood blocking to be equal to the thickness of all layers of insulation and protection board at all locations. Coordinate with Division 6A Rough Carpentry.

2.11.5 Termination Bar (if required):

(a) 1/8" x 1 1/2" aluminum or stainless steel bar with 45 degree sealant pocket where space permits.

(b) 1/8" x 1" aluminum or stainless steel bar under counter flashing or other restricted areas.

2.11.6 Metal Flashings: Coordinate with Section 7B Sheet Metal Flashing and Trim.

2.11.7 Sealants: As recommended by roof manufacturer. Coordinate with Section 7C Joint Sealers.

2.11.8 Top Surface Reflective Coating

(a) Coating: An acrylic based coating consisting of primer and finish coats as recommended by manufacturer for a reflective roof coating. Acrylic coating shall be in a white or light color as selected by Owner or Engineer from manufacturer's standard available colors.

3. EXECUTION:

3.1 Examination

3.1.1 Concrete need to be dry to the touch. Concrete shall have aged for a minimum (2) weeks prior to starting any roofing work.

3.1.2 Verify that surfaces and site conditions are ready to receive work.

3.1.3 Verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains.

3.1.4 Verify deck surfaces are dry and free of snow or ice.

3.1.5 Beginning of installation means acceptance of the surface of the substrate.

3.1.6 Comply with manufacturer's climatic restrictions.

3.2 Preparation

3.2.1 Fill concrete surface honeycomb and variations with latex filler.

3.3 Roof Insulation Installation

3.3.1 Cover Board: Keep cover board dry at all times. Before board is placed on the roof deck, the surface must be clean, dry, free of debris, water, ice or snow and suitably prepared.

3.3.2 Lay underlayment and bottom layer of insulation in accordance with manufacturer's instructions.

3.3.3 Adhere insulation with a bonding mastic or adhesive between concrete roof surface and insulation system, and between successive insulation boards in accordance with manufacturer's recommendations and instructions. Ensure compatibility of adhered insulation method(s) and bonding adhesive to the EPDM membrane system.

3.3.4 Lay insulation in parallel course with all joints staggered between courses and each course firmly adhered to deck.

3.3.5 Where more than one layer of insulation is required, stagger joints where possible in relation with the layer beneath and firmly adhere each layer to the previous layer.

3.3.6 Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and protrusions through roof. Ensure tight joints.

3.3.7 Miter cut all valleys to ensure thermal protection required is achieved.

3.3.8 Place fiberboard or other protective covering as the top surface that meets the EPDM membrane roofing system, as required by roofing manufacturer, and as shown on drawings.

3.4 Membrane Application

3.4.1 Install membrane roofing in accordance with manufacturer's instructions for a fully adhered membrane system using manufacturer’s recommended bonding adhesive.

3.4.2 Overlap edges and ends minimum 4 inches and adhesive seal. Apply uniform bead sealant to joint edge.

3.4.3 Centered over all field seams, apply a minimum 5" wide strip of pressure sensitive, self-adhering EPDM.

3.4.4 Shingle joints on sloped substrate in direction of drainage.

3.4.5 Minimize wrinkles and bubbles.

3.4.6 Seal adjoining surfaces.

3.4.7 Continue membrane up vertical surfaces minimum 8 inches unless otherwise noted. At parapet walls, membrane shall terminate under capstone. At roof hatches, membrane shall terminate as recommended by roof hatch manufacturer’s written instructions.

3.4.8 Install membrane flashings. Seal watertight to membrane.

3.4.9 Reinforce membrane with multiple layers of membrane material over joints, whether joints are static or moving.

3.4.10 Apply roof control and expansion joint materials to isolate roof into areas per manufacturer’s recommendations. Seal roofing membrane sheet to joint flange; apply sealant to edge or seam.

3.4.11 Place traffic surfacing (roof walkway pads) at locations as noted on drawings.

3.4.12 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

3.5 Flashing and Accessories

3.5.1 At parapet wall, carry flashing up and terminate under coping as shown on drawings.

3.5.2 Apply membrane base flashing to seal membrane to vertical elements.

3.5.3 Coordinate installation of roof drains, roof hatches, and related flashing.

3.5.4 Seal flashing and flanges of items penetrating membrane.

3.5.5 Protective - Reflective Coating.

(a) Apply coating to exposed membrane surfaces and base flashing in accordance with manufacturer's instructions.
(b) Comply with manufacturer's recommendations for installation.

3.6 Field Quality Control

3.6.1 Field inspection will be performed under provisions of Division 1.

3.6.2 Correct identified defects or irregularities.

3.6.3 Request site attendance of roofing and insulation materials manufacturers during installation of the Work.

3.6.4 Inspection shall be performed by manufacturer of roofing system for compliance to the Work of this Section. The manufacturer shall certify the installation is complete and in accordance with the manufacturer's requirements for optimal roof life.

3.7 Cleaning

3.7.1 Remove and legally dispose of all debris from the job site.

3.7.2 In areas where finished surfaces are stained/soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

3.7.3 Repair or replace defaced or disfigured finishes caused by work of this Section to match original appearance and as determined by Engineer/Architect.

3.8 Protection

3.8.1 Protect building surfaces against damage from roofing work.

3.8.2 Where traffic must continue over finished roof membrane, protect surfaces.

END OF THIS SECTION

SECTION 7B - SHEET METAL FLASHING AND TRIM

1. GENERAL:

1.1 Section Includes

1.1.1 Sill, lintel, base, through wall and cap flashings.

1.1.2 Counterflashing.

1.1.3 Metal Fascias.

1.1.4 Scuppers, downspouts, and accessories.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 4A – Unit Masonry

1.2.3 Section 5B - Metal Fabrications.

1.2.4 Section 6A – Rough Carpentry

1.2.5 Section 7A - Elastomeric Membrane Roofing.

1.2.6 Section 7C - Joint Sealers.

1.2.7 Section 15A - General Mechanical Provisions.

1.3 References

1.3.1 AISI (American Iron and Steel Institute) - Stainless Steel Uses in Architecture.

1.3.2 ASTM A167 - Stainless and Heat-Resisting Chromium- Nickel Steel Plate.

1.3.3 ASTM B32 - Solder Metal.

1.3.4 FS O-F-506 - Flux, Soldering, Paste and Liquid.

1.3.5 FS QQ-S-571 - Solder, Tin Alloy.

1.3.6 NAAMM - Metal Finishes Handbook.

1.3.7 NRCA (National Roofing Contractors Association) - Roofing Manual.

1.3.8 SMACNA - Architectural Sheet Metal Manual.

1.3.9 ASTM A240 - Heat-resisting, Chromium & Chromium-Nickel Stainless Steel
Plate, Sheet, and Strip.

1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.

1.4.3 Samples: Submit two samples 300 mm (12") long of each type of metal coping, downspouts, flashing, and accessories illustrating typical material, and finish.

1.5 Qualifications

1.5.1 Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years minimum experience.

1.6 Delivery, Storage and Handling

1.6.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.6.2 Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.6.3 Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 Following shall be provided in accordance with construction documents:

2.1.1 Stainless Steel Flashing and Trim: Through wall, base, lintel, sill; Brake formed to required profiles.

2.1.2 Scuppers and downspouts; Brake formed to required profiles.

2.2 Sheet Materials

2.2.1 Stainless Steel: ASTM A240, type 304, 20 gauge, architectural grade alloy, finish to be 2B.

2.3 Accessories and Components

2.3.1 Fastener: Same material and finish as material being fastened.

2.3.2 Underlayment: 6 mil polyethylene.

2.3.3 Slip Sheet: Rosin sized building paper.

2.3.4 Sealant: Type specified in Section 7D.

2.3.5 Solder: ASTM B32; 50/50 type.

2.3.6 Flux: FS O-F-506.

2.3.7 Scupper: Same material and finish as flashing metal (stainless steel). Fabricate to dimensions as shown on drawings.

2.3.8 Downspout: Same material and finish as flashing metal (stainless steel). Fabricate to 4” dia. circular profile.

2.4 Fabrication

2.4.1 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.

2.4.2 Fabricate cleats, hold-down clips, and starter strips of same material as sheet, minimum 50 mm (2 inches) wide, interlockable with sheet.

2.4.3 Form pieces in longest practical lengths.

2.4.4 Hem exposed edges on underside 13 mm (1/2 inch); miter and seam corners.

2.4.5 Form material with flat lock seam.

2.4.6 Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

2.4.7 Fabricate corners from one piece with minimum 406 mm (16 inch) long legs; solder for rigidity, seal with sealant.

2.4.8 Fabricate vertical faces with bottom edge formed outward 6.3 mm (1/4 inch) and hemmed 45° to form drip.

2.4.9 Fabricate flashing to allow toe to extend 50 mm (2 inches) over roofing. Return and brake edges.

3. EXECUTION:

3.1 Examination

3.1.1 Verify roof openings, pipes, or vents through roof are solidly set and nailing strips located.

3.1.2 Verify roofing termination and base flashing are in place, sealed, and secure.

3.2 Preparation

3.2.1 Install starter and edge strips, and cleats before starting installation.

3.2.2 Field measure site conditions prior to fabricating work.

3.3 Installation

3.3.1 Secure flashing in place using concealed fasteners. Use exposed fasteners only in locations approved by Engineer.

3.3.2 Lap, Cleat and seal all joints.

3.3.3 Fit flashing tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.3.4 Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.3.5 Seal metal joints watertight.

3.3.6 Secure scuppers and downspouts in place using concealed fasteners where applicable.

3.4 Field Quality Control

3.4.1 Field inspection will be performed under provisions of Division 1.

3.4.2 Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF THIS SECTION

SECTION 7C - JOINT SEALERS

1. GENERAL:

1.1 Section Includes

1.1.1 Preparing sealant substrate surfaces.

1.1.2 Sealant and accessories.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 4A - Unit Masonry System.

1.2.3 Section 7A – Elastomeric Membrane Roofing

1.2.4 Section 7B - Sheet Metal Flashing and Trim: Sealants used in conjunction with metal flashings.

1.2.5 Section 8A – Stainless Steel Doors and Frames.

1.2.6 Section 8B – Door Hardware.

1.2.7 Divisions 5, 10 through 16

1.3 References

1.3.1 ASTM C804 – Use of Solvent-Release Type Sealants.

1.3.2 ASTM C920 - Elastomeric Joint Sealants.

1.3.3 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

1.3.4 ASTM D1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.

1.3.5 FS HH-F-341 _ Fillers, Expansion Joint: Bituminous

1.3.6 FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.

1.3.7 FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.

1.3.8 SWRI (Sealing, Waterproofing, and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.4.3 Samples: Submit two samples 102 mm x 13 mm (4 x 1/2 inches) in size illustrating color for selection.

1.4.4 Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.4.5 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 Quality Assurance

1.5.1 Perform work in accordance with SWRI requirements for materials and installation.

1.5.2 Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.5.3 Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

1.6 Qualifications

1.6.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

1.6.2 Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.7 Environmental Requirements

1.7.1 Do not install solvent curing sealants in enclosed building spaces without providing adequate ventilation.

1.7.2 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 Coordination

1.8.1 Coordinate work under provisions of Division 1.

1.8.2 Coordinate the work with all sections referencing this section.

1.9 Basis of Payment

1.9.1 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.

1.9.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 General:

2.1.1 Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2.1.2 Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by the Architect from manufacturer's standard colors.

2.2 Sealants

2.2.1 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 or approved equal.

Color Schedule:

(a) Exterior wall joints: match mortar joint color.
(b) Exterior doors: match door color.
(c) Exterior louvers, etc: match louver, equipment color(s)
(d) Interior doors: match door color
(e) Other surfaces: match substrate color as approved by Engineer/Architect

2.3 Accessories

2.3.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

2.3.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

2.3.3 Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

2.3.4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.3.5 Bituminous and Fiber Joint Filler: ASTM D1751 or FS HH-F-341.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that substrate surfaces and joint openings are ready to receive work. Proceed with installation only after unsatisfactory conditions have been corrected. Install work as shown on Drawings and recommended by sealant manufacturer.

3.1.2 Verify that joint backing and release tapes are compatible with sealant.

3.2 Preparation

3.2.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

3.2.2 Clean and prime joints in accordance with manufacturer's instructions.

3.2.3 Perform preparation in accordance with ASTM C804 for solvent release sealants.

3.2.4 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 Installation

3.3.1 Install sealant in accordance with manufacturer's instructions.

3.3.2 Measure joint dimensions and size materials to achieve required width/depth ratios.

3.3.3 Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

3.3.4 Install bond breaker where joint backing is not used.

3.3.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

3.3.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.3.7 Tool joints concave.

3.4 Cleaning and Repairing

3.4.1 Clean work under provisions of Division 1.

3.4.2 Clean adjacent stained/soiled surfaces caused by work of this section.

3.4.3 Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 Protection of Finished Work

3.5.1 Protect finished installation under provisions of Division 1.

3.5.2 Protect sealants until cured.

END OF THIS SECTION

SECTION 7D - BOARD INSULATION

1. GENERAL:

1.1 Section Includes

1.1.1 Cavity Wall: 2" thick board insulation for cavity wall.

1.1.2 Foundation Wall: 2” thick board insulation for foundation wall, 6” to 4’-6” below grade.

1.1.3 Roof insulations requirements are listed in section 7A.

1.2 Related Section

1.2.1 Division 3 - Concrete.

1.2.2 Section 4A - Unit Masonry.

1.3 References

1.3.1 ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions.

1.3.2 ASTM C591 – UnFaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation Board.

1.3.3 ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

1.3.4 ASTM C1621 - Compressive Properties of Rigid Cellular Plastics.

1.3.5 ASTM D1622 - Apparent Density of Rigid Cellular Plastics.

1.3.6 ASTM D2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.

1.3.7 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

1.3.8 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3.9 ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

1.4 System Description

1.4.1 Materials of this Section shall provide a continuous thermal barrier at building enclosing elements.

1.5 Submittals

1.5.1 Product Data: Provide data on product characteristics, performance criteria, and limitations.

1.5.2 Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation and installation techniques.

1.5.3 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 Delivery, Storage, and Protection

1.6.1 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

1.7.1 Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation as determined by manufacturer’s written instructions.

1.8 Basis of Payment

1.8.1 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.

1.8.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Manufacturers - Insulation Materials

2.1.1 The Apache Products Company: Polyisocyanurate Insulation

2.1.2 Celotex Corporation

2.1.3 Johns Manville Corporation

2.1.4 Approved Equal.

2.2 Insulation Materials

2.2.1 Polyisocyanurate Insulation: ASTM C591 rigid, cellular type, conforming to the following requirements:

(a) Thermal Resistance: R-value of minimum 6 per inch.

(b) Compressive Strength: 20 psi minimum per ASTM D1621.

(c) Water Absorption: In accordance with ASTM C2842, less than 1.5 percent by volume maximum.

(d) Board Edges: Square

(e) Board Thickness: 2" min. thickness for walls and foundations. Foundation walls to 4'-6" below grade minimum for frost protection.

(f) Board Density: (2.0 lbs/cu. ft.)

2.3 Adhesive Materials

2.3.1 Adhesive: Type recommended by insulation manufacturer for application.

2.4 Accessories

2.4.1 A ½" or 5/8" fiber board for protection of rigid insulation surfaces.

2.4.2 Nails or Staples: Steel wire; galvanized; type and size to suit application.

2.4.3 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.

3. EXECUTION:

3.1 Examination

3.1.1 Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.

3.1.2 Verify substrate surface is flat, free of honeycomb, fins, irregularities and materials that may impede adhesive bond.

3.1.3 Verify insulation boards are unbroken, not cracked, and are free of damage.

3.2 Installation – Masonry Cavity walls and Foundation Walls

3.2.1 Secure fasteners to substrate at a frequency of 6 per insulation board and as recommended by manufacturer.

3.2.2 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.

3.2.3 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.

3.2.4 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.

3.2.5 Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.2.6 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.

3.2.7 Cut and fit insulation tight to cavity wall protrusions and interruptions to the insulation plane.

3.3 Protection of Finished Work

3.3.1 Protect finished work under provisions of Division 1.

3.3.2 Do not permit work to be damaged prior to covering insulation.

END OF THIS SECTION

SECTION 7E - FIRESTOPPING

1. GENERAL:

1.1 Section Includes

1.1.1 Penetration Firestopping.

1.1.2 Fire Resistive Joint Systems.

1.2 Related Sections

1.2.1 Division 3 – Concrete

1.2.2 Division 4 – Masonry

1.2.3 Divisions 5 through 16

1.3 Submittals

1.3.1 Submit under provisions of Division 1.

1.3.2 Product Data: for each type of product indicated.

1.3.3 Samples: Submit two samples illustrating color for selection.

1.3.4 Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.3.5 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3.6 Product Test Reports.

1.4 Quality Assurance

1.4.1 Installer Qualifications:

(a) A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.4.2 Fire-Test-Response Characteristics: Products shall comply with the following requirements:

(a) Fire-resistive joint systems and penetration firestopping tests are performed by UL.
(b) Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

1.4.3 Single Source Responsibility for firestopping products throughout the building shall be obtained from a single manufacturer.

2. PRODUCTS:

2.1 General

2.1.1 Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

2.1.2 VOC Content: Provide fire-resistive joint systems that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

(a) Architectural Sealants: 250 g/l
(b) Sealant Primers for Non-Porous Substrates: 250 g/l
(c) Sealant Primers for Porous Substrates: 775 g/l

2.1.3 Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

2.2 Mineral Wool Insulation

2.2.1 Provide mineral wool insulation as forming material where fire rated separation is required where shown on drawings. Install in joint opening as a permanent form. Cut pieces of batt to minimum width of 4” and install edge-first into the joint opening, parallel with joint direction, such that batt sections are recessed from each surface of wall as required to accommodate the required thickness of fill material. Adjoining lengths of batt to be tightly-butted with butted seams spaced at minimum 24” apart along the length of the joint.

(a) Maximum joint width is 1”.
(b) Joint shall accommodate 25% movement in either direction.

2.3 Fire Resistive Joint Systems

2.3.1 Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

2.3.2 Joints in or between Fire-Resistance-Rated Construction: Ratings determined per ASTM E 1966 or UL 2079:

(a) Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

(b) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A/D Fire Protection Systems Inc.
2. Hilti, Inc.
3. Johns Manville.
4. 3M Fire Protection Products.
5. Tremco, Inc.; Tremco Fire Protection Systems Group.
6. Approved equal.

2.4 Penetration Firestopping

2.4.1 Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

2.4.2 Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

(a) F-Rating: Not less than the fire-resistance rating of constructions penetrated.

2.4.3 Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

(a) F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
(b) T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

3. EXECUTION

3.1 Installation

3.1.1 Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, joint configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

3.1.2 Install fire stopping products in strict accordance with manufacturer's written instructions.

3.1.3 Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

(a) After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive assembly.

3.1.4 Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

(a) Fill voids and cavities formed by joints, openings, and forming materials as required to achieve fire-resistance ratings indicated.
(b) Apply fill materials so they contact and adhere to substrates.
(c) For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush.

3.2 Identification

3.2.1 Identify penetration firestopping and fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

(a) The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
or
"Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
(b) Contractor's name, address, and phone number.
(c) Designation of applicable testing agency.
(d) Date of installation.
(e) Manufacturer's name.
(f) Installer's name.

3.3 Field Quality Control

3.3.1 Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.3.2 Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

3.3.3 Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF THIS SECTION

DIVISION 8 - DOORS AND WINDOWS

SECTION 8A - STAINLESS STEEL DOORS AND FRAMES

1. GENERAL:

1.1 Section Includes

1.1.1 Exterior stainless steel doors

1.1.2 Exterior stainless steel frames with removable transom.

1.1.3 Exterior stainless steel insulated infill panels (to match style of door leaf) at transom area.

1.1.4 System Description (Design Requirements)

Design and fabricate exterior assemblies to comply with requirements for system performance characteristics listed below as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.

(a) Thermal Movement: Allow for expansion and contraction resulting from ambient temperature range of 120 deg. F.

(b) Wind Loading: Provide capacity to withstand loading indicated below, test in accordance with ASTM E330.
   1) Uniform pressure of 20 psf inward and 20 psf outward.

(c) Transmission Characteristics of Assemblies: Provide exterior doors with jamb and head frames complying with requirements indicated below for transmission characteristics and test methods.
   1) Air Leakage: Air infiltration/lin. Feet of perimeter crack not more than 0.50 cfm for single doors and 1.0 cfm for pairs of doors per ASTM E283 at pressure differential of 1.567 psf.
   2) Condensation Resistance: Not less than 48 crf per AAMA 1503-09.
   3) Thermal Transmittance: U-Value of not more than 0.93 Btu/(hr/sq ft/deg F) per AAMA 1503.1.

1.2 Related Section

1.2.1 Section 3A – Cast-In-Place Concrete.

1.2.2 Section 4A – Unit Masonry

1.2.3 Section 5A - Metal Fabrications.

1.2.4 Section 8B - Door Hardware.

1.2.5 Section 15A - General Mechanical Provisions: Louver and Damper coordination.

1.3 References

1.3.1 ANSI A250.6 – Hardware Reinforcing on Standard Steel Doors and Frames.

1.3.2 ANSI A250.8 – Recommended Specifications for Standard Steel Doors and Frames.

1.3.3 ANSI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

1.3.4 ANSI/SDI A250.11 – Recommended Erectin Instructions for Steel Frames.

1.3.5 ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

1.3.6 ASTM A510– Standard Specification for General Requirements for Wire Rods and Course Round Wire, Carbon Steel.

1.3.7 ASTM A1008 – Standard Specification for Sheet, Sheet Steel, Cold Rolled, Carbon, Structural, High Strength low Alloy, High Strength Low Alloy with Improved Formability Solution Hardened, and Bake Hardened.

1.3.8 ANSI/ASTM A568 – Standard Specification for Sheet, Sheet Steel, Carbon, and High Strength low Alloy Hot rolled and Cold Rolled Sheet Steel.

1.3.9 ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot Dip Process.

1.3.10 DHI A115.1.G – Door Hardware Institute, Installation Guide for Doors and Hardware.

1.3.11 SDI 117 – Steel Door Institute, Manufacturing Tolerances for Steel Doors and Frames.

1.3.12 SDI 122 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 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:

(a) Elevations of each door design.
(b) Details of doors, including vertical and horizontal edge details.
(c) Frame details for each frame type, including dimensioned profiles.
(d) Details and locations of reinforcement and preparations for hardware.
(e) Details of each different wall opening condition.
(f) Details of anchorages, accessories, joints, and connections.
(g) Details of transom panel or louver frames and stops showing panels and louvers, where applicable.
(h) Fire-resistance ratings.

1.4.3 Include instructions and details for removable transom where shown on drawings.

1.4.4 Manufacturer's Installation Instructions: Include special installation instructions.

1.4.5 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 Qualifications

1.5.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

1.6 Quality Assurance

1.6.1 Steel Door and Frame Standard: Comply with ANSI A250.8 unless more stringent requirements are indicated.

1.7 Delivery, Storage and Protection

1.7.1 Deliver, store, protect and handle products to site under provisions of Division 1.

1.7.2 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.

1.7.3 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.

1.7.4 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

1.8.1 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.

1.8.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 Manufacturers: Subject to compliance with requirements, provide doors by one of the following manufacturers or approved equal:

2.1.1 Ceco Door Products.

2.1.2 Steelcraft.

2.1.3 Next Door Company

2.2 Materials: Frame and Doors:

2.2.1 Stainless Steel: ASTM A240, Type 304, No. 4 finish, vertical strokes.

2.2.2 Insulated Panel Core:

(a) Stiffened: Continuous Vertical formed stainless steel sections, 0.026 inch (0.6mm) minimum thickness, spaced with interior webs not more than 6 inches (152mm) 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.

2.2.3 Core: Polyurethane foam.

2.2.4 Insulated door R-value shall be 11.0 minimum.

2.3 Doors and Frames

2.3.1 Doors: Level 2 Heavy Duty 1-3/4 inches thick, seamless construction (i.e.: Level II, Model 2).

2.3.2 Doors and Frames: Face sheet construction. (Level II, Model 2) Heavy Duty 0.053 inch minimum wall thickness for both door and frame construction.

2.3.3 Frames: shall be full profile welded 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.

2.3.4 Frames: Base anchors shall be provided with minimum thickness of 0.042 inches.

2.3.5 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.

2.3.6 Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

2.3.7 Thermal Break Construction: Fabricate stainless steel framing system with integrally concealed, low conductance, thermal barrier located between exterior materials and exposed interior members eliminating direct metal to metal contact.

2.3.8 Provide reinforced metal frames for doors of types and styles as shown on drawings and schedules. Frames shall be designed by door manufacturer with required reinforcement to withstand all applicable loads. Frames with transoms shall have a removable intermediate horizontal member with stops top and bottom. Conceal fastenings, unless otherwise indicated.

2.4 Door Silencers

2.4.1 Fabricate stops to receive three silencers on strike jambs of single door frames and two silencers on heads of double door frames.

2.5 Accessories, Supports and Anchors

2.5.1 Fabricated from not less than 0.042 inch thick, stainless steel sheets.

2.5.2 Wall anchors in masonry construction: 0.177 inch diameter, steel wire complying with ASTM A510 may be used in place of steel sheet.

2.5.3 Inserts, Bolts and Fasteners: Manufacturer's standard units for stainless steel doors and frames.

2.5.4 Exterior Top Caps: Stainless steel flush channel.

2.5.5 Frame Thermal Breaks: Rigid polyvinylchloride extrusion.

2.5.6 Compression Weatherstripping: Manufacturer's standard replaceable stripping of either molded neoprene gaskets complying with ASTM D2000 or molded PVC gaskets complying with ASTM D2287.

2.6 Fabrication

2.6.1 Fabricate doors and frames to comply with ANSI/SDI 250.8 and to be rigid, neat in appearance, and free form 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.

2.6.2 Stainless Steel Doors and Insulated Matching Panels: 1.6 mm (16 gauge) thick stainless steel sheet door and panel faces.

2.6.3 Flush Design: Non fire rated:

(a) Flush Design: Butt seam door construction, longitudinal edges fully welded with no visible edge seam.
(b) Top and Bottom Channels: Inverted, recessed, welded steel channels.
(c) Astragals: Stainless steel Z shaped astragals for double doors.
(d) Exterior Door: Flush stainless steel top caps.
(e) Fabricate with stainless steel hardware reinforced plates welded in place.
(f) Core: Stiffened, insulated.

2.6.4 Clearances for Non Fire Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than ¼ inch between pairs of doors. Not more than ¾ inch at bottom.

2.6.5 Stainless Steel Frames and Removable Transom Bars:

(a) Stainless Steel Frames: 2.0 mm (14 gauge) thick stainless steel, continuiously welded type construction, mitred corners.
(b) Factory assemble and weld stainless steel frames.
(c) Stainless steel mullions and transom bars for double doors where indicated on drawings: Removable type.
(d) Fabricate with stainless steel hardware reinforcement plates welded in place.
(e) Reinforce frames wider than 1200 mm (48 inches) with roll formed stainless steel channels fitted tightly into frame lead, flush with top.
(f) Closed tubular transom bars of same material, thickness, and finish as frames where indicated on drawings.

2.6.6 Single-Acting, Door Edge Profile: Square Edge

2.6.7 Double-Acting, Door Edge Profile: Round vertical edges with 2-1/8 inch radius.

2.6.8 Tolerances: comply with SDI 117.

2.6.9 Fabricate concealed stiffeners, reinforcement, edge channels, louvers and moldings from stainless steel sheet.

2.6.10 Exposed Fasteners: Unless previously approved by Engineer/Architect, doors and frames shall have no exposed fasteners. Upon approval, provide countersunk flat or oval heads for exposed screws and bolts.

2.6.11 Hardware Preparation:

(a) 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.
(b) Provide jamb anchors as recommended by manufacturer.

2.6.12 Frame Construction:

(a) Fabricate frames, including transom, sidelight frame, etc. to shape or configuration shown.
(b) Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
(c) Provide temporary spreader bars.

2.6.13 Coordinate fabrication of doors and frames with louver and damper size and mounting requirements as specified in Construction Documents, and as indicated on drawings. Fabrication to include trim to hide exterior mounting fasteners for the louvers and dampers, as required.

2.6.14 Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface applied hardware may be done at project site.

2.6.15 Locate hardware as indicated on Shop Drawings, or, if not indicated, according to ANSI A250.8.

2.6.16 Glazing Stops: Manufacturer's standard, formed from 0.032 inch thick steel sheet.

2.6.17 Prepare frame for silencers. Provide three single rubber silencers for single doors and two single silencers on frame head at double doors.

2.6.18 Locate transom and frame clip angles as indicated on drawings and provide reinforcement as required. Fabricate transom with welded clip angles in shop, galvanize and paint assembly.

2.7 Finish

2.7.1 Standard Stainless Steel Finish: #4 Brushed Finish.

2.7.2 Apply one coat of bituminous paint to concealed steel surfaces in contact with cementitious or dissimilar materials.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that opening dimensions and tolerances are acceptable as recommended by manufacturer.

3.2 Installation

3.2.1 General: Install doors, frames, glazing and hardware in accordance with Shop Drawings, manufacturer's instructions, and as specified.

3.2.2 Installing Frames:

(a) Comply with provisions in ANSI/SDI A250.1 unless otherwise indicated.
(b) Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set.
(c) After wall construction is completed, remove temporary bracing and spreaders, leaving surfaces smooth and undamaged.
(d) Place frames before construction of enclosing walls and ceilings.
(e) 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 or as indicated in Section 4 of these Special Provisions.
(f) For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

3.2.3 Door Installation:

(a) Comply with ANSI A250.8 unless otherwise indicated.
(b) Fit hollow metal doors accurately in frames within tolerances specified in ANSI A250.8.
(c) Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G

3.2.4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

3.2.5 Hardware: Install hardware using templates provided. Refer to Section 8B for hardware installation requirements.

3.3 Tolerances

3.3.1 Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 Adjusting and Cleaning

3.4.1 Adjust work under provisions of Division 1.

3.4.2 Adjust door for smooth and balanced door movement.

3.4.3 Protection Removal: Immediately before final inspection, remove protective material or wrappings from doors and frames where applicable.

3.4.4 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

3.5.1 See Drawings and refer to Shop Drawings.

END OF THIS SECTION

SECTION 8B - DOOR HARDWARE

1. GENERAL:

1.1 Section Includes

1.1.1 Hardware for stainless steel doors: hinges, lock cylinders and keying, lock latch sets, door trim units, astragals or meeting seals on pair of doors, lock guards.

1.1.2 Thresholds.

1.1.3 Weatherstripping.

1.2 Products Furnished but not Installed Under This Section

1.2.1 Section 8A – Stainless Steel Doors and Frames.

1.3 Related Sections

1.3.1 Section 4A - Unit Masonry.

1.3.2 Section 5A - Metal Fabrications.

1.3.3 Section 8A – Stainless Steel Doors and Frames.

1.4 References

1.4.1 ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.4.2 BHMA - Builders' Hardware Manufacturers Association.

1.4.3 DHI - Door and Hardware Institute.

1.4.4 NAAMM - National Association of Architectural Metal Manufacturers.

1.4.5 NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

1.4.6 UL 305 - Panic Hardware.

1.5 Submittals

1.5.1 Submit under provisions of Division 1.

1.5.2 Shop Drawings: Indicate locations and mounting heights of each type of hardware.

1.5.3 Submit manufacturer's parts lists, templates.

1.5.4 Product Data: Provide data on specified hardware.

1.5.5 Samples: Submit 1 sample of hinge, lockset, latchset, closers, thresholds, flushbolts, astragal, Department Deadbolt, and weatherstripping illustrating style, color, and finish.

1.5.6 Samples: May be incorporated into the work or returned to supplier.

1.5.7 Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5.8 Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

(a) Type, style, function, size and finish of each hardware item.
(b) Name and manufacturer of each item.
(c) Fastenings and other pertinent information.
(d) Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
(e) Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
(f) Mounting locations for hardware.
(g) Door and frame sizes and materials.
(h) Keying information.

1.6 Project Record Documents

1.6.1 Submit under provisions of Division 1.

1.6.2 Record actual locations of installed cylinders and their master key code.

1.7 Operation and Maintenance Data

1.7.1 Submit under provisions of Division 1.

1.7.2 Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 Quality Assurance

1.8.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

1.8.2 Hardware Supplier: Company specializing in supplying commercial door hardware with 5 years documented experience.

1.8.3 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.

1.8.4 Perform work in accordance with the following requirements:
(a) ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.8.4 Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements herein.

1.10 Regulatory Requirements

1.10.1 Conform to applicable code for requirements applicable to fire rated doors and frames.

1.11 Delivery, Storage, and Handling

1.11.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.11.2 Package hardware items individually; label and identify package with door opening code to match hardware schedule.

1.11.3 Deliver keys to Owner by security shipment direct from hardware supplier.

1.11.4 Protect hardware from theft by cataloging and storing in secure area.

1.12 Coordination

1.12.1 Coordinate work with other directly affected Sections involving manufacturer or fabrication of internal reinforcement for door hardware.

1.13 Warranty

1.13.1 Provide minimum five year warranty under provisions of Division 1.

1.13.2 Warranty: Include coverage of door closures.

1.14 Maintenance Materials

1.14.1 Provide maintenance materials under provisions of Division 1.

1.14.2 Provide special wrenches and tools applicable to each different or special hardware component.

1.14.3 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.15 Basis of Payment

1.15.1 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.

1.15.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 Manufacturers: subject to compliance with requirements, provide by one of the following manufacturers or approved equal products:

2.1.1 Exit Devices (Rim Type): Corbin Russwin, Adams Rite, Von Duprin.

(a) Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

(b) Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

2.1.2 Exit Devices (Vertical Rod Type): Corbin Russwin, Adams Rite, Von Duprin.

2.1.3 Mortise Lockset: Corbin Russwin, Schlage, and Yale.

2.1.4 Dummy Trim: Corbin Russwin, Schlage and Yale.

2.1.5 Hinges: Hager, Stanley, and Lawrence.

2.1.6 Closers: Corbin Russwin, LCN, and Norton.

2.1.7 Flush Bolts: Corbin Russwin, Hager, Rockwood, Baldwin, Ives.

2.1.8 Weatherstripping: National Guard Products, Hager, Pemko, Reese Enterprises.

2.1.9 Thresholds: National Guard Products, Hager, Pemko, Reese Enterprises.

2.1.10 Astragals: National Guard Products, Reese Enterprises, Pemko.

2.1.11 Door Sweeps: National Guard Products, Pemko.

2.1.12 Kick plates: National Guard Products, Hiawatha, Ives, Brookline, Rockwood.

(a) Provide kickplates at both sides of door. Fabricate kick plates and mop plates not more than 1-1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x 8" high unless otherwise indicated. Metal plates shall be stainless steel, 0.050" (U.S. 16 ga.).

2.1.13 Wall stops: Ives, Rockwood.

2.1.14 Lock guard: Ives, Hager.

(a) To deter insertion of tools, picking, or forcing of latch at opening between door and frame for doors in public areas that open outward. Lock guard to be non-handed, suitable for mortise locks, have an offset that permits use on hollow metal installations and allow clearance for lip of lock strike. Lock guard to be of 16 gauge stainless steel, satin finish. Lock guard minimum dimensions to be 1 ½" wide X 10" long.

2.1.15 Substitutions: Under provisions of Division 1.

2.2 Keys and Keying

2.2.1 Supply 5 keys for each lock.

2.2.2 Keys shall match Owner's keying system.

2.2.3 Serial numbers shall be stamped or engraved on all keys.

2.2.4 Provide individual blank change keys for each lock which is noted below. Each key blank to be permanently inscribed with the notation "DO NOT DUPLICATE" and will be permanently inscribed with a number or lock that identifies cylinder manufacturer key symbol.

2.2.5 Key Material: Provide blank keys of nickel silver only.

2.3 Weatherstripping

2.3.1 Weatherstripping: Provide compression weatherstripping against fixed stops for exterior doors. At other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

(a) Provide EPDM/vinyl blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

2.4 Finishes

2.3.1 Finishes: Identified in schedule at end of section.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

3.2 Installation

3.2.1 Install hardware in accordance with manufacturer's instructions and requirements of NAAMM.

3.2.2 Use templates provided by hardware item manufacturer.

3.2.3 Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.3 Field Quality Control

3.3.1 Field inspection will be performed under provisions of Division 1.

3.3.2 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.

3.3.3 Provide two copies of certification to Engineer.

3.4 Protection of Finished Work

3.4.1 Protect finished work under provisions of Division 1.

3.4.2 Do not permit adjacent work to damage hardware or finish.

3.5 Schedule

General: Provide hardware to match door and frame as required to provide a fully operation door assembly. Refer to drawings for designated door.

3.5.1 Exit Devices: (Rim Type-Single Leaf Door) Heavy Duty, visible parts US 32D finish, non ferrous internal parts, surface mounted rim type with ¾" throw on latch bolt. Keyed access with trim lever handle mounted on exterior side of door leaf.

a.	Corbin Russwin	Model ED5200
b.	Adams Rite	Model 8300
c.	Von Duprin	Model CRE
d.	Approved equal	

3.5.2 Exit Devices: (Vertical Rod Type-Active Leaf Door of Double Doors) Heavy Duty, visible parts US 32D finish, non ferrous 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.

a.	Corbin Russwin	Model No. ED5400
b.	Adams Rite	Model 8100
c.	Von Duprin	Model No. 9847/9947
d.	Approved equal	

3.5.3 Mortise Lockset (Entrance Type): Wrought bronze, visible parts US32D finish, non-ferrous internal parts, with minimum 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

a.	Corbin Russwin	Model ML2048 x LSM
b.	Schlage	Model L9453x03
c.	Yale	Model 8847 CRE
d.	Approved equal	

3.5.4 Dummy Trim Lockset x Lever Action: (No lever on inside face) Heavy Duty, visible parts US 32D finish, non ferrous internal parts, surface mounted rim type with ¾" throw on latch bolt. Keyed access with trim lever handle mounted on exterior side of door leaf.

a.	Corbin Russwin	Model LSM
b.	Schlage	Model L9176x03
c.	Yale	Model CRE
d.	Approved equal	

3.5.5 Department standard outside deadbolt: Heavy duty, high security padlock locking bolt with a 3/4" throw adjustable from 3/4" to 2-3/8" shall be provided mounted on the exterior of doors. Doors shall be reinforced as necessary for installation of the outside deadbolt. Heavy duty padlock for the doors will be provided by the Department.

3.5.6 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.

(1) Door size up to 8'-0" x 4'-0"
2 pr. 4.5" x 4.5"

(2) Door size over 8'-0" x 4'-0"
2-1/2 pr. 6" x 6", or as required by door manufacturer.

a.	Hager	Model BB1199.
b.	Stanley	Model FBB 191
c.	Lawrence	Model BB4101
d.	Approved equal	

3.5.7 Closers: Heavy duty parallel arms with adjustable closing speed, with hold-open for outswinging exterior doors. 626(satin chrome plated).

a.	Corbin Russwin	Model DC6000 Series (DC6210 A2 M72)
b.	LCN	Model 4010/4110 Smoothe Series
c.	Norton	Model 7500 Series
d.	Approved equal	

3.5.8 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.

a.	Corbin Russwin	Model 2849 W/ No. 70-1/2M Strike
b.	Hager	Model 282D x 26D
c.	Rockwood	Model 555 x 26D
d.	Baldwin	Model 0600 x 26D
e.	Ives	Model FB458 X 26D
f.	Approved equal	

3.5.9 Weatherstripping: Head and jamb gasket, aluminum with clear anodized aluminum finish and neoprene insert.

a.	National Guard Products	Model 110 NA
b.	Hager	Model 412S x AL
c.	Pemko	Model 332 CR
d.	Reese Enterprises	Model DS 69C
e.	Approved equal	

3.5.10 Thresholds: Heavy Duty, clear anodized aluminum finish, with chemically treated stainless steel screws, set in full bed of sealant. 5” x 12”. Thermally broken.

a.	National Guard Products	Model 8425 x AL
b.	Hager	Model 412S x AL
c.	Pemko	Model 252 x 3AFG x AL
d.	Reese Enterprises	Model S282A x AL
e.	Approved equal	

3.5.11 Astragals: Full height, clear anodized aluminum, surface mounted, meeting stile gasketing with silicone seal.

Doors with one active leaf:

a.	National Guard Products	Model 109NA
b.	Reese Enterprises	Model 93C
c.	Pemko	Model 375CR
d.	Approved equal	

3.5.12 Door Sweep: Nylon brush gasketing, clear aluminum finish.

a.	National Guard Products	Model 600A
b.	Pemko	Model 18137CNB
c.	Approved equal	

3.5.13 Kick Plate: Ives Model 8400 10”x34” US32D x 16GA, or equal selected from manufacturers listed below.

a. National Guard Products
b. Hiawatha
c. Ives
d. Brookline
e. Rockwood
f. Approved equal

3.6 Hardware Schedule per Door. Provide panic hardware on all doors leading outside.

Door 101 Hardware Group Set 1 (exterior single leaf)

1-1/2 pr. Butts, Hager BB1199-32D-NRP, 630
1 Cylinder, 1-5/32", keyed to No. 6 (or Russwin 981) key, "B" Master and Grandmaster, Corbin Russwin or Best 1E 74 C181 RP3 with construction core.
1 Exit Device, Von Duprin No. XP98L/XP99Lwith knurled handle.
1 Closer, LCN 4111, Prime.
1 Kickplate 630, B4E.
1 Threshold, Pemko No. 2005 AS Alum.
1 set Weatherstripping, Zero No. 328 A, all around.
1 Stop, Ives No. 407 or 438, 630.
1 set Door silencers, Glynn-Johnson No. SR64 or SR65.
1 Lock guard, Ives # 182S32D.

Door 102, 103, 104 Hardware Group Set 2 (exterior double leaf)

3 pr. Butts, Hager BB1199-32D-NRP, 630
1 Cylinder, 1-5/32", keyed to No. 6 (or Russwin 981) key, "B" Master and Grandmaster, Corbin Russwin or Best 1E 74 C181 RP3 with construction core.
1 Exit Device active leaf, Von Duprin No. 9847L/9947Lwith knurled handle.
1 set Flush Bolts inactive leaf, Ives FB51P-DP2.
1 Closer, LCN 4111 with auxiliary stop, 630.
1 Kickplate 630 B4E.
1 Threshold, Pemko 2005 AS Alum.
1 set Weatherstripping, Zero No. 328 A, all around
1 Stop, Ives No. 407 or 438, 630.
1 set Door silencers, Glynn-Johnson No. 64 or 65.
1 Lock guard, Ives No. 162S32D.
END OF THIS SECTION

DIVISION 9 - PAINTING

SECTION 9A - PAINTING

1. GENERAL:

1.1 Description

1.1.1 This portion of work includes the furnishing, preparation and application of coating/painting and related items to complete the work indicated on drawings and described in these specifications.

1.1.2 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.

1.1.3 Terms used in this Section shall be as defined in ANSI/ASTM DIG.

1.2 Reference Standards

1.2.1 The work shall be in conformance with the applicable standards/regulations of:

(a) Society of Protective Coatings.

(b) National Fire Protection Association (NFPA).

(c) American National Standards Institute (ANSI).

(d) Occupational Safety and Health Act (OSHA).

(e) SSPC SP10 "Near White Metal Blast Cleaning", Society of Protective Coatings.

(f) Military Specification MIL-L-81352A.

(g) Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction.

1.2.2 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.

1.2.3 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.

1.2.4 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

1.3.1 Painting shall conform to applicable Section 1008, PAINT MATERIALS and MIXED PAINTS, of the IDOT Standard Specifications.

1.3.2 The types of paint products to be used in the work shall be identified by the manufacturer's name and number.

1.3.3 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 in writing.

1.3.4 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.

1.3.5 Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

1.4 Delivery and Storage of Materials

1.4.1 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.

1.4.2 Store materials outside the building. Keep storage place neat and clean and correct all damage thereto or to its surroundings.

1.4.3 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

1.5.1 Submit product data and safety data under provisions of Section 1A.

1.5.2 Shop Drawings

(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.

1.5.3 Copies of manufacturer's complete color charts for each coating system.

1.5.4 The coating manufacturer shall submit certification that the products in a multi-layer coating system are of the same manufacturer, appropriate for the intended use, are compatible with each other and with project substrates, and are compatible with any existing coatings.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Payment Withheld.

2. PRODUCTS:

2.1 Manufacturers: (First named manufacturer products listed in sections and schedule below. Contractor is responsible for selecting the appropriate equal system based on manufacturer selected.)

2.1.1 Tnemec Co., Inc.

2.1.2 Sherwin Williams

2.1.3 Approved equal.

2.2 Colors

2.2.1 Unless otherwise indicated, colors will be selected by the Engineer during the submitted review process.

2.2.2 Complete color charts shall be submitted of proposed paint manufacturers to the Engineer for final paint color selections.

2.2.3 Unless otherwise indicated, all surfaces without a final finish color shall be painted. In general, colors will be differentiated as follows:

(a) Ceiling.
(b) Grade floor.
(c) Lower level floors.
(d) Lower level concrete walls.
(e) Interior metal trim.
(f) Exterior metal trim (excluding louvers, s.s. coping, and aluminum framing).
(g) Exterior piping and appurtenances (such as sluicegate stands and operators).
(h) Natural or anodized aluminum surfaces shall not be painted. Surfaces and equipment which are provided with a factory final finish shall not be painted.
(i) Stainless steel surfaces shall not be painted unless noted otherwise.
(k) Interior concrete walls of building (including masonry surfaces that are not glazed block surfaces).
(l) Safety items as necessary (bollards, hoist beams/trolley, etc.).

Notes:

1. Walls and floor at wet well level shall not be painted.
2. All piping shall be shop finish painted.

2.3 Color Coding

2.3.1 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

2.4.1 Concrete floors above the wet pit shall have an abrasive coating of Series 66HS as manufactured by Tnemec Co., Inc., Macropoxy 646 as manufactured by Sherwin-Williams, or approved 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.

(a) Color: April Haze by Tnemec.
(b) Or Approved Equal if by another manufacturer.

2.5 Graffiti-Resistant Coating for Masonry

2.5.1 Exterior masonry work shall be coated with a low VOC clear coating to resist water absorption and provide easy removal of graffiti.

(a) Coating shall be RTV Silicone Rubber based.

(b) Provide DurAPell GS Series V626 as manufactured by Tnemec Co Inc., Anti-Graffiti Coating 1K as manufactured by Sherwin Williams, or approved equal.

3. EXECUTION:

3.1 Preparation

3.1.1 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.

3.1.2 Surfaces to be cleaned 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.

3.1.3 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.

3.1.4 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.

3.1.5 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 Societyof 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.

3.1.6 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.

3.1.7 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.

3.1.8 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

3.2.1 Furnish and lay drop cloths or other means of protection for finished surfaces during the work.

3.2.2 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.

3.2.3 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

3.3.1 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.

(a) 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.

(b) 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.

(c) 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.

3.3.2 The work shall include all touch-up and remedial painting as required until the completion and acceptance of the final work.

3.3.3 Spray painting shall not be allowed.

3.4 Installation

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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.

3.4.5 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.

3.4.6 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.

3.4.7 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.

3.4.8 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.

3.4.9 All painting shall be done in accordance with the paint manufacturer's recommendations.

3.4.10 All wall surfaces which will be concealed by equipment shall be painted before equipment installation.

3.5 Cleaning

3.5.1 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.

3.5.2 Rubbish, debris, empty paint cans and discarded materials shall be placed in metal containers and removed from the site.

3.6 Graffitti-Resistant Coating for Masonry Installation

3.6.1 Comply with all of manufacturer's recommendations for surface preparation and application.

3.6.3 2 flood coats are required to ensure graffiti-protection.

3.6.6 Maintenance:

Surfaces that have been properly treated with Series 626 provide for easy removal of graffiti using Series 680 Mark A Way. Remove graffiti as soon as possible after surface has been defaced. Apply Mark A Way directly to the "tagged" surface and allow it to work for 5 to 8 minutes keeping substrate wet with cleaner. Agitate with a nylon brush and rinse thoroughly with water. A power washer (not to exceed 1000 psi) may be required to completely remove graffiti. After surface has been cleaned and allowed to dry completely, it will continue to protect against graffiti penetration and permit additional cleaning cycles if necessary. In areas that receive multiple "taggings" and if graffiti removal becomes difficult, a reapplication of coating may be required.

3.7 Schedule

3.7.1 Material Painting Schedule

Class of Work	Primer Shop Coat	Field or Shop Finish Coats 1st	2nd	3rd
Nonferrous Metal and Galvanized Steel:				
Interior				
Exterior		A	A	A
		A	A	C
Steel and Iron:				
Interior				
Exterior	B	B*	A	A
Submerged	B	B*	A	C
or Constantly Wetted				
Asphaltic Coated Steel	B	B*	D	D
Concealed in Masonry		E*	A	A
Exposed to Potable Water	B	B*		
Wrapped in Insulation	B	B*	B	F
Exterior, Exposed to Process Wetting and Drying	B	B*		
	B	B*	D	D
Concrete:				
Interior		A	A	A
Exterior		H	H	H
Pipe and Duct Insulation:				
Exposed		A	A	
PVC		A	A	

*Touch-up bare metal with primer.

3.7.2 Paint Schedule

(a) 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.

Symbol	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 Biege Pota-Pox Plus	69	102-152	(4.0-6.0)
C	Tnemec Series 74 Endura-Shield	54	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 Acryic Emulsion	44	102-152	(4.0-6.0)

3.7.3 Notes

(a) 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 or approved equal.

(b) 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.

(c) Applicable to insulated and uninsulated pipes: Steel pipe not available with a shop coat shall be prime coated in the field immediately after installation.

(d) 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.

(e) 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.

3.7.4 General Color Scheme

General color scheme shall be as follows:

(c) Interior Concrete Ceiling – white.
(d) Interior Grade Floor - April Haze (Tnemec).
(e) Interior Steel Frame and Metal Trim – light gray.
(f) Exterior Metal Trim (except aluminum and stainless steel) – light gray.
(g) Exterior piping and appurtenances – Turbine Blue.
(h) Interior piping – Turbine blue.
(i) Electrical Conduits – light gray.
(j) Fire protection equipment – standard red.
(k) Hoist Beams/Trolley – Safety yellow.
(l) Bollards (Guard Posts) – Safety yellow.

Note: Contractor to submit manufacturer's color chart for Engineer's selection.

END OF THIS SECTION

DIVISION 10 - SPECIALTIES

SECTION 10A - SPECIALTIES

1. GENERAL:

1.1 Description

1.1.1 This item of work includes the furnishing and installation of bulletin board, fire extinguishers, first aid kit, shop desk, nameplate, metal shelf, trash bins and related items to complete the work shown and specified.

1.1.2 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 5B - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.

1.2.2 Section 9A – Painting.

1.3 Submittals

1.3.1 Submit shop drawings and product data under provisions of Section 1A.

1.4 Delivery, Storage and Handling

1.4.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 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.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Bulletin Board

2.1.1 Furnish and install one (1) two panel bulletin board with glass doors. 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, 60" long, 3" deep.

2.2 Station Identification Plate

2.2.1 Furnish and secure in position and location, one cast bronze tablet for each such required tablet. The tablet shall be made by a firm specializing in bronze tablet work and shall be of best grade of statuary bronze. 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.

2.2.2 Lettering shall read as shown on drawing.

2.3 Staff Gauges

2.3.1 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.

2.3.2 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.

2.3.3 Each staff gauge shall be attached and supported using corrosion resistant hardware at locations to avoid conflict with level controls and other elements.

2.4 Shop Desk

2.4.1 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

2.5.1 Furnish and install a first aid kit with brackets for wall mounting as directed in the pump room and Electrical Control Room. First aid kit shall be contained with a metal box having a continuous hinge along either side or the bottom. First aid kit shall be rated to serve at least 50 people.

2.6 Fire Extinguishers

2.6.1 Furnish and install two 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

2.7.1 Clock shall be synchronous motor type, 12" face, 120 V. 60 Hz. Cord length shall be coordinated with electrical contractor to ensure it is adequate to reach nearest receptacle.

2.8 Metal Shelf

2.8.1 Metal shelf shall be approximately 53” long, 12.5” wide by 15” deep to be wall mounted above the bulletin board.

2.9 Trash Can

2.9.1 Trash can shall be made of polyethylene and the capacity shall be approximately 40-50 gallon industrial type with wheels/casters.

3. EXECUTION:

3.1 Installation

3.1.1 Install the specified specialties in accordance with manufacturer's recommendations and instructions to permit intended performance.

3.1.2 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

3.2.1 The specified specialties shall be painted in accordance with applicable AWWA standard specified and with Section 9A of these specifications.

END OF THIS SECTION

SECTION 10B - FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

1. GENERAL:

1.1 Related Documents

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

1.2 Summary

1.2.1 This section includes the following FRP Products design, fabrications, and installation:

1. FRP Grating.
2. FRP Railing.
3. Grating Fasteners.
4. FRP Ladders.
5. FRP Structural Shapes.
6. FRP Stairs and Platforms.

1.3 Scope of Work

1.3.1 Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) products as specified herein.

1.4 Quality Assurance

1.4.1 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.

1.4.2 Substitution of any component or modification of system shall be made only when approved by the Architect or Engineer.

1.4.3 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.

1.4.4 In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.5 Design Criteria

1.5.1 The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

1.5.2 Design of FRP live loads on grating shall not be less than 100 pounds per sq. ft. Grating deflection at the center of a simple span not to exceed the lesser of 0.375 inch or clear span divided by 180.

1.5.3 Structural members shall be designed to support all applied loads. Deflection in any direction shall not be more than L/240 of span for structural members. Connections shall be designed to transfer the loads.

1.6 Submittals

1.6.1 Shop drawings of all FRP structural members, handrails, gratings, plate, ladders, stairs and appurtenances shall be submitted to the Engineer for review.

1.6.2 Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating.
2. Design tables showing limits for span length and deflection under various uniform and concentrated loads.
3. Materials of construction.
4. Chemical resistance table

.

1.6.3 Detail shop drawings showing:

1. Dimensions.
2. Sectional assembly.
3. Location and identification mark.
4. Size and type of supporting frames required.

1.6.4 All shop drawings shall be sealed by Structural Engineer registered in the State of Illinois.

1.7 Shipping and Storage Instructions

1.7.1 All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

1.7.2 Items shall be covered and protected from exposure to sun or ultra violet light during storage.

1.7.3 All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, structural shapes and building panels 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. 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.

1.7.4 Identify and match-mark all materials, items, and fabrications for installation and field assembly.

1.8 Basis of Payment

1.8.1 FRP products 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.

1.8.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 General

2.1.1 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.

2.1.2 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 cages and other members that may be submerged in the wet well or discharge chamber and in continuous contact with sewage.

2. Resins for members for exterior or dry service shall be either polyester or vinyl ester resin.

2.1.3 After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.

2.1.4 All exposed surfaces shall be smooth and true to form.

2.1.5 FRP Manufacturers:

1. Strongwell Corporation.
2. Fibergrate Composite Structures.
3. Bedford Reinforced Plastics.
4. Or approved alternative manufacturer.

2.1.6 Grating Fastener Manufacturers:

1. Grating Fasteneres, LLC.
2. Strongwell Corporation.
3. Fibergrate Composite Structures.
4. Or approved alternative manufacturer.

2.2 Gratings

2.2.1 General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected by cardboard to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

2.2.2 All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

2.2.3 Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

2.2.4 Resin shall be Vinyl Ester, Isophthalic Polyester, Polyester or Modified Acrylic, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

2.2.5 All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

2.2.6 All grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

2.2.7 All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.2.8 Pultruded I-bar grating with bearing bars at 1 ½ in o.c. and cross bars at maximum 12 in o.c.

2.2.9 Measurements: Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.

2.2.10 Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication. Provide additional support bars, hold-downs or framing as required for cutouts shown on plans.

2.2.11 Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

2.3 Grating Fasteners

2.3.1 Grating fasteners shall be Type 316 stainless steel saddle clips or C-clips.

2.3.2 Fasteners shall allow grating panels to be secured to structural steel beam supports without field drilling, welding or otherwise damaging steel coating. Each outside panel edge and/or corner of gratings supported by structural steel I-beams or channel beams shall be secured to structural steel support with stainless steel G-clips specifically designed for securing grating shapes to steel members without drilling or damaging steel surface coating. Hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

2.4 Structural Shapes and Plate

2.4.1 Structural shapes and plate shall be made from a premium grade polyester or vinyl ester resin.

2.4.2 Structural shapes and plates shall be manufactured by the pultrusion process.

2.4.3 Structural FRP members composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% resin to glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.

2.4.4 Structural members shall be designed to support all applied loads. Deflections in any direction shall not be more than L/240 of span for structural members. Connections shall be designed to transfer the loads.

2.5 Fiberglass Ladders

2.5.1 Ladders shall be fiberglass reinforced plastic (FRP) constructed of siderails, rungs, and brackets.

2.5.2 Resins for ladders shall be vinyl ester resin.

2.5.3 All finished surfaces of FRP items and fabrication shall be smooth, resin-rich, free of voids, and without dry spots, due to wear or weathering. All pultruded structural shapes shall be further protected for ultraviolet (UV) light.

1. The side rails and rungs shall be fiberglass reinforced pultruded structural shapes pigmented throughout in OSHA safety yellow.

2. The side rail shall be 1-3/4" square tube or greater with a wall thickness of 1/4" or greater. The rungs shall be 1" diameter or greater pultruded structural shapes, continuously fluted or gritted to provide a non-slip surface.

3. Type 304 or 316 stainless steel bolts shall be used for connecting brackets and other components to ladder.

4. Ladders systems shall meet the load and design requirements set forth in OSHA 1910.27 (latest edition). The ladder shall also be capable of supporting a concentrated vertical load of 1,200 pounds applied at the mid-span of the rung.

2.5.4 Ladders shall be fully shop assembled. All rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both epoxy and rivets to provide both a chemical and mechanical lock, respectively.

3. EXECUTION:

3.1 Preparation

3.1.1 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.

3.2 Inspection and Testing

3.2.1 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.

3.2.2 All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Department.

3.2.3 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

3.3.1 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.

3.3.2 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.

3.3.4 Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.

3.3.5 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.

3.3.6 Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15A - GENERAL MECHANICAL PROVISIONS

1. GENERAL:

1.1 Section Includes

1.1.1 The scope of work under this Division shall be all mechanical work required for the project work as shown or specified.

1.1.2 The mechanical work shall include the furnishing and installing of various items of mechanical equipment and appurtenances. Unless otherwise specifically indicated, electrical work shown on the electrical drawings shall be provided under Division 16. Any additions or modifications to the work shown on the electrical drawings required for the proper installation or operation of work under this Division shall be provided under this Division, at no additional cost to the Department, in conformance with the requirements of Division 16. The Contractor shall be responsible for ascertaining the extent of electrical connections required for items furnished under this Division, for ascertaining the extent of electrical work shown on the electrical drawings and for coordinating the electrical work accordingly.

1.1.3 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 and provide functional pump station conforming to the current operation philosophy, whether specifically identified or not, such that the electrical systems are complete and operational.

1.1.4 Furnishing and installing of work under this Division shall comply with Division 1 requirements relating to the furnishing and installing of work.

1.2 Code Compliance

1.2.1 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 applicable codes, as a minimum.

1.3 Standards

1.3.1 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	Manual for Highway Storm Water Pumping Station
AASHTO	American Association of State Highways and Transportation Officials
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWWA	American Water Works Association
IPCEA	Insulated Power Cable Engineers Association
IES	Illuminating Engineering Society of North America
	Illinois Plumbing Code
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
OSHA	Occupational Safety and Health Administration
UL	Underwriter's Laboratories
HIS	Hydraulic Institute Standard
FM	Factory Mutual
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association

1.3.2 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

1.4.1 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.

1.4.2 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 work, however, field conditions or interferences, may require changes in the installation. The Contractor shall coordinate his work to avoid interferences and shall obtain approval prior to making any changes from the installation shown.

1.4.3 Prior to installation, the Engineer may make reasonable minor changes in the locations of the installation without additional cost to the Department.

1.4.4 The electrical work shown on the electrical drawings (or on electrical portions of multi-trade drawings) shall be provided under Division 16. Any changes in the electrical installation required for the proper installation or operation of items provided under this Division shall be provided under this Division in full conformance with the requirements of Division 16. In other words, if a change to the electrical work is required to accommodate equipment provided under Division 15, that electrical change shall be the responsibility of Division 15 and it must be in full compliance with the requirements of Division 16.

1.5 Coordination

1.5.1 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.

1.6 Workmanship

1.6.1 The mechanical work shall be performed in a neat and workmanlike manner in accordance with the best practices of the trade.

1.6.2 Unless otherwise indicated, all materials and equipment shall be installed in accordance with the codes, contract requirements and manufacturer's recommendations.

1.7 Protection of Work

1.7.1 All mechanical work, including equipment and appurtenances, shall be protected from damage until final acceptance. 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.

1.7.2 Prior to final acceptance, protective measures shall be removed and equipment and items shall be cleaned as required to deliver the installation to the Department in clean, undamaged condition.

1.8 Clean-up and Safety

1.8.1 The work site shall be maintained in a clean condition, free of hazards, all in conformance with the requirements of Article 104.06 of the Standard Specifications. Special care shall be taken to assure that systems are not left in a hazardous condition.

1.9 Materials and Equipment

1.9.1 Quality

(a) All materials, equipment and appurtenances shall be new, shall be suitable for the application and shall be the product of established, reputable manufacturers.

1.9.2 Standards

(a) The construction, sizes, ratings and capacities of items shall be in conformance with the requirements of the codes and with ASTM and ASME standards, as applicable.

1.9.3 UL and/or FM Label

(a) Unless otherwise indicated, materials and equipment shall bear the UL and/or FM label whenever such labeling is available for the type of material or equipment being furnished.

1.9.4 Other Requirements

(a) Refer to Division 1 for other requirements relating to materials and equipment.

1.10 Erecting and Jointing Interior Piping

1.10.1 Description

(a) This section includes furnishing of supports and hangers and installation of all interior piping and supports.

(b) Piping of the materials, coatings and linings shown or specified shall be installed and supported at the locations specified or where shown.

1.10.2 Delivery, Storage and Handling

(a) All products and materials shall be delivered, stored and handled as specified in Division 1.

(b) Extreme care shall be taken in loading and unloading the pipe and fittings. The work shall be done slowly using skids or suitable power equipment keeping the pipe under control at all times.

(c) Under no condition is the pipe to be dropped, bumped, dragged, pushed or moved in any way which will cause damage to the pipe, lining or coating.

(d) When handling the pipe with a crane, a suitable pipe hook or sling shall be used around the pipe. Under no condition is the sling to be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends, lining and coating.

(e) Any piping or fittings damaged in the process of delivery, storing, handling, or laying shall be replaced or repaired as approved.

1.10.3 The interior of pipelines shall be cleaned of all dirt and superfluous material of every description in an approved manner.

1.10.4 All bolts shall be primed by dipping with a bituminous coating, except the threads, which are coated immediately prior to installation of the nuts.

1.10.5 All threads shall be coated with a suitable pipe dope, Masters Metallic Compound, Loctite, or equal, before jointing.

1.10.6 Installed piping shall be free of sags or bends.

1.10.7 Piping shall be installed to allow for expansion and contraction without stressing pipe, joints or connected equipment.

1.10.8 The fire rated integrity shall be maintained where pipes pass through fire rated walls, partitions, ceilings, and floors.

1.10.9 Pipelines shall be fitted and installed in a neat and workmanlike manner in accordance with approved shop drawings.

1.10.10 Flanged joints shall be made with bolts or bolt studs with a nut on each end.

1.10.11 Welding of pipe joints shall conform with the requirements of ANSI B31.1 unless otherwise specified. All off site welding of steel pipe shall conform to the appropriate requirements.

(a) Pipe and fittings with wall thickness of 3/16-inch and larger shall have ends beveled for welding. Parts to be welded shall be securely held in place and in proper alignment during welding.

(b) The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping.

(c) Welding shall be continuous around the joint and completed without interruption.

(d) Welds shall be of the single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee.

(e) Welds shall be free from cold shuts, pinholes, oxide inclusions or other defects.

1.10.12 Anchors and stands shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment.

Where adjustable supporting devices are not required, pipelines 3 inches in diameter and smaller shall be supported on cast-iron, malleable iron, or steel hooks, hook plates, rings or ring plates.

1.10.13 Hangers and Supports

(a) Pipe hangers shall be provided at each change in pipe direction at minimum spacing recommended by manufacturer or reference standards, on both sides of pipe mounted valves and equipment and on both sides of pipe loops and expansion absorbing devices. Pipe support spacing for roof drain storm water (STM) piping shall be in accordance with the requirements of the Illinois Plumbing Code.

(b) Brackets shall be used for the support of piping from vertical surfaces.

(c) Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment.

(d) Hangers and supports shall be installed to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

(e) Hangers shall be adjusted to distribute loads equally on the attachment and to achieve any indicated slope of the pipe.

(f) Hangers and Supports shall be hot dipped galvanized or of stainless steel construction unless otherwise noted.

1.10.14 For sleeve type couplings, equally tighten diametrically opposite bolts on the coupling to bring the gaskets up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.

1.10.15 All piping shall be installed in accordance with the manufacturer's recommendations and approved Shop Drawings and as specified in Division 1.

1.10.16 After installation of the interior piping and supports, control equipment and all appurtenances, the units shall be subjected to a field running test, as specified in Division 1, under actual operating conditions. Where field welding of pipe joints shown, specified, permitted, or required meet the requirements of ASME/ANSI B31.1 -Power Piping, Chapter VI Section 137.4 Hydrostatic Testing. Testing of pipelines shall be in accordance with the requirements of Division 15A Section 12.

1.11 Leakage Tests

1.11.1 Leakage tests shall be performed for any signs of leakage in all pipelines and structures required to be watertight.

1.11.2 Leaks shall be repaired by replacing broken pipe or joint assemblies found to leak at no addition to the Contract Price.

1.12 Testing

1.12.1 All mechanical equipment and systems provided under this Division shall be adjusted and tested. The Contractor shall adjust, repair or replace faulty or improper Division 15 work or equipment discovered during testing.

1.12.2 Tests may be made progressively as portions of the work are complete.

1.12.3 Tests shall be made in the presence of the Engineer.

1.12.4 A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted for the record.

1.12.5 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.

1.12.6 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 to the Department.

1.13 O&M Manuals and Data to be Filed with the Engineer

1.13.1 Legible 11”x17” shop drawings and O&M manuals, as specified in Section 1A and herein, shall be furnished to the Engineer when installation is complete, before testing and final acceptance.

1.13.2 As a minimum, the O&M manuals shall include:

(a) A table of contents.

(b) Approved, final shop drawings and product data for all equipment and materials incorporated in the work under this Division.

(c) Tabulation of motor & equipment name plate data.

(d) Manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer.

1.13.3 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 and title block without drawing numbers shall not be accepted.

1.13.4 See Division 1 for further requirements.

1.15 Record Drawings

1.15.1 Record drawings shall be prepared and submitted in accordance with Division 1.

1.15.2 Alterations and additions to the mechanical installation depicted on the contract drawings 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.

1.16 Final Acceptance Inspection

1.16.1 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.

1.16.2 The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall be as further described in Section 105 of the Standard Specifications.

1.17 Warranty

1.17.1 Warranty shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

1.18 Maintenance

1.18.1 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.

1.19 Basis of Payment

1.19.1 Work required to comply with this Division shall be paid as specified under each individual Section, which shall be payment in full for the work described.

1.19.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

SECTION 15B - BASIC MECHANICAL MATERIALS AND METHODS

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.2 Concrete

1.2.1 Concrete for equipment bases and other work under this Section shall be provided under this Section in conformance with Division 3.

1.3 Cutting and Patching

1.3.1 All cutting and patching of building materials required for work under this Section shall be provided under this Section.

1.3.2 Cutting and patching shall be provided under this Section in conformance with Division 1.

1.4 Fasteners

1.4.1 Fasteners used to mount pipe supports and other items attached to the structure shall be suitable for the weight supported and shall be compatible with the structure material, i.e. wood screws shall be used for wood, toggle bolts shall be used for hollow masonry, expansion bolts or power-set studs shall be used for solid masonry or concrete and clamps shall be used for structural steel.

1.4.2 Installation shall conform to requirements of Division 5 - Metals.

1.5 Support and Anchors

1.5.1 This section includes requirements for designing and providing all hanging and supporting devices of construction shown, specified, or required for pipelines, apparatus, HVAC system, plumbing, miscellaneous system, and equipment other than electrical equipment. Installation shall conform to requirements of Division 5 - Metals.

1.5.2 Submittals

(a) All submittals, including the following, shall be provided as specified in Division 1.

(b) Shop drawings shall be submitted to show the quantity, type, design and location of all supports, hangers and anchors required.

1.5.3 Supporting devices adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating and testing conditions with due allowance for expansion and contraction shall be provided. Installation shall conform to requirements of Division 5 - Metals.

1.5.4 Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Supporting devices shall accommodate loads imposed during leakage tests for the test pressures specified. The required strength of supporting devices shall be based on the combined weight of the piping and connected equipment, the weight of the denser of the fluids used in operations or testing and the weight of insulation where applicable. Supports shall be installed with a working safety factor of not less than 5. Installation shall conform to requirements of Division 5 - Metals.

1.5.5 Springs shall be provided where necessary. Hangers and supports shall be of standard design where possible and shall be best suited for the service required. Proper pipe protection saddles shall be included for hangers and supports on pipes which are covered with insulation. Where required, supports shall be screw adjustable after installation unless approved otherwise. Installation shall conform to requirements of Division 5 - Metals.

1.5.6 All supporting devices shall be designed to minimize interference with access and movement. Eliminate the potential for injuries due to protruding supporting devices. Installation shall conform to requirements of Division 5 - Metals.

1.5.7 All piping supports, hanger rod size, brackets and spacing shall meet the requirements of ANSI/ASME B31.1, MSS SP-58, SP-69, SP-89 and SP-90 except as modified herein. Installation shall conform to requirements of Division 5 - Metals.

1.5.8 All products and materials shall be delivered, stored and handled as specified in Division 1.

1.5.9 Structural and miscellaneous steel, metal castings, ductile iron pipe and fittings, steel pipe and fittings, and supports meeting the requirements of Division 5 - Metals shall be used.

1.5.10 Overhead hangers shall be supported using threaded rods properly fastened in place by suitable screws, clamps, inserts, or bolts, or by welding. Hangers shall be subjected to tensile loading only. Where lateral or axial movement may occur, suitable linkage shall be provided to permit sway. Installation shall conform to requirements of Division 5 - Metals.

1.5.11 Suspended piping shall be supported by adjustable ring or clevis hangers and threaded rods from heavy duty concrete inserts or other fastening devices, except as otherwise specified or noted. Installation shall conform to requirements of Division 5 - Metals.

1.5.12 Brackets shall be of welded steel and designed for the following load classifications:

Load Classification	Maximum Load per Bracket
Light	750 pounds
Medium	1,500 pounds
Heavy	3,000 pounds

When medium or heavy brackets are bolted to vertical surfaces, backplates of adequate size and thickness shall be furnished and installed to distribute the load against the vertical surfaces. When the use of backplates is not practicable, the brackets shall be fastened to the vertical surfaces in such a manner that the safe bearing strength of the vertical surfaces will not be exceeded.

1.5.13 Piping shall be connected, supported and guided to permit and control pipe expansion and contraction and to accommodate building expansion, contraction and settling without damage to the piping or support system.

(a) Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets.

(b) Anchors shall be cast-iron chair type anchors for piping with steel straps, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

(c) Insert material shall be stainless steel. Inserts shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically. Inserts shall be recessed near the upper flange to receive reinforcing rods. Inserts shall be designed so that they may be held in position during concrete placing operations. Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

1.5.14 Hanger and supports shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1 and Section 15A.

1.5.15 Hangers and Supports shall be hot dipped galvanized or of stainless steel construction unless otherwise noted.

1.5.16 Hangers, supports, anchors, and similar devices shall be painted as specified in Division 9.

1.5.17 Field welds, bolted connections and abraded areas shall be cleaned and painted as specified in Division 9.

1.6 Basis of Payment

1.6.1 The work required to comply with this Division shall be paid as specified under each individual Section, which shall be payment in full for the work described.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 15 – MEC

SECTION 15C - PIPING AND APPURTENANCES

1. GENERAL:

1.1 Section Includes

1.1.1 The work specified herein includes furnishing and installing all piping, fittings, valves, and accessories, required for a complete and satisfactorily working installation as shown and specified.

1.2 Related Sections

1.2.1 Section 5C - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.
1.2.2 Section 9A – Painting.
1.2.3 Section 15A - General Mechanical Provisions.
1.2.4 Section 15B - Basic Mechanical Materials and Methods.
1.2.5 Section 15D - Pumping Equipment.

1.3 Submittals

1.3.1 Submit shop drawings and product data under provisions of Sections 1A and 15A.

1.3.2 Submit detailed drawings and data on pipe fittings, valves, slide gate, actuators and appurtenances and as specified under individual subsection.

1.3.3 Pipe and equipment manufactures' submittals as specified under individual subsection.

1.3.4 A certification of the welder’s qualification, in conformity with the requirement of the code, shall be submitted to the engineer.

1.4 Delivery, Storage and Handling

1.4.1 Delivery, storage and handling shall be as specified under Section 1A.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 The piping and appurtenances 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.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Water Piping

2.1.1 General

(a) All piping shall be generally arranged and aligned as shown and specified. Where special conditions are encountered in the field, the arrangement and alignment of piping shall be as directed by the ENGINEER.

(b) Piping shall be installed as directly as possible between connecting points insofar as the work of other trades permit. Where interference occurs with another trade whose work is more difficult to reroute, the Contractor shall revise the routing as required to avoid subject interferences. Piping shall be carefully installed to provide for proper alignment, slope and expansion.

(c) To allow for expansion and contraction, pipe shall be guided and supported in such manner that pipe lines shall not creep, sag or buckle. Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping. Pipe support shall not be limited to support indicated on the drawings.

(d) Small tubing to gauges, controls, or other equipment, installed on any apparatus shall not be coiled nor excessive in length but shall be installed neatly, carefully, bent at all changes in direction, secured in place and properly fastened to equipment at intervals to prevent sagging.

(e) Prior to the start of any piping installation work, the Contractor shall prepare and submit for approval detailed piping installation drawings. These shall be prepared on the basis of actual equipment being furnished and actual dimensions of walls, openings and other significant elements.

(f) Piping and appurtenances shall conform to applicable Section 1006, METALS, of the Standard Specifications.

2.1.2 Ductile Iron Pipe and Fittings

(a) Ductile iron pipe shall meet the requirements of AWWA C151, Class 53 for exposed interior piping and buried piping.

(b) Ductile iron fittings shall have flanged joints or mechanical joints as shown or specified.

(c) Fittings shall be provided as shown and specified and shall be ductile iron meeting the requirements of AWWA C110.

(d) Pipe shall be installed in maximum lengths of 10 feet.

(e) Buried piping shall have restrained mechanical joints. Anchor bolts and nuts shall be “Cor-Ten” type steel for buried pipe installation.

(f) Cement lined in accordance with AWWA C104.

2.1.3 Flanged Connections

(a) Flanged connections shall be made as shown and specified. All flanges shall be drilled in conformance with the 125/150 ANSI Standard template.

(b) Class 150 pound steel flanges shall be smoothed finished (flat faced) for connection to dissimilar metals such as cast iron.

(c) Flanged joints shall be made with bolts or bolt studs with a nut on each end. Bolts, stud bolts, and nuts shall meet the requirements of ASTM A 307 Grade B and ASME B16.1. Bolts shall have a 1/4-inch projection beyond the nut when joint with gasket is assembled.

(d) Rubber gaskets for flanged joints shall meet the requirements of AWWA C207 as modified and supplemented herein. Gaskets shall be 1/8-inch thick. Gaskets shall be full face.

2.1.4 Wall Pipe

(a) Wall pipe shall be furnished and installed for all storm water piping passing through walls, as shown. Wall pipe material, thickness and coatings shall be the same as the connected piping.

(b) Wall pipe shall meet the requirements of AWWA C110.

(c) Wall pipe shall have an integrally cast intermediate collar located at the center of the wall.

2.1.5 Temporary bulkheads shall be provided at the ends of pipeline sections where adjoining pipelines have not been completed and are not ready to connect. Temporary bulkheads shall be removed when they are no longer needed.

2.1.6 Rubber Expansion Joints

(a) Manufacturers

1) General Rubber
2) Garlock
3) Mercer
4) Or Equal

(b) Joints:

1) Cover, body, seamless tube, and integral full-faced flanges. Standard 125-pound flange drilling.
2) Materials and construction shall be suitable for fluid service, maximum operating temperature, maximum operating pressure and test pressure of piping system.
3) Single arch. Unfilled.

(c) Split metal retaining rings

(d) Provide control unit for each expansion joint

1) Gusset plates, washers, bolts, and elastomeric bushings.
2) No metal-to-metal contact to eliminate transmission of noise and vibration.
3) Size control units for maximum operating pressure and test pressure of piping system.

(e) Minimum movement capability for single, unfilled arch joints:

Joint Size (inch)	Axial Compression (inch)	Axial Extension (inch)	Lateral Deflection (inch)
≤ 6	7/16	1/4	1/2
8 to 18	11/16	3/8	1/2
20 to 24	13/16	7/16	1/2
26 to 40	15/16	1/2	1/2
≥ 42	1-1/16	9/16	1/2

(e) Minimum movement capability for single, filled arch joints shall be at least 50 percent of movement specified above for unfilled arch joints.

(g) Installation:

1) Install expansion joint components in accordance with manufacturer's written instructions.
2) Install rubber expansion joints where indicated on Drawings and elsewhere as determined by Contractor for adequate expansion compensation and vibration isolation of piping systems

2.1.6 Polyvinyl Chloride (PVC) Pipe and Fittings

(a) PVC pipe and fittings shall be Schedule 80 meeting the requirements of ASTM D 1784 Class 12454-B and ASTM D 1785.

(b) Joints shall be ASTM D 2855 solvent welded joints utilizing ASTM D 2564 solvent cement.

2.1.7 Submittals

(a) All submittals, including the following, shall be provided as specified in Division 1 with the following stipulations.

(b) The following shop drawings shall be submitted.

1) Flanged, screwed, welding and mechanical coupling fittings and pipe, couplings, harnessing and special fittings. When special designs or fittings are required, the Work shall be shown in large detail and the special or fitting shall be completely described and dimensioned.

2) Fully Dimensioned layout of pipe, fittings, couplings, sleeves, expansion joints, supports, anchors, harnessing, valves and equipment. Pipe size, type and materials shall be labeled on drawing and a schedule shall be included.

3) Cross sections showing elevation of pipe, fittings, sleeves, couplings, supports, anchors, harnessing, valves and equipment.

4) Catalog data for pipe, couplings, harnessing and fittings.

(c) The following certifications shall be submitted:

1) Certificate of compliance for pipe, fittings, restrained flange adapter, gaskets, specials, and coatings in accordance with this Division.

2) A certification of the welder’s qualifications.

2.1.8 Quality Assurance

(a) Certified welders, having current certifications conforming to the requirements of the ANSI code shall perform all welding on steel pipelines.

2.1.9 Painting and Coating

(a) All pipe and fittings shall be lined and coated in accordance with the piping schedule. All bolts, nuts, couplings and the like shall be coated after the joint has been made.

(b) Ductile-iron pipe and fittings shall be shop coated on the outside with one coat of liquid epoxy primer Symbol B as specified in Section 9A, 4.0 mils minimum dry thickness, for use in exposed locations, such as inside buildings, where finish painting or insulating is required.

(c) Pipe for use not exposed to view shall also be coated with liquid epoxy primer Symbol B as specified in Section 9A.

(d) Immediately after facing and drilling, the back of the flanges and bolt holes shall be coated with liquid epoxy primer coating meeting the requirements of AWWA C210.

(e) The weight and class designation shall be conspicuously painted in white on the outside of each pipe, fitting, and special casting after the shop coat has hardened.

(f) Painting shall be in accordance with Section 9A and meeting the requirements of AWWA C210.

(g) Galvanizing: Provide galvanizing in accordance with ASTM A 53 where shown or specified.

(h) PVC pipe and fittings shall not be painted or coated.

(i) Sleeve –type Couplings

1) Couplings shall be shop coated with liquid epoxy primer in accordance with Section 9A and meeting the requirements of AWWA C210.

2.2 Motor Operated Actuator for Slide Gates (IG-1, DG-1 & RG-1)

2.2.1 General: The electric actuator shall include a motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, de-clutch lever, and auxiliary handwheel, reversing motor starter and space heaters, as a self-contained unit. The actuator shall meet AWWA-C-540-93 specifications. A 3-pole disconnect switch shall be built in the motor starter or furnished with the actuator for field mounting. Unless otherwise noted the actuator shall be designed to operate the slide gate at the rate of 12 inches per minute.

2.2.2 Enclosures for IG-1 and DG-1: The actuator motor and all electrical enclosures shall be NEMA 4X.

Enclosures for RG-1: The actuator motor and all electrical enclosures shall be Class I Div 2.

2.2.3 Motor: The motor shall be 460 volts, 3 phase, 60 hertz specifically designed for valve gate actuator service and shall be of high starting torque, totally enclosed, non-ventilated construction non-explosion proof except RG-1 shall be explosion proof, Class F insulation, 85^{o}C rise, 40^{o}C ambient. Motor leads shall be brought into the control compartment or limit switch compartment for external connections. Motors shall not exceed 1 HP.

The motor shall be of sufficient size to open or close the slide gate from any position and under any condition of operation 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 pre-lubricated and all bearings shall be of the anti-friction type. The motor speed shall not exceed 188.5 radian per second (1,800 rpm).

2.2.4 Electric Actuator Gearing: The actuator gearing shall be a double reduction unit with 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.

2.2.5 Position Limit Switch: Position limit switches and associated gearing shall be an integral part of the valve gate actuator. Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease-lubricated, and enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train. The limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. The trip points of the switches shall be adjustable over the entire range of the valve travel. They shall not be subject to breakage or slippage due to over-travel. Limit switches shall be of the heavy duty, open contact type with a rotary wiping action.

2.2.6 Torque Switch: Each actuator shall be equipped with a double torque switch which is responsive to loads encountered in both the opening and closing direction. Each side of the switch shall have a graduated dial and shall be adjustable. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be designed to shut off the actuator motor in the event that abnormally high torque is realized in either direction of travel. The torque switch is utilized as a protective device in valve applications requiring position seating. For torque seated valves, such as wedge gate and glove valves, the closing torque switch shall shut off the actuator motor when a predetermined torque is reached, corresponding to the required seating torque of the valve.

2.2.7 Manual Operation: A handwheel shall be provided for manual operation with an arrow to indicate "open" rotation. The handwheel shall not rotate during motor operation. A fused motor shall not prevent manual operation. When in manual operating position, the unit will remain in this position until the motor is energized. The actuator will automatically return to electric operation when the motor is energized. The actuator will remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation is accomplished by a positive de-clutching lever which disengages the motor and related gearing mechanically but not electrically with no damages to clutch a gear mechanism. It shall not be possible for the unit to be simultaneously in manual and motor operation.

2.2.8 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 actuator by means of a national pipe thread (NPT) and shall be capped and vented.

2.2.9 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.

2.2.10 Motor Starter: The motor starter shall be 3 phase AC full voltage reversing, rated 600V AC operated at 480V, 60 Hz unless otherwise noted. The starter shall include two 3 pole contactors mechanically and electrically interlocked, fused control transformer with 120V secondary, 120V, 60 Hz coils, 3 phase thermal overload relay, and auxiliary contacts. Heavy duty industrial type control station rated 10 amperes at 480 VAC, with open-close-stop pushbuttons and open-closed indicating lights shall be provided on the motor starter. Local-Off-Remote with start/stop/close pushbutton and indicating lights shall be mounted on the actuator. Terminal blocks shall be provided for all external wiring connections. Each terminal shall be properly marked.

2.2.11 Space Heater: Space heaters shall be provided in the motor enclosure and starter or limit switch enclosure. The heaters shall be 120V, 60 Hz, with sufficient capacity to prevent condensation in the enclosures.

2.2.12 Power Input: The power input to the actuator shall be 480V, 3 phase, 60 Hertz.

2.3 Slide Gate

2.3.1 General

(a) This section includes requirements for furnishing and installing the slide gate, operator and all appurtenances necessary for a complete installation.

(b) Gate operator shall be complete, including a suitable enclosure, with all appurtenances necessary for the operator to perform its intended function as specified under subsection 2.2, Motor Operated Actuator for Slide Gates, of this Section.

(c) Slide gate shall be stainless steel. Quantity of gate, guide, size, location and type shall be as shown or specified. Each gate shall be provided with the type of operator specified in the Slide Gate Schedule.

(d) Slide gate shall conform to AWWA C561. Slide gate shall be designed to limit deflection under maximum loading to 1/720th of the span or 1/16-inch whichever is less under design head. Slide gate shall be designed for the seating or unseating pressures specified, measured to the center of the gate.

(e) Submittals

1) Working drawings shall be submitted, including arrangement and erection drawings of the gate, operator and control equipment; structural design data, if requested; and operating characteristics.

2) The following certifications shall be submitted:

i. Manufacturer's certified performance and material specifications, as specified.

ii. If requested, complete calculations shall be submitted for each size of motor operator indicating the force required to operate the gate, the operator force provided, full load and locked rotor current, and watts (horsepower).

3) Operation and maintenance manuals shall be submitted for the slide gate and gate operator.

2.3.2 Stainless Steel Slide Gate

(a) The stainless steel slide gate shall be of ASTM A276, Type 304 stainless steel with a thickness of not less than 1/4 inches, reinforced with Type 304 stainless steel structural shapes, capable of withstanding the water pressure in either direction with the water level at maximum operating level.

(b) The gate and guide shall be fabricated of Type 304 stainless steel. Gate shall be reinforced as required to keep gate deflection within specified limits.

(c) The gate shall be designed for flush bottom closure. Bottom, side and top seals shall be resilient (50 $\pm$ 5 Durometer A) neoprene. The bottom seal shall be installed across the bottom of the gate or frame, mating with the side seals to keep leakage within specified limits. Provide replaceable seals, securely mounted with stainless steel retainer bars bolted to the gate with stainless steel bolts.

(d) Guides shall consist of slotted side pieces with a flush type bottom cross piece. Fabricate pieces of castings or structurals with integral anchoring ribs, shop assembled into a rigid assembly for embedment in concrete. Side slots shall be provided of the width and depth required for support and free operation of the gate without binding.

(e) Bearing surfaces shall be 3/8-inch minimum thickness, installed in a recess or keyed into the guide, designed to hold the polymer bearing surface in position against the gate.

(f) Where guides extend above concrete side walls, guides shall be supported by stainless steel structural members or by the gate operator support structure.

2.3.3 Slide Gate Operators and Lifting Stem

(a) Operator shall be rising stem, unless otherwise specified. Stem shall be securely fastened to the gate by means of a casting, mounting block or angles secured to the gate. Acme-threaded stem shall have 16 microfinish or better. Gate stem attachment shall be provided with provisions for keying or pinning the stem to the gate attachment.

(b) Stem shall be designed for the maximum operating torque of the operator and the weight and service of the gate. The length over radius of gyration (l/r) ratio of the stem shall be limited to 200, and the stem diameter shall be limited to 1.50 inches. Stems shall be stainless steel meeting the following applicable standards.

1) Stainless Steel ASTM A 276, Type 304 or 304L ASTM A 582, Type 303

(c) Stem shall be provided with a stem cover of polycarbonate ASTM D-3935. Rising stem gates shall be provided with clear rigid plastic stem covers to provide indication of gate position, permit inspection of stem threads, and protect stem from contamination. Vent holes shall be provided to prevent condensation. Stem cover shall have cap and condensation vents as well as a clear Mylar position indicating tape. Tape shall be field applied to stem cover after gate has been installed and positioned.

(d) Provide a freeze proof cold weather and corrosion-resistant chain for padlock to be installed through the handwheel operator and around the stem to prevent unauthourized operation of the slide gate. Department will provide padlock and keys. Padlock chain shall be heavy-duty flat-link, zinc-plated chain.

(e) Provide stainless steel or ductile iron pedestal to place input shaft approximately 36 inches above floor. Level pedestal with grout pad and fasten pedestal to surface. Pedestals shall be fabricated from 304L stainless steel and shall have a 3/8-inch minimum thick base plate and operator mounting plate. Install pedestals using max. 1-in thick leveling grout pad.

2.3.4 Manufacturers

(a) Whipps, Inc.
(b) RW Gate Company
(c) Hydro Gate
(d) Or equal

2.4 Pipe Supports and Anchors

2.4.1 Pipe supports and anchors shall be furnished and installed as shown on the Drawings or as specified in Sections 15A and 15B.

2.5 Restrained Flange Adapter

2.5.1 Flange adapter shall be made of ductile iron conforming to ASTM A536 and have flange boltcircles that are compatible with ANSI/AWWA C115/A21.15.

2.5.2 Restraint for the flange adapter shall consist of a plurality of individually actuated gripping wedges to maximize restrained capability. Torque limiting actuating screws shall be used to insure proper initial set of the gripping wedges.

2.5.3 The flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6’ gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

2.5.4 The flange adapter shall have a safety of factor of 2 for ductile iron pipe.

2.5.5 The flange adapter shall be the SERIES 2100 MEGAFLANGE adapter as produced by EBAA Iron, Inc. or approved equal.

2.6 PVC Ball Valve and Check Valve

2.6.1 PVC ball valve shall be trunnion ball design with Viton or EPDM O-rings. Ball valve shaft shall be reinforced with stainless steel rod.

2.6.2 PVC ball check valve shall be design with union connector with Viton and EPDM O-rings seals. Ball shall be supported by a system of guide ribs to give full flow with minimum turbulence and chatter.

2.7 Pressure Gauges

2.7.1 Provide ½ % accuracy pressure gauges with stainless steel movements with Bourdon tube and socket type as per manufacturer's recommendations for service and pressure. All gauges, unless otherwise specified, shall have dials not less than 41/2" in diameter, with white faces and black graduations.

2.7.2 Gauges shall be liquid filled (Glycerline or silicone), such as Ashcroft 1279. Discharge gauge shall be 0 to 75 ft.

2.8 Knife Gate Valve

2.8.1 Valve shall be of wafer face-to-face design with full diameter flanges having through pipe flange bolt holes to permit independent upstream or downstream pipe flange removal without affecting the shut-off or body shell pressure rating of the valve.

(a) Body shell pressure rating shall be 20 psig cwp.

(b) Shut-off pressure rating shall be 20 psig cwp.

2.8.2 The valve body shall be tested at 1.5 times the rated pressure and the valve gate at 1.1 the rated pressure while in the fully shut position with zero leakage permitted past the seat or to the exterior of the valve.

(a) Valve body material shall be cast 316 stainless steel.

(b) Gate shall be type 316 stainless steel.

2.8.3 Resilient seat ring material shall be type 316 stainless steel and seat material shall be natural or synthetic rubber material suitable for the application. The packing shall be a mixture of PTFE fibers and grease compounded to permit ease of handling but with sufficient fluidity to transmit equal sealing pressure across the full length of the packing chamber.

2.8.4 The actuator support structure of the valve shall be fabricated of carbon steel. If external support of the actuator is required to insure overall valve performance, the valve manufacturer shall include suitable located support brackets with instructions for proper support and alignment. The valve yoke shall be of sufficient strength to withstand five times the maximum operating torque and thrust.

(a) The drive stem shall be of chrome steel.

(b) The stem drive nut shall be of bronze.

(c) Yoke bearings shall be cast bronze.

(d) All mechanical fasteners shall be cadmium plated.

2.8.5 The valve shall be furnished with a resilient seat which seals around the edge, not the face, of the gate and shall be mechanically retained without the use of adhesives and replaceable. The seat design shall provide drip-tight shut-off at the fully rated pressure difference in either direction.

2.8.6 The packing shall be a square braided PTFE impregnated synthetic fiber material.

2.8.7 The valve shall have scraper blades on both sides of the gate to wipe the faces of the gate clean of any media prior to contact with the packing.

2.8.8 Both faces of gate shall have a surface finish of 16 microinch to insure ease of operation and seal performance.

2.8.9 The gate shall be guided for the full length of the stroke and supported to withstand full rated shut-off pressure in either direction for the full length of valve stroke. The interior of the valve port shall be contoured to insure self cleaning of the valve. The resilient seat in the bottom port area of the valve shall be flush with the port area and shall not form a cavity in which debris can collect.

2.8.10 All non-stainless steel metal surfaces shall be painted with a zinc free primer.

2.7 Flap Valve

2.7.1 Pump discharge application with bumper. Flange style mount (ANSI 125#).

2.7.2 All welded stainless steel components shall be constructed of Type 304L stainless steel.

2.7.3 All structural stainless steel used in the construction of the flaps, frames shall have a minimum material thickness of ¼-inch.

2.7.4 Flap and reinforcing stiffeners shall be constructed of stainless steel plate with a minimum thickness of 1/4-inch.

2.7.5 The flap shall be attached to the frame with a 1/4-inch thick stainless steel retainer bar and stainless steel attachment hardware.

2.7.6 Anchor bolts and assembly bolts shall be Type 316 stainless steel

2.7.7 Neoprene seal for tight sealing.

2.7.8 3 to 10 degree seating angle

2.7.9 Leakage shall not exceed 0.1 gpm/ft of wetted seal perimeter

2.7.10 Manufacturers - Subject to compliance with requirements provide flap valve of one of the following:

(a) Whipps, Inc.
(b) RW Gate Company
(c) Hydro Gate
(d) Or equal

3. EXECUTION:

3.1 Transportation and Delivery

3.1.1 Every precaution shall be taken to prevent damage to the pipe during transportation and delivery to the site. Extreme care shall be taken in loading and unloading the pipe and fittings. Such Work shall be done slowly with skids or suitable power equipment, and the pipe shall be under perfect control at all times. Under no condition shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe or coating. When handling the pipe with a crane, a suitable pipe hook or sling around the pipe shall be used. Under no condition shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends.

3.1.2 If any pipe or special is damaged in the process of transportation, handling or laying, such pipe or pipes shall be replaced or repaired by the Contractor at its own expense.

3.1.3 The Contractor shall furnish and install suitable blocking and stakes to prevent the pipe from rolling. The type of blocking and stakes, and the method of installation, shall be approved by the Engineer.

3.2 Piping Installation General

3.2.1 The dimensions shown on the Drawings for the location of pipelines have been established with the intent that there will be no interferences. The Contractor shall check all dimensions shown on the Contract Drawings prior to the installation of Work and shall notify the Engineer promptly of any interferences or errors discovered. If interferences are found to exist prior to or during construction, changes in the location of pipelines to avoid such interferences shall be made at no extra cost to the Department and in a manner as reviewed by the Engineer.

3.2.2 Elevations and dimensions locating pipelines are shown on the Drawings to the centerlines of the pipe unless otherwise indicated.

3.2.3 Piping connections and dimensions to equipment are subject to changes as reviewed by the Engineer to suit the types of equipment furnished.

3.2.4 Piping suspended from ceilings shall be installed to provide maximum head room consistent with good installation.

3.2.5 The layout of the piping and fittings shall be carefully checked to determine that the related equipment can be properly assembled to produce a workable arrangement. Defective or improperly fabricated Work shall be rejected and replaced with Work which, when completely assembled, shall result in an arrangement which shall function as intended and as shown on the Drawings.

3.2.6 All pipelines shall be straight and true in alignment, grade and location indicated, designated or required, and all installation shall be made in a workmanlike manner to the satisfaction of the Engineer. The pipe and fittings shall be adequately braced and blocked or tied, hung or supported for satisfactory installation.

3.2.7 As soon as pipes are in place, all open ends shall be capped until permanent connections are made. All pipelines shall be securely supported when required either by hanging from beams with suitable pipe hangers or supported on walls by suitable wall brackets. Where it is necessary, install hangers or supports after concrete is poured or other masonry Work finished. Anchor bolts with expansion shields shall be used.

3.2.8 Where pipes pass through masonry walls, floors and partitions, the juncture shall be made as shown on Plans. Where no details are shown, the Contractor shall either rough in the piping before the concrete is poured or the masonry completed, or shall provide suitable plugs, sleeves or forms for piping. After the pipes have been installed, the openings shall be filled solid; suitable allowance being made, however, for the expansion and contraction of the piping. The cutting of concrete for pipe shall be avoided wherever possible, and in no case where such cutting is necessary shall reinforcing rods be cut or disturbed, and no such cutting shall be done without the permission of the Engineer. All openings made for pipe Work shall be neatly patched in a workmanlike manner.

3.2.9 Horizontal runs shall be given as steep a pitch with even grade toward the outlet as conditions will permit, and care shall be taken in laying out piping that there is no interference with the proper location of piping for other purposes or other equipment. No change shall be made in the general location shown for piping, or in the method of running and connecting same, except with the written approval of the Engineer. When any change is made, a record of the location of all pipes so changed shall be kept by the Contractor and a copy of such record shall be given to the Engineer showing the location of all piping.

3.3 Protection of Piping System

3.3.1 Install and maintain pipe and equipment which is clean and free from rust, dirt, scale, etc.

3.3.2 Install temporary airtight covers at all pipe and equipment openings. Special attention shall be given to vacuum and air piping and each pipe section shall be individually inspected prior to placing. No piping shall be placed when wet, nor shall any free moisture be present inside any air piping during installation.

3.4 Pipe Supports and Hangers

3.4.1 Pipe supports and hangers shall be in accordance with Sections 15A and 15B.

3.5 Welding

3.5.1 All welding of piping and/or special fittings shall be done in conformity with the current ANSI B31.1, "Pressure Piping".

3.5.2 Tee connections in welded piping shall be made with a factory fabricated butt welding tee or with weld-o-let of butt, socket or threaded type. When weld-o-lets are used, the branch connection shall be one-half the diameter of the main or less. Scarf welding or direct butt welding of side connections shall not be permitted. Tees fabricated from pipe shall not be permitted.

3.5.3 Long radius welding elbows shall, whenever possible, be used for changing direction of welded pipelines. Mitered joints shall be subject to approval by the Engineer.

3.6 Flanged Joints

3.6.1 All flanged joints shall be made temporarily with gaskets in place using a minimum number of bolts to support the piping. Any misalignment of the assembled piping shall be adjusted or corrected in a manner approved by the Engineer.

3.6.2 Tightening of flange bolts to "pull up" misaligned flanges will not be permitted and shall not be done. The misaligned flanges shall be machined to fit, or approved spacer pieces and gaskets shall be installed if necessary and directed by the Engineer. The temporary assembly of the flanged piping shall demonstrate that there will be no undue stresses in the piping or at the connections to the equipment. The temporary assembly shall be approved by the Engineer before the joints are tightened. Flanged joints shall then be completed and made watertight and the tension in the flange bolts, when tightened, shall not exceed 15,000 psi at the minor diameter of the bolt threads.

3.7 Installation of Slide Gate

3.7.1 Slide gate shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.7.2 Floor stand shall be accurately centered over the gate. Stand shall be solidly bolted to the floor or support structure, with through-bolts wherever possible. Approximately 3/4 inch of nonshrink cement grout shall be placed beneath stand mounted on concrete or similar construction to assure uniform support.

3.7.3 Field Tests

(a) After installation of the gate, control equipment and all appurtenances, the units shall be subjected to a field running test, as specified in Division 1, under actual operating conditions.

(b) Slide gate shall be tested for leakage, strength, and opening and closing against the maximum heads practicable to obtain under operating conditions. Any leaks around the frame or gate shall be stopped. Seating Head Leakage shall not exceed 0.05 gallon per minute per foot of periphery under design head conditions. 2. Unseating Head Leakage shall not exceed 0.1 gallon per minute per foot of periphery under design head condition.

3.8 Sleeve Type Couplings

3.8.1 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.

3.9 Testing

3.9.1 Pipes shall be flushed clean and tested and any leaks shall be made tight. Perform hydrostatic pressure testing for piping systems. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to Engineer. Maintain test pressure for sufficient length of time to permit Engineer to observe piping under test but not less than 2 hours. Piping systems shall show no visual evidence of weeping or leaking. If leakage is evident, make appropriate repairs and retest.

3.10 Painting

3.10.1 Piping, fittings and appurtenances shall be painted in accordance with Section 9A - Painting.

3.11 Supports for Present Piping

3.11.1 Wherever Contractor is required to expose, suspend or reroute present piping, supports for such piping shall be provided as is required for new piping in accordance with paragraph 3.4 Pipe Supports, this Section.

3.12 Installation of Pipe and Fittings

3.12.1 All pipe and fittings shall be installed in accordance with the specifications contained herein and in Division 15A and 15B and in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.13 Schedule

3.13.1 Valve and Gate Schedule

Service	Valve Type	Opening Size Inches	Type	Joint Type	Actuator Remarks
Influent	Slide Gate 22-ft Unseated Head	60		E	Channel Mounted (7ft Wide)
Recirculation	Slide Gate 8-ft Seated Head	18		E	Surface Mounted
Discharge	Slide Gate 8-ft Seated Head	36		E	Surface Mounted
Suction	Knife Gate	10 & 16	F	H	
Discharge	Flap Valve	10 & 16	F		
Sump	PVC Ball Valve	2	T		
Sump	PVC Ball Check Valve	2	T		

Note: Coordinate slide gate size with mounting requirements over wall opening for piping. Opening size above is internal diameter piping.

(1) Abbreviations used in the schedule are as follows:

Joints & Actuators

F Flanged
T Threaded
E Electric motor actuator (Non-modulating)
H Hand wheel manual operator

3.13.2 Inside Piping Schedule

Service Remarks	Size (Inches)	Pipe Material[1]	Protective Coatings[3] Int.	Ext.	Joints[2]	Test Pressure (psig)
Suction Bell	10, 16	DI	CLDI	P	F	20
Pump Suction	10, 16	DI	CLDI	P	F	20
Pump Discharge	10, 16	DI	CLDI	P	F	20
Vent	4	DI	CLDI	P	F	NA
Vent	4	PVC	N	N	SWJ	NA
Recirculation	18	DI	CLDI	P	F	10
Sump Pump Discharge	2	PVC				20

Notes:

(1) DI Ductile Iron

(2) C Solvent Welded Joints
F Flanged

(3) N No Finish
P Shop Finish Painted
CLDI Cement Lined Ductile Iron Pipe

4) NA = Not Applicable

END OF THIS SECTION

SECTION 15D - PUMPING EQUIPMENT

1. GENERAL:

1.1 Description

1.1.1 This section includes requirements for furnishing and installing dry pit submersible motor pumping units, together with suction elbow and side discharge, splitter plates, cables, cable holders and all appurtenances necessary for a complete installation.

1.1.2 Pumping units include main pumps and low flow pump as shown on the Drawing and specified.

1.1.3 Pump shall be of the vertical, centrifugal, heavy duty, non-clog, close-coupled, submersible type, with bottom suction and side discharge, each driven by submersible electric motor mounted as an integral part of the pump. The pumping unit shall be designed to pump at the capacities specified. The pumping units shall be designed for continuous and intermittent duty. The pumping unit shall be designed to be suitable to operate in a dry well environment.

1.1.4 All pumps of a specified type shall be identical, the product of the same manufacturer. Refer to Division 15A. All main flow pumps within the pump station shall be interchangeable at any location without requiring piping and flange modification, and all main pumps shall be identical with respect to its technical rating, dimensions and flange connections. All low flow pumps within the pump station shall be interchangeable at any location without requiring piping and flange modification, and all low flow pumps shall be identical with respect to its technical rating, dimensions and flange connections.

1.1.5 The pumps and associated facilities, including pump station dry pit / wet pit layout and configuration, supporting structures, electrical equipment and all other related items, have been designed based on a single pump manufacturer. If an alternate pump manufacturer is utilized, Contractor is responsible for all revisions and re-design required to accommodate the proposed pumps to provide a properly functioning pumping system.

1.1.6 Furnish one spare main pump. The spare main pump assembly shall not be included in MAIN PUMPS unit price work and will be paid for at the contract lump sum work for COMPLETE SPARE MAIN PUMP ASSEMBLY which shall be payment in full for the work specified.

1.1.7 Furnish one spare low flow pump. The spare low flow pump assembly shall not be included in LOW FLOW PUMP unit price work and will be paid for at the contract lump sum work for COMPLETE SPARE LOW FLOW PUMP ASSEMBLY which shall be payment in full for the work specified.

1.1.8 Spare main pump and low flow pumps shall be subject to install field tests per 3.2.2 of this section.

1.1.9 Spare main pump and low flow pumps shall be stored at pump room floor at EL. 676.00.

1.2 Operating Conditions

1.2.1 The main pumps shall be capable of a pump down to a low water level at El. 650.50 without cavitation occurring. The low pumps shall be capable of a draw down to a low water level at El. 647.00 without cavitation occurring. Manufacturer's certification of the preceding shall be provided as part of the submittal data.

1.2.2 The new pumps including main pumps and low flow pumps shall operate at the capacities and heads and over the range of operating conditions specified without overloading, cavitation, and vibration. The pumps shall conform with the following requirements:

Items	Requirements	
	Main Pumps (MP1 thru MP3)	Low Flow Pump (LFP1)
Capacity at primary rating point	3,000 gpm	921 gpm
Total head at primary rating point	24.7 ft	25.6 ft
Overall efficiency, wire to water, at rating point, minimum, percent	66.5	66.1
Shutoff head: Maximum	48 ft	45 ft.
Capacity at secondary rating point	3,415 gpm	986 gpm

Total head at secondary rating point	21.9 ft	23.7 ft
Capacity at tertiary rating point	3,705 gpm	1,034 gpm
Total head at tertiary rating point	19.1ft	22.3 ft
Pump suction diameter, Minimum *(Note: 16"x10" reducing elbow connected to pump bottom suction shall be provided on Main Pumps by pump manufacturer prior to delivery to site, 8"x6" reducing elbow connected to pump bottom suction shall be provided on Low Flow Pump by pump manufacturer prior to delivery to site.)	10 inch*	6 inch*
Min Spherical Solids Size Passing	3.3 inch	2.4 inch
Pump discharge diameter, minimum	10 inch	6 inch
Pump speed, maximum, rpm	1,180	1,800
Motor horsepower, maximum	25 hp	8.7 hp
Motor efficiency at full load, minimum, percent	86.5	92.4
Motor power factor at full load, minimum	0.86	0.93
Locked rotor kVa/hp, maximum, NEMA code letter	G	K
Maximum overall pump height including lifting eye	72.25"	47"
Minimum pump start per hour	15	15
Minimum Service Factor	1.15	1.15

1.2.3 Each pump shall have a continuously rising characteristic curve from the rating point to shutoff which passes through the rating point, and which meets or exceeds the specified heads and capacities, all within the Hydraulic Institute tolerances per 1.5.5(a) of this section.

1.2.4 Submersible units shall be capable of sustaining full reverse runaway speed without damage.

1.2.5 Motors shall be capable of operating pumps over entire range of pump curves operating conditions without overloading and without using the service factor.

1.2.6 The entire pumping equipment including power supply system shall meet the NEC requirement for Class 1, Div. 2, Group D hazardous locations.

1.3 Related Sections

1.3.1 Section 3A - Cast-In-Place Concrete
1.3.2 Section 3B - Grout
1.3.3 Section 5C - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts
1.3.4 Section 9A - Painting
1.3.5 Section 15A - General Mechanical Provisions
1.3.6 Section 15B - Basic Mechanical Materials and Methods
1.3.7 Section 15C - Piping and Appurtenances
1.3.8 Section 16A - General Electrical Provisions
1.3.9 Section 16C – Basic Electrical Materials and Methods
1.3.10 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment
1.3.11 Section 16F – Motor Control Center
1.3.12 Section 16H - Major Electrical Equipment

1.4 Submittals

1.4.1 All submittals, including the following, shall be provided as specified in Division 1.

1.4.2 Submit a list of not less than five (5) installations where pumping equipment of the type and approximate size specified herein have been in successful operation for at least five (5) years.

1.4.3 Submit location where pumps and motor are manufactured and the nearest permanent service headquarters of the pump and motor manufacturers.

1.4.4 Submittal data shall include:

(a) Complete manufacturer's specifications and descriptive bulletins highlighting applicable data for all equipment including size, capacity, description and make of pumps and motors. Detailed data sheets for pumps and motors, cable, temperature/moisture monitoring unit.

(b) Detailed control description, illustrations, wiring diagrams of manual-off-automatic controls and starting equipment.

(c) Complete motor and manufacturer supplied cables and cable support data.

(d) Pump performance curves for the specified conditions including head, input kilowatts, net positive suction head and overall efficiency, as a function of capacity from zero to maximum capacity.

(e) Drawings of the equipment, including arrangement and erection drawings of the equipment and equipment operating characteristics in such detail as to give all dimensions necessary to accurately locate through the floors and walls all openings for pipes, anchor bolts and fittings for motors, pumps, motor and pump control center openings, and conduit between the associated equipment. This includes drawings, indents, pockets, and clearances necessary in the floors and walls for proper installation of the equipment specified.

(f) General arrangement drawing of pumping unit, suction elbow and pump stand. Include equipment weight and anchor methods and materials.

(j) Cross section drawing of pumping unit.

(k) Factory and field testing procedures shall be submitted prior to factory testing.

(f) Parts list with materials of construction technical descriptions and complete model number and quantity

(i) Motor performance characteristics. Information shall include data specific for the impeller used on project to provide efficiency and power factor values at the actual expecting loading of the motor. Submitted values may be based on a pump prototype. Submitting efficiency and power factor values for a pump assuming it operates at full load is not acceptable.

(j) Spare parts list with technical description, complete model number and quantity.

(k) Painting procedure, details of finish color and ANSI numbers.

(l) Six certified copies of the Shop Test results including analysis of test results and recommendations.

(m) Explosion proof UL or FM Certification for all proposed pumps.

1.4.5 Submit copies of all manufacturers' warranties obtained by the contractor to be transferred to the Department, at the time of final acceptance of this project by the Department.

1.4.6 Motor Nameplate Technical Data shall include:

(a) Manufacturer name
(b) Model number
(c) Series number
(d) Rated horsepower
(e) Rated voltage
(f) Full load current
(g) No load current
(h) Rated frequency
(i) Number of phases
(j) Rated full load rpm
(k) Rated temperature rise
(l) Insulation class
(m) Recommended starting restrictions, including allowable starts per hour
(n) Locked rotor motor starting inrush current and NEC code letter
(o) Service factor
(p) Efficiency
(q) Frame size
(r) NEMA design letter
(s) Full load power factor
(t) Recommended maximum KVAR rating of power factor correction capacitors.
(u) Class 1, Division 2, Group D rating showing UL or FM approval
(v) Year of manufacturing

1.4.7 Pump nameplate technical data

(a) Pump manufacturer name
(b) Pump model and serial number
(c) Nominal size
(d) Impeller code
(e) Impeller diameter
(f) Suction and discharge size
(g) Specific duty conditions
(h) Customer name
(i) Rated rpm and rated HP
(j) Max temperature rating
(k) Total weight of pump and motor assembly.

1.5 Quality Assurance

1.5.1 General

(a) Pumping equipment shall be produced by a manufacturer who regularly engages in the design, manufacture, assembly and production of submersible storm water pumping equipment of the size and type as specified for not less than five years.

(b) Motor wiring shall be rated for service in hazardous Class I, Division 2, Group D location.

(c) All materials used in the construction of the equipment herein specified shall be new and of the highest available grade and of properties best suited to the Work required.

(d) One manufacturer shall be responsible for providing pumping equipment, including pump motor and all accessories.

(e) Unless otherwise indicated, all pumps of a specified type under this Section shall be identical, the product of the same manufacturer.

(f) 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 the pump manufacturer in whom shall be vested unit responsibility for the proper function of the complete system, including pumps, motors, electrical, control equipment and accessories as shown and specified. Contractor, however, shall retain overall responsibility for equipment coordination, installation, testing, commissioning and operation.

1.5.2 Contractor's Responsibility

(a) If the power demand of pumping units proposed to be provided for this Project exceeds the maximum horse power and/or full load amps as specified and as provided or shown in the Drawings, it is the Contractor's sole responsibility, without additional cost to the Department, 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.

1.5.3 Manufacturer's Certifications

(a) 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.

(b) 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 Engineer.

(c) Submit manufacturer's certification that they have reviewed the location and discharge piping design, the discharge valve locations and types, 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.

(d) Submit manufacturer's certification that they have inspected the storage of the pumping equipment and find no conditions that have adversely affected the equipment.

(e) Submit manufacturer's certification that they have supervised the installation of the pumping equipment and that the pumping equipment has been properly installed.

(f) Submit manufacturer's certification that they have inspected the pumping equipment after 1,000 hours of operation and certify the pumping equipment is operating satisfactorily.

(g) Submit manufacturer's certification that the pumps were certified by UL and/or FM as listed in these specifications and meet the requirements of Class I Division 2.

1.5.4 Data to be filed with the Engineer

(a) Record Drawings: The Contractor shall keep one record copy of all Specifications, Plans, Addenda, Supplementary Drawings, Working Drawings, Change Orders and Clarifications at the site in good order. Specifications, Plans, Supplementary Drawings and Working Drawings shall be annotated to show all changes made during the construction process. These shall be available to the Engineer at all times and shall be delivered to the Engineer upon completion of the work.

(b) Four bound copies of operating and maintenance instructions, diagrams, parts, lists, requirements and other information pertinent to the operation of the various systems and equipment including bill of material with technical description, detailed technical data sheets, record shop drawings, catalog cuts highlighting applicable data shall be furnished to the Engineer. Refer to Division 1.

1.5.5 Source Quality Control

(a) Factory tests shall be performed on each pumping unit including spare pumps in accordance with the test code of the current Hydraulic Institute, except as modified herein. The pumps shall be tested in the position that they will be installed for all test parameters in Table 11.6.5.4 below. Low Flow Pumps shall demonstrate compliance with Grade 2B from Hydraulic Institute Standard 11.6. Main Pumps shall demonstrate compliance with Grade 1U from Hydraulic Institute Standard 11.6 at Primary Rating Point including power and efficiency and Grade 2B from Hydraulic Institute Standard 11.6 at Secondary and Tertiary Rating Points.

Table 11.6.5.4 — Pump test acceptance grades and corresponding tolerance band

Test parameter	Guarantee requirement	Grade	Grade 1			Grade 2		Grade 3
		Δt_Q	10%			16%		18%
		Δt_H	6%			10%		14%
		Symbol	Acceptance grade					
			1B	1E	1U	2B	2U	3B
Rate of flow	Mandatory	t_Q (%)	± 5%	± 5%	0% to + 10%	± 8%	0% to +16%	± 9%
Total head	Mandatory	t_H (%)	± 3%	± 3%	0% to + 6%	± 5%	0% to +10%	± 7%
Power[a]	Optional (either/or)	t_P (%)	+ 4%	+ 4%	+ 10%	+ 8%	+ 16%	+ 9%
Efficiency[a]		t_n (%)	− 3%	− 0%	− 0%	− 5%	− 5%	− 7%

[a] The power and efficiency tolerances are not the result of an exact calculation using the maximum values of a related column. They are instead reflecting real life experience. For grade 1E and 1U, no negative tolerance on efficiency is allowed.

NOTE: All tolerances are percentages of values guaranteed.

(b) Detailed factory test procedures shall be submitted prior to testing. The procedures shall include diagrams and drawings showing the exact set-up of the test and the location of the tested pump and the piping system with all required elevations. The diagrams and the drawings shall be clear and legible.

(c) Tests shall be conducted at rated speed to determine the curves of head, electric input kilowatts, and overall efficiency, wire to water, as a function of capacity. A minimum of six points shall be taken, including shutoff. One point shall be as near as possible to each specified condition of head and capacity and the remaining points at capacities necessary to provide a uniform distribution of data. Capacity shall be expressed in gallons per minute and head shall be expressed in feet. Raw test data, calculated results and sufficient information for computation and plotting of the curves shall be furnished with the certified shop test curves. Record voltage, amps, power factor, and frequency at each point; provide screen shots and formulae tables for the derivation of raw data tabulations. The screen shots shall be colored. Manual calculation shall not be accepted. The testing screen shall present to the Departments' representatives the following parameters: Flow (GPM), Head (feet), Power (HP), Power Factor, Voltage (V), Amperage (Amp), frequency (Hz), and Efficiency (%), and their dynamic change in response to the flow change. The testing screen shall present the development of all the required curves as the points are being recorded. The testing screen shall present the settings for the vertical and horizontal tolerances in accordance to the specified Hydraulic Institute Standards. A copy of the nameplate of the pump and the motor shall be included in the factory witness test report.

(d) Certified test curves shall be furnished for approval prior to shipment. All tests shall be witnessed by the manufacturer by a Registered Professional Engineer. The witnessing Registered Professional Engineer shall sign and seal each copy of the curve and test data sheets. Six copies of the curves along with the certified drive unit test data, shall be furnished for approval. Shipment of the pumping units shall not be made until the test data and curves are approved.

(e) Curves shall be drawn to such scale that values can be read accurately within 1%. The efficiency curves submitted shall constitute a guarantee within 1% on the scale, for all deliveries between 3/4 rated capacity and 1-1/4 rated capacity.

(f) In addition to the hydraulic test, the pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

1) Impeller, motor rating and electrical connections shall first be checked for compliance with the Specifications.

2) Motor and power cable insulation shall be tested for moisture content and insulation defects with a megga-ohm meter once before performance test and again after completion of performance test.

3) Winding resistance factory test for pump motors.

4) Moisture and temperature detector factory tests and describe acceptance and rejection criteria.

5) Describe tests acceptance and rejection criteria.

6) After operational test and hydraulic test, the moisture and temperature detector tests as described in 1.5.5. c and the insulation test 1.5.5. f shall be performed again and readings shall be recorded. A written report, stating the foregoing steps have been done, shall be submitted prior to shipment.

7) Each pump shall be subjected to a hydrostatic test and certification of the hydrostatic test shall be provided. The hydrostatic pressure shall, in any case, not be less than 150% the shut-off pressure of the pump as shown by the characteristic curve. The minimum test duration time shall be 10 minutes.

8) The certified test reports shall be submitted within two weeks from the completion of the tests. The results shall be certified that the equipment supplied meets the contract requirements.

(g) The Contractor shall provide transportation and reasonable expenses to and from all factory pump testing for two (2) representatives of the Department to witness such testing. The Department shall designate these individuals. The Contractor shall notify the Engineer of a scheduled test date two months prior to said date and shall arrange an exact suitable date not less than two weeks prior to the test.

1) It is the responsibility of the Contractor to coordinate with the manufacturer and ensure that the testing facility is ready for the test and fully equipped with the required equipment and fittings to perform the tests as described in the special provisions in a timely manner. No more than three business days shall be allowed for the factory witness test.

2) If the Engineer and Engineer's representatives, at their sole discretion, deem the testing facility is causing unreasonable delay, or the set-up of the test does not match with the testing procedures and diagrams provided prior to the test, or there is a malfunction in any of the testing equipment, the test shall be cancelled and the Contractor shall re-arrange for the test on a different date that fits with the Engineer's schedule. Any delay to the project due to the cancellation of the test shall be the Contractor's responsibility and shall not be allowed any extension or compensation.

3) The Contractor shall credit the Department all expenses for any additional trips that the Engineer and Engineer's representatives have to make to the testing facility due to tests cancelation.

1.6 Warranty

1.6.1 Refer to Division 1.

1.6.2 Provide 5 years non-prorated warranty from the date of final acceptance of the Pump Station.

1.7 Delivery, Storage and Handling

1.7.1 Products and materials shall be delivered, stored and handled as specified in Division 1.

1.8 Spare Parts

1.8.1 The following spare parts shall be provided; two sets for the main pump and two sets for the low flow pump:

(a) Two sets of mechanical seals - upper and lower
(b) Two sets of cable entry grommets
(c) Two sets of Motor Bearings
(d) Two sets of Wear Rings

1.8.2 A complete set of special wrenches, spanners, eyebolts and other special tools shall be furnished sufficient to completely dismantle and reassemble each kind and size of pumping unit. Tools shall be forged steel, case hardened, full finished, and furnished with a metal tool case with a handle and provision for padlocking.

1.9 Basis of Payment

1.9.1 The pumping equipment shall be paid for per contract unit price each for

MAIN PUMPS
LOW FLOW PUMP
COMPLETE SPARE MAIN PUMP ASSEMBLY
COMPLETE SPARE LOW FLOW PUMP ASSEMBLY

which shall be payment in full for the work described herein unless otherwise noted.

1.9.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Pump Specifics

2.1.1 Manufacturer and Model

(a) Main Pumps: Flygt NT 3171 LT 3 292mm, no substitutions permitted

(b) Low Flow Pumps: Flygt NT 3127 LT 183mm, no substitutions permitted

2.1.2 Design

(a) The pumps shall be dry pit submersible and shall be a self-contained pump/motor unit without the need for any external cooling system.

(b) The pump/motor unit shall be designed with a suction elbow and stand to be bolted to a concrete base or floor as shown on the Drawings. Main pump suction elbow shall be 16” x 10” reducing elbow.

2.1.3 Cooling System

(a) The main pumps shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

(b) Low flow pump motors shall be sufficiently cooled by the surrounding environment or pumped media.

2.1.4 Casing

(a) Pump casing shall be of the centerline discharge type.

(b) Pump casing shall be ASTM A48 Class 35B cast iron, with smooth surfaces devoid of blow holes or other casting irregularities.

2.1.5 Impellers

(a) The impeller shall be of Duplex Stainless Steel (ASTM CD-4MCuN), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be capable of handling solids, fibrous materials, sludge and other matter normally found in wastewater..

(b) The impeller shall be secured to the shaft with an aluminum bronze clamping sleeve in such a way that it cannot unscrew or become loosened due to rotation in either direction.

(c) Each pump shall be equipped with a grey cast iron renewable impeller wear ring.

(d) Low Flow Pump impeller shall be adaptive type.

2.1.6 Oil Chamber

(a) The low flow pumps shall be equipped with an oil chamber to function as a buffer between the pumped liquid in the casing and the motor. The oil chamber shall be arranged to accommodate thermal expansion of the oil and furnished with an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components. The oil chamber shall be ASTM A48 cast iron. The oil sample shall be taken from the oil chamber in place and without the need to pull the pump out of the dry well.

2.1.7 Mechanical Seal Main Pump

(a) Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

(b) Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

(c) The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

(d) A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

2.1.8 Mechanical Seal Low Flow Pump

(a) Pump shall be provided 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. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber

(b) Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

2.1.9 Motor

(a) Submersible pump motors shall be of 460-volt, 3-phase, 60-hertz squirrel cage induction type conforming to the latest applicable requirements of NEMA and NEC standards and suitable for application in Class 1, Division 2, Group D hazardous location. Motor shall be explosion proof UL or FM approved.

(b) Motors shall have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. Nameplate horsepower rating shall not be exceeded under maximum load conditions for constant speed pumping units. The motors shall be for continuous load operation and shall be capable of sustaining continuous on-off cycling of fifteen (15) starts per hour minimum without exceeding the 80 degree C temperature rise.

(c) The stator windings and stator leads shall have a minimum of NEMA Class H (180 degrees C) moisture resistant insulation. The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. Impregnation resin shall be applied to stator assembly in three dip and bake steps.

(d) Motors shall have an ASTM A48 cast iron stator housing. For motors that employ cooling water jackets, the water jacket passages shall preclude clogging by solids contained in the pumped liquid.

(e) The motor cables shall be multi-conductor flexible cables designed specifically for use with submersible pumps and shall be of stranded, tinned copper conductors with 600V ethylene-propylene insulation, cabled with non-hygroscopic vulcanized rubber fillers and binder tape, covered with water & oil resistant chloroprene rubber jacket, rated 90^{o} C in 40^{o} C ambient. Separate cables shall be provided for power and control. The power and control cables shall have sufficient length to reach the termination boxes as shown on Plans without splices.

(f) Motor cable entries shall have a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Do not use epoxy for this purpose. Cable entries shall have watertight seals. Cable entry leads shall be isolated from the internal motor leads to prevent entry of water into the motor chamber by leakage or wicking. One cable for power and one cable for controls shall be provided. Cables shall be suitable for submersible pump application and shall conform to NEC specifications for cable sizing. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter.

(g) The motor shall be designed for operating under completely submerged or unsubmerged conditions without damage while pumping under load.

(h) The combined service factor (combined effect of voltage, frequency and specific gravity) shall not be less than 1.15.

(i) The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

(j) The rated motor horsepower shall not be less than the brake horse power of the pump throughout the range of operating conditions specified.

(l) Motor nameplate shall be per NEMA standards and must show these specific items:

1) Manufacturer name
2) Model number
3) Series number
4) Rated horsepower
5) Rated voltage
6) Full load current
7) No load current
8) Rated frequency
9) Number of phases
10) Rated full load rpm
11) Rated temperature rise
12) Insulation class
13) Recommended starting restrictions, including allowable starts per hour
14) Locked rotor motor starting inrush current and NEC code letter
15) Service factor
16) Efficiency
17) Frame size
18) NEMA design letter
19) Full load power factor
20) Recommended maximum KVAR rating of power factor correction capacitors.
21) Class 1, Division 2, Group D rating showing UL or FM approval
22) Year of manufacturer

2.1.10 Shaft

(a) Shafts shall be one piece, fully machined pump and motor shafts. Maximum shaft deflection under maximum pumping load to shall be 0.002 inches at the lower mechanical seal face.

(b) Shafts material shall be stainless steel ASTM A 479 S43100-T and adequately designed to meet the maximum torque required at any start-up condition or operating point in the system.

2.1.11 Bearings

(a) The pump shaft shall rotate on permanently lubricated bearings. One assembly shall carry only radial loads and be free to float axially within the frame. The other assembly shall carry both radial and axial loads and be restrained from axial movement.

(b) Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize deflection

(c) Bearings shall conform with ANSI B3.15 and B3.16, Load Ratings and Fatigue Life for Ball and Roller Bearings, and have 50,000 hour minimum L_{10} bearing life at the maximum pumping load that occurs under the specified operating conditions.

2.1.12 Protection Monitoring System

(a) Each pumping unit shall be supplied with a monitoring system to protect critical machine functions during operation.

(b) Three thermoswitches, one per phase, shall be provided in the motor windings to protect against overheating by initiating an alarm on high temperature.

(c) A moisture sensor shall be provided to protect against damage from water contamination. The sensor shall be arranged to initiate the alarm upon sensing moisture in the oil chamber or prior to water reaching the motor windings.

(d) A monitoring device or devices designed to be compatible with the sensors and motor controls shall be provided for each pump. The monitoring system shall be intrinsically safe, intrinsically safe barriers shall be provided where required. The protective monitoring unit shall be installed on MCC bucket door for each pump configured with ability to automatically reset.

(e) Interface and coordination between pump and MCC manufacturers shall be required prior to shipment. See Section 16D for pump interface requirements with SCADA. Motor Protection Relay (MPR) interface signals:

1) Motor High Temperature.

2) Motor Moisture Sensor

2.1.13 Power Cable Holder or Cable Support Tray

(a) Contractor shall coordinate the installation of the cable holder or Cable Support Tray with the aluminum hatch cover supplier.

(b) Stainless steel cable support grip, cable pull line, snap hook and anchor as required or as shown on the drawing shall be coordinated with and provided by Division 16.

2.2 Operation and Control

2.2.1 Pump controls shall be provided in accordance with Division 16.

2.2.2 Pumps shall function in rising water and in falling water as shown on the drawings.

2.2.3 Float Level Detectors

(a) The float level detecting devices shall be located in the wet well as shown and as specified in Section 16D. One float shall be supplied for each control level.

2.3 Bolts, Studs and Nuts

2.3.1 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.

2.3.2 Bolts 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. All nuts shall be hexagonal in shape.

2.3.3 Stainless steel anchor bolts, flange bolts, studs and nuts shall be in conformity with the current ASTM Designation: A193, Grade B8 (AISI 304), Class 1 and ASTM A194, Grade 8 (AISI 304), AISI 316 or approved equal.

2.4 Splitter Plates (below Main Pump Suction Elbows as shown on Drawing S-2)

2.3.1 Contractor shall install splitter plates below suction elbows on Main Pumps as per direction from pump manufacturer. Pump manufacturer shall provide splitter plates for main pumps to prevent pre-swirl that leads to vortices. Splitter plate shall be ½" 304 Stainless Steel. Pump manufacturer shall provide all mounting hardware.

3. EXECUTION:

3.1 General

3.1.1 All equipment shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Divisions 1 and 15A. The manufacturer shall inspect the pump installation and shall certify that the pumps have been installed properly. Information submitted for approval shall include a letter of intent to provide this certification. All wiring and piping shall be completed and all necessary adjustments to equipment shall be made to provide a complete operational pumping system.

3.1.2 The manufacturer shall have joint responsibility with the Contractor for the proper installation and operation of the equipment, and jointly with the Contractor shall furnish a written statement to the Engineer certifying that the equipment as installed complies with the Plans and Specifications, will perform as specified, and is properly installed.

3.2 Field Quality Control

3.2.1 Representative of the Manufacturer

(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.

3.2.2 Field Testing

(a) Written test procedures shall be submitted two weeks prior to field testing. The pumps shall be tested in accordance with the manufacturer's instructions and Hydraulic Institute Standards.

(b) After installation of the pumping units, control equipment and all appurtenances, each unit shall be subjected to a field running test under actual operating conditions. Water for these tests shall be the responsibility of the Contractor and adequate water supply shall be available for testing of two pumps concurrently. Field tests shall be performed in the presence of Engineer's Representative and as directed by the Engineer. Tests shall demonstrate that under all conditions of operation each unit:

1) Has not been damaged during transportation or installation.

2) Has been properly installed.

3) Has no physical or mechanical defects.

4) Has been properly connected.

5) Is free of overheating of any parts.

6) Is free of overloading of any parts.

7) Verification of pump shaft rotation in proper direction.

8) The pump shall be free of any vibration and cavitation.

(c) Hand, off, auto, lead/lag, bump mode of each pump shall be tested from local control station, SCADA panel, and MCC to demonstrate that the pumps and control system operate as specified. Any defects in the equipment or failure to meet the requirements of the Specifications shall be promptly corrected.

1) Each Pump operates as expected at specified levels for on/off operation based on SCADA entered level variable data.

2) Each Pump operates as expected at specified levels for on/off operation based on ball float level switches.

3) Each pump shall be tested to verify rated flow.

4) Verify that each Pump does not operate from local control station and or from MCC when hand-off-auto switch is in off position.

5) Each Pump start and stop operates as expected manually from MCC and from local control station located at grade level.

6) Each Pump is sequenced as expected for rising and falling water levels in the wet well (this shall be a real water test, and Pump operation may be simulated by not allowing pump to actually run in order to accomplish testing).

7) Every possible pump auto sequence of each pump shall be tested for lead/lag/standby for rising and falling water levels based on SCADA controls.

8) Every possible pump auto sequence of each pump shall be tested for lead/lag/standby for rising and falling water levels based on hard wire float mode control through float switches.

(d) The following shall be checked on start-up:

1) Current draw and voltage on all legs of each pump shall be observed and recorded to see if there is any imbalance.

2) Megohm meter testing shall be performed and record reading on each pumps.

3) Winding resistance test for each phase shall be performed and recorded for each pump.

4) Pump controls and terminations shall be checked.

5) Each pump, including all spare pumps, shall be run in recirculation for a minimum of 30 minutes or longer as directed by the Engineer. Engineer can extend the time of the test if any issue was observed and required more time to verify

6) Moisture and temperature detector tests and record results on each pump.

7) Each PLC I/O point shall be verified for proper operation. Analog signals shall be simulated with multimeter at 0,4,8,12,16, and 20 mA levels. Results of I/O checkout shall be witnessed by Engineer. A sign-off sheet shall be generated for each I/O point.

8) Additional tested as described in Section 16D.

(e) It is the Contractor's responsibility to ensure that the field test is ready to be performed. If the Engineer and the Engineers' representatives, at their sole discretion, deem that the field test is not ready, or the requirements of the field test are not met, or there is a malfunction in any equipment to be tested and verified; the Engineer shall cancel the field test and the contractor shall re-arrange for the field test after certifying that all issues are resolved. No compensation nor time extension shall be allowed due to the cancelation of the field test.

3.3 Painting

3.4.1 All pumping equipment shall be painted as specified in Division 9.

3.4 Equipment Schedule and Pumping Operating Elevations

3.5.1 Refer to Drawing M8.

3.6 Start-up

3.6.1 The start-up services for the following equipment shall be coordinated with Department; the Department shall be notified at least two weeks in advance:

Pumping Equipment

END OF THIS SECTION

DIVISION 15E - VENTILATION

1. GENERAL:

1.1 Section Includes

The work specified herein includes furnishing and installing the ventilating system including fans, louvers, dampers, air inlets and outlets and all associated appurtenances and work as indicated and as specified herein.

1.2 Related Sections

1.2.1 Section 4A - Unit Masonry.
1.2.2 Section 5B - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.
1.2.3 Section 15A - General Mechanical Provisions.
1.2.4 Section 15B - Basic Mechanical Materials and Methods.
1.2.5 Section 16A - General Electrical Provisions.
1.2.6 Section 16B - Basic Electrical Materials and Methods.

1.3 References

All reference standards shall be from the latest edition.

1.3.1 AMCA 99 Standards Handbook.

1.3.2 AMCA 210 Laboratory Methods for Testing Fans for Rating Purposes.

1.3.3 AMCA 300 Test Code for Sound Rating Moving Air Devices.

1.3.4 AMCA 301 Method of Publishing Sound Ratings for Air Moving Devices.

1.3.5 ASHRAE Standards American Society of Heating, Refrigerating and Air Conditioning Engineers.

1.3.6 NFPA 90A Installation of Air Conditioning and Ventilating Systems.

1.3.7 OSHA Occupational Safety and Health Administration

1.3.8 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.3.9 UL 181 Underwriters Laboratories- Factory-Made Air Ducts and Connectors.

1.4 System Description

1.4.1 Ventilation system consisting of dampers, louvers exhaust and supply fans for the Electrical Room, Pump Room, and Wet Pit areas. The Electrical Room ventilation system will operate when temperature rises above setpoint 85° F (adjustable), while the Pump Room, Pump Levels and Wet Pit areas ventilation systems will operate whenever the building is occupied or combustion gas level rises above setting.

1.4.2 Heating system shall consist of electric unit heaters in each space. Heaters shall run on call for heating.

1.4.3 All fan and damper motors associated with the Electrical Room shall be corrosion resistant equipment. All fans and damper motors associated with all other spaces shall be rated for use in Class I, Division 2 areas.

1.5 Submittals

1.5.1 Submit Product Data in sufficient detail to confirm compliance with requirements of this section.

1.5.2 Submit shop drawings and product data in accordance with sections 1A and 15A.

1.6 Warranty

1.6.1 Provide warranty under provisions of Section 1A.

1.7 Delivery, Storage and Handling

1.7.1 Delivery, storage and handling shall be as specified under Section 1A.

1.8 Definitions

1.8.1 Low Pressure (Three pressure classifications):

(a) 1/2 inch WG positive or negative static pressure and velocities less than 1,500 fpm.

(b) 1 inch WG positive or negative static pressure and velocities less than 2,000 fpm.

(c) 2 inch WG positive or negative static pressure and less than 2,500 fpm.

1.9 Basis of Payment

1.9.1 The pump station ventilation work shall be paid at the Contract lump sum price for
HEATING AND VENTILATION

which shall be payment in full for the work described herein.

1.9.2 Refer to 1.22 of Section 1A for Method of Measurement.

2.0 PRODUCTS:

2.1 Ductwork and Ductwork Accessories:

2.1.2 Ductwork Materials:

(a) General: All ductwork shall be constructed of non-combustible or conforming to requirements for Class 0 or 1 air duct materials, or UL 181.
(b) Exposed Ductwork Materials - Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.
(c) Sheet Metal:

1) Aluminum Sheet - ANSI/ASTM B209 aluminum sheet, alloy 3003H-14.
2) Stainless Steel Sheet - ASTM A480, 304 stainless steel sheet No. 1 finish for concealed work and No. 4 finish for exposed work.

(d) Ductwork Material Selection

1) All ductwork installed within an Electrical Room shall be constructed of aluminum ductwork.
2) All ductwork other than within an Electrical Room, shall be constructed of stainless steel.

2.1.3 Miscellaneous Ductwork Materials

(a) Duct Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
(b) Ductwork Support Materials and Fasteners: 304 stainless steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.1.4 Fabrication - General

(a) Fabricate ductwork of gauges and reinforcement complying with SMACNA Duct Construction Standards and ASHRAE handbooks for 2-In. W.C. Pressure Class.
(b) Ductwork shall be constructed to provide the minimum clear inside dimensions indicated on the Drawings.
(c) Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centerline radius 1.5 times the associated duct width; and fabricate to include airfoil turning vanes in elbows where shorter radius is necessary.
(d) Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.
(e) Limit angular tapers to 30°(for contracting tapers and expanding tapers).
(f) Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.
(g) Button punch snaplock construction will not be accepted on aluminum ductwork.
(h) When approved by the Engineer, size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
(i) Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.
(j) Use double nuts and lock washers on threaded rod supports.
(k) Fabricate ductwork with accessories installed during fabrication to the greatest extent possible

2.1.5 Duct Sealants:

(a) Manufacturers:

1) 3M 800.
2) H.B. Fuller/Foster.
3) Or equal.

(b) Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations.
(c) Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.1.6 Gaskets:

(a) For 2-IN. Pressure Class and lower, provide soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

2.1.7 Turning Vanes:

(a) Provide turning vanes constructed of curved blades supported with bars perpendicular to blades and set into side strips suitable for mounting in ductwork.
(b) Turning vanes installed in aluminum ductwork shall be of aluminum construction.
(c) Manufacturer - Subject to compliance with requirements, provide turning vanes of one of the following:

1) Cain Mfg Co.
2) Tuttle & Bailey.
3) Or equal.

2.1.8 Duct Hardware:

(a) Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
(b) Manufacturers - Subject to compliance with requirements provide duct hardware of one of the following:

1) Ventfabrics, Inc.
2) Young Regulator Co.
3) Or equal.

2.1.9 Duct Access Doors:

(a) Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Access doors shall be constructed of same material as the duct system served.
(b) Provide flush frames for uninsulated ductwork, extended frame for externally insulated duct.
(c) Provide one side hinged, other side with 1 handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
(d) Provide access doors on exhaust systems upstream of all elbows with turning vanes and upstream of electric heating coils.
(e) Manufacturers - Subject to compliance with requirements provide duct access doors of one of the following:

1) Ruskin Mfg. Co.
2) Ventfabrics, Inc.
3) Or equal.

2.1.10 Flexible Connections:

(a) Provide flexible duct connections wherever ductwork connects to vibration isolated equipment.
(b) Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make air tight joint.
(c) Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
(d) Manufacturers - Subject to compliance with requirements provide flexible connections of one of the following:

1) Ventfabrics.
2) Hypalon.
3) Or equal.

2.2 Dampers:

2.2.1 Rectangular Manual Balancing Dampers (MVD):

(a) Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA Standards. Dampers greater than 10-in height shall be multiblade type.
(b) 16-gage galvanized steel frame and damper blade with 20-gage blade stop. Dampers installed in aluminum or stainless steel duct systems shall be constructed of 304 stainless steel.
(c) ½-in hex axle with molded synthetic bearings.
(d) All dampers shall be furnished with locking hand quadrant. Dampers installed on insulated duct systems shall be furnished with extended quadrant.
(e) Manufacturer - Subject to compliance with requirements, provide dampers of one of the following:

1) Ruskin model MD35.
2) Greenheck.
3) Or equal.

2.2.2 Gravity Backdraft Dampers (BDD-1, -2):

(a) Parallel blade, counterbalanced, adjustable backdraft damper.
(b) Provide in vertical or horizontal configuration as required by installation location.
(c) Aluminum frame and blade construction with vinyl blade seals.
(d) Units installed in Electrical Control Rooms shall be set for 0.05 beginning pressure relief.
(e) Manufacturer – Subject to compliance with requirements, provide dampers of one of the following:

1) Greenheck model BR.
2) Dayton.
3) Or equal.

2.2.3 Insulated Blade Control Dampers (DM-1, -2, -3, -4):

(a) Manufacturer:

1) Greenheck model ICD-45.
2) Ruskin.
3) Or equal.

(b) General:

1) No single damper shall be larger in size than 48-in in either dimension. Where a larger damper is required, multiple damper assemblies shall be provided.
2) Where multiple damper assemblies are provided, a common actuator may be used to drive a maximum of four dampers. Provide stainless steel connecting linkage as required. Where an assembly is constructed of more than four dampers, multiple actuators shall be provided.

(c) 0.125-in aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin gaps.
(d) Aluminum airfoil blades internally insulated with polyurethane foam and thermally broken.
(e) Plated steel axle with dual bearings. Bearings shall have acetal inner sleeve and flanged outer bearing with no metal-to-metal or metal-to-plastic contact.
(f) External (out of the airstream) blade to blade linkage.
(g) Suitable for pressures to 8-in. w.c. and velocities to 4,000-fpm with maximum AMCA leakage rate of 8 cfm/sq. ft at 4-in w.c.

2.2.4 Damper Actuators:

(a) Actuators shall be adequately sized for the damper size and air pressures anticipated in the system with a safety factor of two.
(b) Actuators shall have ISO9001 quality certification and be UL listed under standard 60730-1 or UL listed under standard 873.
(c) Actuators used on dampers shall be designed to directly couple and mount to a stem, shaft or ISO style-mounting pad. Actuator mounting clamps shall be a V-bolt with a toothed V-clamp creating a cold weld, positive grip effect. Single point, bolt, or single screw actuator type fastening techniques or direct-coupled actuators requiring field assembly of the universal clamp is not acceptable.
(d) Actuators shall two position (Open-Close). Actuators shall have visual position indicators and shall operate in sequence with other devices if required.
(e) Provide all actuators with proof of full open limit switch.
(f) Actuators shall have an operating range of –22° to 122°F.
(g) Actuators shall be capable of operating on 120 VAC power supply. Power consumption shall not exceed 10 VA.
(h) Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation.

(i) For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Spring return actuators shall be capable of CW or CCW mounting orientation. Spring return models > 60 in-lbs. and non-spring return models > 90 in-lbs. shall be capable of mounting on shafts up to 1.05-in diameter. Spring return actuators with more than 60 in-lb. of torque shall have a metal, manual override crank. Actuators using "on-board" chemical storage systems, capacitors, or other "on-board" non-mechanical forms of fail-safe operation are unacceptable. Upon loss of control signal, a proportional actuator shall fail open or closed as described below. Upon loss of power, a nonspring return actuator shall maintain the last position.

(j) Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required. Dampers requiring greater torque or higher close off may be assembled with multiple low torque actuators. Dual mounted actuators using additional anti-rotation strap mechanical linkages, or special factory wiring to function are not acceptable. Actuators in a tandem pair must be "off the shelf," standard actuators ready for field wiring.

(k) Damper actuators shall not produce more than 62 dB (A) when furnished with a mechanical fail-safe spring. Non-spring return actuators shall conform to a maximum noise rating of 45 dB(A) with power on or in the running or driving mode.

(l) All damper operators shall be oil submerged, geartrain type, inherently positive positioning.

(m) The actuators shall be mounted externally of ducts or air handling equipment wherever possible for ease of service and isolated from internal temperatures.

(n) Actuator enclosure:

1) Unless otherwise indicated, NEMA 2.
2) In areas designated as Class 1, Division 2 hazardous environments, provide explosion proof (NEMA 7) enclosure.

(o) Fail Position: (Loss of Power)

1) Outside Air Louvers/Intakes: Closed.
2) Exhaust Air Louvers/Hoods: Closed.

2.3 Fans:

2.3.1 Centrifugal Wall Ventilators:

(a) Applicable Units:

1) EF-WP, EF-PR.

(b) Manufacturers:

1) Greenheck.
2) Carnes Company.
3) Cook Company.
4) Or equal.

(c) Type: Provide centrifugal wall ventilators of types, sizes, direct or belt-driven and capacities as shown on drawings or schedules.

(d) Construction: Fan and motor housing shall be constructed of aluminum, fan hood shall be beaded or internally supported for rigidity. Fans shall be provided with pre-punched square mounting plate for mounting to wall. Up-blast type fans shall be provided with drain for the wind band. Drive assembly shall be isolated from fan plate to reduce vibration and noise transmission.

(e) Wheel, Shaft and Drive: Fan wheel shall be backward inclined non-overloading or forward curved as noted above. Bearings shall be heavy-duty pillow block bearings selected for minimum life of 100,000 hours at maximum rated speed of the fan. Drives shall be sized for a minimum of 150% of installed motor horsepower. Sheaves shall be of cast iron construction. Motor sheaves shall be adjustable for system balancing. Fans shall be dynamically and statically balanced and tested before shipment. Fans scheduled to be of spark resistant construction shall be constructed of non-ferrous materials in accordance with AMCA Type B Spark Resistant Construction.

(f) Motors: Provide TEFC motors for all belt drive fans unless scheduled to be explosion proof, ODP for direct drive fans. Fans scheduled to be explosion proof shall be furnished with motor suitable for a Class 1, Division 2, Group D hazardous environment.

(g) Accessories: Provide fans with the following accessories and as scheduled:

1) Dampers: Provide motor operated or gravity actuated dampers as scheduled. Dampers supplied shall meet the applicable requirements of this Section.
2) Birdscreen: Provide manufacturer's standard aluminum birdscreen.
3) Wall Grille: Provide manufacturer's standard wall grille as scheduled.

2.3.2 Centrifugal Inline Fans:

(a) Applicable Units:

1) SF-WP
2) SF-PR
3) SF-ER

(b) Manufacturers:

1) Greenheck.
2) Carnes Company.
3) Cook Company.
4) Or equal.

(c) Type: Inline centrifugal ventilator.
(d) Construction: Fan housing shall be constructed of aluminum. Fan wheel shall be backward inclined, non-overloading of aluminum construction. Drives shall be sized for a minimum of 150% of driven horsepower.
(e) Motors: Provide TEFC motors for all belt drive fans unless scheduled to be explosion proof, ODP for direct drive fans. Fans scheduled to be explosion proof shall be furnished with motor suitable for a Class 1, Division 2, Group D hazardous environment.
(f) Accessories: Provide fans with the following accessories:

1) Inlet and discharge collars.
2) Vibration isolation kit for horizontal hanging installation.
3) Aluminum belt and motor cover.

2.4 Electric Heaters:

2.4.1 Explosion-Proof Electric Unit Heaters:

(a) Applicable Units:

1) EUH-WP, EUH-PR-1, EUH-PR-2, EUH-DP-1, EUH-DP-2

(b) Manufacturers:

1) Modine
2) Ruffneck Heaters
3) Berko.
4) Qmark.

(c) Type: Propeller type, spark resistant, explosion-proof electric unit heater, suitable for a Class 1, Division 2, Group D hazardous environment.

(d) Construction: Unit casing shall be constructed epoxy coated heavy gauge steel with 14-ga. heavy duty steel frame.

(e) Heating Element:

1) Provide units of voltages and capacities as scheduled.
2) Heat exchanger shall have heavy duty immersion heating elements enclosed in a heat transfer fluid.
3) Heating element shall be designed to ensure surface temperature does not exceed 320°F.

(f) Fans: Fan shall have permanently lubricated explosion-proof motor with built-in overloads.

(g) Controls: Provide the following control devices prewired to unit.

1) Magnetic contactor.
2) Automatic overtemperature cutout.
3) Transformer for 24-volt control circuit.
4) Wall mounted explosion-proof thermostat meeting applicable requirements of this Section.

2.4.2 Propeller Electric Unit Heaters:

(a) Applicable Units:

1) EUH-ER

(b) Manufacturers:

1) Modine.
2) Berko.
3) Qmark.
4) Or equal.

(c) Type: Propeller type electric unit heater.
(d) Construction: Unit casing shall be constructed heavy gauge steel. Provide with louvered air outlet and inlet grille to act as fan guard.
(e) Heating Element: Element shall aluminum-finned, copper clad steel sheath construction. Provide units of voltages and capacities as scheduled.
(f) Fans: Fan shall be of aluminum construction and dynamically balanced.
(g) Controls: Provide the following control devices prewired to unit.

1) Power contactor.
2) Fan Delay Relay: Provide fan delay relay to keep unit fan running until all heat is dissipated from the heating elements.
3) Automatic overtemperature cutout.
4) Transformer for 24-volt control circuit.
5) Wall mounted thermostat meeting applicable requirements of this Section.

2.5 Air Grilles:

2.5.1 Manufacturers:

(a) A-J Manufacturing Company.
(b) Carnes.
(c) Titus.
(d) Or equal.

2.5.2 Construction: Provide grilles constructed of aluminum or stainless steel as scheduled.
2.5.3 Performance: Provide grilles that do not exceed scheduled maximum pressure drop and noise criteria ratings at scheduled airflow rate or airflow rate as shown on drawings.
2.5.4 Substrate Compatibility: Provide grilles with border styles that are compatible with adjacent substrate and specifically manufactured to fit into construction openings with accurate fit and adequate support. Refer to Drawings and Specifications for types of substrate which will contain each type of grille.
2.5.5 Grille Face / Pattern: Provide grilles of the following face / pattern type as scheduled. Blade width and spacing shall be dictated by the model number shown in the schedules.

(a) Single Deflection: Provide grilles with ¾-inch horizontal or vertical set of blades. Refer to schedules for position of each set of blades.
(b) Double Deflection: Provide grilles with ¾-inch horizontal and vertical sets of blades. Refer to schedules for position of each set of blades.

2.5.6 Finish: Provide grilles with anodized, matte or white baked enamel finish as scheduled.

2.6 Louvers:

2.6.1 Manufacturers:

(a) Greenheck.
(b) Carnes.
(c) Ruskin.
(d) Or equal.

2.6.2 Construction: Provide louvers constructed of aluminum extrusions, Alloy 6063-T5. Weld units or use stainless steel fasteners.
2.6.3 Performance: Provide weatherproof louvers of sizes as shown in schedules or on drawings. Louvers shall not exceed scheduled maximum values for free area face velocity and pressure drop at schedules airflow rates. Intake air louvers shall not have rated minimum water entrainment velocity lower than scheduled maximum free area velocity.
2.6.4 Substrate Compatibility: Provide louvers with frame and sill styles compatible with adjacent substrate and specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Refer to Drawings and Specifications for types of substrate which will contain each type of louver.
2.6.5 Finish: Provide louvers with 70% Kynar finish. Finish color to be Anodized Aluminum.
2.6.6 Accessories: Provide louvers with the following accessories as scheduled:

(a) Bird Screen: Provide manufacturer's standard aluminum bird screen mounted on inside face of louver.
(b) Provide motor operated or gravity backdraft dampers as scheduled. Dampers shall meet applicable requirements of this Section.
(c) Extended sill.

2.7 Blank-off Panels:

2.7.1 Panels shall be of double wall aluminum construction with an interior layer of 2-inch thickness polyisocyanurate board insulation.

2.8 Thermostats:

2.8.1 Explosion Proof Thermostats:

(a) Manufacturer:

1) Johnson Controls A19AUC
2) Honeywell.
3) Or equal.

(b) Suitable for use in Class 1, Division 2 Group D hazardous environment.
(c) Liquid filled, coiled bulb type element.
(d) SPDT, cooling or heating as required by application.
(e) Suitable for pilot duty (24 to 600 VAC) or line voltage duty up to 16-FLA at 120V.
(f) 20°-80°F temperature adjustment range with front of device dial.
(g) Coordinate requirements with equipment served.

2.8.2 Space Thermostats:

(a) Manufacturer:

1) Johnson Controls A19PRC
2) Honeywell.
3) Or equal

(b) NEMA 4X corrosion resistant enclosure.
(c) Coiled bulb type element.
(d) SPDT, cooling or heating as required by application.
(e) Suitable for pilot duty (24 to 600 VAC) or line voltage duty up to 16-FLA at 120V.
(f) 30°-100°F temperature adjustment range with front of device dial.
(g) Coordinate requirements with equipment served.

3.0 EXECUTION:

3.1 Ductwork

3.1.1 Low pressure duct work shall be fabricated and supported in accordance with SMACNA Duct Construction Standards - Metal and Flexible and ASHRAE handbooks. The duct gages, reinforcing and sealing shall be suitable for the operating pressures of the system.

3.1.2 Double nuts and lock washers shall be used on threaded rod supports. Hanger rods shall be galvanized steel, threaded at both ends or continuously threaded.

3.1.3 During construction, temporary closures of metal or taped polyethylene shall be provided on open duct work to prevent the entry of construction dust. For a facility in continuous operation, the closures may only be required during dust-generating construction operations, as directed by the Engineer.

3.1.4 Increase duct sizes gradually, not exceeding 15 degrees divergence whenever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

3.1.5 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular duct elbows are used, provide turning vanes.

3.1.6 The installation shall conform to the requirements of NFPA 90A and 90B, as applicable.

3.1.7 Provide ductwork with inside dimensions equal to sizes indicated on Drawings.

3.1.8 Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with ties, braces, hangers and anchors of type holding ducts true-to-shape and preventing buckling.

3.1.9 After installation, seal ductwork to seal class recommended and method prescribed in SMACNA - HVAC Duct Construction Standards.

3.1.10 Complete fabrication at Project necessary to match shop-fabricated Work and accommodate installation requirements.

3.1.11 Locate ductwork runs, except as otherwise indicated, vertically and horizontally, avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details, and notations or, if not otherwise indicated, run ductwork in shortest route not obstructing usable space or block access for servicing building or its equipment. Hold ducts close to walls, overhead construction, columns and other structural and permanent enclosure elements of building.

3.1.12 Coordinate duct installations with installation of accessories, dampers, equipment, controls, and other associated Work of ductwork system.

3.1.13 Support ductwork to comply with SMACNA - HVAC Duct Construction Standards, hangers and support section.

3.1.14 Where dissimilar metal ducts meet, provide positive electrical isolation using insulating materials, sealants and fasteners.

3.1.15 Clean ductwork internally of dust and debris as it is installed. Clean external surfaces of foreign substances causing corrosive deterioration of metal.

3.1.16 Strip protective paper from stainless ductwork surfaces, and repair finish wherever damaged.

3.1.17 Unless otherwise indicated, ducts shall be attached using rivets, bolts or sheet metal screws compatible with the duct material, i.e. aluminum screws for aluminum duct.

3.1.18 Sealant shall be non-hardening, water resistant, fire resistive and compatible with the mating materials. The sealant shall be applied as recommended by the manufacturer, either used alone or with tape or heavy mastic.

3.1.19 Contractor shall verify the location of all duct runs and wall, floor and ceiling penetrations.

3.1.20 Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Install access doors where indicated and at each control damper.

3.2 Fans

3.2.1 Do not operate fans for any purpose until ductwork is clean, bearings lubricated, and fan has been test run under observation.

3.2.2 Install fans as indicated, with resilient mountings and flexible electrical leads.

3.2.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connections are parallel with minimum 1" flex between ductwork and fan while running.

3.2.4 Each fan shall be provided with the controls as indicated on the electrical drawings. Refer to Division 16.

3.2.5 Support fans in accordance with manufacturer’s instructions. As part of submittals, include drawings showing fan support design and construction materials.

3.4 Field Quality Control

3.4.1 Upon completion of installation, start-up and test each electric unit heater, power and gravity ventilator to demonstrate capabilities and compliance with requirements.

3.4.2 Where possible, field correct malfunctioning units then retest to demonstrate compliance.

3.4.3 Replace units which cannot be satisfactorily corrected.

3.4.4 Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

3.4.5 Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.

3.5 Air Balancing

3.5.1 Quality Assurance:

(a) A firm certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) in those testing and balancing disciplines similar to those required for this project.

(b) Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated and NEBB "Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems".

3.5.2 Air side system balancing shall include but not be limited to the following procedures:

(a) Test and adjust fan RPM to design requirements. For fans operating with pressure controlled VFDs, fan speed shall first be set to lowest output that allows design flow to most remote terminal served. Measured minimum required supply air pressure shall be identified to the Temperature Controls Contractor for establishing setpoint.
(b) Test and record motor full load amperage.
(c) Check all fans for correct rotation.
(d) Test and record system static pressures, suction, discharge and external at all air handling equipment.
(e) Test and adjust system for design outside air and re-circulated air quantities.
(f) Adjust and record all main supply and return air ducts and zones to proper design CFM.

(g) Test and adjust each diffuser, grille and register to within 5% of design requirements. Record data and location. Use manufacturer's rating and calculations.
(h) Adjust all grilles to minimize drafts in all areas.
(i) Test and record all air temperatures - supply, return, mixed, and outside air

3.5.3 The contractor shall include the cost of new sheaves and belts if it becomes necessary to change the drives during balancing of system.

3.5.4 Patch holes in ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

3.5.5 Mark equipment settings, including damper control positions, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

3.5.6 Balancing contractor shall coordinate damper position settings with temperature control contractor to verify airflows and positions. Include time for this verification. See HVAC controls specification for time included by temperature controls contractor to work with balancing contractor.

3.5.7 Balancing contractor to work with temperature control contractor and HVAC contractor to verify correct operation of entire HVAC system, before submitting report.

3.6 Start-Up

3.6.1 Manufacturers or authorized Manufacturer’s representative to provide start-up services for fans and unit heaters.

3.7 Spare Parts

3.7.2 General- Furnish to Engineer, with receipt, the following spare parts for each fan

(a) One (1) set of matched fan belts for each belt-driven fan
(b) Two (2) sets filters for each unit requiring filters.

3.8 Training/Start-Up Services

3.7.1 Provide one half day training session for Department’s personnel. Training schedule shall be approved by Engineer.
3.7.2 Provide one half day start-up/installation inspection services.

3.9 Cleaning

3.9.1 Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer’s touch-up paint.

END OF SECTION

SECTION 15F - MISCELLANEOUS MECHANICAL ITEMS

1. GENERAL:

1.1 Section Description

1.1.1 This Section shall include all work required for the satisfactory operation of pump station, furnishing and installing complete, the Items indicated on the Drawings, as specified herein and not limited to the items listed below:

(a) Cable Support system for power and control cables supplied by the pump manufacturer.
(b) Stilling Wells for floats.
(c) Pavement Flood Float Alarm Box
(e) Pump Dolly
(f) Sump Pump
(g) Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 15A - General Mechanical Provisions.
1.2.2 Section 15B - Basic Mechanical Materials and Methods.
1.2.3 Section 15C - Piping and Appurtenances.
1.2.4 Section 15D - Pumping Equipment.
1.2.5 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.

1.3 Submittals

1.3.1 Submit shop drawings and product data under provisions of Sections 1A and 15A.

1.4 Delivery, Storage and Handling

1.4.1 Delivery, storage and handling shall be in accordance with the provisions under Section 1A.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 Payment: The work specified under this Section and as required shall be included for payment in the Contract lump sum price for the item, PUMP STATION MECHANICAL WORK.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Cable Supports

2.1.1 The cable supports shall be constructed as indicated on the Drawings. The cable support shall be complete and shall support all cables required for the main pumps and low flow pumps whether or not shown on the Drawings. Mesh cable supports and grips shall be of stainless steel.

2.2 Stilling Well

2.2.1 Stilling well shall be provided as indicated on the Drawings and as specified herein. Stilling well shall be provided for the Float Control Systems specified under Division 16.

2.2.2 Stilling wells for back-up float systems shall be constructed of 3/8" fiberglass consisting of 60% polyester resin and 40% glass material with stainless steel barrel slide bolt latch and stainless steel door hinges. Barrel shall stay firmly in place until the handle is lifted from the groove.

2.2.3 All hardware and metal parts shall be all stainless steel.

2.3 Pavement Flooded Float Alarm Box

2.3.1 Pavement flooded float alarm box shall be provided as indicated on the Drawings and as specified herein. Pavement flood float alarm box shall be provided for the Float Control System specified under Division 16.

2.3.2 Pavement flooded float alarm box shall be constructed of 316 Stainless Steel material with stainless steel hasps with padlocks.

2.3.3 All hardware and metal parts shall be all stainless steel.

2.3.4 Fasteners shall be concealed or type that cannot be readily be removed when the door is locked.

2.3.5 Pavement flooded float alarm box shall be located on northbound traffic side of US-41 and mounted to bridge wall beneath IL-176 at low point in roadway. Pavement flooded float alarm box shall be mounted 6" above low point in roadway.

2.4 Pump Dolly

2.4.1 Furnish two (2) pump dollies for moving pumps at floor El. 676.0 for the low flow pump and main pump.

2.4.2 Dolly shall 48"x30" with 18" deck height and 3,000lbs capacity, 12 gauge steel deck, flush edges, double grip T-bar handle, 1" axle and roller bearing wheels. Dolly shall easily be mobile while carrying heavy load.

(a) CH-3048-16PFSD by Little Giant supplied by Global Industrial.

(b) G5757132 by Zoro.

2.5 Sump Pump (P1)

2.5.1 Sump pump shall be completely submersible vertical centrifugal. Casing to be cast iron and oil filled motor chamber. Impeller to be 2 vane bronze, open non-clog, passing ½ inch solids. Bearings to be oversized, heavy duty ball thrust bearing, oil impregnated bronze top bearing. Shaft to be stainless steel. Provide 50 feet of flexible power cable with explosion proof plug. Sump pump to be explosion proof rated and 1-½ hp maximum. Sump to be rated for 20 gpm at 33-ft total dynamic head. Sump pump to be designed for installation in 24" x 24" at 36" deep sump. Sump pump manufacturer to be Weil (Series 8100), Hydromatic, or approved equal.

2.5.2 Floats shall be supplied by pump manufacturer in accordance with Section 16D.

2.5.3 Provide UL listed, NEMA 7 control panel (SPCP) for the pump with following components:

a. 480 volt main disconnect with Hand-Off-Auto switch.
b. Direct acting float switches for pump ON/OFF and high water alarm. Mercury switches not acceptable.
c. Motor contactor and motor circuit protector.
d. Numbered and wired terminal board for controls.
e. Push to test lights to indicate pump run, control power, and motor overload.
f. Control terminal board, numbered and wired.
g. Provide with suitable explosion proof receptacle with matching explosion proof plug for pump cable. Receptacle shall be weather proof while in use type.
h. Cable sized to reach control panel without splices.

3. EXECUTION:

3.1 Installation

3.1.1 Install the specified specialties in accordance with manufacturer's recommendations and instructions to permit intended performance.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16A - GENERAL ELECTRICAL PROVISIONS

1. GENERAL:

1.1 Description

1.1.1 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.

1.1.2 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.

1.1.3 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.

1.1.4 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

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

1.3.1 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
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society of North America
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Assoc.
NESC	National Electrical Safety Code
NETA ATS	InterNational Electrical Testing Agency, Acceptance Testing Specifications
UL	Underwriter's Laboratories

1.3.2 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

1.4.1 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.

1.4.2 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.

1.4.3 Prior to installation, the Engineer may make reasonable minor changes in the locations of the installation without additional cost to the Department.

1.5 Coordination

1.5.1 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 coordination 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 incidental to Pump Station Electrical.

1.6 Workmanship

1.6.1 The electrical work shall be performed in a neat and workmanlike manner in accordance with the best practices of the trade.

1.6.2 Unless otherwise indicated, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.7 Testing

1.7.1 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 16 work or equipment discovered during testing.

1.7.2 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 Department.

1.7.3 Tests may be made progressively as portions of the work are complete; all systems will require demonstration that they are functional and comply with the Contract Documents.

1.7.4 Tests shall be made in the presence of the Engineer; Engineer and Department shall be notified a minimum of 14 days prior to testing.

1.7.5 A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted to the Engineer for the record.

1.7.6 Independent Contractor shall perform all tests necessary to assure proper functioning of materials and equipment. As a minimum, the tests shall include the following:

(a) Before making final connections check the insulation resistance of all cables of 3-phase circuits that operate above 150 volts.

(b) Check wiring for proper phase sequencing including buses, feeder cables and transformers and assure proper connection at motors for proper rotation.

(c) 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.

(d) Check and record the motor nameplate data for each 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.

(e) Set control relays, protective relays and instruments in accordance with manufacturer's recommendations. Record the set points.

(f) 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.

(g) Check all alarm circuits for proper operation and proper set points, as applicable. Record any appropriate set points.

(h) Measure and record the line currents of each phase of each 3-phase motor under load.

(i) Align and adjust lighting fixtures and assure proper operation of all controls, ballasts and lamps.

(j) All equipment must be properly calibrated for proper operation of the system.

(k) All equipment devices shall be tested for proper operation, including but not limited to, selector switches, pushbuttons, indicating lights, timers, lock-out relay, and counters.

(l) See Testing Electrical Systems under paragraph 3.8 of this Section for further testing requirements.

1.7.7 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 Department.

1.7.8 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 automatic operation including simulation to the Engineer's satisfaction.

1.7.9 Note that failure to test the equipment completely is not an allowance for an extension.

1.8 Data to be filed with the Engineer

1.8.1 Submit shop drawings and product data under provisions of Section 1A. Certain data, as specified herein, shall be furnished to the Engineer when installation and testing are complete, before final acceptance.

1.8.2 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 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.

1.8.3 Four sets of the data files shall be provided.

1.8.4 As a minimum, the data files shall include:

(a) A table of contents.

(b) Approved, final shop drawings and product data for all equipment and materials incorporated in the work under this Division.

(c) Manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer.

(d) A tabulation of cable insulation tests.

(e) A tabulation of motor nameplate data.

(f) A tabulation of required voltage tests.

(g) A tabulation of required motor current tests.

(h) A tabulation of relay and control device set points.

(i) A tabulation of alarm set points.

(j) A tabulation of megger tests.

(k) A tabulation of breaker settings, timer set points, and protection relay setpoints. Tabulation shall include complete model or catalog number of each breaker, protection relay and fuse.

(l) A tabulation of motor winding resistance tests for pump motors.

(m) A Study Report providing summary of results of power systems study under Section 16B including:

1. Description, purpose, basis, and scope of study and single line diagram of power system.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties and commentary regarding same.
3. Protective device time versus current color coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
4. Fault current calculations including definition of terms and guide for interpretation of computer printout.
5. Tabulation of appropriate tap settings for relay units.
6. Arc flash calculations and tabulation of incident energy level (calories/cm^2) for each equipment location and recommended personal protective equipment (PPE).

(n) Complete testing report for the testing of electrical systems under paragraph 3.8 of this Section utilizing NETA printed forms. Submit report no later than 30 days after testing is complete. Submit proof of testing agency qualification.

1.8.5 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

1.9.1 Record Drawings shall be prepared and submitted in accordance with Division 1. Note that equipment wiring diagrams shall be project specific and cross reference terminal and wiring numbers to other equipment. Showing generic terminations and wiring numbers is not acceptable.

1.10 Warranty

Warranty shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

1.11 Basis of Payment

1.11.1 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.

1.11.2 The work for Electric Service specified under Subsection 3.4 shall be paid for at the Contract lump sum price under the pay item ELECTRICAL SERVICE CONNECTION. This work includes the relocation of the existing pump station feeder by ComEd to accommodate the jacking pit. The contractor is responsible for coordinating with ComEd and marking the jacking pit location. Work shall occur during dry weather (no rain forecast); existing pump station shall be without power for a maximum of 12 consecutive hours.

1.11.3 Telephone service installation and connection shall be paid for at the contract lump sum under pay item TELEPHONE SERVICE INSTALLATION AND CONNECTION and shall be in accordance with the work described herein unless otherwise noted.

1.11.4 Refer to 1.22 of Section 1A for Method of Measurement.

1.12 Classification of Electrical Enclosures and Installations in Project Locations

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:

NEMA 7(CLASS I, Division 2, GROUP D): All spaces in the pump station including Discharge Chamber, Dry Pit, Pump Room, and Wet Well except otherwise indicated.

NEMA 1: Electrical Room.

NEMA 4X Stainless Steel: Outdoor area and other unspecified wet or damp area.

NEMA 12: Other area not defined.

1.13 Final Acceptance Inspection

1.13.1 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.

1.13.2 The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall be as further described in Section 105 of the Standard Specifications.

2. PRODUCTS:

2.1 Materials and Equipment

2.1.1 Quality

All materials, equipment and appurtenances shall be new, shall be suitable for the application and shall be the product of established, reputable manufacturers.

2.1.2 Standards

The construction, sizes, ratings and capacities of items shall be in conformance with the requirements under paragraph 1.3.1 of this Section, as applicable.

2.1.3 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.

2.1.4 Service Equipment

Equipment which is used as electric service equipment shall bear a UL listing: "SUITABLE FOR USE AS SERVICE EQUIPMENT".

2.1.5 Other Requirements

Refer to Division 1 for other requirements relating to materials and equipment.

3. EXECUTION:

3.1 General

3.1.1 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.

3.1.2 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.

3.1.3 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 Engineer’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 Department. 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 Department.

3.1.4 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.

3.1.5 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.

3.1.6 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.

3.1.7 Location of electrical equipment shown on Plans are approximate and are subject to minor changes as directed by and at no extra cost to the Department.

3.1.8 Perform equipment tests as per manufacturer's instructions except where otherwise specified

3.2 Protection of Work

3.2.1 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.

3.2.2 Prior to final acceptance, protective measures shall be removed and equipment and items shall be cleaned as required to deliver the installation to the Department in clean, undamaged condition.

3.3 Clean-Up and Safety

3.3.1 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 Electric Service

3.4.1 Work under this Section shall include all equipment, wiring and appurtenances required for both the complete, operational temporary and permanent electric service.

3.4.2 All electric utility's charges for disconnecting the existing electric service and providing new service to the pump station shall be paid to the utility by the Contractor. The Contractor will be reimbursed the exact amount of these charges under a separate pay item, ELECTRICAL SERVICE CONNECTION. For bidding purposes, this item shall be estimated at $30,000.

3.4.3 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.

3.4.4 Power metering cabinets shall consist of transformers, and meter socket in a NEMA 3R enclosure. Coordinate the transformer rating with the electric utility.

3.4.5 All electric service work must conform to the requirements of the electric utility.

3.4.6 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.

3.4.7 Existing Pump Station shall remain operational until new Pump Station is operational. Contractor is responsible for coordinating with Com Ed service disruptions such that one service is in constant operation.

3.5 Telephone Service

3.5.1 Work under this Section shall include all equipment, wiring and appurtenances required for complete, operational telephone service with connection to the AEGIS system. The telephone line shall be shared between the AEGIS system and station phone.

3.5.2 Charges by the telephone utility shall be paid to the utility by the Contractor under the pay item, PUMP STATION TELEPHONE SERVICE INSTALLATION AND CONNECTION. The installation and coordination of charges by the telephone utility shall be referred to IDOT Business Services, telephone number (847) 705-4011.

3.5.3 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.

3.5.4 All telephone service work must conform to the requirements of the telephone utility.

3.5.5 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

3.6 Final Acceptance Inspection

3.6.1 When the work is complete, tested and fully operational, and only after the Record Drawings 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.

3.6.2 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.

3.7 Maintenance

3.7.1 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.

3.8 Testing Electrical Systems

3.8.1 Summary

(a) Prior to energizing equipment, retain services of recognized independent testing laboratory for purpose of performing inspections and tests as herein specified.
(b) Ensure electrical equipment supplied by Contractor and Owner is operational within industry and manufacturer’s tolerances and installed in accordance with Specifications.
(c) 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 Section 16B.

3.8.2 General

(a) Testing agency shall meet federal, state, and local safety requirements for accreditation of testing laboratories, CFR Title 29, art 1907, “Accreditation of Testing Laboratories.” and have membership in InterNational Electrical Agency (NETA).

(b) Contractor’s Responsibilities:

1. Supply source of test power to testing agency at each equipment location.
2. Notify testing agency when equipment becomes available for tests.
3. Coordinate work to minimize Project delay.
4. Supply complete set of approved and updates record electrical drawings, specifications, and pertinent change orders to testing agency prior to commencement of testing.

(c) Testing Agency’s Responsibilities:

1. Notify Engineer and Department a minimum of 14 days prior to commencement of testing.
2. Provide material, test procedures, applicable tables of NETA to verify acceptance of test results, equipment, labor, and technical supervision to perform such tests and inspections.
3. Test labeling: On satisfactory completion of tests for each piece of equipment, attach dates and signed “Satisfactory test” label to tested component.
4. Test forms submitted for Engineer review shall include the range of accepted values in the test forms for insulation resistance tests.

(d) Test Work and equipment installed to ensure proper and safe operation accordance with intent of Drawings and Specifications.

1. Check interlocking and automatic control sequences and test operation of safety and protective devices.
2. Correct defects found by Work of this paragraph (3.8 Testing Electrical Systems).
3. Cooperate with Power Company, supplier, and manufacturer representatives in order to achieve proper intended operation of equipment.

(e) Test, adjust, and record operating voltages at each system level before energizing branch circuits.

1. Transformer taps shall be adjusted to obtain as near as possible nominal system voltage.
2. Where transformer is under utility jurisdiction, obtain services of utility to correct voltage.
3. Replace devices and equipment damaged due to failure to comply with this requirement.

(f) 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%.

3.8.3 Motor Control Center Assemblies

(e) Refer to paragraph 3.8.4 for appropriate inspections and tests of the motor control center bus.
(f) Refer to paragraph 3.8.5 for appropriate inspections and tests of the motor control center circuit breakers.
(g) Refer to paragraph 3.8.6 for appropriate inspections and tests of the motor control center motor starters.
(h) Refer to paragraph 3.8.11 for appropriate inspections and tests of the motor control center automatic transfer switches.

3.8.4 Motor Control Centers Bussing

(a) Visual and Mechanical Inspections:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect for physical and mechanical damage.
3. Verify equipment supplied and connected in accordance with Specifications.
4. Inspect for proper alignment, anchorage, grounding and required clearance areas.
5. Verify the unit is clean and all shipping bracing, loose parts, and documentation shipped inside cubicles/sections have been removed.
6. Verify that fuse and circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker’s address for microprocessor-communication packages.

7. Verify that current and voltage transformer ratios correspond to approved shop drawings.
8. Verify that wiring connections are tight and that wiring is secure to prevent damage during routine operation of moving parts.
9. Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels or NETA ATS Table 100.12.
10. Key interlock system shall be physically tested to ensure proper function.
11. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
12. Inspect insulators for evidence of physical damage or contaminated surfaces.
13. Verify correct barrier and shutter installation and operation.
14. Exercise all active components.
15. Doors, panels, and sections shall be inspected for paint, scratches, and fit.
16. Inspect mechanical indicating devices for correct operation.
17. Verify that filters are in place and vents are clear.
18. Perform visual and mechanical inspection of instrument transformers in accordance with paragraph 3.8.7.
19. Mechanical operation of relays, switches, and other devices.
20. Inspect control power transformers.

    i. Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
    ii. Verify that primary and secondary fuse or circuit breaker ratings match approved shop drawings.
    iii. Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

(b) Electrical Tests:

1. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground, for one minute in accordance with NETA ATS Table 100.1.
2. Perform a dielectric withstand voltage test on each bus, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data. If manufacturer has no recommendation for this test, it shall be in accordance with NETA ATS Table 100.2 The test voltage shall be applied for one minute.
3. Perform electrical tests on instrument transformers in accordance with paragraph 3.8.7.
4. Perform ground-resistance tests in accordance with Section 3.8.9.
5. Determine accuracy of all meters and calibrate watthour meters in accordance with paragraph 3.8.8.

6. Control Power Transformers.

    i. Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be in accordance with NETA ATS Table 100.1 unless otherwise specified by the manufacturer.
    ii. Perform a turns-ratio test on all tap positions.
    iii. Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to a rated secondary voltage source. Verify correct potential at all devices.
    iv. Verify correct secondary voltage by energizing the primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
    v. Verify correct function of control transfer relays located in the switchgear with multiple control power sources.

7. Voltage Transformers.

    i. Perform secondary wiring integrity test. Verify correct potential at all devices.
    ii. Verify secondary voltages by energizing the primary winding with system voltage.

8. Perform current-injection tests on entire current circuit in each section of switchgear.

    i. Perform current tests by secondary injection with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit. Verify correct magnitude of current at each device in the circuit.

9. Verify operation of cubicle switchgear/switchboard space heaters.
10. Perform system function tests to verify the correct operation of all sensing devices, alarms, and indicating devices and the correct operation of all interlock safety devices for fail-safe functions in addition to the design function.
11. Perform phasing checks on double-ended or dual-source switchgear to insure correct bus phasing from each source.

(c) Test Values:

1. Bolt torque levels shall be in accordance with manufacturer's instructions. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
2. Insulation-resistance values of bus insulation shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1 Values of insulation-resistance less than this table or manufacturer's recommendations should be investigated. Dielectric withstand voltage tests shall not proceed until insulation-resistance levels are raised above minimum values.
3. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
4. Results of electrical tests on instrument transformers shall be in accordance with paragraph 3.8.7.
5. Results of ground-resistance tests shall be in accordance with paragraph 3.8.9.
6. Accuracy of meters shall be in accordance with paragraph 3.8.8.
7. Control Power Transformers.

    i. Insulation-resistance values of control power transformers shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.5. Values of insulation resistance less than this table or manufacturer's recommendations should be investigated.
    ii. Turns-ratio test results shall not deviate by more than one half percent from either adjacent coils or the calculated ratio.
    iii. Secondary wiring shall be in accordance with design drawings and specifications.
    iv. Secondary voltage shall be in accordance with design specifications.
    v. Control transfer relays shall perform as designed.

8. Voltage Transformers

    i. Secondary wiring shall be in accordance with design drawings and specifications.
    ii. Secondary voltage shall be in accordance with design specifications.

9. Current-injection tests shall prove current wiring is in accordance with design specifications.
10. Heaters shall be operational.
11. Results of system function tests shall be in accordance with NETA ATS Section 8.
12. Phasing check shall prove the motor control center phasing is correct and in accordance with the system design.

3.8.5 Circuit Breakers (600 V) – Insulated-Case/Molded-Case

(a) Visual and Mechanical Inspections:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect for physical and mechanical damage.
3. Inspect for proper alignment and anchorage.
4. Verify the unit is clean.
5. Operate the circuit breaker to insure smooth operation.
6. Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels or NETA ATS Table 100.12.
7. Inspect operating mechanism, contacts, and arc shuts in unsealed units.
8. Perform adjustments for final protective device settings in accordance with coordination study.

(b) Electrical Tests:

1. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1.
2. Perform a contact/pole-resistance test.
3. Determine long-time pickup and delay by primary current injection.
4. Determine short-time pickup and delay by primary current injection.
5. Determine ground-fault pickup and time delay by primary current injection.
6. Determine instantaneous pickup by primary current injection.
7. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data.
8. Verify correct operation of auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, anti-pump function, and trip unit battery condition. Reset all trip logs and indicators.
9. Verify operation of charging mechanism.

(c) Test Values:

1. Bolt torque levels shall be in accordance with manufacturer's instructions. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
2. Settings shall comply with coordination study recommendations.
3. Insulation-resistance values of bus insulation shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1 Values of insulation-resistance less than this table or manufacturer's recommendations should be investigated.
4. Long-time pickup values shall be as shown in coordination study, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors. If manufacturer's curves are not available, trip times shall not exceed the value shown in NETA ATS Table 100.7.
5. Short-time pickup values shall be as shown in coordination study, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band.
6. Ground fault pickup values shall be as shown in coordination study, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band.
7. Instantaneous pickup voltage shall be as shown in coordination study, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band.
8. Pickup values and trip characteristics shall be within manufacturer's published tolerances.
9. Minimum pickup voltage of the shunt trip and close coils shall conform manufacturer's published data. In the absence of the manufacturer's published data, refer to NETA ATS Table 100.20.
10. Breaker open, close, trip, trip-free, anti-pump, and auxiliary features shall function as designed.
11. The charging mechanism shall operate in accordance with manufacturer's published data.

3.8.6 Motor Controllers

(a) Refer to paragraph 3.8.4 for appropriate inspections and tests for motor circuit protectors.

(b) Visual and Mechanical Inspections: Include following inspections and related work:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect for physical and mechanical damage.
3. Inspect for proper alignment, anchorage, and grounding.
4. Verify the unit is clean.
5. Check tightness of accessible bolted electrical connections by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels or NETA ATS Table 100.12.
6. Test all electrical and mechanical interlocking systems for correct operation and sequencing.
7. Verify correct barrier and shutter installation and operation.
8. Exercise all active components and confirm correct operation of all indicating devices.
9. Inspect contactors.

    a. Verify mechanical operation.
    b. Verify contact gap, wipe, alignment, and pressure in accordance with manufacturer's published data.

10. Verify overload protection rating is correct for its application. Set adjustable or programmable devices according to protective device coordination study.
11. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

(c) Electrical Tests:

1. Perform insulation-resistance tests for one minute on contactor(s), phase-to-phase and phase-to-ground and across the open contacts in accordance with NETA ATS Table 100.1.
2. Perform a contact resistance test.
3. Measure blowout coil circuit resistance.
4. Measure resistance of power fuses.
5. Energize contactor using an auxiliary source. Adjust armature to minimize operating vibration where applicable.
6. Test control power transformer in accordance with paragraph 3.8.7.
7. Test motor protection devices in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Section 7.9.
8. Verify operation of cubicle space heater.

(d) Test Values:

1. Bolt torque levels shall be in accordance with manufacturer's instructions. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
2. Mechanical and electrical interlocks shall operate in accordance with system design.
3. Barrier and shutter installation and operation shall be in accordance with manufacturer's design.
4. Indicating devices shall operate in accordance with system design.
5. Insulation-resistance values shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1 Values of insulation-resistance less than this table or manufacturer's recommendations should be investigated.
6. Resistance of blowout coils shall be in accordance with manufacturer's published data.
7. Resistance values shall not deviate by more than 15 percent between identical fuses.
8. Contractor coil shall operate within minimal vibration and noise.
9. Control power transformer test results shall be in accordance with paragraph 3.8.7.
10. Motor protection parameters shall be in accordance with manufacturer's published data.
11. System function test results shall be in accordance with manufacturer's published data and system design.
12. Heaters shall be operational.

3.8.7 Instrument Transformers

(a) Visual and Mechanical Inspection:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect for physical and mechanical damage.
3. Verify correct connection of transformers with system requirements.
4. Verify that adequate clearances exist between primary and secondary circuit wiring.
5. Verify the unit is clean.
6. Check tightness of accessible bolted electrical connections by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels or NETA ATS Table 100.12.

7. Verify that all required grounding and shorting connections provide contact.
8. Verify correct primary and secondary fuse sizes for voltage transformers.
9. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

(b) Electrical tests:

1. Confirm transformer polarity electrically.
2. Verify connection at secondary CT leads by driving low current through leads and checking for this current at applicable devices.
3. Confirm transformer ratio.
4. Measure insulation resistance of transformer secondary and leads with 500 v megohm meter.
5. Measure transformer primary insulation with applicable overpotential tests.
6. Verify connection of secondary PT leads by applying low voltage to leads and checking for this voltage at applicable devices.

3.8.8 Metering and Instrumentation

(a) Visual and Mechanical Inspection:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect meters and cases for physical.
3. Clean front panel and remove shipping restraint material.
4. Verify tightness of electrical connections.
5. Record model number, serial number, firmware revision, software revision, and rated control voltage.
6. Verify operation of display and indicating devices.
7. Record passwords.
8. Verify unit is grounded in accordance with manufacturer’s instructions.
9. Verify unit is connected in accordance with manufacturer’s instructions and approved shop drawings.
10. Set all required parameters including instrument transformer ratios, system type, frequency, power demand methods/intervals, and communications requirements.

(b) Electrical Tests:

1. Apply voltage or current as appropriate to each analog input and verify correct measurement and indication.
2. Confirm correct operation and setting of each auxiliary input/output feature including mechanical relay, digital, and analog.
3. After initial system energization, confirm measurements and indications are consistent with loads present.

(c) Test Values:

1. Tightness of electrical connections shall assure a low resistance.
2. Display and indicating devices shall operate per manufacturer's published data.
3. Measurement and indication of applied values of voltage and current shall be within manufacturer's published tolerances for accuracy.

3.8.9 Grounding System

(a) Visual and Mechanical Inspection:

1. Verify grounding system is in compliance with drawings, specifications, and NFPA 70 National Electrical Code Article 250.
2. Inspect physical and mechanical condition of ground system.
3. Inspect tightness of accessible bolted electrical connections by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels or NETA ATS Table 100.12.

(b) Electrical Tests:

1. 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.
2. 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.
3. Perform tests by 2 point method according to Section 9.03 of IEEE 81.

(c) Maximum grounding resistance values are 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.
5. Manhole Grounds: 10 ohms.

(d) 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.

(e) 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.

3.8.10 Ground Fault Systems

(a) Visual and Mechanical Inspections:

1. Inspect for physical damage and compliance with Drawings and Specifications.
2. Inspect neutral main bonding connection to ensure following.

   i. Zero sequence system grounded upstream of sensor.
   ii. Ground strap systems grounded through sensing device.
   iii. Ground connection made ahead of neutral disconnect link.

3. Inspect control power transformer to ensure adequate capacity for system.
4. Manual operate monitor panels (if present) for following:

   i. Trip test.
   ii. No trip test.
   iii. Non-automatic reset.

5. Record proper operation and test sequence.
6. Inspect zero sequence systems for symmetrical alignment of core balance transformers about current carrying conductors.
7. Verify ground fault device circuit nameplate identification by actuation observation.
8. Pickup and time delay settings shall be set in accordance with settings developed through coordination study and as approved by 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, neutral-ground disconnect link removed, neutral insulation resistance measured, and link replaced.
3. Relay pickup current shall be determined by primary injection at sensor and circuit interrupting device operated.
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.
6. Zone interlock system shall be tested by simultaneous sensor current injective and monitoring blocking function.

(c) Test Parameters:

1. System neutral insulation shall be minimum of 100 ohms, preferably 1 megohm or larger.
2. Relay pickup current shall be within 10% of device dial or fixed setting, and in no case greater than 1,200 amp.
3. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves, but in no case longer than 1 sec.

3.8.11 Transfer Switches

(a) Visual and Mechanical Inspections:

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, grounding, and required clearances.
4. Verify the unit is clean.
5. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
6. Verify that manual transfer switch warnings are attached and visible.
7. Verify tightness of all control connections.

8. Inspect bolted electrical connections for high resistance using one or more of the following methods:
   a. Use of low-resistance ohmmeter in accordance with NETA ATS 7.5.1.2.2.
   b. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
   c. Perform thermographic survey in accordance with NETA ATS Section 9.

9. Perform manual transfer operation.
10. Verify positive mechanical interlocking between normal and alternate sources.

(b) Electrical Tests:

1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with NETA ATS Section 7.22.3.1.
2. Perform a contact/pole-resistance test.
3. Verify settings and operation of control devices.
4. Calibrate and set all relays in accordance with NETA ATS Section 7.9.
5. Verify phase rotation, phasing, and synchronized operation as required by application.
6. Perform automatic transfer tests:

   a. Simulate loss of normal power.
   b. Return to normal power.
   c. Simulate loss of emergency power.
   d. Simulate all forms of single-phase conditions.

7. Verify correct operation and timing of the following functions:

   a. Normal source voltage-sensing and frequency-sensing relays.
   b. Engine state sequence.
   c. Time delay upon transfer.
   d. Alternate source voltage-sensing and frequency-sensing relays.
   e. Automatic transfer operation.
   f. Interlocks and limit switch function.
   g. Time delay and retransfer upon normal power restoration.
   h. Engine cool down and shutdown feature.

(c) Test Values:

1. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar connections by more than 50 percent of the lowest value.
2. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
3. Results of the thermographic survey shall be in accordance with NETA ATS Section 9.
4. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
5. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. In the absence of manufacturer's published data, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
6. Control devices shall operate in accordance with manufacturer's published data.
7. Relay test results shall be in accordance with NETA ATS Section 7.9.
8. Phase rotation, phasing, and synchronization shall be in accordance with system design specifications.
9. Automatic transfer shall operate in accordance with manufacturer's design.
10. Operation and timing shall be in accordance with manufacturer's and system design requirements.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16B - ELECTRICAL POWER SYSTEM STUDIES

1. GENERAL:

1.1 Section Includes:

1.1.1 Short circuit study, protective device evaluation study, protective device coordination study, and arc flash study on entire electrical power distribution system.

1.1.2 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 studies.

1.2 Contractor shall engage services of independent engineering firm (cannot be same manufacturer of equipment supplied on project) for purpose of performing power system studies as specified. Independent engineering firm shall have a minimum of 10 years' experience in Power System Studies.

1.3 The Electrical Power System Studies shall be performed and the shop drawing shall be submitted and approved prior to submitting the shop drawing for the electrical equipment.

1.4 A Study Report providing summary of results of power systems study. Include:

1.4.1 Description, purpose, basis, and scope of study and single line diagram of power system.

1.4.2 Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties and commentary regarding same.

1.4.3 Protective device time versus current color coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

1.4.4 Fault current calculations including definition of terms and guide for interpretation of computer printout.

1.4.5 Tabulation of appropriate tap settings for relay units.

1.4.6 Arc flash calculations and tabulation of incident energy level (calories/cm^2) for each equipment location and recommended personal protective equipment (PPE).

1.5 Regulatory Requirements:

1.5.1 Conform to those listed in Section 16A.

1.6 Qualifications of engineering firm:

1.6.1 Corporately and financially independent engineering organization which can function as unbiased engineering authority, professionally independent of manufacturers, suppliers and installers of equipment or system studies as specified.

1.6.2 Study report shall be signed and sealed by Professional Engineer licensed in the State of Illinois.

1.6.3 Engineering organization may be testing organization.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

(Not Used)

3. EXECUTION:

3.1 Studies to include the following:

3.1.1 Utility Company incoming service lines.
3.1.2 Main switching station.
3.1.3 Power transformers.
3.1.4 Generator System.
3.1.5 Low voltage switchgear.
3.1.6 Motor control centers.
3.1.7 Power and lighting distribution panels.
3.1.8 Cable, wire, and conduit systems.
3.1.9 Studies do not include equipment as shown on Drawings indicated as future.
3.1.10 Contractor and company performing the power system studies are responsible for gathering information on the equipment and conductors required to perform the power system studies.

3.2 Short Circuit Study

3.2.1 Provide complete report with printout data sheets using digital computer type programs as part of study.

3.2.2 Include utilities' short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected, and other source impedances.

3.2.3 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.

3.3 Equipment Device Evaluation Study

3.3.1 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.

3.4 Equipment Device Coordination Study

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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.

3.5 Arc Flash Study

3.5.1 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).

3.5.2 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/cm^2. Provide suggested alternate equipment and settings to minimize incident energy levels.

3.5.3 Provide incident energy level (calories/cm^2) for each equipment location and recommended PPE.

3.5.4 Based on the results of the incident energy study provide and install a warning label (orange <40 cal/cm^2) or danger label (red > 40 cal/cm^2) 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.

3.5.5 Provide one day of arc flash safety training, travel time excluded and at jobsite or classroom designated by the Department, 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.
(b) Selection and utilization of personal protective equipment.
(c) Safe work practices and procedures.

3.6 Protective Device Testing, Calibration, and Adjustment

3.6.1 Comply with Section 16A, see Testing Electrical Systems under paragraph 3.8.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16C - BASIC ELECTRICAL MATERIALS AND METHODS

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 16A – General Electric Provisions.
1.2.2 Section 16C – Basic Electrical Equipment Materials and Methods.
1.2.3 Section 16D – Supervisory Control and Data Acquisition (SCADA) Equipment.

1.3 References

Codes and Standards referred to in this Section are:

Fed. Spec.

W-F-408 - Fittings for conduit, metal (rigid thick wall and thin wall).

ASTM B-3 - Specification for soft annealed copper wire.

ASTM B-8 - Specification for concentric lay stranded copper conductors, hard medium, hard or soft.

ASTM B-33 - Specification for tinned or soft or annealed copper wire for electrical purposes.

IEEE 383 - Class 1E electric cables, field splices and connections for nuclear power generating stations, standard for type test for.

ASTM D 635 - Test method for rate of burning and/or extent and time of burning of self-supporting plastics in a horizontal position.

HH-I-595 - Insulation tape, electrical, pressure sensitive adhesive, plastic.

Fed. Spec.

WC-596 - Electrical power connectors.

NEC - National Electrical Code

NEMA WD-1 - General requirements for ac switches.

UL 50 - Cabinets and boxes.

UL96A - Installation Requirements for Lightning Protection Systems.

ANSI/NFPA 780- Standard for the Installation of Lightning Protection Systems.

1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A for the following items: Cabinets and Enclosures with NEMA classification higher than NEMA 1.

1.4.2 All iron and steel products, which are to be incorporated into the raceway work, including conduit and all conduit fittings, shall be domestically manufactured or produced and fabricated as specified in Article 106.

1.4.3 Raceway, Conductors and Cables, Electrical Identification, Grounding, Wiring Devices, Supporting Devices, and Cabinets and Enclosures with NEMA 1 classification submittals are not required if CONTRATCOR supplies material or equipment as specified. If CONTRACTOR proposes substitutes to material or equipment, submittals identified below are required.

(a) Product data.
(b) Submit in accordance with Section 1A.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Lightning Protection Manufacturer Requirements

1.6.1 Contractor shall retain services of installing manufacturer who is recognized and is UL listed for lightning protection systems and subscribes to the UL Follow-Up Service as herein specified. Installed shall provide four (4) copies of recent project qualifications and project specific floor plan layout and detail submittals.

1.7 Basis of Payment

1.7.1 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.

1.7.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Raceways

2.1.1 Metal Conduit and Tubing

(a) Galvanized Rigid Steel Conduit: ANSI C80.1.

(b) Flexible Metal Conduit: Zinc-coated steel.

(c) Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

(d) Plastic- Coated Steel Conduit and Fittings: UL Listed (UL 6); rigid steel conduit system as specified with coated interior walls and external PVC coating, 40 mil (.1 mm) thick. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations shall be UL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating shall be UL listed.

1) The PVC coating shall have the following characteristics:

Hardness:	85+ Shore A Durometer
Dielectric Strength:	400V/mil @ 60 Hz
Aging:	1,000 Hours Atlas Weatherometer
Temperature	The PVC compound shall conform at 0º F. to Federal Specifications PL-406b, Method 2051, Amendment 1 of 25 September 1952 (ASTM D 746)
Elongation:	200%

2) The exterior and interior galvanized conduit surface shall be chemically treated to enhance PVC coating adhesion and shall also be coated with a primer before the PVC coating to ensure a bond between the zinc substrate and the PVC coating. The bond strength created shall be greater than the tensile strength of the plastic coating.

3) The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above -1°C (30°F).

4) An interior urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. The interior coating shall be applied in a manner so there are no runs, drips, or pinholes at any point. The coating shall not peel, flake, or chip off after a cut is made in the conduit or a scratch is made in the coating.

5) Conduit bodies shall have a tongue-in-groove gasket for maximum sealing capability. The design shall incorporate a positive placement feature to assure proper installation. Certified test results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours shall be submitted for review when requested by the Engineer.

6) The PVC conduit shall pass the following tests:

Exterior PVC Bond test RN1:

Two parallel cuts 13 mm (1/2 inch) apart and 40 mm (1 1/2 inches) in length shall be made with a sharp knife along the longitudinal axis. A third cut shall be made perpendicular to and crossing the longitudinal cuts at one end. The knife shall then be worked under the PVC coating for 13 mm (1/2 inch) to free the coating from the metal.

Using pliers, the freed PVC tab shall be pulled with a force applied vertically and away from the conduit. The PVC tab shall tear rather than cause any additional PVC coating to separate from the substrate.

Boil Test:

Acceptable conduit coating bonds (exterior and interior) shall be confirmed if there is no disbondment after a minimum average of 200 hours in boiling water or exposure to steam vapor at one atmosphere. Certified test results from a national recognized independent testing laboratory shall be submitted for review and approval. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D870, a 6" length of conduit test specimen shall be placed in boiling water. The specimen shall be periodically removed, cooled to ambient temperature and immediately tested according to the bond test (RN1). When the PVC coating separates from the substrate, the boil time to failure in hours shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, a 6" conduit test specimen shall be cut in half longitudinally and placed in boiling water or directly above boiling water with the urethane surface facing down. The specimen shall be periodically removed, cooled to ambient temperature and tested in accordance with the Standard Method of Adhesion by Tape Test (ASTM D3359). When the coating disbonds, the time to failure in hours shall be recorded.

Heat/Humidity Test:

Acceptable conduit coating bonds shall be confirmed by a minimum average of 30 days in the Heat and Humidity Test. The RN1 Bond Test and the Standard Method for Measuring Adhesion by Tape Test shall be utilized.

Exterior Adhesion. In accordance with ASTM D1151, D1735, D2247 and D4585, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. The specimens shall be periodically removed and a bond test (RN1) performed. When the PVC coating separates from the substrate, the exposure time to failure in days shall be recorded.

Interior Adhesion. In accordance with ASTM D3359, conduit specimens shall be placed in a heat and humidity environment where the temperature is maintained at 150°F (66°C) and 95% relative humidity. When the coating disbonds, the time to failure in hours shall be recorded.

2.1.2 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.

2.1.3 Fittings

(a) Fittings for steel conduit:

1) Steel or malleable iron, zinc galvanized or cadmium plated.
2) Do not use set screw or indentor type fittings.
3) Do not use aluminum or die cast fittings.
4) GRS Connectors and Couplings:

i. Threaded.
ii. Insulated throat.
iii. Gland compression type.
iv. 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. All liquid tight flexible metal conduit fittings shall have an insulated throat to prevent abrasion of the conductors sand shall have a captive sealing O-ring gasket. The fittings shall be listed under UL 514B. The insulated throat shall be rated up to 105º C.

(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:

i. Explosionproof - Safe for Class 1, Group C and D.
ii. Capable of passing minimum 25 cc water/min and minimum 0.05 cu ft air/min at atmospheric pressure.

2) Condensate Drain:

i. Conduit outlet body, Type T.
ii. Threaded, galvanized plug with 3/16 in. drilled holed through plug.

(i) Hazardous Areas:

1) Explosionproof.
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.

2.1.4 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.

2.2 Conductors and Cables

2.2.1 Building Wire and Cables

(a) UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as required to meet application and NEC requirements.

(b) Wire and cable for 600 volts and below: Soft drawn, copper wire with 600 volt insulation.

1) Conductors:

i. Annealed, copper in accordance with ASTM B33.
ii. Stranding: Class B in accordance with ASTM B8.

2) Insulations and Coverings:

i. Rubber: Conform to NEMA WC 3.
ii. Thermoplastic: Conform to NEMA WC 5.
iii. Cross-Linked Polyethylene: Conform to NEMA WC 7.
iv. Ethylene Propylene Rubber: Conform to NEMA WC 8.

(c) Feeders, service conductors, and motor feeders: Single conductor Type XHHW-2.

(d) Branch Circuits:

1) Single Conductor Type THHN/THWN (90° C): 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 following basis.

i. 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.

(e) Control Circuits:

1) Single conductor Type THHN/THWN (90° C): Above ground and underfloor conduits.
2) No. 12 AWG minimum size (unless otherwise noted).
3) Multi-wire cable assembly: Duct bank conduits.

(f) 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 THHW/THWN (90° C), above ground and underfloor conduits.
2) Multi-wire cable assembly: Duct bank conduits.

(g) 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.

(i) Telephone wire, above ground conduits:

1) Vinyl insulation, tinned copper, solid twisted pair, cabled conductors, and silver gray vinyl jacket.

i. Up to 4 conductors per cable: 22 AWG solid wire.
ii. Over 4 conductors per cable: 24 AWG solid wire.
iii. Duct Bank: High density polyethylene jacketed multi-wire cable assemblies.

(k) Fire Alarm Circuits: Type THHN/THWN, copper conductor, in raceway.

(l) 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.

i. Bare soft stranded No. 14 or 12 AWG copper in accordance with ASTM B3.
ii. Class B stranded in accordance with ASTM B8.
iii. Type THWN insulation also meeting requirements of NEMA WC-5 with armor-nylon in accordance with UL 83-THHN/THWN.
iv. Color coded in accordance with NEMA WC-5 Method I Table K-2.
v. Cabled with suitable fillers.
vi. Overall black FR-PVC, 90°C, 600 volt sunlight resistant jacket.

4) Shielded Instrumentation:

i. Bare soft stranded No. 16 AWG copper in accordance with ASTM B3.
ii. Class B stranded tinned copper in accordance with ASTM B8.
iii. PVC with nylon armor insulation.
iv. Twisted pairs color coded in accordance with NEMA WC-5 Method I Table K-2, and numbered.
v. Individual and overall aluminum mylar shields and seven strand tinned copper drain wires.
vi. Overall black FR-PVC 90°C 600 volt sunlight resistant jacket.

2.2.2 Connectors and Splices

(a) Underwriters Laboratories (UL) -listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

(b) Select to comply with Project's installation requirements and as required to meet application.

(c) Conductors No. 10 AWG and Smaller: 3M Electric Products, Skotchlok, or equal pre insulated spring connector. Comply with manufacturer's packaging requirements for number, size, and combination of conductors.

(d) Conductors No. 8 AWG and Larger: Bronze 2-bolt type connectors with spacer.

2.2.3 Terminations

(a) Power Conductors: Compression crimp type lugs.

(b) Control and Instrumentation Conductors: Compression crimp type fork tongue, insulated support type lugs on terminal strips. Do not splice.

2.3 Electrical Identification

2.3.1 Raceway and Conductor Labels

(a) Manufacturer’s 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.

(b) 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.

1) Color: Black legend on orange field.
2) Legend: Indicates voltage.

(c) Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is over-laminated with clear, wear and chemical resistant coating.

(d) 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.

(e) 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).

(f) Underground Line Warning Tape: Permanent, bright colored, continuous printed, vinyl tape with following features:

1) Size: Not less than 6 in. wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2) Compounded for permanent direct burial service.
3) Embedded continuous metallic strip or core.
4) Printed Legend: Indicates type of underground line.

(g) 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.

(h) Plasticized Card Stock Tags: Vinyl cloth with preprinted and field printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.

(i) 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.

(j) 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).

2.3.2 Engraved Nameplates and Signs

(a) Manufacturer’s Standard Products: 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.

(b) 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.

1) Engraved Legend: Black letters on white face.
2) Punched for mechanical fasteners.

(c) 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.

(d) 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.

(e) 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.

2.3.3 Miscellaneous Identification Products

(a) Cable Ties: Fungus-inert, self extinguishing, 1 piece, self locking, Type 6/6 nylon cable ties with following features:

1) Minimum Width: 3/16 in. (5 mm).
2) Tensile Strength: 50 lb (22.3 kg) minimum.
3) Temperature Range: Minus 40 to 185°F (Minus 4 to 85°C).
4) Color: As indicated where used for color coding.

(b) Paint: Alkyd-urethane enamel. Primer as recommended by enamel manufacturer.

2.4 Grounding

2.4.1 Grounding and Bonding Products

(a) Governing Requirements: Where types, sizes, ratings, and quantities are in excess of NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.

2.4.2 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.

2.4.3 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. (1 mm) thick and 2 in. (50 mm) wide, except as indicated.

2.4.4 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.

2.4.5 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 (3 mm) thick, size as indicated.

(c) Test Wells: Fabricate from 15 in. (400 mm) long, square-cut sections of 8 in. (200 mm) diameter, Schedule 80, PVC pipe or as detailed on Drawings.

2.5 Wiring Devices

2.5.1 Manufacturers

(a) Wiring Devices:

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.
7) Or Approved Equal.

(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.
4) Or Approved Equal.

2.5.2 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 or Crouse-Hinds 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.

2.5.3 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.

2.5.4 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.

2.5.5 Switches

(a) Snap Switches: Heavy duty: quiet type.

(b) Snap Switches in Hazardous (Classified) Locations:

1) Appleton EFS series, Crouse-Hinds EDS series, or approved equal.
2) Comply with UL Standard 894.

(c) Color: White unless otherwise indicated or required by Code.

2.5.6 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. (1 mm) thick, Type 302, satin finished stainless steel.
3) Unfinished Spaces: Galvanized steel.
4) Exterior and wet locations: Weatherproof plates and covers.

2.6 Supporting Devices

2.6.1 Materials

(a) Stainless Steel.

2.6.2 Manufactured Supporting Devices

(a) Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

(b) Fasteners: Types, materials, and construction to match support materials listed above.

(c) Modular Mechanical Conduit Seals: 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.

(d) Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers.

(e) 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.

2.6.3 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:

i. 3 in. and smaller: 20 ga.
ii. 4 in. to 6 in.: 16 ga.
iii. 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.

2.6.4 Fire Resistant Joint Sealers

(a) Manufacturers:

1) “Dow Corning Fire Stop Foam,” Dow Corning Corp.
2) “Pensil 851,” General Electric Co.
3) Or Approved 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 Cabinets, Boxes, and Fittings

2.7.1 General

(a) 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.

2.7.2 Miscellaneous Materials and Finishes

(a) Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

(b) Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

(c) Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

(d) Finishes:

1) Exterior Finish: Galvanized or Gray baked enamel for items exposed in finished locations except as otherwise indicated.
2) Interior Finish: Where indicated, white baked enamel.

(e) Fastener Style:

1) Stainless steel door clamp assembly (Hoffman SS6LP series, Weigmann SSN4 series or approved equal) for stainless steel boxes. Screw-down clamps are not acceptable.
2) Snap-hinge covers or quarter turn semi-flush oil tight latch for non-metallic boxes.
3) External quick-release or quarter turn semi-flush oil tight latches for galvanized boxes.
4) Spring loaded, triple-thread, captive hex-head bolts for cast metal boxes.

2.7.3 Metal Outlet, Device, and Small Wiring Box

(a) General:

1) Conform to UL 514A and UL 514B.
2) Boxes shall be of type, shape, size, and depth to suit each location and application.

(b) 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.

(c) 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.

2.7.4 Pull and Junction Boxes

(a) General: Comply with UL 50 for boxes over 100 cu in. volume. Unless otherwise noted, boxes shall have continuous hinge on one side with fastening mechanism on the opposite side. Cover and fasteners shall be of material same as box and shall be of size and shape to suit application.

(b) 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.

(c) Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 316 of ASTM A167. Where necessary to provide rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.

(d) Galvanized Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

(e) 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. Provide flat cover with multiple hinges and stainless steel, spring loaded, triple-thread, captive hex-head bolts.

2.7.5 Terminal Strips for Junction Boxes

(a) Manufacturers:

1) Square D Co.
2) Buchanan.
3) Or Approved Equal.

(b) Channel mount snap-on type.

(c) Individual gangable with nylon bases.

(d) Solderless box lug type rated at 600 v to accommodate No. 22 to 8 AWG wire or as otherwise indicated.

(e) Provide 50% spare terminals.

2.8 Lightning Protection

2.8.1 Acceptable Manufacturers

(a) The system components shall be manufactured by a company that has been specializing in the design and manufacture of UL listed lightning protection equipment for at least five (5) years.

2.8.2 Materials

(a) All manufactured and fabricated components shall conform to NFPA 780 Class I or Class II as needed for the structures on which they will be installed. The system component s shall be fabricated from the following metals:

(b)

1) Conductors – Copper
2) Air Terminals – Aluminum

(c) All materials furnished for the lightning protection system shall bear the inspection label of UL.

(d) Class I materials shall be used on structures that do not exceed 75 feet in height and Class II materials shall be used on structures that are 75 feet or higher above average grade.

(e) Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.

(f) Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

2.8.3 Air Terminals

(a) Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20’-0” along ridges and along the perimeter of flat or gently sloping roofs (flat or gently sloping roofs include roofs that have a pitch less than 3:12). Flat or gently sloping roofs exceeding 50’-0” in width shall be protected with additional air terminals located at intervals not exceeding 50’-0”. Air terminals shall be located within two feet of roof edges and outside corners or protected areas.

(b) Air terminals shall be installed on stacks, flues, mechanical units and other metallic objects not located within a zone of protection, which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specific standards using main size conductor and bonding plates having a minimum of three square inches of surface contact area.

(c) Air terminal bases shall be securely fastened to the structure in accordance with the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.

(d) Main conductors shall be sized in accordance with the specified standards for Class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connection with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees not have a radius of bend less than eight inches.

(e) Down conductors shall be sized in accordance with specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. When down conductors are installed exposed on the exterior of a structure and are subject to physical damage or displacement, guards shall be used to protect the conductor a minimum of six feet above grade. Metallic guards shall be bonded at each end.

2.8.4 Roof Penetrations

(a) Roof penetrations required for down conductors shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through roof.

2.8.5 Ground Terminations

(a) The down conductor shall be connected to the ground electrode using an exothermically welded connection.

3. EXECUTION:

3.1 Raceways

3.1.1 Examination

(a) Examine surfaces to receive raceways, wireways, and fittings for compliance with installation tolerances and other conditions affecting performance of raceway system.

(b) Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

(c) Install conduit identification tags as shown on Drawings.

3.1.2 Wiring Methods

(a) Outdoors, Damp or Wet Locations: Use following wiring methods unless otherwise noted on Drawings:

1) Outdoor Exposed: PVC-Coated galvanized rigid steel.
2) Damp or Wet Locations: PVC-Coated galvanized rigid steel.
3) Concealed: Galvanized rigid steel.
4) Underground Power and Control, Single Run: Rigid nonmetallic (PVC) conduit.

i. Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.

5) Underground Power and Control, Grouped: Rigid nonmetallic (PVC) conduit.

i. Concrete encased except for area lighting branch circuits or as otherwise noted on Drawings.

6) Underground Shielded Instrumentation Cables and Shielded Instrumentation Cables run in concrete slabs, Single Run or Grouped: Galvanized rigid steel.

7) Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.

(b) Indoor Non-Hazardous Dry Locations: Use following wiring methods unless otherwise noted.

1) Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit.
2) Exposed: Galvanized rigid steel conduit.

(c) Hazardous classified locations: Use the following wiring methods unless otherwise noted on drawings.

1) Exposed and concealed: PVC-Coated Galvanized rigid steel conduit.

(d) Use 3/4 in. minimum size unless otherwise noted except conduit runs to room light switches may be 1/2 in.

(e) Unless specifically indicated otherwise on Drawings or in Specifications, use galvanized rigid steel conduit for general wiring.

(f) 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.

1) Underground conduit shall be minimum of 1 in., buried at depth of not less than 24 in. below grade.
2) Provide conduits or ducts terminating below grade with means to prevent entry of dirt and moisture.
3) When using concrete encased PVC conduit provide PVC coated galvanized rigid steel elbows.

(g) Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1 in. (25 mm) concrete cover.

1) Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2) Space raceways laterally to prevent voids in concrete.
3) 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.
4) When at right angles to reinforcement, place conduit close to slab support.
5) Conduits embedded in concrete frame shall comply with applicable provisions of ACI 318.

3.1.3 Installation

(a) Conceal raceways by enclosing within finished walls, ceilings, and floors, unless otherwise indicated.

(b) Provide watertight conduit system where installed in wet places, underground or where buried in masonry or concrete.

1) Use threaded hubs when entering top of enclosures.
2) Use sealing type locknuts when entering sides or bottom of enclosures.

(c) 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.

(d) Install raceways level and square and at proper elevations. Provide adequate headroom.

(e) Complete raceway installation before starting conductor installation.

(f) Support raceway as specified in Section 16C-2.6.

(g) Use temporary closures to prevent foreign matter from entering raceway.

(h) Run concealed raceways with minimum of bends in shortest practical distance considering type of building construction and obstructions, except as otherwise indicated.

(i) Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow surface contours as much as practical.

1) 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.
2) Run parallel or banked raceways together, on common supports where practical.
3) 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.

(j) Join raceways with fittings designed and approved for purpose and make joints tight.

1) Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2) Use insulating bushings to protect conductors.

(k) 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.

(l) 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.

(m) 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.

(n) 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.

(o) 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.

(p) Where PVC coated conduit is utilized, all conduit fittings, couplings and clamps shall be PVC coated. All other mounting hardware and appurtenances shall be stainless steel.

The personnel installing the PVC coated conduit must be trained and certified by the PVC coated conduit Manufacturer or Manufacturer’s representative to install PVC coated conduit. Documentation demonstrating this requirement must be submitted for review and approval.

3.1.4 Conduit Stub-Ups

(a) Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above finished slab.

(b) 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.

3.1.5 Conduit Bends

(a) 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.

(b) Provide NEMA standard conduit bends, except for conduits containing medium voltage cable, fiber optic cable, or conductors requiring large radius bends.

3.1.6 Flexible Connections

(a) Use maximum of 6 ft (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures.

(b) 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) liquidtight flexible metal conduit unless otherwise indicated.

(c) Use liquidtight flexible conduit in wet or damp locations.

(c) Use approved flexible connections in hazardous locations.

(d) Install separate ground conductor inside flexible conduit connections.

3.1.7 Fittings

(a) 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:

1) Where conduits enter or leave hazardous locations.
2) Where conduits pass from warm locations to cold locations, such as boundaries of refrigerated spaces and air-conditioned spaces.
3) Where otherwise required by NEC.

(b) 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.

(c) Install automatic breather drain fittings according to manufacturer's 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.

1) Where vertical seals are installed.
2) Low points in conduit system.
3) Below filed instrumentation at junction boxes of flexible and rigid conduit.
4) Where otherwise required by NEC.

(d) Install wall entrance seal as dictated by application where conduits pass through foundation walls below grade.

(e) Install conduit expansion fittings complete with bonding jumper in following locations.

1) Conduit runs crossing structural expansion joints.
2) Conduit runs attached to 2 separate structures.
3) Conduit runs where movement perpendicular to axis of conduit may be encountered.

(f) 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.

3.1.8 Grounding

(a) Ground in accordance with Section 16C-2.4.

(b) Provide grounding connectors for raceway, boxes, and components 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.

3.1.9 Protection

(a) Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

1) Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2) Repair damage to PVC or paint finishes with matching touch-up coating recommended by manufacturer.

3.1.10 Cleaning

(a) Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.2 Electrical Identification

3.2.1 Installation

(a) Install As indicated where used for color coding.

(b) Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

(c) 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.

(d) Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

(e) Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

(f) Install painted identification as follows:

1) Clean surfaces of dust, loose material, and oily films before painting.
2) 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 s
3) Apply one intermediate and one finish coat of silicone alkyd enamel.
4) Apply primer and finish materials according to manufacturer's instructions.

(g) Identify Raceway Systems containing power, control and instrumentation conductors with adhesive labels. Locate labels at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.5 m) in congested areas. Labels shall be color coded and identify the contents (i.e. orange label with black print reading 480V FEEDER – ID #001)

(h) Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of systems listed below for identification.

1) Fire Alarm Systems: Red.
2) Combined Fire Alarm and Security System: Red and blue.
3) Security System: Blue and yellow.
4) Telecommunications System: Green and yellow.

(i) Install Circuit Identification Labels on Boxes: Label externally as follows:

1) Exposed Boxes: Pressure sensitive, self adhesive plastic label on cover.
2) Concealed Boxes: Plasticized card stock tags.
3) Labeling Legend: Permanent, water proof listing of panel and circuit number or equivalent.

(j) Identify Paths of Underground Electrical Lines: During trench backfilling, for grade. Where multiple lines installed in common trench or concrete envelope, provide multiple underground line warning tapes, one for each 16 inches of width of lines. If lines do not exceed an overall width of 16 in. (400 mm), use single line marker.

1) Install line marker for underground wiring, both direct buried and in raceway.

(k) Color Code Conductors: Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.

1) Field applied, color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.

i. 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.

ii. 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.

2) 208/120-V Systems: As follows:

i. Phase A: Black.
ii. Phase B: Red.
iii. Phase C: Blue.
iv. Neutral: White.
v. Ground: Green.

3) 480/277-V Systems: As follows:

i. Phase A: Brown.
ii. Phase B: Orange.
iii. Phase C: Yellow.
iv. Neutral: Grey (comply with NEC exhibit 200.3).
v. Ground: Green.

(l) Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, and switchboard rooms.

1) Legend: 1/4 in. (6.4 mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2) Fasten tags with nylon cable ties; fasten bands using integral ears.

(m) 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: Ide

(n) Apply warning, caution, and instruction signs and stencils as follows:

1) 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.
2) 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.

(o) Install identification as follows:

1) 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 field. Apply labels for each unit of following categories of equipment.

i. Panelboards, electrical cabinets, and enclosures.
ii. Access doors and panels for concealed electrical items.
iii. Motor control centers.
iv. Push button stations.
v. Power transfer equipment.
vi. Transformers.
vii. Power generating units.
viii. Telephone switching equipment.
ix. Fire alarm master station or control panel.
x. Security monitoring or control panel.

2) 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.

3.3 Conductors and Cables

3.3.1 Installation

(a) Install wires and cables as indicated, according to manufacturer's written instructions and NECA "Standard of Installation".

(b) 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.

1) Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
2) Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
3) Do not draw conductor into conduits until building is enclosed, watertight, and work causing cable damage has been completed.

(c) Install cable supports for vertical feeders in accordance with NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

(d) For panelboards, cabinets, switches, and equipment assemblies, neatly form, train, and tie cables in individual circuits.

(e) Seal cable and wire entering building from underground between wire and conduit, where cable exits conduit, with non-hardening approved compound.

(f) Install wire and cables in separate raceway systems as follows:

1) Exit lights.
2) Shielded Instrumentation
3) Telephone cables.
4) Fire Alarm System.
5) As required by NEC.

(g) Where control or instrumentation cables are run in underground conduit and ducts provide multi-wire cable assemblies.

(h) 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.

(i) Do not run instrumentation cables into control cabinets or MCC unless cables are terminated in cabinet or MCC.

(j) Wiring at Outlets: Install with at least 12 in. (300 mm) of slack conductor at each outlet.

(k) 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.

(l) 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.

3.3.2 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 mat
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".

3.3.3 Control Circuits

(a) 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.

(b) 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).

3.3.4 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.

3.3.5 Feeders

(a) Extend feeders at full capacity from origin to termination.

(b) Each conduit raceway shall contain only those conductors constituting single feeder circuit.

(c) Where multiple raceways are used for single feeder, each raceway shall contain conductor of each phase and neutral if used.

(d) Where feeder conductors run in parallel, conductors shall be of same length, material, circular-mil area, insulation type, and terminated in same manner.

(e) Where parallel feeder conductors run in separate raceways, raceways shall have same physical characteristics.

(f) Confine feeders to insulated portions of building unless otherwise shown.

(g) On network systems, neutral shall be run with phase wires. Unbalanced neutral current shall not exceed normal or derated conductor capacity.

3.3.6 Motor and Equipment Wiring

(a) Provide motor circuits in accordance with diagrams and schedules on Drawings and code requirements, from source of supply to associated motor starter and starter to motor terminal box, including necessary and required interm

(b) Do not include associated control conductors in same conduit with power conductors.

(c) Provide branch circuits to conform with NEC requirements and nameplate ratings. CONTRACTOR responsible for verification of ratings of motors and installing proper branch circuits.

3.3.7 Color Coding

(a) Conductors for Lighting and Power wiring:

Phase	208/120 v	480/277 v
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Travelers	Pink	Purple
Neutral	White	Grey
Ground	Green	Green

(b) Colored pressure-sensitive plastic tape.

1) Apply in half overlapping turns for minimum of three inches at terminal points, and in junction boxes, pull boxes, and troughs.
2) 3/4 in. wide with colors as specified.
3) Apply last two laps of tape with no tension to prevent possible unwinding.
4) Where cabling markings are covered by tape, apply tags to cable starting size and insulation type.

(c) Color code for insulated power system wiring shall be in accordance with NEC.

(d) Color code for intrinsically safe systems shall be light blue.

3.3.8 Control, Communication and Signal System Identification

(a) Install permanent wire marker at termination.

(b) Identifying numbers and letters on wire markers shall correspond to those on terminal blocks or wiring diagrams used for installing systems.

(c) Plastic sleeve or self adhesive vinyl cloth.

3.3.9 Feeder Identification

(a) Pullboxes and junction boxes, install metal tags on circuit cables and wires to clearly designate circuit identification and voltage.

(b) Comply with Section 16C-2.3.

3.3.10 Field Quality Control

(a) Visual and Mechanical Inspection:

1) Inspect cables for physical damage and proper connection in accordance with single-line diagram.
2) Test cable mechanical connections to manufacturer's recommended
3) Check cable color coding with specifications and NEC standards.

(b) Electrical Tests:

1) Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 min.
2) Perform continuity test to insure proper cable connection.

(c) Test Values:

1) Evaluation results by comparison with cables of same length and type. Investigate any value less than 50 megohms.

3.4 Grounding

3.4.1 Application

(a) Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1) Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:

i. Feeders and branch circuits.
ii. Lighting circuits.
iii. Receptacle circuits.
iv. Singe-phase motor or appliance branch circuits.
v. Three-phase motor or appliance branch circuits.

2) Isolated Grounding-Receptacle Circuits: Install separate insulated equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding-conductor terminal of applicable derived system or service, except as otherwise indicated.
3) Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply raceway with nonmetallic raceway fitting listed for purpose. Install fitting where raceway enters enclosure, and install separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding-conductor terminal of applicable derived system or service, except as otherwise indicated.

(b) Signal and Communications Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1) Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on 1/4 by 2 by 12 in. (6 by 50 by 300 mm) grounding bus.
2) Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

(c) Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

(d) Common Ground Bonding with Lightning Protection System: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system grounding conductor and install in conduit.

(e) Piping Systems and Other Equipment: Comply with NEC Article 250 for bonding requirements.

3.4.2 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) Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

(f) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

(g) 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.

(h) 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.

3.4.3 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) Noncontact Metal Raceway Terminations: Where metallic 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 noncontinuous 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 manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A an

(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.

3.4.4 Underground Distribution System Grounding

(a) Ground pad-mounted equipment and noncurrent-carrying metal items associated with substation by connecting them to underground cable and grounding electrodes.

3.4.5 Field Quality Control

(a) Test in accordance with 16A-3.8.

(b) Testing Agency: Provide services of qualified independent testing agency to perform specified acceptance testing.

(c) Testing: Upon completion of installation of ground-fault protection system and after electrical circuits have been energized, demonstrate capability and compliance with requirements.

1) Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

(d) Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.4.6 Restoration

(a) Restore surface features, including vegetation, at areas disturbed by work of this Section.

1) Re-establish original grades, except as otherwise indicated.
2) Where sod has been removed, replace it as soon as possible after backfilling is completed.
3) Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition.
4) Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
5) Maintain restored surfaces.
6) Restore disturbed paving.

3.5 Wiring Devices

3.5.1 Installation

(a) Mounting height as follows unless otherwise shown on Drawings:

1) Switches: 48 in. above floor.
2) AC Receptacles and Telephone Outlets: 15 in. above floor or 6 in. above counters, counter back-splashes, and baseboard radiators in finished areas; 48 in. above floor in unfinished areas.

(b) Install devices and assemblies plumb and secure.

(c) Install wall plates when painting is complete.

(d) 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.

(e) Protect devices and assemblies during painting.

3.5.2 Identification

(a) Comply with Section 16C-2.3.

1) Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
2) Receptacles: Identify panelboard and circuit number from which served. Use machine printed, pressure sensitive, abrasion resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.5.3 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.

3.5.4 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.

3.5.5 Cleaning

(a) Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

3.6 Supporting Devices

3.6.1 Installation

(a) Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

(b) Coordinate with structural system and with other electrical installation.

(c) Raceway Supports: Comply with NEC and following requirements:

1) Conform to manufacturer's recommendations for selection and installation of supports.
2) Strength of each support shall be adequate to carry present and future load multiplied by safety factor of at least four. Where this determination results in safety allowance of less than 200 lbs, provide additional strength until there is minimum of 200 lbs safety allowanc
3) Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
4) Support parallel runs of horizontal raceways together on trapeze-type hangers.

5) Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 in. and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4 in. dia or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
6) In vertical runs, arrange support so load produced by weight of raceway and enclosed conductors is carried entirely by conduit supports with no weight load on raceway terminals.

(d) Vertical Conductor Supports: Install simultaneously with installation of conductors.

(e) Miscellaneous Supports: Support miscellaneous electrical components as required to produce same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

(f) Sleeves: Install in concrete slabs and walls and other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

(g) Conduit Seals: Install seals for conduit penetrations of slabs below grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

(h) Conduit extending through roof shall pass through ceiling box at roof line.

1) Provide 14 ga minimum copper box complete with watertight soldered seams and flanged to serve as pitch pocket for each conduit.
2) Install conduit and pitch pocket in advance of roofing work.

(i) Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with following:

1) Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wo
2) Holes cut in concrete shall not cut main reinforcing bars. Fill holes that are not used.
3) Load applied to any fastener shall not exceed 25% of proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

3.7 Cabinets, Boxes and Fittings

3.7.1 Installation, General

(a) Locations: Install items where indicated and where required to suit code requirements and installation conditions.

(b) Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

(c) Support and fasten items in accordance with Section 16C-2.11.

(d) Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated

(e) Remove sharp edges where they may come in contact with wiring or personnel.

3.7.2 Applications

(a) Hinged Door Enclosures: Sheet steel, baked enamel finish, NEMA type 12 enclosure except as indicated.

(b) Hinged Door Enclosures in Corrosive Locations: NEMA type 4X stainless steel metal enclosure, or as indicated on Drawings.

(c) 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:

1) 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:
2) Locations Exposed to Weather or Dampness: Galvanized, cast metal, NEMA Type 3R.
3) Wet Locations: Stainless Steel, NEMA type 4X enclosures.
4) Corrosive Locations: Stainless Steel, NEMA type 4X enclosures.
5) Hazardous (Classified) Locations: NEMA type listed and labeled for location and class of hazard indicated.

(d) Pull and Junction Boxes:

1) Interior Dry Locations: Sheet steel, NEMA type 1 for flush mounting and feraloy Type FS or FD cast boxes with threaded conduit hubs for surface mounting.
2) Locations Exposed to Weather or Dampness: Stainless Steel, NEMA type 4X enclosures.
3) Wet Locations: Stainless Steel, NEMA type 4X enclosures.
4) Corrosive Locations: Stainless Steel, NEMA type 4X enclosures.
5) Hazardous (Classified) Locations: NEMA type listed and labeled for location and class of hazard indicated.

3.7.3 Installation of Outlet Boxes

(a) Outlets at Windows and Doors: Locate close to window or door trim.

(b) 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.

(c) 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.

(d) Gasketed Boxes: At following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

1) Exterior Locations.
2) Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
3) Where exposed to moisture laden atmosphere.
4) Where indicated.

(e) Mounting: Mount outlet boxes for switches with long axis vertical or as indicated. Mount boxes for receptacles vertically. Gang boxes shall be mounted with long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on side opposite hinges and close to door trim, even though electrical floor plans may show them on hinge side.

(f) Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4 in. sq by 1-1/2 in. deep, minimum with raised plaster or tile cover. Provide 3/8 in. fixture stud.

(g) Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

(h) Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

(i) Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6 in. depth.

(j) Secure boxes rigidly to substrate upon which being mounted or solidly embed boxes in concrete or masonry. Do not support from conduit, mechanical ductwork or piping.

(k) Set boxes in concealed conduit runs, flush with wall surfaces, with or without covers as required.

(l) Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall minimum 12 in.

(m) Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with finished surface.

(n) Do not burn holes, use knockout punches or saw.

(o) Provide outlet box divider barriers between 277/480 v and 120/240 v devices as required and per NEC.

(p) Where emergency switches occur adjacent to normal light switches, install in separate boxes in accordance with NEC and device plate color coding separation.

3.7.4 Outlet Box Locations

(a) Locate flush mounted wall boxes in corner of nearest brick or block to keep cutting to minimum.

(b) Location of outlets and equipment as shown on Drawings is approximate and exact location to be verified and shall be determined by:

1) Construction or code requirement.
2) Conflict with equipment or other trades.
3) Equipment manufacturer's drawings.

(c) Minor modification in location of outlets and equipment considered incidental up to distance of 10 ft with no additional compensation, provided necessary instructions given prior to roughing in of outlet.

(d) Mounting heights for devices and equipment to be measured from finished floor to centerline of device and unless otherwise noted on Drawings as follows.

1) Switches: 48 in. above floor.
2) 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.
3) Wall Bracket Lighting Fixtures: 8 in. above mirrors or or 6 ft 6 in. above floor.
4) Pushbuttons: 48 in. above floor.
5) Disconnect Switches: 60 in. above floor

3.7.5 Installation of Junction Boxes

(a) Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 in. sq by 4 in. deep. Do not exceed 6 entering and 6 leaving raceways in single box.

1) 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.
2) Mount pull boxes in inaccessible ceilings with covers flush with finished ceiling.
3) 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 types normal for such systems.

3.7.6 Grounding

(a) Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes grounding conductor, provide grounding terminal in interior of cabinet, box or enclosure.

3.7.7 Cleaning and Finish Repair

(a) Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

(b) Galvanized Finish: Repair damage using zinc-rich paint recommended by manufacturer.

(c) Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

3.8 Excavation and Backfill

3.8.1 Excavation and backfill for work under this Division shall be provided under this Division in conformance with Division 2.

3.9 Concrete

3.9.1 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.

3.10 Cutting and Patching

3.10.1 All cutting and patching of building materials required for work under this Division shall be provided under this Division.

3.10.2 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.

3.10.3 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.

3.10.4 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.

3.10.5 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.

3.11 Lightning Protection

3.11.1 The lightning protection system shall be installed in a beat and inconspicuous manner so all components will blend in with the appearance of the building. All conductors shall be concealed or semi-concealed during construction using methods recommended in NFPA 780 and UL 96A.

3.11.2 Air terminals shall have base supports designed for the surface on which they are used and shall be securely anchored. All exposed metal eave troughs, roof vents, guy wires, antennas, and air handling equipment shall be bonded to the lightning protections system in such a way that two paths to ground are provided.

3.11.3 The lightning protection system shall be bonded to the structure/building electrical ground rings wherever they are available.

3.11.4 Copper lightning protection system components shall not be mounted to aluminum surfaces. Aluminum components shall be used to avoid electrolytic corrosion.

3.11.5 Grounded metal bodies within the bonding distance determined by NFPA 780 shall be bonded to the system in accordance with those requirements.

3.11.6 Underground metallic piping entering the building shall be bonded to the nearest down conductor or ground electrode.

3.11.7 Adhesive used with aluminum air terminal bases and conductor fasteners shall be compatible with roofing membrane. Verify with roofing contractor.

3.11.8 Terminals and cables attached to skylights and ventilation equipment must be attached so the panels are not compromised in any way. Fasteners used can only attach through the aluminum.

3.11.9 All roof and parapet penetrations must be sealed to insure no leaking.

END OF THIS SECTION

SECTION 16D - SUPERVISORY, CONTROL AND DATA ACQUISITION (SCADA) EQUIPMENT

1. GENERAL:

1.1. Descriptions, Definitions, and Responsibilities

1.1.1 Process Control System (PCS): a complete, integrated system of PLC's, HMI's, Windows-based computer, instruments, devices, wireless and wired process control networks, software, Application Engineering, and ancillary equipment for monitoring and control of stormwater/wastewater collection and treatment facilities.

1.1.2 System Integrator: Organization, whose principle function is design, program, configure, manufacture, provide, install and service of PCS. An organization, under the direction of the Contractor, who shall assume complete responsibility for: detail design, manufacture, installation, configuration, technically advising on and certifying correctness of installation, testing and adjusting, documenting and starting-up, and training of the complete PCS.

1.1.3 SCADA (Supervisory Control and Data Acquisition) system shall be provided to function as the "Master Control" for the Pump Station facility. The SCADA system shall consist of, but not be limited to; programmable controllers, computer, HMI's, software, network and communications equipment, process instrumentation and control devices, uninterruptible power supplies (UPS), and other devices as required and/or as indicated on Drawings and Plans.

1.1.4 System Integrator shall inspect Equipment provided under this Section prior to shipment to Project site.

1.1.5 System Integrator shall coordinate work with Contactor to insure that:

1.1.5.1 All components provided under this Section are properly installed.

1.1.5.2 All components provided under this Section are properly configured.

1.1.5.3 The proper type, size, and number of control wires within conduits are provided.

1.1.5.4 Proper electric power circuits are provided for all components and systems.

1.1.6 System Integrator shall be responsible for the operational testing of the HMI, and PLC software programs.

1.1.7 Systems Integrator shall be responsible for the configuration and setup of the Power Monitoring Devices and Surge protective devices provided as part of the process control system. The setup shall include data access via the Process Control Network.

1.1.8 System Integrator shall be responsible for all Application Engineering. The System Integrator 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. A PDF sample program will be provided to the successful bidder.

1.1.9 System Integrator shall be responsible for coordination of voltage levels and signal types for signals connected to Process Control System. Provide relays, signal isolators, termination or pull-up resistors, signal conditioners or other devices only as required for proper interfacing and operation of non-compatible devices. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, isolation barriers, or relays to interface with equipment provided under this Contract shall be included whether shown on the Drawings or not.

1.1.10 All materials, equipment, labor, installation, configuration, software, programming, and incidentals required to achieve a fully integrated and operational system shall be furnished and installed complete by a qualified System Integrator with a minimum of 10-years experience with comparable size projects. The system integrator shall design and coordinate the instrumentation and control system for proper operation with related equipment and materials.

1.1.11 The System Integrator shall provide a detailed descriptive narrative of the Pump Station control system strategy describing auto/manual pump controls locally, at MCC, and at SCADA panel. The control system narrative shall include analog level control, float control, monitoring and security systems, communications architecture and scheme for monitoring at District 1, IDOT TSC, and EMC Contractor’s facility. The control system narrative shall include all system components shown on E Drawings within contract documents. HMI screens shall accompany the control system narrative along with any photographs, cut sheets, or other materials that aid in the understanding of Pump Station controls. Pump Station control system strategy shall use Contract documents as a basis for a more detailed narrative and expand in greater detail for each piece of equipment.

1.1.12 The System Integrator shall install the control system and shall perform all on-site testing, calibration, start-up, troubleshooting, and training of Department staff.

1.1.13 All necessary coordination required for interfacing the proposed Pump Station facility with the proposed SCADA system shall be provided by the System Integrator.

1.1.14 The Pump Station SCADA system shall be remotely monitored at District 1 Headquarters, IDOT TSC, and the Electrical Maintenance Facility via redundant 4G radio equipment and technology. The AEGIS system communicates via dedicated phone line. Each remote monitoring site monitors the respective Pump Station, as well as other IDOT Pump Station facilities. Currently, Allen Bradley RSView is the Human Machine Interface (HMI) software that is installed at the workstations at the remote locations and is the means in which the operators monitor the Pump Station.

`

1.1.14.1 Contractor is responsible for coordination with the System Integrator and Electrical Maintenance Contractor required for ensuring the proper functioning of the remote monitoring systems.

1.1.14.2 All inputs at the remote monitoring locations shall be checked via each means of communications. Field test results of all I/O points verifying functionality for remote monitoring shall be submitted to Engineer and Department for review. Contractor to provide PLC I/O addresses for network monitoring from remote locations.

1.1.14.3 Payment for the work specified under this paragraph shall be paid for under Article 109.04 of IDOT's Standard Specifications for Road and Bridge Construction.

1.2. System Integrator

1.2.1 Meade Electric.

1.2.2 Wunderlich-Malec.

1.2.3 Complete Integration & Services.

1.2.4 Primex (ICS Healy-Ruff).

1.2.5 Or Approved Equal.

1.3. System Integrator Experience Requirement

1.3.1 The Contractor shall utilize a System Integrator having the experience and knowledge, as defined herein, to undertake the work specified in this Section. The System Integrator shall be an organization having the following organizational and individual experience, knowledge, and capabilities:

1.3.1.1 System Integrator shall be regularly engaged in the design, installation, and servicing of wastewater and storm-water collection and treatment PCS.

1.3.1.2 System Integrator shall demonstrate the ability to produce electrical and control logic diagrams in the level of detail required by this specification.

1.3.1.3 System Integrator shall have previously executed a minimum of five (5) storm-water collection treatment PCS projects of similar size and complexity to this Project incorporating PLC's and HMI platforms included in this Project.

1.3.1.4 Systems Integrator shall have previously successfully executed Ethernet wired networked projects of comparable size and complexity to this Project.

1.3.1.5 The person(s) performing the field Instrumentation and Controls work, as required by the Contract Documents, shall have a minimum of five (5) years experience on PLC-based systems.

1.3.1.6 System Integrator shall provide, on-site, a Control Systems Engineer to commission the functional testing, start-up and training as required by the Contract Documents. The individual shall have authored and commissioned control logic for no fewer than three (3) projects of similar or greater complexity, and shall have a demonstrated proficiency in authoring logic in PLC ladder logic.

1.3.1.7 Upon request of Engineer and in addition to other specified requirements, Contractor shall provide a minimum of five (5) System Integrator references to confirm compliance with these requirements.

1.3.1.8 Upon written approval of Engineer, additional System Integrator's that meet all requirements may be considered by the Contractor.

1.4. Submittals

1.3.2 Submit project specific product data, shop drawings, project documentation, certified shop test reports, O&M data and record documents in accordance with the provisions of Section 1A. and the following:

1.3.3 Product Data

1.4.2.1 Bill of Material: List all the materials and equipment to be furnished. Tag number, manufacturer's complete catalog number, technical descriptions, service, location, and cross-reference numbers of instruction sheet, specification data sheet and wiring diagram shall be included under each item.

1.4.2.2 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 project specific catalog number 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.

1.4.2.3 All Drawings shall be generated in CAD software. There shall not be handwritten additions/changes/updates. Photocopy or other electronic duplication and submission of Contract Documents is not acceptable and will be rejected.

1.3.4 System Diagrams

1.4.3.1 Panel Layout Drawings: Furnish panel drawings for each instrument/control panel/control station. Drawings shall show all panel mounted devices to scale, dimensioned and shall include legend. List bill of materials including manufacturer’s part numbers, show panel or cabinet structure, outline dimension, internal and external device/equipment arrangements, devices, cutouts and mounting details of instruments, protection and control devices, terminal blocks, wire ways and piping. Prepare in general accordance with NFPA 79, Annex D. A detailed terminal block blowup section shall also be included showing terminal block number for each block (terminal schedule).

1.4.3.2 Elementary Schematic Diagrams: Furnish ladder type circuit diagrams prepared to facilitate the understanding of the system functionality, maintenance and fault detection.

a. Control devices shall be shown between vertical lines that represent control power wiring, with the left line representing control circuits common and right representing operating coils common except where permitted by Clause 9 of NFPA 79.
b. Control devices shall be shown on numbered horizontal lines (rungs) between the vertical lines.

c. Drawings shall include a cross referencing scheme used in conjunction with each relay, output device, limit switch, and other devices so that any contact related to a device can be readily located on the drawings.
d. Component designations shall be included for all devices, with the same designations used on Panel Layout Drawings.
e. All depictions of devices shall be specific for selected manufacturer included with submittal, and shall include detailed terminal numbering scheme as specified by manufacturer of said device.
f. Each panel terminal within a terminal strip shall be numbered. When multiple terminal strips exist, each shall be given a unique identification. Terminal strip identification shall be included on Panel Layout Drawings.
g. All wires shall be numbered; wire numbers shall be applied to labels in accordance with Section 16C. Wiring and devices external to panel shall be clearly identified.
h. Control devices shall utilize the symbology depicted in NFPA 79 and IEEE315.
i. Switch symbols shall be shown with utilities turned off and devices in their normal starting condition. Include control settings on the diagrams when available (timer settings, trip current, etc.).
j. Drawings shall indicate source of control circuit power (lighting panel circuit number, etc.).
k. Drawings shall be prepared on a per-panel basis.

1.4.3.3 Instrument Loop Diagram: Furnish 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.

1.4.3.4 SCADA System Block Diagram: Furnish system hardware configuration and identify model numbers of each system component.

1.4.3.5 PLC Equipment Layout Drawing: Furnish system hardware layout for each individual component (module, rack, power supply, etc.), and their relative location to one another. This shall be a scaled drawing whereby each component manufacturers number is easily readable.

1.4.3.6 Interconnecting Wiring and/or Piping Diagrams (to/from): Show schematically the wiring and conduit 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.

1.4.3.7 SCADA System Block Diagram: Furnish system hardware configuration and identify model numbers of each system component.

1.4.3.8 I/O List segregated by PLC module and module type. Include detailed description of each I/O point with respect to function (i.e.: Main Pump 1 Running, etc.).

1.4.3.9 Process Control Network Drawings: Furnish Drawings showing connections between Process Control System devices including computer, HMI's, PLC's, radios, power monitors, network devices. Drawings shall indicate network domain and device IP addresses, subnet masks, gateways, and other pertinent network address information. Drawings shall show type of media used for communications (radio, copper Ethernet, fiber, etc.).

1.4.3.10 Detailed Pump Control system descriptions and associated communications with remote facilities.

1.4.3.11 SCADA screen shots for review prior to in-factory testing.

1.3.5 Test Procedures and Results

1.4.4.1 Detailed field test procedure for SCADA Panel.

1.4.4.2 Detailed field test procedure for Gas Monitor and associated alarms and circuits.

1.4.4.3 Fiber optic test reports. Test reports shall be in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (latest edition) article 801.13 (d) and shall include OTDR, attenuation, transceiver power levels, and continuity.

1.3.6 Software Documentation

1.4.5.1 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 logic shall be submitted in CD format.

1.3.7 O&M and Instruction Manuals

1.4.6.1 Submit project specific instruction manuals covering installation, operation, calibration, maintenance, diagnostic and repair for all hardware and software. Refer to Section 1A for additional requirements.

1.3.8 Record Documents

1.4.7.1 Accurately record actual calibration setting and scales of instruments.

1.4.7.2 Approved Shop Drawings.

1.4.7.3 Record Contract Drawings.

1.4.7.4 Refer to Section 1A for additional requirements.

1.5. Work for Hire

1.5.1 Any and all configuration, programming, setup or other software functions (SOFTWARE) performed on all intelligent devices provided as part of this Project is considered “Work for Hire” under the 1976 Copyright Act as amended (title 17 of the United States Code). The SOFTWARE shall be owned by the Department and shall be turned over to the Department fully documented (with accompanying commentary) as the work is completed.

1.5.2 Department intends only to obtain the SOFTWARE for its own use.

1.5.3 Department 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 the Department 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

1.6.1 The SCADA system includes a rack-mount computer system as the HMI screen server, redundant PLC processors for Pump Station system control, redundant analog wet-well level sensing system, and multi-float/relay level monitoring system as a redundant pump control system. Communications with remote monitoring sites is also included.

1.6.2 The redundant PLC’s utilize the analog level signals measured with the primary and secondary level sensors for Pump control, while the floats utilize digital signals for simultaneous and redundant Pump control.

1.6.3 The redundant PLC's operate in parallel with the "primary" processor controlling the Pumps based on water level in the wet-well. The "secondary" processor monitors the health of the "primary" processor and, upon failure, immediately assumes control of the Pumps in a bump-less transfer over a fiber optic link between the "primary" and "secondary" processors. When a PLC processor fails it shall generate an alarm. Water elevations for SCADA Pump control is shown on Drawings.

1.6.4 The PLC shall check the validity of the primary level signal (LE/LT-0121P), and the secondary level signal (LE/LIT-0121S) using float level signals as broad reference, and select a valid signal for pump control (LE/LT-0121P as primary, LE/LIT-0121S as secondary). If the primary and secondary level signals differ (by an adjustable set value), it shall generate an alarm. If the PLC deem both the primary and secondary level signals invalid (or out of range, broken wire, etc.), then the point level inputs signals from the multi-float system shall be used for pump control. If the primary PLC fails, and the secondary PLC fails, then the point level inputs signals from the multi-float system will be used for pump control.

1.6.5 The SCADA system shall be designed for fully automatic PLC control of the Pump Station. Pumping operation of the facility shall respond to water levels sensed in accordance with the pumping operation tables shown on the Drawings. The PLC's and associated personal computer with SCADA software herein specified shall be capable of automatically controlling pumping operations and storing and retrieval of all digital and analog points/trends for a period of 1 year.

1.6.6 The Pump Station shall operate as a 3-pump sequencer for the Main Pumps and shall operate the singular Low Flow Pump when called. The Main Pump Lead/Lag/Standby sequencer will determine which Main Pump is called to run.

1.6.7 Shall a pump fail (fail to start, overload, over-temp, seal fail, MCC breaker off, or H-O-A switch set to anything other than "AUTO"), then the failed Pump is automatically removed from the pump sequencer, and the Standby Pump takes the failed pump position in the pump sequencer. The failed pump then becomes the Standby Pump until the original fail condition is corrected.

1.6.8 Shall a Main Pump fail due to over-temp and/or seal fail (as detected by respective motor protection relay), then any succeeding pumps that fail due to the same condition (motor protection relay) shall remain in the pump sequencer and shall be called to run over-riding the condition.

1.6.9 All pumps shall be inhibited from running if Discharge and Recirculation gates are both confirmed closed.

1.6.10 All pumps shall be inhibited from running if the Influent Gate is confirmed closed. The HMI shall include a manual override allowing the Pumps to operate with the Influent Gate confirmed closed. Override shall be temporary and shall automatically reset after 12 hours. The override mode will be used for recirculation testing of the Pump Station, or manually drawing down the wet well for maintenance.

1.6.11 Only two of the three Main Pumps are allowed to run at any one time.

1.6.12 The Lead Pump is defined as the first pump called to run on rising water level. The Lag Pump is defined as the second pump called to run on rising water level. If either of these two pumps fail to operate, the Standby Pump shall be called to run in its stead. The Main Pumps are preceded by the Low Flow Pump operating at the levels indicated on the Drawings.

1.6.13 Pumps, when called to run, shall be delayed by a time delay relay (located in the respective pump MCC bucket). Time delay relays shall be set such that only one Pump can be started at a time. Time delay setting for each pump shall be included in shop drawing phase and included in pump control wiring schematics for the Pump Station.

1.6.14 Control of the Pumps shall be as shown in Figure 1.6.12 below:

Rising Level Action	Falling Level Action	Elev.
High Level Alarm		657.11
Start Standby Pump		654.00
Start Lag Pump		653.00
Start Lead Pump		652.00
Stop Low Flow Pump		
	Stop Main Pumps	650.50
	Start Low Flow Pump	
Start Low Flow Pump		648.50
	Stop Low Flow Pump	647.00
	Low Level Alarm	646.50

1.7. Related Sections

1.7.1 Section 16A – General Electrical Provisions.
1.7.2 Section 16C – Basic Electrical Materials and Methods.
1.7.3 Section 16E – Packaged Engine Generator Systems.
1.7.4 Section 16F – Motor Control Center.
1.7.5 Section 16H – Major Electrical Equipment.

1.8. Reference

1.8.1 ISA Standards and Recommended Practices for Instrumentation and Control.

1.9. Warranty

1.9.1 Provide warranty from all defects of material and workmanship for the manufacturer's standard length of warranty or for 1 year from the date final acceptance, whichever is longer.

1.10. Deliver, Storage and Handling

1.10.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

1.11. Basis of Payment

1.11.1 Supervisory, Control and Data Acquisition (SCADA) equipment and programming will be paid for under the contract lump sum price for PUMP STATION SCADA EQUIPMENT.

1.11.2 Gas monitoring equipment shall be paid for under the contract lump sum price for GAS DETECTION PANEL.

1.11.3 Fiber optic cable, installation, and testing of cable shall be paid for under the contract per foot price for FIBER OPTIC CABLE IN CONDUIT, SINGLEMODE, 6-STRAND.

1.11.4 Refer to 1.22 of Section 1A for Method of Measurement.

1.12. SCADA System I/O List

1.12.1 PLC (ControlLogix platform) Hardwired I/O Points:

1.12.1.1 See Drawing E-26 for I/O list and distribution.

1.12.2 PLC (MicroLogix platform) Hardwired I/O Points:

MLX 4.1 MICROLOGIX	
ADDR	DESCRIPTION
I:0/0	
I:0/1	
I:0/2	
I:0/3	
I:0/4	
I:0/5	
I:0/6	
I:0/7	
I:0/8	
I:0/9	
I:0/10	
I:0/11	
I:0/12	
I:0/13	
I:0/14	
I:0/15	
I:0/17	
I:0/18	
I:0/19	
O:0/0	
O:0/1	
O:0/2	
O:0/3	
O:0/4	
O:0/5	
O:0/6	
O:0/7	
O:0/8	
O:0/9	
O:0/10	
O:0/11	

1.12.3 SCADA data via Modbus TCP:

1.12.1.2 From dual MCC Power Monitors:

1) Normal Line-Line Voltage.
2) Emergency Line-Line Voltage.
3) Normal Line Current.
4) Emergency Line Current.
5) Normal Line Power (kW).
6) Emergency Line Power (kW).
7) Normal Line Power Factor.

1.12.1.3 From Surge Protective Device (SPD-1):

1) Battery Life (%).
2) Protection Available (%).
3) Sags.
4) Surges.
5) Swells.
6) Dropouts.
7) Outages.
8) Volts per Phase.
9) Frequency.

1.13. System Description

1.13.1 The following narrative 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) Collect 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 monitoring and diagnostics.

1.13.2 The system is based on the SCADA system architecture diagram shown on Drawings. The system shall include:

a) Redundant programmable logic controllers (PLC's) with local input/output (I/O), network communications and other capabilities as specified herein and shown on the SCADA system architecture diagram.

b) SCADA computer with redundant Human Machine Interface (HMI) with control/graphic software.

c) HMI's shall be linked to the PLC's over an Ethernet/IP based local area network (LAN) via managed Ethernet Switch.

d) Communications with Power Monitors and Surge Protection Devices.

e) Communications with outside entities (District 1, IDOT TSC, and Maintenance Contractor).

1.13.3 All process control functions including PID, calculations, sequencing, set-points, timing, etc., shall reside in the PLC. The real-time database, report generation, graphic screens, program development, set-point modification, data archiving, etc., shall be done by the HMI computer.

1.13.4 HMI computer shall be loaded with FactoryTalk View SE Client, and FactoryTalk Historian SE (250 tags). System Integrator is responsible for hardware/software compatibility.

2. PRODUCTS:

2.1 Process Control, Network, and field devices:

2.1.1 Equipment listed in the table below shall conform to the instrumentation standards described in the paragraphs following the table:

a) Control Stations (Type A).
b) Control Stations (Type B).
c) Control Stations (Type C).
d) Analysis Instrumentation (A Series).
e) Level Instrumentation (L Series).
f) Miscellaneous Instrumentation (M Series).
g) Pressure Instrumentation (P Series).
h) Temperature Instrumentation (T Series).

Tag	Device Type	Location/Description	Additional Information
CS-MP1	Type A	Main Pump No.1 Control Station	NEMA 7
CS-MP2	Type A	Main Pump No.2 Control Station	NEMA 7
CS-MP3	Type A	Main Pump No.3 Control Station	NEMA 7
CS-LFP1	Type A	Low Flow Pump Control Station	NEMA 7
CS-SF-WP	Type B	Control Station – Supply Fan – Wet Pit	NEMA 7
CS-SF-PR	Type B	Control Station – Supply Fan – Pump Room	NEMA 7
CS-SF-ER	Type B	Control Station – Supply Fan – Elect. Room	NEMA 12
IS-SF-WP	Type C	Indicator Station – Supply Fan – Wet Pit	NEMA 7
IS-SF-PR	Type C	Indicator Station – Supply Fan – Pump Room	NEMA 7
GM-1	A25	Gas Monitor	
GS1	A25	Combustible Gas Sensor, Intermediate Floor	NEMA 7
GS2	A25	Combustible Gas Sensor, Dry Pit	NEMA 7
FS8	L8	High Level Alarm Float	See Figure 1.6.12 for float elevations.
FS7	L8	Ball Float for Pump Control	
FS6	L8	Ball Float for Pump Control	
FS6	L8	Ball Float for Pump Control	
FS5	L8	Ball Float for Pump Control	
FS4	L8	Ball Float for Pump Control	
FS3	L8	Ball Float for Pump Control	
FS2	L8	Ball Float for Pump Control	
FS1	L8	Low Level Alarm Float	
FSPF	L8	Pavement Flood Float (↑)	El: 663.00
LE/LIT-0121S	L10	Secondary Wet Well Level	Ultrasonic
LE/LT-0111	L11	Screen Chamber Level	Hydrostatic
LE/LT-0121P	L11	Primary Wet Well Level	Hydrostatic
LE/LT-0131	L11	Discharge Chamber Level	Hydrostatic
FAHS-1	N/A	Fire/Gas Horn and Strobe, Electrical Room	Provided by Fire Alarm Panel manufacturer. See Section 16H.
FAHS-2	N/A	Fire/Gas Horn and Strobe, Pump Room	
FAHS-3	N/A	Fire/Gas Horn and Strobe, Grade Floor	
DS1	N/A	Door Switch, Grade Floor, East Door 1	Provided by AEGIS manufacturer. See Section 16H.
DS2	N/A	Door Switch, Grade Floor, East Door 2	
DS3	N/A	Door Switch, Electrical Room, South Door 1	
DS4	N/A	Door Switch, Electrical Room, South Door 1	
DS5	N/A	Door Switch, Electrical Room West Door	

DS6	N/A	Door Switch, Pump Room Door 1	
DS7	N/A	Door Switch, Pump Room Door 2	
SD1	N/A	Electrical Room Smoke Detector 1	Provided by Fire Alarm Panel manufacturer. See Section 16H.
SD2	N/A	Electrical Room Smoke Detector 2	
HD6	N/A	Dry Pit Heat/Smoke Detector 6	
HD5	N/A	Dry Pit Heat/Smoke Detector 5	
HD4	N/A	Intermediate Level Heat/Smoke Detector 4	
HD3	N/A	Grade Floor Heat/Smoke Detector 3	
HD2	N/A	Pump Room Heat/Smoke Detector 2	
HD1	N/A	Pump Room Heat/Smoke Detector 1	
ISH-LP1-3	M34	Torodial Current Sensing Switch	Lights
ISH-LP1-10	M34	Torodial Current Sensing Switch	Lights
ISH-LP1-7	M34	Torodial Current Sensing Switch	Lights
ISH-LP1-8	M34	Torodial Current Sensing Switch	Lights
ISH-LP1-12	M34	Torodial Current Sensing Switch	Lights
LI-0111	M37	Process Indicator, Screen Chamber Level	
LI-0121P	M37	Process Indicator, Wet Well Level	Primary
LI-0121S	M37	Process Indicator, Wet Well Level	Secondary
LI-0131	M37	Process Indicator, Discharge Chamber Level	
ISB 8	M60	Float Switch 8 IS Barrier	Discrete
ISB 7	M60	Float Switch 7 IS Barrier	Discrete
ISB 6	M60	Float Switch 6 IS Barrier	Discrete
ISB 5	M60	Float Switch 5 IS Barrier	Discrete
ISB 4	M60	Float Switch 4 IS Barrier	Discrete
ISB 3	M60	Float Switch 3 IS Barrier	Discrete
ISB 2	M60	Float Switch 2 IS Barrier	Discrete
ISB 1	M60	Float Switch 1 IS Barrier	Discrete
ISB 0111	M60	Screen Chamber Hydrostatic IS Barrier	Analog
ISB 0121P	M60	Primary Hydrostatic IS Barrier	Analog
ISB 0131	M60	Discharge Chamber Hydrostatic IS Barrier	Analog
LF1	M62	Line Filter with Transient Protection 1	
LF2	M62	Line Filter with Transient Protection 2	
TS1	M64	SCADA Enclosure Thermostat	
FAN1	M66	SCADA Enclosure Fan	
UPS-1	M68	Uninterruptible Power Supply 1	
UPS-2	M68	Uninterruptible Power Supply 2	
BATT-1	M68	USP-1 Extended Battery	
BATT-2	M68	USP-2 Extended Battery	
PS1	M70	Power Supply 1, 24Vdc	
PS2	M70	Power Supply 2, 24Vdc	
PLC	M75	PLC Hardware	
SW-1	M80	Ethernet Switch	
MG-1	M81	Mobile Gateway	Primary
SC-1	-	SCADA Computer	

HMI-1	-	SCADA HMI 1	Primary
HMI-2	-	SCADA HMI 2	Secondary
NET-1	-	Network Rack, 19” Wall-mount, 26U	
FOC	-	Fiber Optic Cable	6-strand SM
FOPP-1	-	Fiber Optic Patch Panel	24-strand
PI-LFP1	P4	Low Flow Pump1 Discharge Pressure (ftH2O)	Local Indication
PI-MP1	P4	Main Pump 1 Discharge Pressure (ftH2O)	Local Indication
PI-MP2	P4	Main Pump 2 Discharge Pressure (ftH2O)	Local Indication
PI-MP3	P4	Main Pump 3 Discharge Pressure (ftH2O)	Local Indication

2.2 Control Stations – Definitions:

2.2.1 Type A.

a) One amber pilot light for PUMP CALL, One red pilot light for HOA SWITCH IN OFF POSITION, One green pilot light for PUMP RUN, One momentary contact black pushbutton (2NO) for MOTOR BUMP, One momentary contact green pushbutton (2NO) for START, One momentary contact extended head red pushbutton (2NC) for STOP.
b) Include nameplate from nameplate schedule described on Drawings.
c) Include legend plates engraved as shown on Drawings.

2.2.2 Type B.

a) One 3-position selector switch for HAND-OFF-AUTO, One red pilot light for HOA SWITCH IN OFF POSITION, One green pilot light for FAN ON.
b) Include nameplate from nameplate schedule described on Drawings.
c) Include legend plates engraved as shown on Drawings.

2.2.3 Type C.

a) One red pilot light for HOA SWITCH IN OFF POSITION, One green pilot light for FAN ON.
b) Include nameplate from nameplate schedule described on Drawings.
c) Include legend plates engraved as shown on Drawings.

2.3 Operator Devices and Control Station Components:

2.3.1 Manufacturer:

a) Allen Bradley 800T/800H.
b) Square D Class 9001, Type K.
c) No Substitutes Allowed.

2.3.2 Construction:

a) Heavy duty.
b) Watertight.
c) Oil-tight.
d) Flush panel mounting.
e) 30.5mm.
f) Match NEMA rating of device with the installed location environmental classification.

2.3.3 Pushbuttons:

a) Flush head unless specified elsewhere.
b) Contact Blocks:

1) Double break silver contacts.
2) Ac Ratings: 7,200 va make, 720 va break.
3) Single pole, double throw or double pole, single throw.
4) 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.

2.3.4 Selector Switches:

a) Maintained position.

1) Exception. The “Control Mode” 3-position selector switch shall include spring return to center from the left position. Center position shall be maintained, and the right position shall be maintained.

b) Contact Blocks:

2) Double break silver contacts.
3) Ac Ratings: 7,200 va make, 720 va break.
4) Contact configuration as specified.
5) Up to six tandem blocks.

c) Number of positions as specified elsewhere.
d) Knob Lever Style unless specified elsewhere.
e) Legend plates as required for type of operation or specified elsewhere.

2.3.5 Pilot Lights:

a) LED Type.
b) Transformer type.
c) Colored lens as specified elsewhere.
d) Interchangeable lenses.
e) Transformer rated for 120Vac
f) Push to test.
g) Legend plates as specified elsewhere.

2.3.6 Control Stations:

a) NEMA ratings:

1) NEMA 7 in Class 1, Division 1 or 2 Hazardous (Classified) Locations.
2) NEMA 4X 316 stainless steel in indoor wet/corrosive locations or outdoors.
3) NEMA 12 in other areas.

2.3.7 Legend Plates:

a) Engraved metal.
b) 2-1/4” square minimum.
c) Silver background, black letters.

2.3.8 Nameplates:

a) Engraved laminated plastic.
b) Letters 3/16 in. high.
c) Black letters on white background.
d) Identify per equipment controlled, using names found on Drawings.

2.4 (A25) Gas Monitoring System:

2.4.1 Manufacturer:

a) MSA 9000 Series.
b) General Monitors “Smart Sensor” Series.
c) Honeywell
d) No Substitutes Allowed.

2.4.2 The manufacturer must be capable of supplying all equipment used to check or calibrate the sensor / transmitter units.

2.4.3 The manufacturer must be capable of providing on-site service with factory trained personnel.

2.4.4 The manufacturer must be capable of providing on-site training for the Department.

2.4.5 Gas Monitor:

a) Enclosure Type – Wall mount
b) 2 input analog sensor channels minimum per installed module.
c) Include one installed spare module minimum.
d) Operating Temperature range: -10° to +50°C (14° to 122°F).
e) Operating Humidity range 0-90% RH, non-condensing.
f) 115 / 230 VAC ± 15% 50/60 Hz.
g) The system shall have the ability to operate with 1 or 2 channel controller boards.
h) Each module shall have two (SPDT) relays with change-over contacts for verification of Warning and Alarm conditions.
i) Shall be a large 4-digit 7-segment back lit Liquid Crystal Display and bright LED's to provide ease of reading and alarm notification.
j) The Display provides information on the gas concentration, alarm status, measurement units, flags indicating status and settings such as calibration interval, time-out function, alarm ON delay and alarm inhibit.
k) Ability to choose from LEL, LELm, PPM, % Vol, g/m3 or blank.
l) Controller shall have user defined access codes to prevent accidental or undesired tampering.
m) Audible Alarm push-button reset switch shall silence the Audible Alarm when alarm points are exceeded. The LED visual alarms will remain on as long as alarm levels are exceeded. This push-button will reset latched alarms if normal gas conditions exist.
n) Warning and Alarm Relay Set Points shall be customer selectable between 1-100% of the measuring range.
o) Failure mode shall utilize two SPST relays in series and shall be normally energized. 5A / 24VDC and 250VAC - resistive load.
p) Shall be high brightness LED's to provide ease of reading and alarm / failure notification.
q) Each unit shall have two, SPDT relays.
r) Complies with UL / CSA 61010-1 per MET.
s) Instrument shall have one year parts and labor standard warranty with extended warranty available. Warranty shall commence from the Final Acceptance of the Pump Station.
t) The Controller shall not require periodic maintenance other than verifying the Sensor Transmitter inputs are responding to the target gases.
u) Provide relay contacts for remote monitoring alarming as shown on Drawings.

2.4.6 Combustible Sensor Requirements:

a) Infrared (IR) Combustible Sensor shall detect 0-100% LEL of combustible gas.
b) Sensor module shall store all calibration data so that module may be calibrated off-site and field-installed without necessity of recalibration.
c) Heated optics prevent condensation buildup.
d) 4–20 mA analog output.
e) Complete product shall have minimum useful life of three (3) years.
f) IR source within infrared sensor will have minimum useful life of ten (10) years.
g) Sensor/transmitter will be contained within a 316 stainless steel enclosure suitable for location in Class I, Division 1 & 2, Groups A, B, C & D, Class II, Division 1, Groups E & F, Class III classified areas.
h) Optional junction box enclosure shall have minimum of three entries, allowing for mounting options for sensor, power and signal, and should be constructed with 316 stainless steel.

2.4.7 Hydrocarbon combustible gasses to be detected include:

a) Octane
b) Ethane
c) Ethanol
d) Propane
e) Butane
f) Methane

2.4.8 The gas detection system shall measure and display gas concentration. The system shall alarm when preset limits are exceeded. Relays and timers for different alarm set-point levels shall be provided as additional contacts for alarms and ventilation controls.

2.4.9 The system shall consist of two (2) dual-channel monitor/readout units, one (1) relay programmer module, one (1) power supply unit, four (4) alarm relays, a horn relay, a buzzer and two (2) remotely mounted gas sensor/transmitter units. An independent monitoring channel 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 5000 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 enclosure suitable for NEC Class I, Division 1, Group C & D hazardous locations. The sensor units shall have provisions for mounting to a wall or similar structure.

2.4.10 The gas monitor shall be of the wall-mount style suitable for mounting inside the Electrical Room. 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.

2.4.11 Alarms and relays at the monitoring/readout unit shall be set for the following levels of gas concentration:

a) "WARNING" 5% LEL
b) "ALARM" 10% LEL
c) “TROUBLE” Failure of sensor or master controller.

2.4.12 The combustible gas sensor/transmitter shall be of the infrared type sensing element with 3-wire loop detector lead-in (LDL) signal transmitting electronic circuit designed to monitor the presence of petroleum (complex hydrocarbon) vapor in the ambient air. The transmitter circuit shall produce a 4 -20 mA output signal proportional to 0 to 100% LDL and shall be mounted in an explosion proof enclosure with a 3-1/2 digit LCD display. The transmitter circuit shall have real time clock and internal memory for day stamping and logging minimum and maximum gas concentrations.

2.4.13 In response to an ALARM signal from SCADA system, due to a high concentration of explosive vapor in the monitored space, an explosion-proof horn and alarm strobe beacon shall be energized at all levels of the Pump Station. Alarm system is in parallel with Fire Alarm system. The ventilation system for the monitored space shall be activated.

2.4.14 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 the monitor panel. Test kit shall include detailed instructions on carrying out calibration including programmed offsets for included test gases.

2.4.15 Spare parts shall be provided for the air monitoring equipment as follows:

a) One set of fuses, and one dual-channel monitor module.

2.4.16 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.

2.4.17 The Gas Monitoring System and Fire Alarm System share common strobes and horn annunciators. Reset of system is accomplished at respective system responsible for alarming.

2.5 (L8) Direct Acting Float Switches

2.5.1 Manufacturer:

a) Contegra FS 90.
b) Siemens 9G-EF.
c) Anchor Scientific.
d) Or Approved Equal.

2.5.2 Float: 316 Stainless steel ball with Teflon or Laminex coating.

2.5.3 Provide sufficient length of oil resistant jacketed cable for direct connection to junction box without splice.

2.5.4 For Class 1, Divisions 1 or 2 hazardous (classified) locations, provide intrinsically safe relays in corresponding control panel.

2.5.5 The float switches shall be mounted to a 1" pipe utilizing all 316 stainless steel float switch mounting hardware and secured in place by 316 stainless steel mounting clamps. See M Drawings for mounting details.

2.5.6 Switch: non-mercury SPDT reed type 1A@150Vac/Vdc non-inductive.

2.5.7 Float shall have a 3-year factory warranty minimum. Warranty shall commence from the Final Acceptance of the Pump Station.

2.6 (L10) Ultrasonic Level Element and Transmitter

2.6.1 Manufacturer:

a) Siemens Sitrans LUT 420
b) Endress Hauser Prosonics FMU90
c) No Substitutes Allowed.

2.6.2 Transducer:

a) Transducer shall emit ultrasonic signal with time lapse between transmitted and received signal converted into usable voltage capable of driving totalizer, sample rate counter, and liquid level indicator. DC voltage produced shall be proportional to distance from detector to material being measured.
b) Ambient temperatures: -40°F to +176°F.
c) Process temperatures: -40°F to +185°F.
d) Integral temperature sensor for compensation.
e) Beam angle shall not exceed 6°.
f) Mounting shall be as shown on detail Drawings.
g) Non-contact design detector with no moving parts or mechanical linkages.
h) Include submergence shield.
i) Explosion-proof element certified by Factory Mutual Research for Class I, Division 2, Groups C and D when sensor is located in hazardous area.

2.6.3 Transmitter:

a) 120Vac Power Supply.
b) Ambient temperatures: -4°F to +122°F.
c) Shall have local LCD with bar graph indication.
d) One isolated 4-20 mAdc, output.
e) One form C and two form A output contacts.
f) Nema type 4X/IP65 enclosure
g) </= 3mm resolution
h) Accuracy: +/- 1mm plus 0.17% distance.
i) 10” blanking distance maximum.

2.6.4 Cable:

a) Provide sufficient standard length of manufacturer’s signal cable connecting transducer and transmitter or junction box without splice.

2.6.5 Measurement Requirements:

a) Range of measurement is 0-15ft.

2.7 (L11) Submersible Level Element and Transmitter

2.7.1 Manufacturer:

a) E+H.
b) KPSI
c) PMC Engineering
d) WIKA Instrument, LP
e) Viatran
f) No Substitutes Allowed.

2.7.2 Transducer: Level transmitter consisting of variable capacitance, hydrostatic head-pressure sensing assembly enclosed in submersible Type 316 stainless steel housing with 316L SS or ceramic pressure sensing diaphragm, special cable containing 1/8 in. breather tube and signal wiring, and sealed breather bag and transmitter assembly.

2.7.3 Provide intrinsically safe barriers when used in hazardous areas.

2.7.4 Transducer:

a) Designed for continuous submergence.
b) Low movement 316L SS (or ceramic) diaphragm.
c) Protective, weighted, plate kit for diaphragm.
d) Oil-filled.
e) Barometrically compensated
f) Temperature compensated.
g) Variable capacitance type internal sensing element.

2.7.5 Cable Assembly:

a) 1/2 in. outside dia.
b) Positive seal where entering transducer housing.
c) Contains 1/8 in. breather tube.
d) Provide sufficient length to accommodate installation.

2.7.6 Junction Box and Breather Assembly:

a) Desiccant systems not allowed.
b) 2-wire, 4-20 mAdc.
c) Fused.
d) Output loop resistance 0-750 ohms.
e) Span and off-set adjustable.
f) Active transient protection.
g) Repeatability: ± 0.25%.
h) Accuracy: ± 0.25% of full scale.
i) Loop powered.

2.7.7 Measurement Requirements:

a) Range of instrument shall be 0-11.5ft. (0-5psi) for discharge chamber.
b) Range of instrument shall be 0-23ft. (0-10psi) for wet well and inlet chamber.

2.8 (M34) Current Sensing Switch

2.8.1 Manufacturer:

a) AcuAMP ACS200
b) Eaton
c) Veris Industries
d) Or Approved Equal

2.8.2 Input Range: 0-6, 6-40, 40-175 Amp (Jumper selectable).

2.8.3 Output: Normally open relay (1A @ 240Vac).

2.8.4 UL Listed.

2.8.5 Panel Mount.

2.9 (M37) Electronic Process Indicator:

2.9.1 Manufacturer:

a) Precision Digital.
b) Red Lion, IMP.
c) Moore Industries.
d) Or Approved Equal.

2.9.2 4-20mAdc Input.

2.9.3 4 ½ digit LED indicator.

2.9.4 Loop powered.

2.9.5 Enclosure shall reflect same NEMA rating as panel it is located in.

2.10 (M60) Intrinsically Safe Relay:

2.10.1. Manufacturer:

a) P.R. Electronics 5104B (discrete), and 5202B (analog).
b) Pepperl+Fuchs
c) No substitutes Allowed.

2.10.2. Input/Output:

a) (discrete) pulse/relay contact
b) (analog) 4-20mA/4-20mA

2.10.3. Protection: IP20.

2.10.4. Mounting: DIN rail.

2.10.5. Operating temperature: -20°C to 60°C.

2.10.6. Operating humidity: <95% non-condensing.

2.10.7. Non-zener diode operation.

2.10.8. UL-913, UL-508 Listed.

2.11 (M62) Line Filter:

2.11.1 Manufacturer:

a) Emerson Islatrol IE Series.
b) SOLA STFE Elite Series.
c) No substitutes Allowed.

2.11.2 UL 1449 Surge Voltage Rating:

a) 120V Normal Mode: 330 Volts.
b) 120V Common Mode: 400 Volts.

2.11.3 Peak Surge Current Capability (8 x 20 µs)

a) 120V Line to Neutral: 15,000 Amps.
b) Line to Ground: 15,000 Amps.
c) Neutral to Ground: 15,000 Amps.
d) Total: 45,000 Amps.

2.11.4 Frequency Response (Forward-Reverse)

a) Normal Mode: 100 kHz to 50MHz - 90 dBMin.
b) Common Mode: 5MHz to 50MHz - 60 dBMin.

2.11.5 Typical Category A Ringwave (6kV, 200A, 100kHz) Normal Mode/Common Mode

a) 3 Amp: 1 V/300 V
b) 5 Amp: 0.7 V/292 V
c) 10 Amp: 0.7 V/300 V
d) 20 Amp: 0.7 V/300 V

2.11.6 Typical Category B Ringwave (6kV, 500A, 100kHz) Normal Mode/Common Mode

a) 3 Amp: 178 V/300 V
b) 5 Amp: 162 V/291 V
c) 10 Amp: 153 V/300 V
d) 20 Amp: 200 V/300 V

2.11.7 MCOV

a) 120 Volt: 150 VRMS
b) 240 Volt: 275 VRMS
c) Line Frequency: 47 - 63 Hz
d) Connection: Terminal
e) Mounting Type: DIN/Flange
f) Weight: < 3 lbs

2.11.8 Response Time

a) Normal Mode: < 0.5 ns
b) Common Mode: < 5 ns
c) Operating Temperature: -40°C to +45°C Derate Linearl to 60% at +70ºC
d) Operating Humidity: 0% to 95%

2.11.9 Other Features:

a) LED status indication and form C contact for remote indication.
b) DIN mountable enclosure.
c) UL 1449, 1283, CUL recognized, CE.
d) Active tracking filtration.
e) 10 year warranty. Warranty shall commence from the Final Acceptance of the Pump Station.

2.12 (M64) Enclosure Thermostat:

2.12.1 Manufacturer:

a) Hoffman.
b) Honeywell.
c) Or Approved Equal.

2.12.2 Features:

a) One normally open and one normally closed contact.
b) 32°F to 142°F adjustability.
c) Bimetallic sensor element.
d) DIN mountable.

2.13 (M66) Enclosure Fan:

2.13.1 Manufacturer:

a) Hoffman.
b) Dayton.
c) Or Approved Equal.

2.13.2 Features:

a) Size for enclosure heat dissipation requirements.
b) Includes filters and grille.
c) Include one additional filter .
d) Include exhaust grille.

2.14 (M68) Uninterruptible Power Supply (UPS):

2.14.1 Manufacturer:

a) APC Smart-UPS
b) Emerson
c) Alpha
d) Liebert
e) Eaton
f) No Substitutes Allowed.

2.14.2 Uninterruptible Power Supply (UPS) System shall be provided for the SCADA and instrumentation systems as shown on the Drawings 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 full isolation between the control system and the plant power system.

2.14.3 Provide true on-line non switching uninterruptible power supply (UPS). Double power conversion on-line operation including rectifier and inverter, constantly conditioned AC output.

2.14.4 Provide make-before-break automatically operated bypass contactor to bypass UPS to allow operation of system controls in event of UPS failure.

2.14.5 Each system shall consist of a static dc to ac sine wave inverter, a battery charger, sealed batteries, a monitor and transfer switch, and accessories as listed below.

2.14.6 Each system shall operate on a 120-volt, 60-Hz ac branch circuit. The input ac circuit shall supply energy to the battery charger which shall supply energy to the inverter as well as to the battery to maintain its charge. The output of the inverter shall supply energy to the load. If the input ac circuit is interrupted, the inverter shall continue to supply energy to the load without interruption, drawing power from the battery. If the input ac circuit is restored prior to discharge of the battery, the charger shall resume the supply of energy to the inverter and shall restore the battery to full charge. In the event of malfunction of the battery charger, battery or inverter that results in interruption of the output from the inverter, the monitor shall detect this condition and shall automatically transfer the load to the system's ac input circuit within 25 milliseconds. After the malfunction is corrected, the load shall be retransferred to the inverter manually.

2.14.7 System output voltage shall be regulated within plus or minus 5 percent of 120 volts and frequency stability shall be plus or minus 1/2 percent of 60-Hz. The output characteristic shall be sinusoidal with not more than 5 percent total harmonic distortion at full load with input ac circuit at 120 volts. For a 20 percent instantaneous load change, voltage overshoot or undershoot shall be not more than plus or minus 10 percent. For a 10 to 90 percent load change, recovery time shall be not longer than 100 milliseconds.

2.14.8 The UPS system shall have an efficiency of at least 90% when operated from AC line.

2.14.9 UPS shall supply power to PLC's, HMI's, Ethernet Switch, DC power supplies, field instruments, and other low voltage control devices as specified and as shown on Drawings and Plans.

2.14.10 UPS shall have enough capacity to power these devices for a period of 30 minutes after the utility power has failed. Provide with extended battery module(s) to meet this requirement.

2.14.11 Size UPS for 125% of connected electrical load with 1500VA as a minimum UPS size.

a) The System Integrator shall provide sizing data on the UPS listing all loads and calculations required for sizing the UPS system, and include with submittal.

2.14.12 Rack Mount Form Factor shall be used unless stated otherwise on Drawings or Specifications.

2.14.13 UPS shall be located in network wall-mount Rack (NET-1). Additional batteries, if required, shall be mounted internal to the wall-mount rack.

2.15 (M70) DC Power Supplies:

2.15.1 Manufacturer:

a) Phoenix Contact Quint-PS
b) ABB
c) Sola/Hevi-Duty
d) Or Approved Equal.

2.15.2 General

a) Power supply shall be fully enclosed, and provide screw terminations. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger in accordance with IEC 529. Housing shall be at least IP20.
b) Power Supplies shall have an efficiency of at least 80%.
c) The power shall have an MTBF (Mean Time Between Failures) greater than 500,000 hours according to IEC 1709.
d) The power supply shall be able to withstand shock of 30G in all space directions according to IEC 68-2-27 and vibration up to 2.3G 90 min. (<15hz, amplitude = +/-2.5mm/15-150hz) according to IEC 68-2-6.
e) Power supplies shall be UL-508A listed to allow the use of the power supply at full rated output amperage with no "de-rating".

2.15.3 Mounting

a) All power supplies shall have integral metal mounting foot to attach to 35mm DIN-rail conforming to DIN EN50022.

2.15.4 Wire Connections

a) Attach wires to the power supplies by means of a cable-clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated with non-ferrous, non-corrosive materials.
b) Wire connection for currents less than 20A shall use pluggable terminals on both input and output ends.
c) Pluggable terminals shall accept wire sizes 24 through 14 AWG.

2.15.5 Equipment

a) Nominal current rating to be based on an operating temperature of 60°C or higher.
b) Power supplies shall have a visible "DC Power OK" indicator. This indicator will flash when the output drops below 10% of the adjusted output voltage.
c) Ambient temperature range for operation shall be at least -25°C to +70°C
d) Residual ripple shall not exceed 100 mV peak to peak at nominal current values.
e) Integral surge suppression shall be incorporated into the power supply.
f) Power supplies shall conform to CE electromagnetic compatibility as described in EN61000-6-2 and EN 50081-2.
g) Power supplies shall have means of limiting DC current in case of short circuit or an overload and shall automatically reset themselves when the fault is corrected.
h) Power supplies when wired in parallel will not require external circuitry.
i) Power supplies shall have a voltage monitoring relay contact and signaling output.
j) Input must auto-range between 85 to 264VAC and 90 to 350VDC for 1 phase power supplies with no manual intervention.
k) Power supplies shall have a power factor of at least 0.6.

2.16 (M75)Programmable Logic Controller Hardware:

2.16.1 Manufacturer:

a) Rockwell Automation.
b) No Substitutes Allowed.

2.16.2 A Programmable Logic Controller (PLC) system shall be furnished and shall be programmed to operate all functions specified herein. 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 interrogated from the District 1 Dispatcher's Alarm Panel, as well as Maintenance Contractor via cellular modem and (future) fiber optic Ethernet. 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.

2.16.3 The PLC shall be equipped with sufficient memory and I/O capacity to handle control functions of present system plus 20% spare memory and 10% spare I/O minimum.

2.16.4 The System Integrator shall furnish the Pump Station operational program. A CD copy and printout of the PLC control program shall be furnished to DEPARTMENT at the time of start-up. Disk and printed copy of the operating program shall be maintained on the file with the System Integrator.

a) PLC shall be programmed using Studio 5000 (latest edition).
b) Program shall be fully commented including each page and each rung with detailed description of the logic performed.

2.16.5 Additional Materials:

a) Provide one shelf spare for each I/O module type used on project.
b) Provide one shelf spare for each power supply used on project.
c) Provide one shelf spare for each communications module used on project.

2.16.6 Chassis:

a) 1756-A4 for primary and secondary processor racks.
b) 1756-A17 for I/O racks.

2.16.7 Power Supply:

a) 1756-PA75 for primary and secondary processor racks.
b) 1756-PA75R for I/O racks.

2.16.8 Processor:

a) 1756-L72.
b) 4MB user Memory.
c) USB port.
d) Provide redundant processors.
e) Provide orderly shutdown on power failure, saving register contents with automatic restart on power restoration.

2.16.9 Communication Modules:

a) Ethernet communications with network switch: 1756-EN2T.
b) Ethernet ring topology for communications with remote I/O Rack: 1756-EN2TR.
c) Processor redundancy: 1756-RM2 with 1756-RMC1 fiber cable.

2.16.10 Input/Output Modules:

a) Digital Input: 1756-IA16I.
b) Relay Output: 1756-OW16I.
c) Analog Input: 1756-IF8I.

2.16.11 Each relay output shall be individually protected with properly sized MOV, and interposing relay.

2.16.12 Wiring and Termination System:

a) Wiring of PLC I/O modules shall be through cable assemblies to individual terminal blocks.
b) Cable assemblies shall be pre-wired and shall have PLC I/O module-specific wiring arms on one end and flying leads on the other.
c) Provide sufficient terminations to accommodate active I/O points, spares, and future expansion.

2.16.13 Manufacturer part numbers listed above reflect information known at time of design and shall be independently researched and verified for availability with latest version available prior to submittal.

2.16.14 MicroLogix hardware:

a) 1766-L32AWA
b) 120/240Vac
c) (20) 120Vac Inputs
d) (12) Relay Outputs

2.17 (M80) Managed Data Switch:

2.17.1 Manufacturer:

a) Cisco Systems Catalyst Series.
b) N-Tron 7026TX Series.
c) Sixnet.
d) No Substitutes Allowed.

2.17.2 Features:

a) Twenty-Four (24) RJ-45 10/100BaseTX Ports.
b) Two (2) SFP ports.
c) ESD and Surge Protection Diodes on all Ports.
d) Auto Sensing 10/100 BaseTX, Duplex, and MDIX
e) Advanced management features including: VLAN, IGMP Snooping, Port Trunking, QoS, and Mirroring, Local Port IP addressing, EtherNet/IP CIP Messaging, Port Security – MAC Address Based.
f) Rack Mounting.
g) Redundant Power Inputs 18-49Vdc.
h) Fault Relay Support
i) -40°C to 80°C Operating Temperature.
j) UL Listed.

2.17.3 Include SFP modules as required to terminate fiber at switch.

2.18 (M81) Mobile Gateway:

2.18.1 Manufacturer:

a) Sierra Wireless AirLink GX450.
b) No Substitutes Allowed.

2.18.2 4G secure mobile communications.

2.18.3 Provide antenna and cable for mounting to exterior of panel.

2.18.4 Hardware Interfaces:

a) 1 10/100 Base-T RJ45 Ethernet
b) 1 RS-232 serial (DB-9 connector)
c) 1 Digital I/O
d) 1 USB 2.0
e) 2 Cellular antenna
f) 1 GPS antenna

2.18.5 Power: 9-36 Vdc.

2.18.6 Operating Temperature: -30°C to 70°C.

2.18.7 90%RH @60°C.

2.18.8 3-year standard warranty.

2.18.9 Dimensions: 5.6” x 3.9” x 1.6”.

2.18.10 Contractor shall verify cellular carrier (4G-LTE) prior to ordering and coordinate with Meade Electric (EMC).

2.18.11 Meade Electric (EMC) shall assume responsibility for setup and configuration of devices at head end for secure communications using VPN tunneling and port filtering to remote facilities (data plan, provider, cellular number, etc.).

2.19 Fiber Optic Cable:

2.19.1 Material, installation, testing shall be in accordance with Illinois Department of Transportation District 1 Special Provisions titled; Fiber Optic Cable, Single Mode (latest edition).

2.19.2 At every instance where fiber optic cable is visible (hand holes, enclosures, pull boxes, etc.) an engraved lamicoid nameplate shall read “FIBER OPTIC COMMUNICATIONS CABLE TO IDOT PUMP STATION 37”, and shall be attached to the cable with no. 6 brass beaded chain or equal.

2.19.3 SC style fiber connectors shall be used at Pump Station 37 fiber patch panel, and at the Pump Station 37 Ethernet Switch.

2.19.4 Fiber shall be 6-strand singlemode in accordance with Illinois Department of Transportation District 1 Special Provisions titled; Fiber Optic Cable, Single Mode (latest edition).

2.20 Fiber Optic Patch Panel:

2.20.1 Manufacturer:

a) Lucent Technologies.
b) Panduit OPTICOM.
c) Or Approved Equal.

2.20.2 Provide rack mounted distribution panel for terminations, cross connection, interconnection, splicing and fiber identification for 24 strands fiber.

2.20.3 Provide protection from mechanical stress on the cable and fibers and from macro-bending losses.

2.20.4 Provide fiber patch cords as required.

2.20.5 The connector panels shall accommodate SC style connectors.

2.20.6 The unit shall be UL® approved.

2.21 (P4) Pressure Gauge with Indicator:

2.21.1 Manufacturer:

a) Ashcroft.
b) US Gauge, a Division of Ametek, Inc.
c) Wika Type 213.34
d) Or Approved Equal.

2.21.2 Housing Material: 316 Stainless Steel

2.21.3 Mounting: Stem

2.21.4 Dial Size: 4-1/2 inch

2.21.5 Accuracy shall be ±1% of span.

2.21.6 Scale shall read in feet of water column.

2.21.7 Units shall be bellows or Bourdon tube actuated pressure gauges. Gauges shall be stem mounting with 4-1/2-inch dial size, unless otherwise noted. Scale range shall be as noted and accuracy shall be plus or minus 1/2 percent of span.

2.21.8 The sensing element material shall be phosphor-bronze.

2.21.9 Element shall be suitable for temperatures of media monitored, and filled for alleviation of vibration.

2.21.10 Provide with two ½" full port stainless steel ball valves as shown on detail Drawings.

2.21.11 Provide with diaphragm seal as follows:

a) Lower Housing Material: Unless otherwise noted, type 316 Stainless Steel with flushing connections.
b) Diaphragm Material: Unless otherwise noted, type 316 Stainless Steel.
c) Upper Housing Material: Steel with bleed screw
d) Connections: Threaded Female NPT
e) Filling Fluid: Silicone
f) Unit shall be pressure-sensing suitable for measuring dirty or corrosive fluids.
g) Unit shall be arranged and designed to directly transmit the process pressure by means of the fluid through an opening in the lower housing to a pressure-sensing device attached and sealed to the upper housing by a drilled and threaded boss.
h) Seal shall be suitable for fluid pressures to 500 psig.
i) Unit shall have fill connections and other features required permitting refill of the seal volume and calibration of unit in the field.
j) Unit shall be suitable of for temperature of media monitored.
k) Ametek, Mansfield and Green Division, Type SG or Ashcroft Type 101.

2.22 Control Relays:

2.22.1 Manufacturer:

a) Allen Bradley.
b) Potter and Brumfield.
c) Or Approved Equal.

2.22.2 Operating Data:

a) Pickup Time: 13 ms maximum.
b) Dropout Time: 10 ms maximum.
c) Operating Temperature: -45°F to 150°F.

2.22.3 ac Coil:

a) 120Vac.
b) Continuous rated.
c) 3.5va inrush maximum.
d) 1.2va sealed, maximum.
e) 50-60 Hz.
f) Light to indicate energization.
g) Minimum Dropout Voltage: 10% of coil rated voltage.

2.22.4 dc Coil:

a) 24Vdc.
b) Continuous rated.
c) Light to indicate energization.
d) Minimum Coil Resistance: 24Vdc: 450 Ω.

2.22.5 Contacts:

a) Gold flashed fine silver, gold diffused for 1 amp or less resistive load.
b) Silver cadmium oxide.
c) 3 form C.
d) 300 vac.
e) 10 amp (B300) make, 1.5 amp break, (inductive).

2.22.6 Rated at 10 million operations.

2.22.7 11 pin, square socket (shall be same manufacturer as relay).

2.22.8 DIN rail mountable.

2.22.9 Enclosed and protected by polycarbonate cover.

2.22.10 Provide relay-retaining clips.

2.23 Interval/Duration Timer (Rear of Panel):

2.23.1 Manufacturer:

a) Idec
b) Potter and Brumfield, CN series.
c) Eagle Signal DM 100 series.
d) Or Approved Equal.

2.23.2 Mounting: Plug-in with dust tight cover.

2.23.3 Type: Integrated circuit.

2.23.4 Range: 0.5 sec to 99 min. Field selectable.

2.23.5 Contacts: 2 DPDT contacts rated 10 amp, 120 vac.

2.23.6 Power: 120Vac, 60 Hz.

2.24 Terminal Blocks:

2.24.1 Manufacturer:

a) Allen Bradley.
b) Phoenix Contact.
c) Weidmuller.
d) Or Approved Equal.

2.24.2 300 v rating for 120 v circuits and below, 600 v rating for 480 v circuits.

2.24.3 Clamping screw type.

2.24.4 Isolating end caps for each terminal.

2.24.5 Identification on both terminals.

2.24.6 Clip-mounted on DIN rail.

2.24.7 Accept AWG 12 to 22.

2.24.8 Feed-Through Terminals:

a) 20 Amp rating

2.24.9 Switched Terminals:

a) Knife disconnect with test sockets.
b) 10 Amp rating.

2.24.10 Fused Terminals:

a) Hinged fuse removal/disconnect.
b) 10 Amp rating.
c) Include blown fuse indication.

2.25 Power and Data Port:

2.25.1 Manufacturer:

a) Hubbell PR4X205E
b) GracePort
c) Automation Direct ZP-PGA-32-201
d) Or Approved Equal.

2.25.2 General

a) One Ethernet port.
b) 120Vac GFCI Receptacle.
c) Bulkhead style.
d) Nema 4X.
e) Mounted on SCADA Panel.
f) Wired to Ethernet switch.

2.26 Electronic Current Isolator:

2.26.1 Manufacturer:

a) Phoenix Contact Model MCR Series.
b) PR Electronics.
c) Entrelec.
d) Or Approved Equal.

2.26.2 Solid state instrument to electrically isolate one instrument loop from another instrument loop. Converter to accept 4-20 mAdc input signal and provide equal but isolated and power-boosted output.

2.26.3 Mounting: DIN Rail.

2.26.4 Temperature compensated, calibration-free.

2.26.5 Signals: Input: 4-20 mAdc into 50 ohms. Output: 4-20 mAdc into output load up to 500 ohms.

2.26.6 Isolation: Common mode up to 700Vac between input and output.

2.26.7 Accuracy: 0.5% of span.

2.26.8 Provide power supply specific to isolator.

2.27 SCADA Panel (SP-1) located in Electrical Control Room:

2.27.1 A SCADA panel shall house redundant programmable logic controllers (PLC's) which shall be programmed for automatic control and monitoring of the operations of all control and monitoring functions at the Pump Station. The PLC's shall control the starting and stopping of one Low Flow Pump and three Main Pumps to prevent roadway flooding. The PLC's shall be configured with redundant processors communicating over fiber optic cable with individual power supplies for each processor and redundant power supplies for each I/O rack. I/O communication shall be over Ethernet with ring topology.

2.27.2 The SCADA panel shall be NEMA 12, 10 gauge steel, floor mounted, front accessible only, metal enclosed type, arranged for cable and/or conduit entry from the top as required. Panel design shall allow easy access to all internal wiring and appurtenances. LED lighting kits activated by door switches shall be provided. Thermostatically controlled ventilation fan, air filters, thermostatically controlled space heater, light kit and 120V receptacle shall be provided. Redundant front of panel HMI's shall also be included whose software application is located on a computer in the Network Rack Enclosure. 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 the Department's system. Additional devices as shown on Drawings.

2.27.3 The SCADA panel shall be finished inside and out. Exterior color shall be ANSI 61 and shall match that for the motor control center, and the interior color shall be white or as otherwise approved by the Engineer.

2.27.4 Nameplates shall be as specified in Section 16C. All devices located on front door and inside the panel shall be identified with functional nameplates that match device ID's on Drawings.

2.27.5 The SCADA panel shall house relays, timers and intrinsically safe relays which shall be wired for backup automatic control and monitoring of the operations of critical functions at the Pump Station. Space shall be allocated for 25% spares for future equipment/devices. The logic shall control the starting and stopping of one Low Flow Pump and three Main Pumps to prevent highway flooding. The SCADA panel shall be configured with hardwired logic and shall serve as a simultaneous backup system to the primary and secondary PLC's in the same Panel. The panels shall conform to all applicable standards of NEMA and ANSI and shall be complete with float type water level control systems integrated as indicated on the Drawings and as specified.

2.27.6 Unless otherwise indicated, pushbuttons, selector switches, indicating lights, relays, and other devices shall be provided as part of the SCADA Panel and shall be as similar to those in the MCC and shall be of the same manufacturer and style.

2.27.7 Wiring shall be brought to terminal strips within the enclosure and 25 percent spare terminals shall be provided. The identification of terminals shall conform to the schematic diagrams and shall consist of slip-on heat shrink labels as manufactured by Brady, Thomas and Betts, or equal. Terminals and devices that are provided for intrinsically safe circuits shall be segregated from all other circuits/devices as described elsewhere.

2.27.8 The float control system shall operate in parallel with the PLC when calling pumps to run. The float relays shall be intrinsically safe.

2.27.9 Intrinsically Safe circuits, wiring, mounting and installation shall be in accordance with NEC Article 504 (latest edition).

2.28 Float Control System:

2.28.1. The float system shall function as described on Drawings and as described above.

2.28.2. The float control system shall include floats, interconnecting integral cable of length required, and controls for the functions indicated.

2.28.3. The system shall be intrinsically safe for installation in the wet well.

2.28.4. The system shall be complete with control logic to provide the contacts for control and alarm functions indicated. Intrinsically safe relays and associated wiring shall be located in SCADA Panel.

2.28.5. The system shall be complete with all required mounting hardware and accessories.

2.28.6. The float system shall be complete with mounting arrangement with a stilling well of adequate size, as shown in Drawing details to minimize collection of debris and calm liquid disturbances. The mounting arrangement shall permit easy removal of the floats and easy realignment when replaced.

2.28.7. When float arrangement is such that there is a possibility of float switch entanglement with an adjacent float switch, then two float trees with stilling well assemblies shall be provided - staggering the switches as required to alleviate float switch entanglement.

2.29 Network Rack (NET-1) located in Electrical Control Room:

2.29.1. Manufacturer:

a) Pentair.
b) APC.
c) TrippLite.
d) Hoffman.
e) Or Approved Equal.

2.29.2. 19” EIA Compliant Device Mounting.

2.29.3. 26U Wall-Mount Rack, ventilated, Lockable front glass door.

2.29.4. Nominal Dimensions (HxWxD): 48” x 24” x 25”

2.30 SCADA Panel HMI Computer:

2.30.1. Provide one fully configured computer system including hardware, peripherals, operating software, application software, and configuration as specified herein for running application, data logging, and trending animation.

2.30.2. Manufacturer:

a) HP
b) Dell
c) Or Approved Equal.

2.30.3. The computer shall be a Intel processor based PC in a rack-mount configuration with the following features as minimum system requirements:

a) Rack-mount 4U configuration.
b) Intel Xeon Processor (6Core, 15MB Cache, 3.6 GHz clock speed)
c) Memory: 16GB 2400MHz DDR4 Memory.
d) Internal Hard Drive: 1TB 2.5inch SATA (7.200 RPM)
e) Removable Media Options: 16x DVD ROM SATA
f) Recovery DVD.
g) 10/100/1000 Ethernet port, 1 VGA port
h) Graphics Card shall be dual-port, and capable of running multiple monitors simultaneously.
i) Operating System: Windows 11 (x64) Professional
j) Dual, hot-plug, redundant power supply, 1,100W
k) USB Quiet Keyboard
l) USB – Optical Mouse
m) Input Voltage: 90…264V ac, autoranging
n) Line Frequency: 47…63 Hz

o) Operating Temperature: 0…50 °C (32…122 °F)
p) Operating Humidity: 10…90% without condensation
q) Operating Vibration: 1 g peak, 10…500 Hz
r) Operating Shock: 15 g (1/2 sine, 11 ms)
s) Rating: NEMA Type 1, 12, 4, IP66
t) Certifications: UL 60950 recognized component, c-UL 950 recognized component, or UL/c-UL listed when marked; CE marked, C-Tick

2.30.4. Provide USB Quiet Keyboard and USB mouse in a 1U rack configuration as a slide out drawer.

2.30.5. Warranty: 3 years parts, 3 years labor, 3 years onsite services (3/3/3). Warranty shall commence from the Final Acceptance of the Pump Station.

2.30.6. Provide Microsoft Office Professional software installed.

2.30.7. Provide Adobe Acrobat reader software installed.

2.30.8. Provide virus scan software installed, with automatic updates turned off.

2.30.9. System requirements listed above reflect information known at time of design and shall be independently researched, verified, and updated based on availability, and compatibility prior to submittal. Submitted system shall be based on mid range level of performance. Operating system and software shall be most current version that is fully compatible with all software installed on the machine for the project.

2.30.10. Provide all software on original media, software publisher licenses, and manuals.

2.30.11. The computer shall be capable of off line usage for purposes other than system logging and trending without loss of statistical data.

2.30.12. The computer shall be programmed for auto-startup and login after loss of power.

2.30.13. The computer shall be arranged for system monitoring and management. The primary function of the computer shall be to provide monitoring, trend analysis and, operational records for the pump station facility.

2.31 System Software

2.31.1. General Requirements

a) The System Integrator shall furnish and install all software and programming necessary to provide a fully debugged and operating system based on the system descriptions. The software required shall consist of those programs necessary for the System to perform the functions specified herein, plus enable convenient and efficient preparation of new programs. The System Integrator shall assume complete responsibility for the successful operation of all software and application programs provided as part of the System. All programs shall be completely debugged and operable prior to delivery of the System. Department shall not be required to expend any programming effort in order to achieve a fully operational system.

b) The System Integrator is responsible for computer hardware and software compatibility.

c) Software shall be modular, comprised of an integrated group of proven, standard software modules.

d) All of the programs are to be generalized in nature such that DEPARTMENT may later add new functions. Integration of future application programs and the servicing of their input and output requirements, including construction of new printing formats and other system interfaces, shall be accomplished without recompiling of application software.

e) Changes in process parameters, addition and deletion of process schemes or equipment, and addition or modification of graphic displays and printed report formats shall be via the use of process operator and control engineer oriented icons, graphics, and menus organized in a hierarchical fashion.

f) System parameters such as: date, time, set points, alarm limits, PID tuning constants, etc., shall be entered or modified via the LCD/keyboard. Any input which modifies the system shall be logged and a historical disk file with date, new value, and previous value.

g) The System Integrator shall develop and implement all specified screens, logs, reports, etc. Department shall provide input to the System Integrator in the areas of presentation format, included information and other general operator interface considerations.

h) Provide Rockwell FactoryTalk View SE Station, FactoryTalk Historian SE (250 tags) and other software as required for a complete an operable system.

2.32 HMI Monitor:

2.32.1. Manufacturer:

a) Hope Industrial Systems Inc.
b) No Substitutes Allowed.

2.32.2. Two required. Both HMI's located at SCADA Panel.

2.32.3. Industrial monitor and touch screen, 22" panel mount active matrix LCD, NEMA 4X, stainless steel faceplate, 5-wire resistive analog touch-screen, mouse emulation, USB interface to computer.

2.32.4. 1680x1050 resolution, 16:10 widescreen aspect ratio, 16.7 million colors.

2.32.5. UL-508A listed.

2.32.6. Include vendor cables of sufficient length to connect to computer.

2.32.7. 3-year factory warranty. Warranty shall commence from the Final Acceptance of the Pump Station.

2.32.8. Include hinged screen protector for each Monitor.

2.33 Graphics and HMI Configuration:

2.33.1. Department will provide sample HMI screen captures upon request of the Contractor. Sample screen captures shall be used as the basis for screen development on this project.

2.33.2. HMI-1 shall be configured to display various graphics screens as the Operator selects for monitoring and control of the Pump Station. HMI-2 shall be configured to display an alarm annunciator-style graphics screen as default with the ability of each HMI to interpose functionality between the two with one click of mouse or active touch space on-screen. Each HMI shall have access to all graphics screens. The HMI's shall operate as redundant equipment.

2.33.3. All color displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers as shown on the Drawings. The following basic types of LCD displays are required:

a) Index displays
b) Graphic displays
c) Trend displays
d) Alarm summary displays

e) System status displays
f) Single point configuration/status displays
g) Pop-up displays
h) Help displays
i) Set-point displays

2.33.4. The LCD displays shall make maximum use of the colors available. Colors for status such as open/close, start/stop shall be the same as the indicators on the local control panels and motor control center. The use of color for status shall be unique and consistent for all graphic screens.

2.33.5. The LCD displays shall be interlinked for easy and direct access. Navigation shall be accomplished by mouse selection from Windows like pulldown menus or via hot links on displays. Display hot links shall allow navigation from the general to the specific and include a "PREVIOUS" select point for reversing the previous 10 navigation steps.

2.33.6. The system shall allow the operator to manually interrogate the status of pumps, valves, etc., via either keyboard entry on the currently displayed graphic screen.

2.33.7. Index displays: Display shall be provided as a guide to the available display options. The index displays shall be a complete and logical listing of the names and number of all screens. Provide hot links on the index displays to allow immediate access to any screen listed.

2.33.8. Graphic displays: The display shall depict basic process schematic diagrams with representative symbols for pumps, generator, etc., combined with real time process variables or conditions. The equipment represented on the display shall be suitably titled for identity. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.) The data shall be identified on the display by its name and tag number. All of the current data in the database shall be available for graphic displays. It shall be possible to easily modify an existing display or generate a new display. The graphic displays shall consist of a single master plant flow schematic and multiple subscreens detailing specific plant systems or elements. The process graphic displays shall be comprised of master, area and system displays. The master and area displays shall show general graphic representations of the facility covered with general equipment, alarm, analytical summaries and control capabilities. The system display shall detail all relevant aspects of the individual equipment or system (i.e., an individual pump). The intent is to provide the Operator with an overview (Master) with the capability to "zoom in" on a process (Area) or a piece of equipment (System) as necessary. The System Integrator shall use the Process, Mechanical, and Instrumentation Drawings included as part of this Contract to generate the graphic displays.

a) Trend display: The trend display shall display the value of a process variable versus time. The intent of the display is to resemble the type of plot produced on an analog recorder, only displayed on the LCD. Each of the assigned points will have its point identification number, point name, current value, and instrument range displayed in the color used for its trend. Each point will be trended in a different color. The time period shall be selected and time and date of start, shall be displayed. The values displayed on an historical trend shall consist of the stored values for each variable trended. Provide both historical and real-time trending capability. Real-time trends shall be updated at the scan frequency of the variable. Provide historical and real-time trending for all analog inputs shown on the P&ID. Points shall be logically grouped on a trend screen as directed by the Department or Engineer.

b) Alarm summary display: The display shall consist of all equipment current in alarm, and shall include the tag number, description, time of occurrence, present status (high, low, normal, etc.). The alarm summary shall identify alarm points by severity by utilizing distinct colors for each severity category. The severity classification shall be a configuration option.

c) System status displays: The displays shall summarize all error status of all devices in the system capable of reporting errors to the CPU (e.g., printers, communication devices, communication lines, remote PLCs, etc.). The display shall indicate if an error is detected or a failure occurs. These displays shall be used primarily for maintenance purposes.

d) Single Point Configuration/Status displays: The configuration/status displays shall be of the software vendors standard format.

e) Pop-up displays: Provide pop-up style displays for operator notification, help screens, or ancillary display functions. Pop-up display shall conform to Microsoft Windows look and feel including pop-up termination or action pushbuttons.

f) Help displays: Provide process help displays for all graphic screens developed for this project. Help displays shall be pop-up type and provide operator information about the process graphic currently displayed.

g) Set-point displays: Provide standard display for all PID loops presenting all analog process variables, associated PID set-points and loop tuning parameters stored in the PLC. Provide additional level of password protection prior to allowing any changes to loop tuning parameters.

h) Provide button link graphic icons that allow operator action by selection of the button with the mouse and mouse key. Button link shall be a standard graphic item and be modifiable for any process action or graphic call.

2.33.9. Alarm/Equipment Status Reporting:

a) The alarm log shall store all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag number, and whether it's a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be printed. All reports shall include the plant equipment number of the associated device.

b) Equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The status monitoring shall be capable of being disabled and/or suppressed from the operator's console. The equipment status log shall include the time, the equipment name, tag number, and the particular change in status.

2.33.10. Prior to final completion of construction project, the System Integrator shall turn over two thumb drives with all HMI and Historian programs fully documented and labeled: “Pump Station 37 HMI” with System Integrator full contact information. Two hardcopies of the HMI and Historian programs shall accompany the thumb drives.

2.34 PLC Program Development and Software:

2.34.1. The System Integrator shall provide all PLC programming and configuration required to implement the control strategies specified in this Section and shown on Drawings for a complete and fully operational Pump Station.

2.34.2. ControlLogix PLC’s shall be programmed using Allen-Bradley RSLogix 5000 (latest version compatible with all software and hardware), and be fully commented.

2.34.3. Provide PLC program fully documented with individual rung and page commentary describing the action and interaction of rung with other control ladder logic. A PDF of sample program will be provided to the successful bidder.

2.34.4. Prior to final completion of construction project, the System Integrator shall turn over two thumb drives with all PLC programs fully documented and labeled: “Pump Station 37 PLC Programs” with System Integrator full contact information. Two hardcopy of the PLC program shall accompany the thumb drives.

2.35 PLC Program Development Guidelines:

2.35.1. Department will provide sample PLC logic upon request of the Contractor. Sample logic shall be used as the basis for programming development on this project.

2.35.2. Set-points, alarm values, timer values, control loop tuning parameters, and other numeric values used within PLC and HMI programs shall be part of continuous common data table within program. Parameter changes shall not require modification to instructions within program. Parameter changes shall be adjustable by changing data table through operator input via HMI.

2.35.3. Unless specified otherwise, procedure for control power fail restart for equipment shall be as follows:

a) Equipment shall shut down on loss of control power (if UPS has been exhausted).
b) Upon restoration of power, previously running equipment shall be restarted using same sequence of startup used for “Auto” control.
c) Prior to Restart, Auxiliary equipment shall be placed in “Off” position.
d) Equipment Restart shall be sequenced through use of timer functions to prevent simultaneous restart.

2.35.4. PLC shall not be enabled to control equipment unless respective field or MCC Hand/Off/Auto, Local/Remote, On/Off/Remote or Open/Close/Remote selector switch is in “Remote” or “Auto” position. Equipment status monitoring/displaying and process parameter logging/trending shall continue in all modes of control.

2.35.5. Determination of high (low) Off-Normal conditions shall be by comparing an analog input value to Operator entered set-point values. Off-Normal status bit shall be set when rising (falling) input value is equal or greater (less) than entered set-point value. Off-Normal status bit shall be reset when falling (rising) input value is equal or less (greater) than entered set-point value minus (plus) entered deadband value. Operator entered high (low) set-point values are absolute values and deadband values are relative values. All values are entered through HMI.

2.35.6. Setting of Off-Normal status bits shall cause status conditions to be displayed and/or alarmed at HMI.

2.35.7. Resetting Off-Normal status bits shall cause status conditions displayed and/or alarmed at HMI to be cleared.

2.35.8. Adjustable delay timers on alarm points shall prevent nuisance alarming or nuisance clearing of alarms. Timer values shall be ranged 0-30 seconds. Initial setting, unless otherwise specified shall be 5 seconds.

2.35.9. All status conditions at HMI shall also be logged to data table and event log.

2.35.10. Motor Running status shall be monitored and displayed at HMI continuously.

2.35.11. Setting of Motor Failed status bits:

a) If motor is required to run via PLC control (MCC Hand/Off/Auto selector switch in “Auto”),
b) And if absence of Motor Running status causes Motor Fail watchdog timer to time out,
c) Then Motor Failed status bit shall be set.

2.35.12. Setting a Motor Failed status bit shall cause motor command output to be inhibited and shall cause Motor Failed status to be displayed and alarmed at HMI.

2.35.13. Resetting of Motor Failed status bits:

a) If MCC Hand/Off/Auto selector switch is in “Auto” position,
b) And if failure condition is abated,
c) Then Motor Failed status bit shall be reset.

2.35.14. Resetting a Motor Failed status bit shall cause motor command output to be re-enabled and shall cause Motor Failed status displayed and alarmed at HMI to be cleared.

2.35.15. Adjustable filtering of analog inputs shall eliminate process upsets due to noise. Filtering shall be by running-average method.

2.35.16. Integration algorithm shall be included for “Totalizing” analog flow signals.

2.35.17. Integration algorithm shall be included for “Totalizing” Equipment Run times (Elapsed Time Meter). Pump ETM and Pump number of starts shall be password protected and require Supervisor level verification to reset.

2.35.18. PLC input coils shall be configured as non-latched unless specified otherwise.

2.35.19. PLC output contacts shall be configured as maintained unless specified otherwise.

2.35.20. The following are PLC generated alarms or conditions (specific to Pump Station 37) that are extrapolated based on field I/O conditions:

a) If LE/LT-0111 (located in the Screen Chamber) exceeds 651.50 elevation, then the PLC shall evaluate level differential between LE/LT-0111 (located in the Screen Chamber) and LE/LIT-0121P (located in the wet well). If level differential exceeds an Operator adjustable set-point (initially set at 18") an alarm shall be generated. Level differential calculation shall only be made when LE/LT-0111 exceeds 651.50 elevation. Alarm shall be designated "Bar Screen Blockage".
b) "SCADA MPR Override" output shall be generated if more than one Main Pump exhibits a High Temp or Seal Fail as detected by the Motor Protection Relay (MPR). Effectively, this allows the Lag Pump and the Standby Pump to operate with the MPR in alarm.
c) "Pump Off" is defined as the MCC Hand/Off/Auto switch in the "off" position.
d) "Pump Not Running" is defined as the inverse of pump running.
e) "Pump Fail to Stop" status alarm shall be generated if a Pump is running and Low Water Level float is de-activated.
f) "Pump Alarm" status transmitted to AEGIS shall be determined as any pump in overload, over-temp, seal-fail, or fail-to-start condition.
g) "Not in Auto" is defined as the inverse of any PLC input "In Auto".
h) "Equipment Out Of Service" status shall be determined by main breaker in the off position, and the Hand-Off-Auto selector switch in the off position.
i) "Gates in Non-Discharge Mode" status is set when the Recirculation Gate (RG-1) is not closed, and/or the Discharge Gate (DG-1) is not open.
j) "Pump Station Isolated" status is set when the Influent gate (IG-1) is confirmed closed.
k) "SCADA Call" output to supply fans and exhaust fans is generated whenever lights are on in the Pump Station in a respective area as the fans.
l) "FLOAT FAIL" alarm shall be generated when a float fails to activate when water level (as measured by analog level elements) exceeds the floats expected activation level by more than 12". Additionally, if a float remains active when water level drops below the floats deactivation level by more than 12".
m) "PLC Fail" output that is de-energized when primary and secondary level elements are out of range, and/or both PLC processors fail.
n) An alarm shall be generated if the lights and or the fans in the Pump Station are continuously on for more than (an Operator adjustable) 8 hours.
o) An alarm shall be generated if the primary or secondary analog level signals are outside the two float elevations (above and below) for a period of 30 minutes. Alarmed device shall be removed from all control until remedied.

p) An ultrasonic level sensor alarm shall be generated if an “Out of Bounds”, “Fail Safe Fault, or “Loss of Echo” signal is received by the PLC and sustained for 15 seconds or longer. Alarmed device shall be removed from all control until remedied. Signals are dependent on manufacturer selected.

2.36 HMI Program Development Guideline:

2.36.1. Graphical Screens:

a) Overview screens and reports shall be first screens configured. Coordinate layout and information requirements with Engineer and Department prior to development of screens – see EXECUTION Section below for details and requirements.
b) HMI screens shall be developed for the complete operation of the Pump Station as allowed by design and PLC involvement in the processes.
c) Screen development is understood to be partially an art form in conveying the data in graphical manner that is best understood. Screen development shall be a coordinated effort with the Department with input from being incorporated while staying within the scope of the project. Changes in color, texture, font, area of screen an item is located, and other artistic changes shall be incorporated without additional costs to the Department.
d) Graphic screens for HMI shall be formatted to resemble P&ID’s, one-line diagrams, and physical layout of the Pump Station. As a minimum, one graphic display per process loop shall be provided.
e) Screens shall be simplified representation of process flow stream and associated equipment as shown on Drawings. Only major devices shall be shown. Non-reporting equipment (isolation valves, check valves, indicators) need not be shown.
f) Each screen shall include a legend of shapes and colors that depict status of equipment.
g) The following shall be provided as minimum:

1) Main Menu Screen: Icon selection of all graphics screens available for selection.
2) Alarm Annunciator-style Screen: The display shall be designed to have the look of an annunciator panel whereby critical Pump Station equipment is listed in individual squares that change color depending upon status of the equipment. If the equipment is operating normal with no alarms, then the square is gray in color. If the equipment is under an alarm condition, the respective square shall turn red and flash. The following equipment (or condition) shall be individually segregated with an alarm square:

a. Low Flow Pump Fail to Start
b. Low Flow Pump Overtemp/moisture
c. Low Flow Pump Overload
d. Main Pump 1 Fail to Start
e. Main Pump 1 Overtemp/moisture
f. Main Pump 1 Overload
g. Main Pump 2 Fail to Start
h. Main Pump 2 Overtemp/moisture
i. Main Pump 2 Overload
j. Main Pump 3 Fail to Start
k. Main Pump 3 Overtemp/moisture
l. Main Pump 3 Overload
m. Low Water Level
n. High Water Level
o. Pavement Flooded
p. Discharge Chamber Flooded
q. Float Failure
r. Intrusion Alarm
s. Fire Alarm
t. Fire Panel Trouble
u. Normal Electrical service Failure
v. Emergency Electrical Service Failure
w. SCADA Power Failure
x. SCADA Panel Common Alarm
y. Gates in non-discharge Mode
z. Oxygen Gas Alarm
aa. Combustible Gas Alarm
bb. Gas Monitor Failure
cc. UPS Low Battery
dd. UPS Failure
ee. PLC Failure
ff. Station in Float Mode
gg. Pump Not in Auto
hh. Pump “Under Maintenance”
ii. Bar Screen Blockage
jj. Level Sensor Alarm
kk. Up to (10) additional as defined by Engineer.

3) System Overview: Depiction of wetwell (including wetwell level) and pumps, status of pumps (running/off/under maintenance), status of gates/valves Open/Closed/Transitioning), and Lead/Lag/Standby position of each pump in the pump sequencer. Icon of all other Screens shall be provided for jump to that specific screen.

4) Float Status Screen: Shows wetwell level and status of each float switch with legend for status. This screen may be combined with System Overview Screen if all equipment depictions are clear, concise, and unambiguous to the Operator. Icon of all other Screens shall be provided for jump to that specific screen.
5) Individual Pump Screens: Containing graphical information about each Pump. See Drawings for specific requirements (total runtime hours, total number of starts, running/off/under maintenance status, amps, breaker position, overload, overtemp, seal fail status, not in auto, etc.). Icon of all other Screens shall be provided for jump to that specific screen.
6) Motor Current Alarm Set-points Screen: contains Operator adjustable variables for low and high current limits for each Pump used for alarming and maintenance purposes (pumps will not stop based on these entered values). This may be included on the Individual Pump Screen of space permits. Icon of all other Screens shall be provided for jump to that specific screen.
7) Electrical one-line Diagram Screen: containing status of circuit breakers (green = breaker open, red = breaker closed) as seen by the PLC in a graphical power one-line schematic representation. A legend shall also be included indicating color representation. Each power service shall indicate voltage (A-B, A-C, B-C, and each leg with respect to ground), amps of each leg, frequency, power (kW), and power factor. Icon of all other Screens shall be provided for jump to that specific screen.
8) Network Communications Diagram. Icon of all other Screens shall be provided for jump to that specific screen.
9) Generator Screen: containing status of Generator equipment. See Drawings for specific requirements (total runtime hours, total number of starts, on/off/under maintenance status, fuel tank level, level low, not in auto, e-stop, leak detection, common alarm, etc.). Icon of all other Screens shall be provided for jump to that specific screen.
10) Analog Level Element Set-point Screen: contains Operator adjustable variables for Pump on/off level operation. A default level setting matrix shall also be included as the default Pump Station settings, with a reset-to-defaults selection available. A graphical representation of wet-well, with pumps listed at various levels (Lead, Lag, etc.) on the left side of wet-well in order of operation. The numerical level of each level element with floats also represented as reference to the analog level. An Operator adjustable set-point (initially set at 18”) shall be provided whereby a level differential between level sensor in the Screen Chamber and the level sensor in the Inlet Chamber shall cause an alarm. Icon of all other Screens shall be provided for jump to that specific screen.

11) Station Status Screen: contains depiction of all PLC's and their status with regards to power and communications. Also contains the following: status of each supply and exhaust fan, gas monitor status, fire alarm panel status, AEGIS alarm status, key switch box position, and pump room lighting status, etc. Icon of all other Screens shall be provided for jump to that specific screen.
12) Alarm Screens: contains all alarms in a LED style depiction with status of each (normal = green, alarm = red). Any device, equipment, or PLC generated alarm shall be represented with time and date stamp.
13) Event logs and password protected system administration screens.
14) AEGIS Common Alarm Screen: There is a SCADA Common Alarm that is transmitted to the AEGIS Panel for alerting outside entities of possible alarms in the Pump Station (from Pump Failure, lights on, etc.). Provide an alarm selection screen whereby the Operator may select which Pump Station alarm conditions will be part of the SCADA Common Alarm that is transmitted to the AEGIS Panel. This screen shall have each alarm condition listed and a check box selection matrix. This screen is provided as a means to de-select possible nuisance alarm conditions.
15) Trend Screen: Operator adjustable points for trending. Provide trending capability for all analog inputs at PLC. 96 hours retained trend data minimum.

h) Operator and Engineering screens shall be segregated to allow password protection of engineering-entered values.
i) There shall be pick-fields on all screens that will allow for return to main menu or to adjacent process flow screen (continuation of all process flow paths, either entering or existing).
j) Pick-fields shall be activated by placing mouse cursor on object or text and clicking left mouse button, or by selection of associated function key (F1-F12).

2.36.2. Data Input:

a) Data entry areas shall be provided at HMI for adjustment of process and alarm set-points. Data entry areas shall be password protected.
b) Upper and lower limits shall be provided for all data entry values. Entry of values outside of limits shall not be accepted and shall generate appropriate error message on screen. Upper and lower limit values shall be adjustable at HMI and shall be password protected.
c) Upper and lower limits shall be provided for all logged analog input values. Logged values outside of limits shall generate appropriate alarm. Upper and lower limit values shall be adjustable at HMI and shall be password protected.
d) Upper and lower limits shall determine range of analog input value. Value shall be scaled in standard Engineering Units.

e) Password protection shall consist of alpha-numeric sequence and shall be intended for Plant Supervisor and Head Operator entry only.
f) Unless otherwise specified process points shall be scanned as follows:

    1) Critical Alarm points and analog input process points shall be scanned continuously.
    2) General Alarm points shall be scanned only on change of state into alarm condition.
    3) All other points scanned only when required for display at HMI.

g) All dynamic screen displays shall be updated every 2 seconds, minimum.

2.36.3. Display Objects – General

a) Process piping and pumps/fans/mixers may be animated with color to show active/non-active status.
b) Use graphic symbology for rendering of objects.

2.36.4. Display Objects – Process Lines and Inline Device Symbology

a) Where inline devices are dynamic in nature, their equipment symbols shall be formatted as Display Objects to change color based upon feedback. Coordinate color use with Department's existing HMI configuration. Recommended color use:

    1) Off – Red.
    2) On – Green.
    3) Fail/Alarm – Red, Flashing.
    4) Status – Amber.

b) Inline devices shall have alphanumeric tag identified near them, adjacent to associated symbol.
c) Arrow heads shall be used as pointers for flow direction at all points of entrance to equipment, at all points where process lines change direction and at points of merger.
d) Process lines entering or leaving screen shall have points of continuation identified by boxed text, indicating From/To screen. One end of box shall form arrow to show direction of flow and act as pick-field for selection of screen of continuation. Color shall be same as associated process line.
e) Process lines shall be identified with flow stream abbreviation as listed in standard symbolic table and as shown on Drawings, where convenient.

2.36.5. Display Objects – Data Fields

a) Analog process data not conducive to graphic symbology shall be formatted as rectangular Data Fields.
b) Process values (i.e. Flow, Elapsed Time) shall be displayed as Data Fields near associated device symbol and shall consist of: alphanumeric tag, green in color; data value, white in color, right justified; engineering unit, green in color. Entire field shall be grouped as one block.
c) Data Fields shall be configured with high and low limits (adjustable) as described above.

2.36.6. Display Objects – Status Displays

a) Status Displays shall be similar to Data Fields but shall be linked to discrete data points or status bits.
b) Discrete equipment parameters (i.e. Run, Fail, On/Off, Open/Close) shall be indicated as rectangular Status Displays and shall consist of: alphanumeric tag, green in color; single or dual-state equipment value, white in color, center justified. Entire field shall be grouped as one block.
c) Displays shall be classified as Alarms or Events (see below).

2.36.7. Data Entry Field:

a) Similar to Data Display Field described above. Allows Operator entry of process values such as set-points.

    1) Pop-up activation for dynamic control of equipment shall be by pick-fields associated with symbol of device to be controlled. Pop-up shall be small window or graphic overlay on current screen in location that will not interfere with current operation. Pop-up will contain necessary symbolism for dynamic control and worded prompts as necessary.

2.36.8. Alarming Requirements:

a) Alarms and Events shall be logged to data file.
b) Critical alarms shall alert AEGIS system (See selection matrix above).
c) Alarms shall fall within one of following categories.

    1) Critical: Alarms displayed and annunciated at AEGIS and broadcast to IDOT District 1, IDOT TSC, and Maintenance Contractor Facility.
    2) General: Alarms displayed and annunciated at local HMI and logged to alarm event file.

d) Provide alarm summary screen(s) at HMI.
e) Display only current alarms. Acknowledged alarms which are no longer active shall not be displayed.
f) Allow operator to acknowledge alarms using single keystroke or cursor pick at alarm summary screen.
g) Alarm Display shall include following information:

    1) Time and date alarm initially occurred.
    2) Alarm point identification.
    3) Alarm value and engineering units for alarms generated from analog process points.
    4) Description of alarm (up to 40 characters).

h) Events shall be logged to separate data file. Events shall not be displayed unless evoked and shall not be annunciated.

i) In addition to the above, an alarm matrix shall be developed for expanding upon basic FactoryTalk alarming features which allow the Operator to select which alarms shall transmit to AEGIS when active (described in greater detail above).
j) The Operator shall have the ability to silence alarms.
k) The alarm silence feature shall also have a manual override.

2.36.9. Data Logging requirements – Analog and Discrete

a) All input process points shall be logged to the hard disk of the HMI computer.
b) Procedure for data collection and storage shall be as follows:

    1) HMI I/O driver shall poll process points as specified on I/O list and transfer data to image table.
    2) HMI shall scan image table for analog process points once every second, and log value to data base.
    3) HMI shall calculate minimum, maximum and average for each analog process point and log to data base.
    4) HMI shall scan image table for discrete process points on status change only, and log value to data base.

2.36.10. Trend Display Requirements

a) Configure HMI computer to display logged data in graphical trend format.
b) Trend Display Requirements:

    1) Identification of process point being displayed. Use same nomenclature as used on HMI screens.
    2) Start and end time of data being displayed.

3) Display shall incorporate movable vertical cursor along time axis. Parameter values at cursor date and time shall be displayed digitally.
4) Initial configuration of displays shall display data from present time back to 96 hrs prior to present time. Provide capability for operator to enter new start time for data being displayed to view parameter trend more than 96 hrs old. System shall be capable of retrieving 1 year of stored data.
5) Displays shall include y-axis range identification, including values and engineering units.
6) Configure trend displays to use maximum of computer screen area possible for purpose of increased resolution.
7) Trend displays shall be accessible, via single keystroke, from graphic screen displaying trended point.

c) Organize graphics screens for trend displays into categories by process:

1) Provide separate graphic screen within each category to display each process point trend. Provide different color for each process point.
2) Provide separate category for manually entered data from HMI computer.

3. EXECUTION:

3.1 Inspection

3.1.1 Verify that field conditions are acceptable and are ready to receive work.

3.2 Installation

3.2.1 Install devices and equipment in accordance with manufacturer's instructions.

3.2.2 All wires and cables shall be labeled and identified at both ends. This includes spares.

3.3 HMI Screen Development and PLC Programming

3.3.1 Two meetings are required to include: Contractor, System Integrator, the Department, and Phase 3 Engineer in attendance.

a) The first meeting shall be limited to 4 hours and shall consist of a formal review of HMI Screens which shall be provided [48 hours in advance] in color hardcopy for all attendees by Contractor. Review shall be an opportunity to provide creative input to the development and artistic representation for Screens. All requested changes/alterations shall be documented and a formal response to each alteration by the Contractor presented prior to the second meeting. PLC programming and operational strategies are also discussed and input provided. Site of meeting shall be at the discretion of the Department, and shall occur prior to Shop Testing described below.
b) The second meeting shall be limited to 4 hours and shall consist of a formal review of HMI Screens which shall be provided [48 hours in advance] in color hardcopy for all attendees by Contractor. Review shall be an opportunity to provide creative input to the development and artistic representation for Screens. All requested changes/alterations shall be documented and a formal response to each alteration by the Contractor presented within 3 weeks of meeting. PLC programming and operational strategies are also discussed and input provided. Site of meeting shall be at the discretion of the Department, and may be combined with Shop Testing (described below) at the discretion of the Department.

3.4 System Testing:

3.4.1 System testing and Start-up including the following, shall include provisions of Section 1A, and 15D.

3.4.2 System Shop Tests:

a) The System Integrator shall be able to simulate the SCADA system within his shop. Shop testing shall include, but not necessarily be limited to, the following:

1) Manually fill-in required additions to PLC data base.
2) Manual forcing of outputs.
3) Operation of the control programs.
4) Forcing redundant transfer from primary PLC to secondary as a bump-less transfer.
5) Recall of simulated data points on the HMI display.
6) Recall of all reports with partial fill-in data and manual fill-in data at time of testing.
7) Routing testing of logger, AEGIS alarm, and HMI display based upon manual input data.
8) Change of alarm and limit set-points, etc., and observation of results.
9) Any additional testing which may be found to be necessary at the time the above is observed.

10) All necessary contact and analog inputs must be provided to permit satisfactory testing of the above. If analog instrument switch over from one test to another is required, it shall be done in a most expeditious predetermined manner so as to permit nearly continuous testing during final shop acceptance.
11) Prior to such acceptance tests, the System Integrator shall submit the detailed procedures of the proposed shop tests and a time schedule within which such tests can be run, both subject to acceptance and approval by the Engineer. The System Integrator will be expected to do all necessary pretrial testing and debugging to ascertain that the system is in running order. After the System Integrator has confirmed that the proper responses can be achieved, the date for final shop test may be established.
12) During shop testing, the System Integrator shall generate hard copy printouts 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, and all panels meet contract requirements shall be submitted. The Department reserves the right to be present when shop tests are run as described below.

b) The Contractor shall notify the Department, in writing, with the System Shop Test date(s). The Contractor shall submit an itinerary to the Department, for review and acceptance, a minimum of four (4) weeks prior to the scheduled travel.

3.4.3 System Field Tests

a) The pre-acceptance test procedures, as outlined in the preceding paragraphs, shall apply. Acceptance testing shall include the following:

1) Acknowledge receipt of all analog and contact inputs, their reliability value and range.
2) Transmission of contact and analog signals to perform their intended tasks.
3) Any additional testing which may be found necessary at the time the above is observed.

3.4.4 Start-up and Operational Testing:

a) The start-up services and Operational Test for the following equipment shall be coordinated with the Department; Department shall be notified at least two weeks in advance:

1) SCADA System complete.
2) Float System.
3) Pumping System.
4) Gas Detection and Monitoring System.
5) Outside Communications.

b) Shall include detailed written description of each test performed, parameters for each test, interlocks and prerequisites for each test, and results of each test preformed and room for initials and date for each witness of test. Testing procedures shall be made available in hardcopy two weeks prior, and also during Operational Testing.
c) Department and Engineer shall both be given the opportunity to witness all Operational Testing. Contractor shall coordinate schedules of all parties.

3.5 Operational Testing:

3.5.1 Pump operational testing shall verify both manual and automatic modes of operation of equipment confirming flow rates, and electrical characteristics are within equipment manufacturer's recommendations.

3.5.2 Automatic pump operational testing shall be performed based on the rising water and falling water conditions.

3.5.3 Operational testing shall include verification of local indication, HMI indication, and District 1, IDOT TSC, and at Maintenance Contractor's facility indication.

3.5.4 Prior to Operational Testing, the Contractor shall coordinate with the IDOT Maintenance Contractor and complete all work at remote locations at District 1, IDOT TSC, and at Maintenance Contractor's facility.

3.5.5 With the H-O-A switch at the MCC in "Hand", each Pump shall be started, stopped, and bumped from the Local Control Station and the MCC individually. Pump time delays shall be tested for accuracy. Pump motor current shall be documented during running. All associated pump pilot lights shall be tested for function. All pump interlocks (leak, overtemp, overload, etc.) shall be tested on each pump (this may require jumpers installed/removed in electrical circuits or manually initiating the fault condition). Motor protection relays and intended functionality shall be tested during this time. Elapsed time meters, number of starts, voltage meter, and motor current shall be confirmed. Low Flow Pump and one Main Pump shall be run concurrently for testing. Two Main Pumps shall be run concurrently for testing. Testing shall utilize both power sources, assuring functional testing of the ATS and Generator. During testing, Contractor shall assure minimum pump submergence is observed at all times. During pump operational testing, Discharge Gate shall be confirmed closed, while and the Recirculation Gate is confirmed open.

3.5.6 With the H-O-A switch at the MCC in "Auto", pump operational testing shall include SCADA system with analog level element signals as control variable, and also the float system using hardwired control circuitry. Testing shall occur concurrently and separately.

3.5.7 SCADA Pump testing shall be performed as follows:

a) Confirm wet-well level is above Low Level Alarm Float Switch (FS1), and no pumps are running.
b) Close Influent Gate and receive confirmation.
c) Override Pump inhibit (due to Influent gate closed) at HMI.
d) Open Recirculation Gate and receive confirmation.
e) Close Discharge Gate and receive confirmation.
f) Fill water in the wet well – Contractor shall be responsible for providing water.
g) For each rising water level benchmark shown on Drawings, verify operation of respective pump. Verify on/off operation. Verify a maximum of two Main Pumps running at a time. Verify HMI pump sequencer operation. Verify Lead/Lag/Standby configuration for all six possible scenarios of pump sequencer. Verify pilot light functionality and SCADA HMI operation for each signal and respective status of equipment.
h) Place Lead Pump in “under maintenance” mode and verify Standby Pump Operation. Repeat operation with Lag Pump “under maintenance”.
i) Force Lead Pump MPR into alarm (this may require an electrical jumper) and verify Standby Pump Operation. Force Lag Pump MPR into alarm and verify continued operation.
j) Verify analog level sensor accuracy and functionality. Intentionally fail primary level signal and verify SCADA system seamlessly transfers control of pumps to secondary analog level element as level control variable. Repeat in reverse with at least one pump running.
k) Verify wetwell High Level alarm.
l) Reverse Recirculation and Discharge Gate positions.
m) For each falling water level benchmark shown on Drawings, verify operation of respective pump. Verify pilot light functionality and SCADA HMI operation for each signal and respective status of equipment.
n) Verify wetwell Low Level alarm. This may require the use of temporary portable pumping equipment and shall be provided by Contractor.
o) Verify and document all equipment changes of state with respect to water level during functional testing and submit.
p) Verify all alarms at District 1, IDOT TSC, and at Maintenance Contractor’s facility.
q) During testing, Contractor shall assure minimum pump submergence is observed during pump operation.

3.5.8 Analog Level sensors shall be performed as follows:

a) Verify 4-20mA output and respective wet-well level at HMI from empty to full wet-well conditions.
b) Verify Operator adjustable level differential between Screen Chamber and wet well causes SCADA system to give a “Bar Screen Blockage” alarm. Verify Operator adjustable HMI differential level functionality for this alarm.
c) Demonstrate failure of primary level element with bump-less transfer of control to the secondary.

3.5.9 Gas System shall be tested in accordance with manufacturer’s written procedures on testing and calibration.

a) Analog outputs shall be verified for operation at specified gas testing levels.
b) Pump Station alarms verified.
c) System reset verified.
d) Ventilation System coordinated and tested for functionality (all supply and exhaust fans shall operate during a Gas System alarm plus an additional 15 minutes via an off-delay timer – exception is the Electrical Room ventilation equipment.
e) Verify all alarms at HMI, and District 1, IDOT TSC, and at Maintenance Contractor’s facilities.

3.5.10 Communications:

a) Verify each alarm represented on Drawings at AEGIS panel is transmitted and received at District 1, IDOT TSC, and at Maintenance Contractor’s facilities.

3.5.11 Additional Testing:

a) Each of the testing requirements shall include formal written test procedure, test verification, commentary on discovered anomalies and formal submittal in accordance with submittal procedures.
b) Verify each SCADA input and output is tested and verified for functionality, document and submit.
c) PLC’s shall be tested for bumpless transfer on primary processor failure.
d) PLC I/O rack redundant power supplies shall be tested for bumpless transfer upon failure.
e) PLC I/O rack shall be tested for ring topology redundancy with the processors.
f) Demonstrate a complete SCADA computer failure (by removing power from computer), with PLC maintaining control of the Pump Station. Resumption of power shall bring each HMI back to their respective “Home” screens.

g) Demonstrate UPS failure for each UPS, alarming, and bypass contactors.
h) Demonstrate power failure for each 120Vac power circuit to SCADA panel, and alarming.
i) Demonstrate 24Vdc power supply failure and alarming.
j) Demonstrate “Float Failure” when a float fails to activate. Verify for each wet-well float. Float Failure is a level deviation exceeding 12” from analog level.
k) Verify Pumps are inhibited from running (in Auto) with both Discharge and Recirculation gates are confirmed closed.
l) Verify Pumps are inhibited from running (in Auto) with Influent Gate is confirmed closed. Verify override operation (at HMI) of this.
m) Electrical Systems in accordance with procedures as described in relevant Sections (Fire/smoke detection, AEGIS, Intrusion Switches, Generator, ATS, Surge Protection, Grounding, etc.).
n) Mechanical Systems in accordance with procedures as described in relevant Sections (Supply fans, exhaust fans, dampers, heating, air conditioning, etc.).
o) Fiber testing. Testing shall be in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (latest edition) article 801.13 (d).

3.5.12 Final Acceptance

a) Satisfactory operation of the work by the Department 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, and complete training of all systems has been accomplished.
b) All punch list items have been resolved to the satisfaction of Engineer and the Department.
c) All O&M manuals, Record Drawings, and record documents shall be delivered to and approved by IDOT.
d) All contractual spare parts delivered to the Department.
e) All training completed or scheduled (if off-site).
f) Final acceptance test will be run for 30 days within which cumulative major component down time, consisting of the computer systems and the PLC's does not exceed 4 hours. Repeat test if 4-hour limit is exceeded.
g) Written acceptance by the Department shall be the start date of the warranty period. Warranty shall commence from the Final Acceptance of the Pump Station.

4. TRAINING:

4.1. Operator Training:

4.1.1. Operator training shall be provided at Department facility (on-site) 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. Training shall include project-specific examples.

4.1.2. Training shall include operation of the SCADA system, set-points, initiation of diagnostic routine, set up and revisions of graphic and report format, how to perform system shutdown and restart, etc. It shall also include care and maintenance of the equipment.

4.1.3. Upon completion of training, 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.

4.1.4. This training shall consist of a minimum of two 1-day (16 hours total) classes for 5 persons in each class. Training materials and manuals shall be provided for each participant.

4.2. Maintenance Training:

4.2.1. The Contractor shall provide two 1-day (16 hours total) maintenance training classes for 5 persons in each class. The maintenance training may be combined with the Operator Training.

5. WARRANTY AND ADDITIONAL SERVICES:

5.1. Except where noted, all hardware and software furnished under this contract including but not limited to the accessory peripherals, discrete devices, analog instruments and control devices shall have unconditionally warranty for one year from the date of final acceptance.

6. VISITING JOB SITES:

6.1. Prospective bidders are urged to visit the job sites in order to familiarize themselves with the extent and the conditions under which the work must be completed. It is the intent that all work requiring additions, revisions, relocation and/or removals of equipment and facilities be fully included in the original bidding; later claims for extra work will not be approved, occasioned by the failure to comply with this disclaimer.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16E - PACKAGED ENGINE GENERATOR SYSTEMS

1. GENERAL:

1.1 Description

1.1.1 Major electrical equipment shall be the items of equipment specified herein.

1.1.2 The manufacturer of each specified item shall provide not less than four (4) hard-cover operation and maintenance manuals for the respective equipment item furnished. The manuals shall contain final, approved shop drawings and product data sheets (including any field additions or modifications), as well as recommended installation, testing, operation and maintenance procedures.

1.1.3 The manufacturer shall provide one set of any special tools, as applicable, required for the maintenance of the equipment, housed in a metal tool box.

1.1.4 Equipment furnished under this section shall be complete with anchor bolts and associated hardware required to anchor equipment to concrete. Anchor bolts and all hardware shall be galvanized steel.

1.1.5 For each specified item, a representative of the manufacturer shall check the installation and submit, to the Engineer, three (3) certified, signed statements, addressed to the Engineer, that the equipment has been properly installed and is in good working order.

1.1.6 Section Includes:

(a) Engine generator set.
(b) Cooling system.
(c) Fuel system.
(d) Starting system.
(e) Weatherproof housing.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.
1.2.2 Section 16A - General Electrical Provisions.
1.2.3 Section 16C - Basic Electrical Materials and Methods.
1.2.4 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.
1.2.5 Section 16F - Motor Control Center.

1.3 References

1.3.1 Codes and Standards referred to in this Section are:

(a) The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards:

1) IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

2) NFPA37 – Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines.

3) NFPA70 – National Electrical Code.

4) NFPA110 Emergency and Standby Power Systems.

(b) The generator set and supplied accessories shall meet the requirements of the following standards:

1) NEMA MG1-1998 part 32.

2) UL142 – Sub-base Tanks.

3) UL1236 – Battery Chargers.

4) UL2200 - Stationary Engine Generator assemblies.

(c) The control system for the generator set shall comply with the following requirements:

1) CSA C22.2, No. 14 – M91 Industrial Control Equipment.

2) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

3) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

4) FCC Part 15, Subpart B.

5) IEC8528 part 4. Control Systems for Generator Sets.

6) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

7) UL508. Safety Standard for Industrial control Equipment.

8) UL1236 –Battery Chargers.

(d) The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A.

(a) Show connections, mounting, and support provisions, access and working space requirements, and plan layouts.
(b) Schematic and Wiring Diagrams for Systems: Show power and control connections, and distinguish between factory-installed and field-installed wiring.
(c) Interface drawing detailing connections between generator, motor control center and SCADA Panel.
(d) Manufacturer's sizing report detailing the starting KVA, voltage, and frequency drops and individual loads on each step.

1.4.2 Product Data:

(a) Include generator sizing information showing the individual loads and steps from the modeled sizing report.
(b) Include data of features, components, ratings, and performance. Include dimensioned outline plan and elevation drawings of engine generator set and other system components.
(c) Bill of material with technical descriptions, data sheets, and nameplate details.

1.4.3 Test Results:

(a) Certified Summary of Prototype Unit Test Report: Submit certified copies of actual prototype unit test report.
(b) Certified Test Reports of Components and Accessories: Submit for devices that are equivalent, but not identical, to those tested on.
(c) Exhaust Emissions Test Report: Include proof of compliance with applicable requirements.
(d) Certification of Torsional Vibration Compatibility: Conform to NEMA 110.
(e) Factory Project-Specific Equipment Test Reports: For units to be shipped for this Project showing evidence of compliance with specified requirements.
(f) Certified copies of the Factory and Field Test Reports shall be submitted for Engineer review.

1.4.3 Operation and Maintenance Data:

(a) Detailed Operating Instructions: Describe operation under both normal and abnormal conditions.
(b) Lists: Tools, test equipment, spare parts, and replacement items recommended to be stored at site for ready access. Include part and drawing numbers, current unit prices, and source of supply.
(c) Comply with Section 1A paragraph 1.12.

1.5 Warranty

1.5.1 All equipment under this section shall be covered by warranty from all defects of material and workmanship for the manufacturer's standard length of warranty or for 1 year from the date of final acceptance, whichever is longer.

1.6 Delivery, Storage and Handling

1.6.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

1.7 Basis of Payment

1.7.1 The major electrical equipment work shall be paid for at the contract lump sum price for

PUMP STATION PACKAGE ENGINE GENERATOR SYSTEMS

which shall be payment in full for the work described herein.

1.7.2 Refer to 1.22 of Section 1A for Method of Measurement.

1.8 Definitions

1.8.1 Emergency or Standby Rating: Power output rating equal to power that generator set delivers continuously under normally varying load factors for duration of power outage with capability of 36 continuous operating hours.

1.8.2 Operational Bandwidth: Total variation from lowest to highest value of parameter over range of conditions indicated, expressed as percentage of nominal value of parameter.

1.8.3 Power Output Rating: Gross electrical power output to generator set minus total power requirements of electric motor-driven accessories normally constituting part of engine assembly.

1.8.4 Steady-State Voltage Modulation: Uniform cyclical variation of voltage within operational bandwidth, expressed in Hz or cycles per second.

1.9 System Description

1.9.1 Design Requirements:

(a) System Includes: Standby-rated, automatically started diesel engine coupled to ac generator unit. Engine and generator are factory-mounted and factory-aligned on structural steel skid. Subsystems and auxiliary components and equipment are as indicated.

(b) Environmental Conditions: Engine generator system withstands following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1) Ambient Temperature: -30ºC to +50ºC.
2) Altitude: Sea level to 1,000 ft (300m).

1.9.2 Performance Requirements:

(a) Functional Description: Switching “On-Off” switch on generator control to “On” position starts generator set. “Off” position of same switch initiates shutdown of unit. When unit is running, specified system or equipment failures or derangements automatically shut down unit and initiate alarms. Operation of remote emergency stop switch also shuts down unit.

(b) System Performance:

1) Steady-State Voltage Operational Bandwidth: 1% of rated output voltage from no load to full load.
2) Steady-State Voltage Modulation: Less than 0.25 Hz.
3) Transient Voltage Performance: Not more than 10% variation for 50% step-load increase or decrease. Voltage recovers to remain within steady-state operating band within 2 sec.
4) Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
5) Steady-State Frequency Stability: When system is operating at constant load within rated load, there are no random speed variations outside steady-state operational band and no regular or cyclical hunting or surging of speed.
6) Transient Frequency Performance: Less than 3 Hz variation for 50% step-load increase or decrease. Frequency recovers to remain within steady-state operating band within 3 sec.
7) Output Waveform: At no load, harmonic content measures line-to- line or line-to-neutral does not exceed 5% total and 3% for single harmonics. Telephone influence factor determined according to NEMA MG1 does not exceed 50.
8) Sustained Short-Circuit Current: For 3-ph bolted short circuit at system output terminals, system will supply minimum of 300% of rated full-load current for not less than 10 sec and then clear fault automatically, without damage to any generator system component.
9) Temperature Rise of Generator: Within acceptable limits for insulation systems used according to NEMA MG1 when operating continuously at standby rating conditions. Temperature rise not to exceed $105^{O}C$ over $40^{O}C$ ambient.
10) Nonlinear Load Performance: System performance is not degraded from that specified in this Article by continuous operation, with load current having minimum total harmonic content of 15% rms, and minimum single harmonic content of 10% rms.
11) Starting Time: Maximum total time period for cold start, with ambient temperature at low end of specified range, is 10 sec. Time period includes output voltage and frequency settlement within specified steady-state bands.

1.10 Quality Assurance

1.10.1 Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capabilities indicated that have record of successful in-service performance.

(a) Emergency Service: System manufacturer maintains service center capable of providing training, parts, and emergency maintenance and repairs at Project site within 4 hrs maximum response time.

1.10.2 Comply with NFPA 70.

1.10.3 Engine Exhaust Emissions and Fuel System: Comply with applicable Federal, State, and local government requirements.

1.10.4 Permits: Provide required air permitting and fuel system permitting required in accordance with applicable Federal, State, and local government requirements.

1.10.5 Single-Source Responsibility: Obtain engine generator system components from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as unit as evidenced by records of prototype testing.

2. PRODUCTS:

2.1 Manufacturers

2.1.1 Engine Generator Sets:

(a) Cummins Power Generation.

(b) Kohler Co.

(c) Caterpillar.

(d) MTU Onsite Energy.

(e) No substitutions allowed.

2.1.2 Engine Generator System:

(a) System is coordinated assembly of compatible components.

(b) Ratings: 3-ph, 4-wire 277/480v, 60 Hz, 125 kW, 156.25 KVA.

(c) Motor starting KVA of 159.5 minimum required to start and operate following load steps without exceeding 25% maximum voltage dip and with return to steady state in less than 2 sec.

1) Step No. 1 – 30 KVA lighting transformer.
2) Step No. 1 – 5 KW Unit Heater.
3) Step No. 1 – 3 KW Unit Heater.
4) Step No. 1 – 3 KW Unit Heater.
5) Step No. 1 – 3 KW Unit Heater.
6) Step No. 1 – 3 KW Unit Heater.
7) Step No. 1 – 3 KW Unit Heater.

8) Step No. 2 – ¾ HP Exhaust Fan.
9) Step No. 2 – ¾ HP Exhaust Fan.
10) Step No. 2 – ¾ HP Exhaust Fan.
11) Step No. 2 – ¾ HP Exhaust Fan.
12) Step No. 2 – 1 HP Slide Gate.
13) Step No. 2 – 1 HP Slide Gate.

14) Step No.3 25 HP Pump (31 FLA) on across the line starter.

15) Step No.4 25 HP Pump (31 FLA) on across the line starter.

(d) Safety Standard: Comply with ASME B15.1

(e) Nameplates: Equip each major system component with conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.

2.1.3 Engine Generator Set:

(a) Power Output Rating: Nominal ratings as indicated, with capacity as evidenced by records of prototype testing.

(b) Skid: Welded steel base securely mounted with anchored mounting bolts. Adequate strength and rigidity to maintain alignment of mounted components without dependence on concrete foundation. Free from sharp edges and corners. Lifting attachments arranged to facilitate lifting with slings without damaging components.

(c) Vibration Isolation: In accordance with manufacturers recommendations: Integral vibration isolators may be provided. When integral isolators are not provided, provide 95% efficient spring type vibration isolators. Mount isolators between steel base and concrete pad.

(d) Rigging Diagram: Inscribed on metal plate permanently attached to skid. Diagram indicated location and lifting capacity of each lifting attachment and location of center of gravity.

2.1.4 Engine:

(a) Comply with NFPA 37.

(b) Fuel: Diesel fuel oil grade DF-2.

(c) Maximum Speeds:

1) Engine: 1,800 rpm.
2) Piston speed 4-cycles engines: 2,250 ft/min.

(d) Lubrication Systems: Pressurized by positive displacement pump driven from engine crankshaft. Mount following items on engine or skid:

1) Filter and Strainer: Rated to remove 90% of particles 5 microns and smaller while passing full flow.
2) Oil Cooler: Maintains lubricating oil at manufacturer's recommended optimum temperature.
3) Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
4) Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

(e) Engine Fuel System: Comply with NFPA 30.

1) Integral Injection Pumps: Driven by engine crankshaft. Pumps are adjustable for timing and cylinder pressure balancing.
2) Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
3) Parallel Fuel Oil Filters: Ahead of injection pumps. Changeover valves allow independent use of either filter.
4) Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
5) Flexible fuel line connections for supply and return lines.
6) Shut-off fuel solenoid valve field mounted at tank.

(f) Jacket Coolant Heater: Electric immersion type, factory-installed in jacket coolant system. Unit is rated and thermostatically controlled to maintain an engine temperature of 25°C at low end of specified ambient temperature range.

1) Voltage: 120.
2) Watts: 1,500.
3) Quantity: 1.

(g) Speed Governor: Adjustable isochronous type, with speed sensing.

2.1.5 Engine Cooling System:

(a) Closed-loop, liquid-cooled, with radiator factory-mounted on engine generator set skid and integral engine-driven coolant pumping.

(b) Radiator Core Tubes: Nonferrous metal construction other than aluminum.

(c) Size of Radiator: Adequate to contain expansion of total system coolant from start to 100% load condition.

(d) Coolant: Solution of 50% ethylene glycol and 50% water.

(e) Temperature Control: Self-contained thermostatic control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer. Features include:

1) Thermostatic Elements: Interchangeable and nonadjustable.
2) Actuator Design: Normally-open valves to return to open position when actuator fails.

(f) Coolant Hose: Flexible assembly with nonporous rubber inside surface and aging, ultraviolet, and abrasion-resistant fabric outer covering:

1) Rating: 50 psi (345 kPa) maximum working pressure with 180°F (82°C) coolant, and noncollapsible under vacuum.
2) End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.1.6 Fuel Supply System:

(a) Dual Wall Subbase Tank: Factory-fabricated assembly or NRTL-listed fuel tank with integral, float-controlled transfer pump and features described below.

1) Tank Capacity: Adequate to supply fuel to engine for uninterrupted period of 36 hrs operation at 100% of rated power output of engine generator system without being refilled.

(b) Generator Access: Generator manufacturer's access catwalks and stairs accessory for generators mounted on sub-base fuel tanks. Provide aluminum catwalk and stair made with grating and not steel plates on each side on generator for access to generator mounted on top of sub-base fuel tank. Catwalk and stair configurations shall be coordinated with generator and sub-base fuel tank size and height.

(c) Manual over-fill protection.

(d) Internally baffled to prevent immediate resupply of heated return fuel.

(e) Lockable 2 in. fill cap.

(f) Fuel level gauge.

1) Provide 4-20mA output for remote indication of fuel tank level.

(g) Electrical stub-in area with detachable end panel.

(h) Multiple top entry customer-select ports.

(i) Tank to foundation ground clearance for visual secondary leak detection.

(j) Load bearing vertical "C" channel at generator set mounting points.

(k) Vertically accessible primary vent.

(l) Venting to UL142 in both primary and secondary containments.

(m) Weatherproof secondary containment.

(n) Mounted directly to generator set skid.

(o) 8 ga aluminized steel top.

(p) 12 ga aluminized steel sides and bottom.

(q) 4 in. “C” channel side and bottom load bearing structure.

(r) Symmetrical to 1,500 kW generator set footprint.

(s) Baked enamel finish.

(t) Listed to UL142 under Label No. 48-24-2 “Secondary Containment Generator Base Tank.”

(u) Low fuel level alarm.

(v) Leak detection alarm.

(w) Initial Fill: Diesel fuel oil grade DF-2.

2.1.7 Engine Exhaust System:

(a) Muffler: Industrial-type, sized as recommended by engine manufacturer. Measured sound level in 20-75 Hz frequency band, according to “DEMA Test Code for Measurement of Sound from Heavy-Duty Reciprocating Engines” at distance of 25 ft from exhaust discharge, is 75 dB or less.

(b) Connections from Engine to Exhaust System: Furnish flexible section on corrugated stainless steel pipe with generator set.

(c) Insulation for mufflers.

(d) Supports for Muffler and Exhaust Piping: Vibrations isolating-type.

2.1.8 Starting System:

(a) Description: 12 v electric with negative ground and including following items:

1) Components: size so they will not be damaged during full engine-cranking cycle with specified maximum ambient temperature.
2) Cranking Motor: Heavy-duty unit that automatically engaged and releases from engine flywheel without binding.

3) Cranking Cycle: 60 sec.
4) Battery complies with SAE J537 and has adequate capacity within ambient temperature range specified in Part 1 to provide specified cranking cycle series at least twice without recharging.
5) Battery Cable: Size as recommended by generator set manufacturer for cable length required for connection to battery. Include required interconnecting conductors and connection accessories.
6) Battery Compartment: Factory-fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controller heater is arranged to maintain battery above 10°C regardless of external ambient temperature within range specified in Part 1. Include accessories required to support and fasten batteries in place.
7) Battery-Charging Alternator: Factory-mounted on engine with solid-state voltage-regulation and 35 amp minimum continuous rating.
8) Battery Charger: Current limiting, automatic equalizing and float charging-type designed for operation from 120 v 60 Hz supply source. Unit complies with UL 508 and includes following features:

    i. Operation: Equalizing charging rate of 10 amps is initiated automatically after battery has lost charge until adjustable equalizing voltage is achieved at battery terminals. Until then automatically switches to lower float-charging mode, and continues operating in that mode until battery is discharged again.
    ii. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from -40°C to +60°C to prevent overcharging at high temperatures and undercharging at low temperatures.
    iii. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to +10%.
    iv. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.

v. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing “low battery voltage” indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either of these conditions closes contacts that provide “battery charger malfunction” indication at system control and monitoring panel.

vi. Enclosure and Mounting: NEMA Class 1 wall-mounted cabinet.

2.1.9 Control and Monitoring:

(a) Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on common control and monitoring panel mounted on generator set. Mounting method isolates control panel from generator set vibration.

1) Generator Circuit Breaker: Molded case type conforming to Section 16H. Trip rating based on generator full load current.
2) Shunt Trip Device: For generator breaker, connected to trip breaker when generator set is shut down by protective devices.
3) Current and Potential Transformers: Instrument accuracy class.

(b) Indicating and Protective Devices, and Controls: Include those required by NFPA 110 for Level 2 system plus following:

1) Number of Starts Counter.
2) Ac Voltmeter.
3) Ac Ammeter.
4) Ac Frequency Meter.
5) Dc Voltmeter (Alternator Battery Charging).
6) Engine Coolant Temperature Gage.
7) Engine-Lubricating Oil Pressure Gage.
8) Running Time Meter.
9) Ammeter/Voltmeter Phase Selector Switch or Switches.
10) Generator Voltage-Adjusting Rheostat.
11) Frequency Adjusting Rheostat.

(c) Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer’s standard.

(d) Common Remote Audible Alarms: Conform to NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Locate audible device and silencing means where indicated.

1) High Engine Temperature Shutdown.
2) Low-Lube Oil Pressure Shutdown.
3) Overspeed Shutdown.
4) Remote Emergency Stop Shutdown.
5) High Engine Temperature Pre-alarm.
6) Low-Lube Oil Pressure Pre-alarm.
7) Low Fuel Tank Level.

(e) External Signals:

1) Provide dry contact for remote indication of generator run status.
2) Provide dry contact for remote indication of fuel tank leak detected.
3) Provide dry contact for remote indication of generator ESTOP active.
4) Provide dry contact for remote indication of generator common alarm.
5) Provide dry contact for remote indication of generator not in auto.
6) Provide dry contact for remote indication of fuel tank level low.
7) Provide 4-20mA signal for fuel tank level.
8) Ability to accept remote start and stop signals.
9) Ability to send ready to load signal to transfer switch.

(f) Connection to Data Link: Status indication for transmission of generator status and alarms by data link to remote data terminals. Generator control panel shall be provided with Modbus TCP/IP communication capability. Data system connections to terminals are covered in another Section.

2.1.10 Generator, Exciter, and Voltage Regulator:

(a) Comply with NEMA MG 1 and specified performance requirements.

(b) Drive: Generator shaft is directly coupled to engine shaft. Exciter is rotated integrally with generator rotor.

(c) Electrical Insulation: Class H or Class F.

(d) Stator Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

(e) Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125% of rating, and heat during operation at 100% of rated speed.

(f) Excitation uses no-slip or collector rings, or brushes, and is arranged to sustain generator output under short circuit conditions as specified.

(g) Enclosure: Dripproof.

(h) Instrument Transformers: Mounted within generator enclosure.

(i) Voltage Regulator: Solid-state-type, separate from exciter, providing performance as specified:

1) Adjusting rheostat on control and monitoring panel provided +5% adjustment of output voltage operating band.

(j) Surge Protection: Conform to UL 1449. Mount suppressors in generator enclosure and connect to load terminals.

(k) Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.1.11 Outdoor Generator Set Enclosure:

(a) Description: Weatherproof steel housing. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools.

(b) Fixed Louvers: At air inlet and discharge. Louvers prevent entry of rain and snow.

(c) Automatic Dampers: At air inlet and discharge. Dampers are closed to reduce engine and battery heat loss in cold weather when unit is not operating.

(d) Air Flow Through Housing: Adequate to maintain temperature rise of system components within required limits.

(e) Muffler/Silencer mounted inside of enclosure.

(f) A minimum of two (2) GFCI receptacles mounted near access panel within enclosure.

2.1.12 Finishes:

(a) Outdoor Enclosures: Polyurethane enamel over corrosion-resistant pretreatment and manufacturer's compatible standard primer.

2.1.13 Source Quality Control:

(a) Factory Tests: Include prototype testing and Project-specific equipment tests (equipment manufactured specifically for this Project).

(b) Prototype Testing: Performed on separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1) Tests: Conform to those required by Level 1 energy converters in paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
2) Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been acceptable tested to demonstrate compatibility and reliability.

(c) Project-Specific Factory Equipment Tests: Test engine generator set and other system components and accessories prior to shipment. Test items individually and assembled and connected as complete system at factory in manner equivalent to that required at Project site. Record and report test data. Conform to SAE 8528 and following:

1) Test Equipment: Use instruments calibrated within previous 12 mos and with accuracy directly traceable to National Institute of Standards and Technology (NIST).
2) Hydrostatic Test: Perform on radiator, heat exchanger, and engine water jacket.
3) Generator Tests: Conform to IEEE 115.
4) Complete System Continuous Operation Test: Includes nonstop operation for minimum standard factory test, including at least 1 hr at 50% and 75%, and 2 hrs at 100% of full load. If unit stops during standard factory test, repeat complete test. Record following minimum data at start and end of each load run, at 15 min intervals between those times and at 15 min intervals during balance of test:

i. Fuel consumption.
ii. Exhaust temperature.
iii. Jacket water temperature.
iv. Lubricating oil temperature and pressure.
v. Generator load current and voltage, each phase.
vi. Generator system gross and net output kW.
vii. Generator intake air (in cubic feet per minute).
viii. Generator exhaust (in cubic feet per minute).

5) Complete System Performance Tests: Include following to demonstrate conformance to specified performance requirements:

i. Single-step load pickup.
ii. Transient and steady-state governing.
iii. Transient and steady-state voltage performance.
iv. Safety shutdown devices.

6) Observation of Factory Test: Provide 2 wk advance notice of tests and opportunity for observation of test by Engineer.

7) Report rest results within 10 days of completion of tests. Results shall be certified that the equipment supplied meets contract requirements otherwise highlight areas where equipment fails shorts or fails to meet specified requirements.

2.1.14 Special Tools and Spare Parts to be Furnished:

(a) One set of all special tools that are required for the normal operation and maintenance of the engine generator unit.

(b) Two complete spare replacement sets of all filter elements required for the generator unit.

(c) Three complete replacement sets of each type and size of fuses.

(d) Two complete replacement sets of each type of indicating lamps.

3. EXECUTION:

3.1 Examination

3.1.1 Verify location and layout of Engine Generator Set.

3.1.2 Verify that electrical power is available and of correct characteristics.

3.2 Preparation

3.2.1 Install concrete bases after dimensions of equipment are confirmed by equipment manufacturers.

3.3 Installation

3.3.1 Anchor generator set and other system components on concrete bases as indicated. Provide anchorage and vibration isolation according to manufacturer's recommendations.

3.3.2 Maintain minimum working space around components according to manufacturer's approved submittals and NEC.

3.3.3 Ground generator as shown on Drawings.

3.4 Cleaning

3.4.1 Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.5 Field Quality Control

3.5.1 Manufacturer's Field Services:

(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. Include minimum:

i. 1 manday for Installation Services.
ii. 1/2 manday for Instructional Services.
iii. 1/2 manday for Post Startup Services.

(b) Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system related areas.

(c) In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration.

(d) The start-up services for the following equipment shall be coordinated with the Department; the Department shall be notified at least one week in advance:

Engine Generator System.

3.5.2 Tests: Provide services of qualified testing agency to perform tests listed below according to manufacturer's recommendations upon completion of installation of system. Use instruments bearing records of calibration within last 12 mos, traceable to NIST standards, and adequate for making positive observation of test results. Include following tests:

(a) Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of connectors.

(b) Battery Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

(c) System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

(d) Simulation of malfunctions to verify proper operation of local and remote protective, alarm, and monitoring devices.

(e) Load Test: Use variable load bank capable of simulating kVA, kW, and power factor of load for which unit is rated. Run unit at 25, 50, and 75% of rated capacity for 30 min each, and at 100% for 1 hrs. Record voltage, frequency, load current, battery-charging current, power output, oil pressure, and coolant temperature during test.

(f) Exhaust System Back-Pressure Test: Use manometer with scale exceeding 40 in. of water. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's published allowable limits for engine.

(g) Exhaust Emissions Test: Conform to applicable government test criteria.

3.5.3 Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.5.4 Report test results within 10 days of completion of tests. Results shall be certified that the equipment installed meets requirements otherwise highlight areas where equipment falls short or fails to meet specified requirements.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16F - MOTOR CONTROL CENTER

1. GENERAL:

1.1 Description

1.1.1 Motor control center equipment shall be the items of equipment specified herein.

1.1.2 The manufacturer shall provide one set of any special tools, as applicable, required for that maintenance of the equipment, housed in a metal tool box.

1.1.3 Equipment furnished under this section shall be complete with anchor bolts and associated hardware required to anchor equipment to concrete. Anchor bolts and all hardware shall be galvanized steel.

1.1.4 For each specified item, a representative of the manufacturer shall check the installation and submit, to the Engineer, three (3) certified, signed statements, addressed to the Engineer, that the equipment has been properly installed and is in good working order.

1.1.5 Factory Acceptance Testing.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.
1.2.2 Section 14A – Hoist Equipment.
1.2.3 Section 15D - Pumping Equipment.
1.2.4 Section 15E - Ventilation.
1.2.5 Section 15F - Miscellaneous Mechanical Items.
1.2.6 Section 16A - General Electrical Provisions.
1.2.7 Section 16B - Electrical Power System Studies.
1.2.8 Section 16C - Basic Electrical Materials and Methods.
1.2.9 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.
1.2.10 Section 16E - Packaged Engine Generator Systems.
1.2.11 Section 16H - Major Electrical Equipment.

1.3 References

1.3.1 Codes and Standards referred to in this Section are:

(a) NEMA ICS-1 General Standards for Industrial Control and Systems.

(b) UL 845 Motor Control Centers.

(c) ISA Standards and Recommended Practices for Instrumentation and Control.

(e) NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum.)

1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A.

1.4.2 Submittals of shop drawings and product data shall be particularly detailed and complete. Submittals shall be complete with the manufacturer's warranty. Piecemeal submittals will be returned without review.

1.4.3 Submittal information shall include schematic diagrams, point-to-point internal wiring diagrams, point-to-point field wiring diagrams, and other necessary diagrams and installation requirements for the motor starters, motor control center, and automatic transfer switch and other components and systems that are interfaced to these systems.

1.4.4 The manufacturer of each specified item shall provide not less than four (4) hard-cover operation and maintenance manuals for the respective equipment item furnished. The manuals shall contain final, approved shop drawings and product data sheets (including any field additions or modifications), as well as recommended installation, testing, operation and maintenance procedures. Refer to Section 1A for further requirements.

1.5 Warranty

1.5.1 All electrical equipment shall be covered by warranty from all defects of material and workmanship for the manufacturer's standard length of warranty or for 1 year from the date of final acceptance, whichever is longer.

1.6 Delivery, Storage and Handling

1.6.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

1.6.2 Motor control center sections shall be delivered in shipping splits that can be moved past obstructions in delivery path.

1.7 Basis of Payment

1.7.1 The major electrical equipment work shall be paid for at the contract lump sum price for

PUMP STATION MOTOR CONTROL CENTER

which shall be payment in full for the work described herein.

1.7.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Motor Control Centers

2.1.1 Manufacturers

(a) Eaton Corporation.

(b) Allen Bradley - Rockwell Automation.

(d) Schneider Electric.

(e) No substitutions allowed.

2.1.2 Coordination Study

(a) Where coordination study specified in Section 16B recommends changes in types, classes, features or ratings of equipment or devices from those indicated, make written request for instruction. Obtain instructions from ENGINEER before ordering equipment or devices recommended to be changed.

2.1.3 Motor Control Centers

(a) Wiring: NEMA ICS 3, Class I, Type B.

1) Factory installed wiring shall include conductor labels which correspond to approved shop drawings. Each wiring shall have a clear label at terminal strip and termination points.

(b) Enclosures: Surface-mounted cabinets as indicated. NEMA 250, Type 1 gasketed, unless otherwise indicated to meet environmental conditions at operating temperature ranges from 0^0C to 50^0C.

2) Compartments: Modular; individual doors have concealed hinges and quick-captive screw fasteners. Interlocks on combination controller units require disconnect means in off position before door can be opened or closed, except by consciously operating permissive release device.

3) Interchange ability: Compartments are constructed to remove units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in control center. Units requiring same size compartment are interchangeable, and compartments are constructed to permit ready rearrangement of units, such as replacing 3 single units with unit requiring 3 spaces, without cutting or welding.

4) Wiring Spaces: Each vertical section of structure with horizontal and vertical wiring has spaces for wiring to each unit compartment in each section, with supports holding wiring in place.

(c) Short-Circuit Current Rating for Each Section: Equal to or greater than indicated available fault current in symmetrical amperes at motor-control center location.

2.1.4 Buses

(a) Material: Tin plated copper.

(b) Ampacity Ratings:

1) As indicated on horizontal buses.

2) 300 amp min for vertical main buses or larger as required for installed units.

(c) Neutral Buses: Full size in service entrance section only.

(d) Equipment Ground Bus: Noninsulated, horizontal copper bus 2 by 1/4 in. (50 by 6 mm), min.

(e) Horizontal Bus Arrangement: Main phase, neutral and ground buses extended with same capacity entire length of motor-control center, with provision for future extension at both ends by bolt holes and captive bus splice sections.

(f) Short-Circuit Withstand Rating: Same as short-circuit current rating of section.

2.1.5 Functional Description

(a) Description: Modular arrangement of motor controllers, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels, and other items mounted in compartments of motor-control center as indicated.

(b) Motor-Controller Units: Combination controller units of types and with features, ratings, and circuit assignments indicated.

1) Units with full-voltage, across-the-line, magnetic controllers up to and including Size 3 are installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

2) Units have short-circuit current ratings equal to or greater than short-circuit current rating of motor-control center section.

3) Units in motor-control centers with Type B wiring are equipped with pull-apart terminal strips or drawout terminal boards for external control connections.

(c) Overcurrent Protective Devices: Types of devices with features, ratings, and circuit assignments indicated. Individual feeder-tap units through 225-A rating shall be installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

(d) Spaces and Blank Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.

(e) Spare Units: Type, size, and ratings as indicated, and installed in compartments indicated "spare".

2.1.6 Magnetic Motor Controllers

(a) Description: NEMA ICS 2, Class A, full voltage, non-reversing, across-the-line, unless otherwise indicated.

(b) Control Circuit: 120V; obtained from integral control power transformer, unless otherwise indicated. Include control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100% spare capacity.

(c) Controller shall be equipped with a transmitter for providing motor current configured as a 4-20mA signal.

(d) Combinational Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.

1) Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.

(e) Overload Relay:

1) Electronic solid state type with inverse-time-current characteristic, phase loss and phase unbalance protection.
2) Enhanced Protection Overload Relay: Provide overload relays with NEMA Class 10 or better tripping characteristics for submersible equipment or where indicated. Select to protect motor against voltage unbalance and single phasing.

(f) When power factor correction capacitors are indicated provide termination lugs on line side of overload relays.

(g) Time Delay Restart Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection.

1) Provide in starter enclosure for Size 2 and larger starters.
2) Delay initial motor start.
3) Delay motor restart due to starter dropout caused by undervoltage or starter coil circuit interruption for maintained control circuits.

4) Adjustable on delay from 0.15 to 30.0 sec set at 10.0 sec.
5) Connect control relay in motor starter coil circuit.
6) Coordinate control relay section with motor starter to cause motor starter to drop out at voltage slightly higher than dropout voltage of starter and have dropout time slightly faster than motor starter to ensure if motor starter drops out, relay will drop out.

2.1.7 Feeder Overcurrent Protection

(a) Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.

1) Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2) Application Listing: Appropriate for application, including Type HACR for heating, air-conditioning, and refrigeration equipment.
3) Circuit Breakers, 200A and Larger: Trip units interchangeable within frame size.
4) Circuit Breakers, 400A and Larger: Field-adjustable, short-time and continuous-current settings.
5) Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
6) Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
7) Shunt Trip: Where indicated or required for ground fault protection trip.

2.1.8 Automatic Transfer Switch

(a) Manufacturers

1) ASCO.
2) Russelectric.
3) ABB.
4) No substitutions allowed.

(b) Air breaker, double throw interrupter type, electrically operated and mechanically held in both the normal and emergency 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.

(c) Separate arcing contacts, with magnetic blowouts shall be provided. Interlocked molded case circuit breakers ot interlocked contactors will not be accepted.

(d) UL 1008 listed.

(e) Switch shall be 3-pole, 250 amp, 480 volt rated with 42,000 amp withstand current rating (WCR) for 3 cycles at 480 volt. Upstream main breakers shall be coordinated with ATS manufacturer to achieve WCR rating.

(f) Provide fully rated, solid, unswitched neutral terminal.

(g) Manual switch operation: manually operated under load with door closed with either or both sources energized. Transfer time is same for electrical operation. Control circuit automatically disconnects from electrical operation during manual operation.

(h) Switching arrangement: switch operator has programmed neutral position arranged to provide midpoint between 2 working switch positions with an intentional, controlled, timed pause during transfer tat midpoint. Midpoint pause shall be adjustable from 0.5 to 30.0 second minimum, factory set at 2.0 seconds. Time delay shall occur for both transfer directions.

(i) Solid state controls with repetitive accuracy setting of 2% or better over operating temperature range -20^{0}C to 60^{0}C. Voltage sensing shall be true RMS type and shall be accurate to +/- 1% of nominal voltage. Frequency sensing shall be accurate to +/- 0.2%. A four line, 20 character LCD display and keypad shall be integral part of the controller for viewing all available data and setting desired operational parameters. Nominal line voltage and frequency, single or three phase sensing, operating parameter protection, and transfer operating mode configuration shall be the only parameters not adjustable through display/keypad and shall rather use integral DIP switches on the controller.

(j) Voltage sensing for each phase of normal source. Pick-up voltage adjustable from 85% to 100% nominal, and drop-out voltage adjustable from 75% to 98% pick-up value. Factory set for pick-up at 90% and drop-out at 85%.

(k) Time-delay override of normal source voltage sensing delay transfer and engine start signals. Adjustable 0 to 6 seconds, factory set at 1 second.

(l) Voltage/frequency lockout relay: prevents premature transfer. Voltage pick-up adjustable from 85% to 100%. Factory set to pick-up at 90%.

(m) Pick-up frequency adjustable from 90% to 100% nominal. Factory set to pick-up 95%.

(n) Retransfer time delay: adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of delay upon loss of voltage or sustained undervoltage of emergency source when normal supply has been restored.

(o) Test switch: simulates normal source failure.

(p) Switch-position pilot lights: indicate source to which load is connected and source available. Push to test, LED type in accordance with Section 16D.

(q) Transfer switch override switch: overrides automatic retransfer control so ATS remains connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

(r) Engine starting contacts: one is isolated normally closed and 1 isolated normally open. Contacts shall be gold flashed or gold plated and rated 10 amps at 120 VAC minimum.

(s) Engine shut-down contacts: time delay adjustable from 0 to 5 minutes, factory set to 5 minutes.

(t) Switch components shall be easily maintainable from front without removal of switch from its bucket within motor control center and without disconnecting the main power cables. Adequate safety barriers and baffles shall be provided and all components shall be clearly identified with nameplates.

2.1.9 Micro Processor Based Metering Units

(a) Each incoming line shall have a microprocessor based electronic metering unit with digital readout and key pad. Metering unit shall monitor phase amperes, phase-to-phase voltages, and phase-to-neutral voltages with one percent accuracy. Metering system shall also monitor and indicate megawatts, megavars, power factor, megawatt demand and frequency. In addition, overvoltage/undervoltage, phase loss/ unbalance/reversal protective functions shall also be available and user programmable. Furnish two NO/NC alarms and two NO/NC trip contacts. Fused potential transformers shall be included. Current transformers shall be as shown. Metering units shall be equipped with data communications modules capable of communication with the SCADA panel using Modbus protocol. Coordinate with SCADA panel supplier through the Contractor to determine Modbus protocol type. Metering units shall be door mounted.

2.1.10 Surge Protection Device on Main Circuit Breaker and Generator Circuit Breaker

(a) SPD and connecting breaker shall be service entrance rated and provided by motor control center manufacturer located integral to motor control center.
(b) See Section 16H for external surge protection device requirements for MCC.

(c) IEEE C62.41, selected to meet requirements for category C3.

(d) Protection modes and UL 1449 clamping voltages coordinated with circuit system and circuit voltage.

(e) Factory mounted with UL listed and labeled mounting device.

(f) 200 kA per phase surge current capacity minimum.

(g) Dedicated flange mounted disconnect in common MCC bucket.

(h) Door mounted diagnostic lights.

(i) Audible alarm, with silencing switch, to indicate when protection has failed. Switch shall be accessible from outside of bucket and not require bucket door to be opened to access.

(j) Replaceable modular design.

(k) Mounted next to main incoming device in MCC.

(l) One form C contact to indicate suppressor is operational.

(m) Minimum of 10 year warranty.

2.1.11 External Hard Wired Signals

<u>Pump Motor Starter Buckets</u>

(a) Provide dry contact for remote indication of main pump circuit breaker open.
(b) Provide dry contact for remote indication of main pump hand-off-auto selector switch in auto.
(c) Provide dry contact for remote indication of main pump running.
(d) Provide dry contact for remote indication of main pump overload.
(e) Provide dry contact for remote indication of main pump motor high temperature.
(f) Provide dry contact for remote indication of main pump motor moisture.
(g) Provide dry contact for remote indication of main pump float call to run.

(h) Provide dry contact for remote indication of main pump fail to start.
(i) Provide isolated 4-20mA signal for remote indication of motor amps.
(j) Ability to accept call signal from SCADA.
(k) Ability to accept motor protection relay override signal from SCADA.
(l) Ability to accept and send signals to remote control stations as shown on Drawings.

Gate Valves

(a) Ability to accept in remote position signal from actuator.
(b) Ability to accept confirmed open signal from actuator.
(c) Ability to accept operating signal from actuator.
(d) Ability to accept confirmed close from actuator.
(e) Ability to send call to open actuator.
(f) Ability to send call to stop actuator.
(g) Ability to send call to close actuator.

Main Breakers

(a) Provide dry contact for remote indication of normal service (ComEd) main breaker closed.
(b) Provide dry contact for remote indication of normal service (ComEd) main breaker tripped.
(c) Provide dry contact for remote indication of normal service (ComEd) ground fault.
(d) Provide dry contact for remote indication of emergency source (Generator) main breaker closed.
(e) Provide dry contact for remote indication of emergency source (Generator) main breaker tripped.
(f) Provide dry contact for remote indication of emergency source (Generator) ground fault.

Automatic Transfer Switch

(a) Provide dry contact for remote indication of utility power available.
(b) Provide dry contact for remote indication of normal service (ComEd) failure.
(c) Provide dry contact for remote indication of emergency service (Generator) failure.
(d) Provide dry contact for remote indication of transfer switch in normal position.
(e) Provide dry contact for remote indication of transfer switch in emergency position.
(f) Provide dry contact for remote indication of transfer switch in test mode.
(g) Provide dry contact for remote indication of transfer switch ready to load.
(h) Provide ability to send start and stop signals to generator.
(i) Provide ability to accept ready to load signal from generator.

2.1.12 Accessories

(a) Factory install in controller enclosure, unless otherwise indicated.

1) Main and Low Flow Pumps: "Pump Run", "Pump Call", "Manual Operation", and "Off" Pilot Lights, push-to-test: NEMA ICS 2, heavy-duty type. Front of bucket mounted motor protection relay provided by pump manufacturer, install such that bucket does not need to be opened to access relay. If said relay does not contact a means for reset, contractor shall provide a reset pushbutton on front of bucket.
2) Manual overload reset button on all motor starter and solid state reduced voltage controller buckets.
3) Non-resettable pump run timer indicating total run time in hours.
4) Non-resettable pump start counter indicating total number of starts.

(b) Furnish the following devices when indicated on Drawings.

1) Push-Button Stations and Selector Switches: NEMA ICS 2, heavy-duty type.
2) 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.
3) Control Relays: Auxiliary and adjustable time-delay relays.
4) Elapsed Time Meters: Heavy duty with digital readout in hours.

2.1.13 Nameplates

(a) Factory install for each bucket and each individual device. Nameplates shall include equipment description populated from drawings. Use a minimum of 1/2 inch high lettering on 1-1/2 inch high label. Nameplates shall be plastic laminate securing fastened to equipment with screws. Use black lettering on white field.

(b) Factory installed nameplate describing technical ratings of MCC including short circuit current rating. Nameplate to be located outside of the gear on front face of incoming section.

2.1.14 Fabrication

(a) Indoor enclosure: Steel.

(b) Finish: Manufacturer's standard gray finish over rush-inhibiting primer on phosphatizing-treated metal surfaces.

3. EXECUTION:

3.1 Examination

3.1.1 Verify location and layout of 480V Switchgear, Motor Control Centers, Aegis/Intrusion alarm equipment, and Fire alarm equipment.

3.1.2 Verify that electrical power is available and of correct characteristics.

3.2 Preparation

3.2.1 Install concrete bases after dimensions of equipment are confirmed by equipment manufacturers.

3.3 Installation

3.3.1 Install system and components in accordance with manufacturer's specifications.

3.3.2 The installer shall provide all labor and perform all work to install and make operable all mechanical and electrical equipment necessary to assure safe and reliable operation.

3.4 Field Quality Control

3.4.1 Representative of the Manufacturer

(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. Include:

i. 2 mandays for Installation Services for Motor Control Center.
ii. 2 manday for Instructional Services for Motor Control Center.

(b) The start-up services for the following equipment shall be coordinated with the Department; the Department shall be notified at least one week in advance:

Motor Control Center.

(c) Test in accordance with Section 16A.

3.5 Adjustments

3.5.1 Motor Control Centers

(a) Set field-adjustable pick-up time-sensitivity ranges in accordance with Section 16B.

3.6 Factory Acceptance Testing

3.6.1 The motor control center furnished under this Section shall be fully tested and documented by certified factory test reports, in accordance with Section 1A.

3.6.2 As a minimum, the following tests shall be conducted:

(a) The following factory standard tests shall be performed on the circuit breaker element (main breakers only) provided under this Section. All tests shall be in accordance with the latest version of ANSI standards.

i. One minute insulation-resistance test on each pole, phase-to-phase and phase-to-ground per ANSI standards.
ii. Final inspections and quality checks.

(b) The following production test shall be performed on each breaker housing:

i. Operation of wiring, relays and other devices verified by operational sequence test.
ii. Final inspections and quality checks.

(c) MCC/ATS system shall be simulated for correct operation on loss of voltage, under/over-voltage, overcurrent, loss of phase, phase imbalance and under/over-frequency.
(d) Verification of circuit breaker interlocks.
(e) Verification of motor starter circuits and interlocks.
(f) Energize contactors using an auxiliary source.
(g) Verification of meter readouts through application of current and voltage to each analog input.
(h) The manufacturer shall provide three (3) certified copies of factory test reports.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16G - LIGHTING

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.
1.2.2 Section 16A – General Electric Provisions.
1.2.3 Section 16C – Basic Electrical Equipment Materials and Methods.

1.3 References

Codes and Standards referred to in this Section are:

ANSI C82.16 - LED Drivers, methods of measurement of.
ANSI C82.4 - Lamp Ballasts of High Intensity Discharge, methods of measurement of.

UL 50 - Cabinets and boxes.

1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A for the following items: Light Fixtures, Lamps, Ballasts, and Emergency Lighting Units, Panelboards, and Lighting Contactors.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 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.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Lighting Fixtures

2.1.1 Fixtures and Fixture Components

(a) Metal Parts: Free from burrs, sharp corners, and edges.

(b) Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

(c) 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.

(d) Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1) White Surfaces: 85%.
2) Specular Surfaces: 83%.
3) Diffusing Specular Surfaces: 75%.
4) Laminated Silver Metallized Film: 90%.

(e) Lenses, Diffusers, Covers, and Globes: 100% virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

(f) Fixture Support Components: Comply with Section 16B paragraph 2.11.

1) Single-Stem Hangers: 1/2 in. (12 mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
2) Twin-Stem Hangers: Two, 1/2 in. (12 mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

3) Rod Hangers: 3/16 in. (5 mm) minimum diameter, zinc-plated, threaded steel rod.
4) Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

(g) High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.

(h) HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include following features, except as otherwise indicated.

1) Metal Halide Ballasts:

i. Pulse start ballast.

2) Operating voltage: Match system voltage.

(i) 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.

(j) Light-emitting diode (LED) Fixtures: CSA verified, light engines IP 66 rated, luminaire IP 65 rated.

1) Class 1 electronic driver with power factor greater than 90%.
2) Total harmonic distortion less than 20%.
3) Expected life of 100,000 hours.
4) Fire year warranty.
5) Rated for -40° C.

(k) Exit Signs: Conform to UL 924 and following:

1) Sign Colors: Conform to local code.
2) Minimum height of Letters: Conform to local code.
3) Arrows: Include as indicated.

(l) Emergency Lighting Units: Conform to UL 924.

1) Battery: Sealed, maintenance-free, lead-acid type with minimum 10 yr nominal life and special warranty.
2) Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.

3) 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.

4) Wire Guard: Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.

5) 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.

2.1.2 Lamps

(a) Comply with ANSI C78 series that is applicable to each type of lamp.

(b) Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.

2.1.3 Finishes

(a) Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

2.2 Lighting Contactors

2.2.1 Manufacturer: Square-D Model 8903LXG20V02CR6, General Electric or equal.

2.2.2 Description: NEMA ICS 2, magnetic lighting contactor, 100% rated.

2.2.3 Configuration: Mechanically held.

2.2.4 Coil Voltage: 120 volts, 60 Hertz.

2.2.5 Poles: Two.

2.2.6 Contact Rating: 30 amperes.

2.2.7 Enclosure: ANSI/NEMA ICS 6, Type 1.

2.2.8 Accessories:

(a) Selector Switch: ON/OFF/AUTOMATIC
(b) Pushbuttons and Selector Switches: NEMA ICS 2, general duty type.

2.2.9 Lighting Timer:

(a) Tork, Intermatic or approved equal.
(b) Mechanical time switch type/
(c) 24 hour timer.
(d) Manual override.
(e) NEMA 1 steel enclosure.
(f) 120 VAC contact rating.
(g) UL listed.

3. EXECUTION:

3.1 Lighting Fixtures

3.1.1 Installation

(a) Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to Section 16B-2.11.

(b) Supports for Recessed and Semi-recessed Grid-Type Fluorescent Fixtures: Support Units from suspended ceiling support system. Install ceiling support system rods or wires at minimum of 4 rods or wires for each fixture, located not more than 6 in. (150 mm) from fixture corners.

1) Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.

(c) 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

(d) Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.1.2 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.

3.1.3 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:

i. Duration of supply.
ii. Low battery voltage shutdown.
iii. Normal transfer to battery source and retransfer to normal.
iv. Low supply voltage transfer.
v. Replace or repair malfunctioning fixtures and components, th
vi. Report results of tests.

(b) Replace fixtures that show evidence or corrosion during Project warranty period.

3.1.4 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 THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16H - MAJOR ELECTRICAL EQUIPMENT

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.
1.2.2 Section 16A – General Electric Provisions.
1.2.3 Section 16B – Electrical Power System Studies
1.2.4 Section 16C – Basic Electrical Equipment Materials and Methods.
1.2.5 Section 16D – Supervisory Control and Data Acquisition (SCADA) Equipment.

1.3 References

Codes and Standards referred to in this Section are:

Fed. Spec W-P-115	-	Panel, power distribution.
NEMA KS1	-	Enclosed and miscellaneous distribution equipment switches (600 volt maximum).

1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A for the following items: Panelboards, Disconnects and Safety Switches, Transformers, Motors, SPD units, Fire Alarm System and AEGIS Intrusion System.

1.5 Warranty

1.5.1 Provide warranty under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 The work shall be paid at the contract lump sum price for

PUMP STATION ELECTRICAL WORK
FIRE DETECTION PANEL
AEGIS PANEL

which shall be payment in full for the work described herein.

1.6.2 Refer to 1.22 of Section 1A for Method of Measurement.

2. PRODUCTS:

2.1 Panelboards

2.1.1 Manufacturer's

(a) Eaton Corporation.

(b) Schneider Electric.

(c) No substitutions allowed.

2.1.2 Panelboard Fabrication

(a) Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

(b) Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.

(c) Directory Frame: Metal, mounted inside each panelboard door.

(d) Bus: Hard drawn copper of 98% conductivity.

(e) Main and Neutral Lugs: Compression type.

(f) Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

(g) Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.

(h) Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for overcurrent protective device ampere ratings indicated for future installation of devices.

(i) Special Features: Include following features for panelboards as indicated:

1) Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.

(j) Extra Gutter Space: Dimensions and arrangement as indicated.

1) Subfeed: Overcurrent protective device or lug provision as indicated.

(k) Feed-through Lugs: Sized to accommodate feeders indicated.

2.1.3 Lighting and Appliance Branch Circuit Panelboards

(a) Branch Overcurrent Protection Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

(b) Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, keyed alike.

(c) Surge protection device:

1. Protection modes and UL 1449 third edition clamping voltages coordinated with circuit system and circuit voltage.
2. Factory mounted with UL listed and labeled mounting device.
3. 60kA per phase surge current capacity minimum.
4. Door mounted diagnostic lights.
5. Audible alarm, with silencing switch, to indicate when protection has failed. Switch shall be accessible from outside of enclosure and not require door to be opened to access.
6. Replaceable modular design.
7. Mounted next to breaker in panelboard.
8. One for C contact to indicate suppressor is operational
9. Minimum of 10 year warranty.

2.1.4 Distribution Panelboards

(a) Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

2.1.5 Overcurrent Protective Devices

(a) Molded-Case Circuit Breakers: NEMA AB 1, handle lockable.

1) Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2) Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads, Type HACR for heating, air-conditioning, and refrigerating equipment and Class B GFCI for pipeline and vessel fixed electrical heating equipment unless otherwise indicated.
3) Circuit Breakers, 200A and Larger: Trip units interchangeable within frame size.
4) Circuit Breakers, 400A and Larger: Field-adjustable short-time and continuous current settings.
5) Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
6) Current Limiters: Where indicated, integral fuse listed for circuit breaker.
7) Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
8) Shunt Trip: Where indicated.

2.2 Disconnects, Fuses, and Circuit Breakers

2.2.1 Manufacturer’s

(a) Motor and Circuit Disconnects:

1) Eaton Corporation.
2) Schneider Electric.
3) No substitutions allowed.

(b) Molded-Case Circuit Breakers:

1) Eaton Corporation.
2) Schneider Electric.
3) No substitutions allowed.

2.2.2 Enclosed Switches

(a) Enclosed Nonfusible Switch: NEMA KS 1, Type HD handle lockable with 2 padlocks.

(b) Enclosed Fusible Switch, 800 Amps and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in closed position.

1) Minimum Fault Current Rating: 200,000 symmetrical rms amperes.

2.2.3 Enclosed Circuit Breakers

(a) Enclosed Molded-Case Circuit Breaker: NEMA AB 1, handle lockable with 2 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, 10,000 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.

2.2.4 Safety Switches

(a) NEMA heavy duty Type HD. Where indicated, 120 volts, 60 Hz.

(b) Dual cover interlock.

(c) Visible blades.

(d) Provisions for control circuit interlock.

(e) Pin type hinges.

(f) Tin plated current carrying parts.

(g) Quick make and break operator mechanism.

(h) Handle attached to box, not cover.

(i) Handle position indication, ON in up position and OFF in down position.

(j) Padlock provisions for up to 3 padlocks in OFF position.

(k) UL listed lugs for type and size of wire specified.

(l) Spring reinforced fuse clips for Class R fuses.

(m) Provisions for insulated or groundable neutral.

(n) UL listed short circuit rating 200,000 RMS amp with Class R fuses.

2.2.5 Three Phase Manual Motor Switch

(a) Quick make and break operator mechanism.

(b) Padlock provisions in OFF position.

(c) NEMA type.

2.2.6 Enclosures

(a) Enclosure: NEMA AB 1, Type 1, unless specified or required otherwise to meet environmental conditions of installed location.

1) Outdoor or Other Wet or Damp Indoor Locations: NEMA Type 4X 316 stainless steel.
2) Hazardous Areas Indicated on Drawings: NEMA Type 7C.

2.3 Transformers

2.3.1 Manufacturers

(a) Eaton Corporation.

(b) Schneider Electric.

(c) No substitutions allowed.

2.3.2 Transformers, General

(a) Factory-assembled and -tested, air-cooled units of types specified, designed for 60 Hz service.

(b) Cores: Grain-oriented, nonaging silicon steel.

(c) Coils: Continuous copper windings without splices, except for taps.

(d) Internal Coil Connections: Brazed or pressure type.

(e) Enclosure: Class complies with NEMA 250 for environment in which installed.

2.3.3 General-Purpose Distribution and Power Transformers

(a) Comply with NEMA ST 20 and list and label as complying with UL 1561.

(b) Efficiency: Efficiency equal to or greater than that stated in NEMA TP 1, for that type and rating of transformer.

(c) Cores: 1 leg per phase.

(d) Windings: One coil per phase in primary and secondary.

(e) Enclosure: Indoor, ventilated.

(f) 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.

(g) Taps: 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.

1) Taps, 3 through 15 kVA: Two 5% taps below rated high voltage.
2) Taps, 15 through 500 kVA: Six 2.5% taps, 2 above and 4 below rated high voltage.

(h) 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.

1) Transformer design prevents overheating when carrying full load with harmonic content corresponding to designated K-factor.
2) Nameplate states designated K-factor of transformer.

2.3.4 Finishes

(a) Indoor Units: Separate; marked "Shield" for grounding connection.

(b) Outdoor Units: Comply with ANSI C57.12.28.

2.3.5 Source Quality Control

(a) Factory Tests: Design and routine tests comply with referenced standards.

2.4 Electric Motors

2.4.1 Manufacturers

(a) Siemens.

(b) General Electric.

(c) Nidec – U.S. Motors.

(d) Toshiba.

(e) WEG

(f) No substitutions allowed.

.

2.4.2 General

(a) Requirements below apply to motors covered by this Section except as otherwise indicated.

(b) Motors 1/2 hp and larger: Polyphase.

(c) Motors Smaller Than 1/2 hp: Single-Phase.

(d) Frequency Rating: 60 Hz.

(e) Voltage Rating: Determined by voltage of circuit to which motor is connected for following motor voltage ratings (utilization voltages):

1) 120 V Circuit: 115 V - motor rating.
2) 208 V Circuit: 200 V - motor rating.
3) 240 V Circuit: 230 V - motor rating.
4) 480 V Circuit: 460 V - motor rating.

(f) 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.

(g) 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.

(h) Temperature Rise: Based on 40°C ambient except as otherwise indicated.

(i) 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.

(j) Copper Windings.

(k) Winding Insulation Class F.

2.4.3 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 ra
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) Provide 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) 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) Positive lubrication system.
5) Removable eyebolt.
6) Suitable for indoor and outdoor installations.
7) Diagonally split, neoprene gasketed, rotatable oversized conduit box with NPT threaded lead hole.
8) Conduit box mounted, UL approved clamp type grounding lug.
9) Permanently numbered non-wicking loads.
10) Rust inhibitive non-washing lubricant.
11) Stainless steel nameplate with:

i. NEMA nominal efficiency.
ii. AFBMA bearing numbers.
iii. Lubrication instructions.

(j) 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.

(k) Submersible pump and mixer motors.

1) As explosion proof breather drains.
2) 1.10 service factor, unless otherwise indicated in equipment specification sections.

2.4.4 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.

2.4.5 Source Quality Control

(a) Testing:

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.

2.5 External Surge Protection Device

2.5.1 Surge Protective Drives (SPD)

(a) Current Technology, ASCO, or approved equal.

(b) Surge suppressor shall have UL 1449 listed suppression ratings for each mode of protection, as follows:

1) 480/277 volt, 3 phase “WYE” – 800 volts.
2) 120/208 volt, 3 phase “WYE” – 400 volts.
3) 480 volt 3 phase “Delta” – 1500 volts.

(c) 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. (See NEMA 2.2.7 & IEEE Std. 1100-1992).

(d) Include a predetermined number of Selenium cells in parallel with arrays of non-linear voltage dependent metal oxide varistors to protect against system voltage swells.

(e) 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.

(f) MOV’s tested per ANSI/IEEE C62.33-1982.

(g) 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:

150,000 amps, L-N
150,000 amps, L-G min. amps per phase 300,000 (L-N plus L-G)
150,000 amps, N-G
150,000 amps, L-L

(h) Test system for repetitive sequential ANSI/IEEE C62.41 Category C3 waveforms. Minimum repetitive strikes of 1.2 X 50 microsecond, 20 KV open circuit voltage and 8 X 20 microsecond, 10 KA short circuit current with no more than 10% degradation of clamping voltage at the specified surge current.

(i) Provide an extended range noise tracking filter system between 50kHz and 100MHz with a minimum insertion loss ratio of 50:1 or 34 db over the entire range per NEMA LS-1, 1992, Section 2.2.11. UL 1283 Listed as an Electromagnetic Interference Filter. (Standard insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology).

(j) Minimum continuous operating voltage of any component shall not be less than 115% of nominal operating voltage.

(k) The primary suppression path shall be Line to Neutral.

(l) 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.

(m) Each individual Selenium cell, MOV and capacitor shall be fused so that the failure of any component does not affect the operation or protection of the entire unit.

(n) Provide in PVC/Fiberglass or metal enclosure NEMA rated suitable for the installed location.

2.5.2 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 when any value of less than 50% suppression protection is available from the SPD.

1) An audible alarm with battery backup, indicating lights showing loss of power or with any value less than 50% suppression protection is available, a surge counter, and two sets of Form C contacts for remote monitoring.

2) Visual status of suppression protection available, shown in a percentage from 0% to 100%, indication of the number of swells (voltage > 110% of nominal), surges (voltage > 130% of peak voltage), sags (voltage < 90% of nominal), and outages (power interruptions > 1 cycle) the device has encountered.

(b) High Performance Interconnect. Dual shielded, triple insulated multi-sore power conductor, UL approved.

(c) System shall be capable of communicating remotely via Modbus TCP over Ethernet and a web interface via Ethernet.

2.6 Fire Alarm System

2.6.1 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 with 120 VAC power supply. The system shall be supervised and shall be provided with two dry contact outputs for both trouble and alarm status for remote connection to SCADA. Fire panel shall have the ability to provide alarm status output to the AEGIS system and receive a horn relay signal from the gas system.

2.6.2 The system shall be complete with five zones - Electrical Room, Pump Room, Grade Floor, Intermediate Floor and Dry Pit. 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 Plans. All appliances 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.

2.6.3 The system shall have terminals and space for receiving a signal from the gas system (gas monitor horn relay) per the Drawings. The contact closure shall activate the horn/strobes only; the other fire alarm system functions shall not be affected. The horns/strobes are common to the fire and gas detection systems. The audible horns and visual devices shall be configured to be re-settable and silenced from either gas panel or fire panel.

2.6.4 Submittal 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. A detail bill of material with technical descriptions and summary of quantities, project specific catalog cutsheets, one line riser diagram and applicable features of components shall be included.

2.6.5 The system shall be the product of a single manufacturer having local available service. The system shall be UL listed and Factory Mutual approved.

2.6.6 Horns: Electric-vibrating-polarized type, operating on 120 VAC, with provision for housing operating mechanism behind grille. Horns produce sound-pressure level of 90 dB, measures at 10 ft (3 m) from source. Sound-pressure shall be adjustable. Provide with red enclosure suitable for environment listed on drawings (explosion proof, weather proof).

2.6.7 Visual Alarm Devices: Xenon strobe lights with clear or nominal white polycarbonate lens operating on 120 VAC. Mount lenses on aluminum faceplate. Word “FIRE” is engraved in minimum 1 in. (25 mm) high letters on lens. Provide with enclosure suitable for environment listed on drawings (explosion proof, weather proof).

(a) Devices have candela reading as stated in NFPA 72.

2.6.8 Manual Pull Stations: Double-action type, fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

(a) Break-Glass Feature: Stations requiring breaking of glass are unacceptable. Stations requiring breaking of concealed glass rod are acceptable.
(b) Station Reset: Key or wrench operated, double pole, double throw, switch rated for voltage and current at which it operates. Stations have screw terminals for connections.
(c) Provide with enclosure suitable for environment listed on drawings (explosion proof, weather proof).

2.7 AEGIS/Intrusion Alarm System

2.7.1 Intrusion detection systems shall be provided and utilize an ADEMCO Vista 20-P circuit board / digital dialer. The AEGIS (Abnormal Event Guidance and Information System) Intrusion system provides detection of unauthorized entry into the station including the pump room, electrical room, trash rack room (where applicable), and stairway. The system detection is monitored via explosion proof rated magnetic reed switches located at each door leading to the exterior; the electrical room door switches shall be non-explosion proof rated. The switches shall consist of two elements, the magnet mounted 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.

2.7.2 An ‘intrusion’ alarm condition shall be sent to the SCADA panel when a door is opened. The door switches can be disabled via an override switch located on the outside of the electrical room. The override switch shall be weatherproof and key operated, key to be coordinated with the Department’s existing key system (Medeco cylinder type, biaxial high security switch lock) and removable from both positions. The switch shall contain a LED status light to indicate open or closed position and include a tamper pushbutton to be held open by the cover plate and spring closed if the cover is removed. The override switch shall have two contacts, one contact for shutting the door switches and one contact for connection to the SCADA panel.

2.7.3 The system shall be equipped with a wall mounted intrusion panel that houses a ADEMCO circuit board, digital dialer, 120 volt AC power source, 120 volt to 12 volt transformer, DC power supply with battery (sized for 24 hours of operation) and battery charger, panel mounted LED beacon, terminal strips for field wiring (factory installed wiring shall be clearly identified with conductor labels that match approved shop drawing) and various control relays. The panel will report alarms via a dedicated telephone line (shared with pump station telephone) as part of the Department’s system wide AEGIS alarm system, the following signals shall be monitored by the intrusion system setup to alarm on a contact closure:

(1) Intrusion Alarm
(2) Fire Alarm & Gas Alarms
(3) Normal Electrical Service and/or Emergency Generator Service Failures
(4) High Water Level on Pavement
(5) High Wet Well Water Level
(6) SCADA Alarm and/or PLC failure
(7) Low Wet Well Water Level
(8) Pump Alarm
(9) Internal Battery Low
(10) AEGIS Heartbeat

2.7.4 The systems primary function is intrusion detection and alarm reporting of above listed inputs at EMC Contractor's Maintenance Facility and at IDOT District 1. Reporting is performed via telephone output in the event SCADA transmission is lost or disrupted. Alarming via telephone is performed regardless of operational status of SCADA alarm transmissions.

2.7.5 Submittal information shall include all necessary internal and external wiring diagrams and installation requirements. Complete system connection diagrams of all initiating devices and notification appliance A details bill of material with technical descriptions and summary of quantities, project specific catalog cutsheets, one line riser diagram and applicable features of components shall be included.

3. EXECUTION:

3.1 Panelboards

3.1.1 Installation

(a) Install panelboards and accessory items according to NEMA PB 1.1.

(b) Mounting Heights: Top of trim 74 in. (1880 mm) above finished floor, unless otherwise indicated.

(c) Mounting: Plumb and rigid without distortion box. Mount flush panelboards ur

(d) Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.

(e) Install filler plates in unused spaces.

(f) Provision for Future Circuits at Flush Panelboads: Stub four 1 in. (27 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 in. (27 mm) empty conduits into raised floor space or below slab not on grade.

(g) Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

3.1.2 Identification

(a) Identify field-installed wiring and components and provide warning signs as specified in Section 16C.

(b) Panelboard Nameplates: Label each panelboard with engraved laminated-plas

3.1.3 Grounding

(a) Make equipment grounding connections for panelboards.

(b) Provide ground continuity to main electrical ground bus.

3.1.4 Connections

(a) 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

3.1.5 Field Quality Control

(a) Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.

(b) Make continuity tests of each circuit.

(c) Visual and Mechanical Inspection.

1) Check circuit breaker for proper mounting and compare nameplate data to drawings and specifications.
2) Operate circuit breaker to ensure smooth operations.
3) Inspect case for cracks or other defects.

(d) Balancing Loads: After Substantial Completion, conduct load-balancing measurements and make circuit changes as follows:

1) Perform measurements during period of normal working load as advised by Engineer.
2) Perform load-balancing circuit changes outside normal occupancy/working schedule of facility. Make special arrangements with OWNER to avoid disrupting critical 24 hr services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3) Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
4) Tolerance: Difference exceeding 20% between phase loads, within panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

3.1.6 Adjusting

(a) Set field-adjustable pick-up and time-sensitivity ranges in accordance with Section 16B.

3.1.7 Cleaning

(a) On completion of installation, inspect interior and exterior of panelboards. F

3.2 Disconnects, Fuses and Circuit Breakers

3.2.1 Examination

(a) Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
(b) Do not proceed with installation until unsatisfactory conditions have
been corrected.

3.2.2 Installation

(a) Install enclosed switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.

(b) Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

(c) Install enclosed switches and circuit breakers level and plumb.

(d) Install wiring between enclosed switches and circuit breakers and control/indication devices.

(e) 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.

3.2.3 Identification

(a) Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

3,2.4 Coordination Study

(a) Where coordination study recommends changes in types, classes, features or ratings of equipment or devices specified in Section 16B from those indicated, make written request for instructions. Obtain instructions from ENGINEER before ordering equipment or devices recommended to be changed.

3.2.5 Field Quality Control

(a) Manufacturer’s Field Services:

1) Supplier’s or manufacturer’s representative for equipment specified herein shall be present at job site of classroom designated by the Department for minimum mandays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of the Department’s personnel for plant operation. Include minimum of:

i. 1/2 manday for Installation Services.
ii. 1/2 manday for Instructional Services.

(b) Test in accordance with Section 16A.

(c) Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

2) Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for enclosed switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
3) Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.2.6 Adjusting

(a) Set field-adjustable pick-up and time-sensitivity ranges in accordance with Section 16B.

3.2.7 Cleaning

(a) Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.3 Transformers

3.3.1 Installation

(a) Comply with safety requirements of IEEE C2.

(b) Arrange equipment to provide adequate spacing for access and for circulation of cooling air.

(c) Identify transformers and install warning signs according to Section 16B-2.

(d) Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3.2 Grounding

(a) Comply with NFPA 70 requirements separately derived systems for connecting to grounding electrodes and for bonding to metallic piping near transformer.

(b) Comply with Section 16C.

3.3.3 Field Quality Control

(a) Testing in accordance with Section 16A.

3.3.4

(a) On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.3.5 Adjusting

(a) After installing and cleaning, touch up scratches and mars on finish to match original finish.

(b) Adjust transformer taps and connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages, tap settings or connections, and submit with test results.

3.4 Electric Motors

3.4.1 Installation

(a) Field install motors in accordance with manufacturer's instructions and following:

1) Direct Connected Motors: Mount securely in accurate alignment.
2) 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.

3.4.2 Commissioning

(a) Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with commissioning of equipment for which motor is part.

(b) Report unusual conditions.

(c) Correct deficiencies of field-installed units.

3.4.3 Alignment

(a) Installer of motor is responsible for alignment.

(b) Check alignment of motors prior to startup.

(c) Motors over 50 hp: operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with commissioning of equipment for which motor is part.

3.4.4 Field Quality Control

(a) Inspect wire and connections for physical damage and proper connection.

(b) Conduct insulation resistance (megger) test on each motor 25 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 abso
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

(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.

(f) In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration.

3.5 Surge Protective Device

3.5.1 System Testing and Installation

(a) Factory test before shipment:

1) Testing shall include, but not be limited to production-line tests, quality assurance checks, MCOV, and benchmark clamping voltage tests.
2) A copy of the benchmark clamping tests for each individual SPD shall be included with each unit.

(b) Manufacturer's Field Services:

1) Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by the Department for minimum mandays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of the Department's personnel for plant operation. Include:

i. 1/2 man-day for Installation and Testing Services.
ii. 1/2 man-day for Instructional Services.

2) Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process.
3) Obtain the services of a factory-authorized local service representative to provide the following tests:

i. Voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line and Neutral-to-Ground (as applicable),
ii. Impulse injection to verify the system suppression voltage tolerances for all suppression paths. (Note: This testing is separate from any switchgear or other system tests. Completely disconnect the TVSS from the switchgear prior to any switchgear or other system tests, including any hi pot testing.)
iii. Record and compare test results to factory benchmark test parameters supplied with each individual unit.
iv. Submit a copy of the start-up test results and the factory benchmark testing results to the Engineer and the owner for confirmation of proper system function.

3.5.2 Installation

(a) SPDs shall be installed on the load side of the main disconnects.
(b) SPDs shall have a dedicated circuit breaker disconnect at the connection point in the electrical distribution equipment. Low impedance (HPI) cable shall be used to connect the SPD to the electrical distribution equipment. The total cable length between the electrical distribution equipment and the SPD shall be less than 10 feet.

3.5.3 System Warranty

(a) The SPD system manufacturer shall warranty the entire system against defective materials and workmanship for a period of fifteen years following delivery from the manufacturer.

(b) The internal SPD protection suppression system shall be protected by a fifteen year warranty following delivery from the manufacturer providing the SPD system is installed per the manufacturer's specifications.

3.6 Fire Alarm and Intrusion Systems

3.6.1 Verify location and layout of Aegis/Intrusion alarm equipment and Fire alarm equipment.

3.11.2 Verify that electrical power is available and of correct characteristics.

3.6.3 Verify the interface with the gas monitoring system functions as specified and detailed on the Drawings.

3.6.4 Install system and components in accordance with manufacturer's specifications.

3.6.5 The installer shall provide all labor and perform all work to install and make operable all mechanical and electrical equipment necessary to assure safe and reliable operation.

3.6.6 Representative of the Manufacturer

(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 the Intrusion Alarm and Fire Alarm Systems. Include:

i. 1 manday for Installation Services for Intrusion Alarm Panel and Fire Alarm Panel.
ii. 1 manday for Instructional Services for Intrusion Alarm Panel and Fire Alarm Panel.

(b) The start-up services for the following equipment shall be coordinated with the Department; the Department shall be notified at least one week in advance:

Intrusion Alarm Panel.
Fire Alarm Panel.

END OF THIS SECTION

AGGREGATE SUBGRADE IMPROVEMENT (BDE)

Effective: April 1, 2012 Revised: April 1, 2022

Add the following Section to the Standard Specifications:

"**SECTION 303. AGGREGATE SUBGRADE IMPROVEMENT**

303.01 Description. This work shall consist of constructing an aggregate subgrade improvement (ASI).

303.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Coarse Aggregate	1004.07
(b) Reclaimed Asphalt Pavement (RAP)	1031.09

303.03 Equipment. The vibratory roller shall be according to Article 1101.01, or as approved by the Engineer. Vibratory machines, such as tampers, shall be used in areas where rollers do not fit.

303.04 Soil Preparation. The minimum immediate bearing value (IBV) of the soil below the improved subgrade shall be according to the Department's "Subgrade Stability Manual" for the aggregate thickness specified.

303.05 Placing and Compacting. The maximum nominal lift thickness of aggregate gradations CA 2, CA 6, and CA 10 when compacted shall be 9 in. (225 mm). The maximum nominal lift thickness of aggregate gradations CS 1, CS 2, and RR 1 when compacted shall be 24 in. (600 mm).

The top surface of the aggregate subgrade improvement shall consist of a layer of capping aggregate gradations CA 6 or CA 10 that is 3 in. (75 mm) thick after compaction. Capping aggregate will not be required when aggregate subgrade improvement is used as a cubic yard pay item for undercut applications.

Each lift of aggregate shall be compacted to the satisfaction of the Engineer. If the moisture content of the material is such that compaction cannot be obtained, sufficient water shall be added so that satisfactory compaction can be obtained.

303.06 Finishing and Maintenance. The aggregate subgrade improvement shall be finished to the lines, grades, and cross sections shown on the plans, or as directed by the Engineer. The aggregate subgrade improvement shall be maintained in a smooth and compacted condition.

303.07 Method of Measurement. This work will be measured for payment according to Article 311.08.

303.08 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) or ton (metric ton) for AGGREGATE SUBGRADE IMPROVEMENT or at the contract unit price per square yard (square meter) for AGGREGATE SUBGRADE IMPROVEMENT, of the thickness specified."

Add the following to Section 1004 of the Standard Specifications:

"**1004.07 Coarse Aggregate for Aggregate Subgrade Improvement (ASI).** The aggregate shall be according to Article 1004.01 and the following.

(a) Description. The coarse aggregate shall be crushed gravel, crushed stone, or crushed concrete. In applications where greater than 24 in. (600 mm) of ASI material is required, gravel may be used below the top 12 in (300 mm) of ASI.

(b) Quality. The coarse aggregate shall consist of sound durable particles reasonably free of deleterious materials.

(c) Gradation.

(1) The coarse aggregate gradation for total ASI thickness less than or equal to 12 in. (300 mm) shall be CA 2, CA 6, CA 10, or CS 1.

The coarse aggregate gradation for total ASI thickness greater than 12 in. (300 mm) shall be CS 1 or CS 2 as shown below or RR 1 according to Article 1005.01(c).

	COARSE AGGREGATE SUBGRADE GRADATIONS				
Grad No.	Sieve Size and Percent Passing				
	8"	6"	4"	2"	#4
CS 1	100	97 ± 3	90 ± 10	45 ± 25	20 ± 20
CS 2		100	80 ± 10	25 ± 15	

	COARSE AGGREGATE SUBGRADE GRADATIONS (Metric)				
Grad No.	Sieve Size and Percent Passing				
	200 mm	150 mm	100 mm	50 mm	4.75 mm
CS 1	100	97 ± 3	90 ± 10	45 ± 25	20 ± 20
CS 2		100	80 ± 10	25 ± 15	

(2) Capping aggregate shall be gradation CA 6 or CA 10."

Add the following to Article 1031.09 of the Standard Specifications:

"(b) RAP in Aggregate Subgrade Improvement (ASI). RAP in ASI shall be according to Articles 1031.01(a), 1031.02(a), 1031.06(a)(1), and 1031.06(a)(2), and the following.

(1) The testing requirements of Article 1031.03 shall not apply.

(2) Crushed RAP used for the lower lift may be mechanically blended with aggregate gradations CS 1, CS 2, and RR 1 but it shall be no greater than 40 percent of the total product volume. RAP agglomerations shall be no greater than 4 in. (100 mm).

(3).....F
or capping aggregate, well graded RAP having 100 percent passing the 1 1/2 in. (38 mm) sieve may be used when aggregate gradations CS 1, CS 2, CA 2, or RR 1 are used in the lower lift. FRAP will not be permitted as capping material.

Blending shall be through calibrated interlocked feeders or a calibrated blending plant such that the prescribed blending percentage is maintained throughout the blending process. The calibration shall have an accuracy of ± 2.0 percent of the actual quantity of material delivered."

CEMENT, TYPE IL (BDE)

Effective: August 1, 2023

Add the following to Article 302.02 of the Standard Specifications:

"(k) Type IL Portland-Limestone Cement .....1001"

Revise Note 2 of Article 352.02 of the Standard Specifications to read:

"Note 2. Either Type I or Type IA portland cement or Type IL portland-limestone cement shall be used."

Revise Note 1 of Article 404.02 of the Standard Specifications to read:

"Note 1. The cement shall be Type I portland cement or Type IL portland-limestone cement."

Revise Article 1019.02(a) of the Standard Specifications to read:

"(a) Cement, Type I or IL .....1001"

COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017 Revised: April 1, 2019

Revise Article 107.40(b) of the Standard Specifications to read:

"(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 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 work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.

(2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.

(3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days."

Revise Article 107.40(c) of the Standard Specifications to read:

"(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 two weeks plus the cost of move-out to either the Contractor's yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two 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 calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13."

Revise Article 108.04(b) of the Standard Specifications to read:

"(b) No working day will be charged under the following conditions.

(1) When adverse weather prevents work on the controlling item.

(2) When job conditions due to recent weather prevent work on the controlling item.

(3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.

(4) When delays caused by utility or railroad adjustments prevent work on the controlling item.

(5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.

(6) When any condition over which the Contractor has no control prevents work on the controlling item."

Revise Article 109.09(f) of the Standard Specifications to read:

"(f) Basis of Payment. After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited."

Add the following to Section 109 of the Standard Specifications.

"**109.13 Payment for Contract Delay.** Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

(a) Escalated Material and/or Labor Costs. When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.

(b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.

(1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to $5,000,000	One Project Superintendent
Over $ 5,000,000 - up to $25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over $25,000,000 - up to $50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over $50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

(c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid for according to Article 109.04.

When an extended traffic control adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay 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."

CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)
Effective: June 1, 2010 Revised: November 1, 2014

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/cleandiesel/verification/verif-list.htm), or verified by the California Air Resources Board (CARB) (http://www.arb.ca.gov/diesel/verdev/vt/cvt.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.

CORRUGATED PLASTIC PIPE (CULVERT AND STORM SEWER) (BDE)

Effective: January 1, 2021

Revise Tables IIIA and IIIB of Article 542.03 and the storm sewers tables of Article 550.03 of the Standard Specifications to read:

(SEE TABLES ON NEXT 10 PAGES)

"PIPE CULVERTS
TABLE IIIA: PLASTIC PIPE PERMITTED
FOR A GIVEN PIPE DIAMETER AND FILL HEIGHT OVER THE TOP OF THE PIPE

Nominal Diameter (in.)	Type 1					Type 2					Type 3					Type 4				
	Fill Height: 3' and less, with 1' min					Fill Height: Greater than 3', not exceeding 10'					Fill Height: Greater than 10', not exceeding 15'					Fill Height: Greater than 15', not exceeding 20'				
	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP
10	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA
12	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL
15	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL
18	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL
21	X	QPL	NA	QPL	NA	X	QPL	NA	QPL	NA	X	QPL	NA	QPL	NA	X	QPL	NA	NA	NA
24	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
27	X	NA	NA	NA	NA	X	NA	NA	NA	NA	X	NA	NA	NA	NA	X	NA	NA	NA	NA
30	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
36	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
42	X	NA	X	QPL	QPL	X	NA	X	QPL	QPL	X	NA	X	NA	QPL	X	NA	X	NA	NA
48	X	NA	X	QPL	QPL	X	NA	X	QPL	QPL	X	NA	X	NA	QPL	X	NA	X	NA	NA
54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
60	NA	NA	NA	QPL	QPL	NA	NA	NA	QPL	QPL	NA	NA	NA	NA	QPL	NA	NA	NA	NA	NA

Notes:
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

PIPE CULVERTS (metric)
TABLE IIIA: PLASTIC PIPE PERMITTED
FOR A GIVEN PIPE DIAMETER AND FILL HEIGHT OVER THE TOP OF THE PIPE

Nominal Diameter (mm)	Type 1					Type 2					Type 3					Type 4				
	Fill Height: 1 m and less, with 0.3 m min. cover					Fill Height: Greater than 1 m, not exceeding 3 m					Fill Height: Greater than 3 m, not exceeding 4.5 m					Fill Height: Greater than 4.5 m, not exceeding 6 m				
	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	CPE	CPP
250	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA	X	QPL	X	QPL	NA
300	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL
375	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL	X	QPL	NA	QPL	QPL
450	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL
525	X	QPL	NA	QPL	NA	X	QPL	NA	QPL	NA	X	QPL	NA	QPL	NA	X	QPL	NA	NA	NA
600	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
675	X	NA	NA	NA	NA	X	NA	NA	NA	NA	X	NA	NA	NA	NA	X	NA	NA	NA	NA
750	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
900	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	QPL	QPL	X	QPL	X	NA	QPL
1050	X	NA	X	QPL	QPL	X	NA	X	QPL	QPL	X	NA	X	NA	QPL	X	NA	X	NA	NA
1200	X	NA	X	QPL	QPL	X	NA	X	QPL	QPL	X	NA	X	NA	QPL	X	NA	X	NA	NA
1350	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1500	NA	NA	NA	QPL	QPL	NA	NA	NA	QPL	QPL	NA	NA	NA	NA	QPL	NA	NA	NA	NA	NA

Notes:
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

PIPE CULVERTS
TABLE IIIB: PLASTIC PIPE PERMITTED
FOR A GIVEN PIPE DIAMETER AND FILL HEIGHT OVER THE TOP OF THE PIPE

Nominal Diameter (in.)	Type 5					Type 6			Type 7		
	Fill Height: Greater than 20', not exceeding 25'					Fill Height: Greater than 25', not exceeding 30'			Fill Height: Greater than 30', not exceeding 35'		
	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	PVC	CPVC	PE
10	X	QPL	X	QPL	NA	X	QPL	X	X	QPL	X
12	X	QPL	X	QPL	QPL	X	QPL	X	X	QPL	X
15	X	QPL	NA	NA	QPL	X	QPL	NA	X	QPL	NA
18	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
21	X	QPL	NA	NA	NA	X	QPL	NA	X	QPL	NA
24	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
27	X	NA	NA	NA	NA	X	NA	NA	X	NA	NA
30	X	QPL	X	NA	QPL	X	QPL	X	X	QPL	X
36	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
42	X	NA	X	NA	NA	X	NA	X	X	NA	X
48	X	NA	X	NA	NA	X	NA	X	X	NA	X
54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

PIPE CULVERTS (metric)
TABLE IIIB: PLASTIC PIPE PERMITTED
FOR A GIVEN PIPE DIAMETER AND FILL HEIGHT OVER THE TOP OF THE PIPE

Nominal Diameter (mm)	Type 5					Type 6			Type 7		
	Fill Height: Greater than 6 m, not exceeding 7.5 m					Fill Height: Greater than 7.5 m, not exceeding 9 m			Fill Height: Greater than 9 m, not exceeding 10.5 m		
	PVC	CPVC	PE	CPE	CPP	PVC	CPVC	PE	PVC	CPVC	PE
250	X	QPL	X	QPL	NA	X	QPL	X	X	QPL	X
300	X	QPL	X	QPL	QPL	X	QPL	X	X	QPL	X
375	X	QPL	NA	NA	QPL	X	QPL	NA	X	QPL	NA
450	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
525	X	QPL	NA	NA	NA	X	QPL	NA	X	QPL	NA
600	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
675	X	NA	NA	NA	NA	X	NA	NA	X	NA	NA
750	X	QPL	X	NA	QPL	X	QPL	X	X	QPL	X
900	X	QPL	X	NA	NA	X	QPL	X	X	QPL	X
1000	X	NA	X	NA	NA	X	NA	X	X	NA	X
1200	X	NA	X	NA	NA	X	NA	X	X	NA	X
1350	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

STORM SEWERS
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter in.	Type 1								Type 2							
	Fill Height: 3' and less, with 1' min.								Fill Height: Greater than 3', not exceeding 10'							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
10	NA	3	X	X	QPL	X	QPL	NA	NA	1	*X	X	QPL	X	QPL	NA
12	IV	NA	X	X	QPL	X	QPL	QPL	II	1	*X	X	QPL	X	QPL	QPL
15	IV	NA	NA	X	QPL	NA	QPL	QPL	II	1	*X	X	QPL	NA	QPL	QPL
18	IV	NA	NA	X	QPL	X	QPL	QPL	II	2	X	X	QPL	X	QPL	QPL
21	III	NA	NA	X	QPL	NA	QPL	NA	II	2	X	X	QPL	NA	QPL	NA
24	III	NA	NA	X	QPL	X	QPL	QPL	II	2	X	X	QPL	X	QPL	QPL
27	III	NA	NA	X	NA	NA	NA	NA	II	3	X	X	NA	NA	NA	NA
30	IV	NA	NA	X	QPL	X	QPL	QPL	II	3	X	X	QPL	X	QPL	QPL
33	III	NA	NA	NA	NA	NA	NA	NA	II	NA	X	NA	NA	NA	NA	NA
36	III	NA	NA	X	QPL	X	QPL	QPL	II	NA	X	X	QPL	X	QPL	QPL
42	II	NA	X	X	NA	X	QPL	QPL	II	NA	X	X	NA	X	QPL	QPL
48	II	NA	X	X	NA	X	QPL	QPL	II	NA	X	X	NA	X	QPL	QPL
54	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
60	II	NA	NA	NA	NA	NA	QPL	QPL	II	NA	NA	NA	NA	NA	QPL	QPL
66	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
72	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
78	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
84	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
90	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
96	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
102	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
108	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA

RCCP	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
CSP	Concrete Sewer, Storm drain, and Culvert Pipe (number in column indicates strength class)
ESCP	Extra Strength Clay Pipe
PVC	Polyvinyl Chloride Pipe
CPVC	Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE	Polyethylene Pipe
CPE	Corrugated Polyethylene Pipe with a Smooth Interior
CPP	Corrugated Polypropylene Pipe with a Smooth Interior
X	Permitted
QPL	Permitted for the producers approved for that diameter in the Department’s qualified product list
NA	Not Acceptable
*	May also use Standard Strength Clay Pipe

STORM SEWERS (metric)
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter mm	Type 1								Type 2							
	Fill Height: 1 m and less, with 300 mm min,								Fill Height: Greater than 1 m, not exceeding 3 m							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
250	NA	3	X	X	QPL	X	QPL	NA	NA	1	*X	X	QPL	X	QPL	NA
300	IV	NA	X	X	QPL	X	QPL	QPL	II	1	*X	X	QPL	X	QPL	QPL
375	IV	NA	NA	X	QPL	NA	QPL	QPL	II	1	*X	X	QPL	NA	QPL	QPL
450	IV	NA	NA	X	QPL	X	QPL	QPL	II	2	X	X	QPL	X	QPL	QPL
525	III	NA	NA	X	QPL	NA	QPL	NA	II	2	X	X	QPL	NA	QPL	NA
600	III	NA	NA	X	QPL	X	QPL	QPL	II	2	X	X	QPL	X	QPL	QPL
675	III	NA	NA	X	NA	NA	NA	NA	II	3	X	X	NA	NA	NA	NA
750	IV	NA	NA	X	QPL	X	QPL	QPL	II	3	X	X	QPL	X	QPL	QPL
825	III	NA	NA	NA	NA	NA	NA	NA	II	NA	X	NA	NA	NA	NA	NA
900	III	NA	NA	X	QPL	X	QPL	QPL	II	NA	X	X	QPL	X	QPL	QPL
1050	II	NA	X	X	NA	X	QPL	QPL	II	NA	X	X	NA	X	QPL	QPL
1200	II	NA	X	X	NA	X	QPL	QPL	II	NA	X	X	NA	X	QPL	QPL
1350	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1500	II	NA	NA	NA	NA	NA	QPL	QPL	II	NA	NA	NA	NA	NA	QPL	QPL
1650	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1800	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
1950	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
2100	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
2250	II	NA	NA	NA	NA	NA	NA	NA	II	NA	NA	NA	NA	NA	NA	NA
2400	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
2550	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA
2700	II	NA	NA	NA	NA	NA	NA	NA	III	NA	NA	NA	NA	NA	NA	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
CSP Concrete Sewer, Storm drain, and Culvert Pipe (number in column indicates strength class)
ESCP Extra Strength Clay Pipe
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable
* May also use Standard Strength Clay Pipe

STORM SEWERS
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter in.	Type 3								Type 4							
	Fill Height: Greater than 10' not exceeding 15'								Fill Height: Greater than 15' not exceeding 20'							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
10	NA	2	X	X	QPL	X	QPL	NA	NA	3	X	X	QPL	X	QPL	NA
12	III	2	X	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	QPL	QPL
15	III	3	X	X	QPL	NA	QPL	QPL	IV	NA	NA	X	QPL	NA	QPL	QPL
18	III	NA	X	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	QPL	QPL
21	III	NA	NA	X	QPL	NA	QPL	NA	IV	NA	NA	X	QPL	NA	NA	NA
24	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
27	III	NA	NA	X	NA	NA	NA	NA	IV	NA	NA	X	NA	NA	NA	NA
30	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
33	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
36	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
42	III	NA	NA	X	NA	X	NA	QPL	IV	NA	NA	X	NA	X	NA	NA
48	III	NA	NA	X	NA	X	NA	QPL	IV	NA	NA	X	NA	X	NA	NA
54	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
60	III	NA	NA	NA	NA	NA	NA	QPL	IV	NA	NA	NA	NA	NA	NA	NA
66	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
72	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
78	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
84	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
90	III	NA	NA	NA	NA	NA	NA	NA	1680	NA	NA	NA	NA	NA	NA	NA
96	III	NA	NA	NA	NA	NA	NA	NA	1690	NA	NA	NA	NA	NA	NA	NA
102	III	NA	NA	NA	NA	NA	NA	NA	1700	NA	NA	NA	NA	NA	NA	NA
108	1360	NA	NA	NA	NA	NA	NA	NA	1710	NA	NA	NA	NA	NA	NA	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 0.01 in crack.)
CSP Concrete Sewer, Storm drain, and Culvert Pipe (number in column indicates strength class)
ESCP Extra Strength Clay Pipe
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

STORM SEWERS (metric)
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter mm	Type 3								Type 4							
	Fill Height: Greater than 3 m, not exceeding 4.5 m								Fill Height: Greater than 4.5 m, not exceeding 6 m							
	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP	RCCP	CSP	ESCP	PVC	CPVC	PE	CPE	CPP
250	NA	2	X	X	QPL	X	QPL	NA	NA	3	X	X	QPL	X	QPL	NA
300	III	2	X	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	QPL	QPL
375	III	3	X	X	QPL	NA	QPL	QPL	IV	NA	NA	X	QPL	NA	QPL	QPL
450	III	NA	X	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	QPL	QPL
525	III	NA	NA	X	QPL	NA	QPL	NA	IV	NA	NA	X	QPL	NA	NA	NA
600	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
675	III	NA	NA	X	NA	NA	NA	NA	IV	NA	NA	X	NA	NA	NA	NA
750	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
825	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
900	III	NA	NA	X	QPL	X	QPL	QPL	IV	NA	NA	X	QPL	X	NA	QPL
1050	III	NA	NA	X	NA	X	NA	QPL	IV	NA	NA	X	NA	X	NA	NA
1200	III	NA	NA	X	NA	X	NA	QPL	IV	NA	NA	X	NA	X	NA	NA
1350	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
1500	III	NA	NA	NA	NA	NA	NA	QPL	IV	NA	NA	NA	NA	NA	NA	NA
1650	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
1800	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
1950	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
2100	III	NA	NA	NA	NA	NA	NA	NA	IV	NA	NA	NA	NA	NA	NA	NA
2250	III	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	NA
2400	III	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	NA
2550	III	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	NA
2700	70	NA	NA	NA	NA	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 25.4 micro-meter crack.)
CSP Concrete Sewer, Storm drain, and Culvert Pipe (number in column indicates strength class)
ESCP Extra Strength Clay Pipe
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

STORM SEWERS
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter in.	Type 5						Type 6				Type 7			
	Fill Height: Greater than 20', not exceeding 25'						Fill Height: Greater than 25', not exceeding 30'				Fill Height: Greater than 30', not exceeding 35'			
	RCCP	PVC	CPVC	PE	CPE	CPP	RCCP	PVC	CPVC	PE	RCCP	PVC	CPVC	PE
10	NA	X	QPL	X	QPL	NA	NA	X	QPL	X	NA	X	QPL	X
12	IV	X	QPL	X	QPL	QPL	V	X	QPL	X	V	X	QPL	X
15	IV	X	QPL	NA	NA	QPL	V	X	QPL	NA	V	X	QPL	NA
18	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
21	IV	X	QPL	NA	NA	NA	V	X	QPL	NA	V	X	QPL	NA
24	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
27	IV	X	NA	NA	NA	NA	V	X	NA	NA	V	X	NA	NA
30	IV	X	QPL	X	NA	QPL	V	X	QPL	X	V	X	QPL	X
33	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
36	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
42	IV	X	NA	X	NA	NA	V	X	NA	X	V	X	NA	X
48	IV	X	NA	X	NA	NA	V	X	NA	X	V	X	NA	X
54	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
60	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
66	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
72	V	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
78	2020	NA	NA	NA	NA	NA	2370	NA	NA	NA	2730	NA	NA	NA
84	2020	NA	NA	NA	NA	NA	2380	NA	NA	NA	2740	NA	NA	NA
90	2030	NA	NA	NA	NA	NA	2390	NA	NA	NA	2750	NA	NA	NA
96	2040	NA	NA	NA	NA	NA	2400	NA	NA	NA	2750	NA	NA	NA
102	2050	NA	NA	NA	NA	NA	2410	NA	NA	NA	2760	NA	NA	NA
108	2060	NA	NA	NA	NA	NA	2410	NA	NA	NA	2770	NA	NA	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 0.01 in crack.)
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable

STORM SEWERS (metric)
KIND OF MATERIAL PERMITTED AND STRENGTH REQUIRED
FOR A GIVEN PIPE DIAMETERS AND FILL HEIGHTS OVER THE TOP OF THE PIPE

Nominal Diameter mm	Type 5						Type 6				Type 7			
	Fill Height: Greater than 6 m, not exceeding 7.5 m						Fill Height: Greater than 7.5 m, not exceeding 9 m				Fill Height: Greater than 9 m, not exceeding 10.5 m			
	RCCP	PVC	CPVC	PE	CPE	CPP	RCCP	PVC	CPVC	PE	RCCP	PVC	CPVC	PE
250	NA	X	QPL	X	QPL	NA	NA	X	QPL	X	NA	X	QPL	X
300	IV	X	QPL	X	QPL	QPL	V	X	QPL	X	V	X	QPL	X
375	IV	X	QPL	NA	NA	QPL	V	X	QPL	NA	V	X	QPL	NA
450	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
525	IV	X	QPL	NA	NA	NA	V	X	QPL	NA	V	X	QPL	NA
600	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
675	IV	X	NA	NA	NA	NA	V	X	NA	NA	V	X	NA	NA
750	IV	X	QPL	X	NA	QPL	V	X	QPL	X	V	X	QPL	X
825	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
900	IV	X	QPL	X	NA	NA	V	X	QPL	X	V	X	QPL	X
1050	IV	X	NA	X	NA	NA	V	X	NA	X	V	X	NA	X
1200	IV	X	NA	X	NA	NA	V	X	NA	X	V	X	NA	X
1350	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
1500	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
1650	IV	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
1800	V	NA	NA	NA	NA	NA	V	NA	NA	NA	V	NA	NA	NA
1950	100	NA	NA	NA	NA	NA	110	NA	NA	NA	130	NA	NA	NA
2100	100	NA	NA	NA	NA	NA	110	NA	NA	NA	130	NA	NA	NA
2250	100	NA	NA	NA	NA	NA	110	NA	NA	NA	130	NA	NA	NA
2400	100	NA	NA	NA	NA	NA	120	NA	NA	NA	130	NA	NA	NA
2550	100	NA	NA	NA	NA	NA	120	NA	NA	NA	130	NA	NA	NA
2700	100	NA	NA	NA	NA	NA	120	NA	NA	NA	130	NA	NA	NA

RCCP Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (RCCP with a number instead of a Roman numeral shall be furnished according to AASHTO M170 Section 6. This number represents the D-load to produce a 25.4 micro-meter crack.)
PVC Polyvinyl Chloride Pipe
CPVC Corrugated Polyvinyl Chloride Pipe with a Smooth Interior
PE Polyethylene Pipe
CPE Corrugated Polyethylene Pipe with a Smooth Interior
CPP Corrugated Polypropylene Pipe with a Smooth Interior
X Permitted
QPL Permitted for the producers approved for that diameter in the Department's qualified product list
NA Not Acceptable"

Revise the first paragraph of Article 1040.03 of the Standard Specifications to read:

"**1040.03 Polyvinyl Chloride (PVC) Pipe.** Acceptance testing of PVC pipe and fittings shall be accomplished during the same construction season in which they are installed. The pipe shall meet the following additional requirements."

Revise Article 1040.04(b) of the Standard Specifications to read:

"(b) Corrugated PE Pipe with a Smooth Interior. The manufacturer shall be listed as compliant through the NTPEP program and the pipe shall be according to AASHTO M 294 (nominal size – 12 to 60 in. (300 to 1500 mm)). The pipe shall be Type S or D."

Revise the first paragraph of Article 1040.04(d) of the Standard Specifications to read:

"(d) PE Pipe with a Smooth Interior. The pipe shall be according to ASTM F 714 (DR 32.5) with a minimum cell classification of PE 335434 as defined in ASTM D 3350."

Revise the first paragraph of Article 1040.08 of the Standard Specifications to read:

"**1040.08 Polypropylene (PP) Pipe.** Storage and handling shall be according to the manufacturer's recommendations, except in no case shall the pipe be exposed to direct sunlight for more than six months. Acceptance testing of the pipe shall be accomplished during the same construction season in which it is installed. The pipe shall meet the following additional requirements."

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE)

Effective: September 1, 2000 Revised: March 2, 2019

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 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, which may include, but is not limited to:

(a) Withholding progress payments;

(b) Assessing sanctions;

(c) Liquidated damages; and/or

(d) Disqualifying the Contractor from future bidding as non-responsible.

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 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, in the absence of unlawful discrimination and in an arena of fair and open competition, DBE companies can be expected to perform **15.00%** 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 enough DBE participation has been obtained to meet the goal or,

(b) The bidder documents 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:
http://www.idot.illinois.gov/doing-business/certifications/disadvantaged-business-enterprise-certification/il-ucp-directory/index.

BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement and failure of the bidder to comply will render the bid not responsive.

The bidder shall submit a DBE Utilization Plan (form SBE 2026), and a DBE Participation Statement (form SBE 2025) for each DBE company proposed for the performance of work to achieve the contract goal, with the bid. If the Utilization Plan indicates the contract goal will not be met, documentation of good faith efforts shall also be submitted. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor is selected over a DBE for work on the contract. The required forms and documentation must be submitted as a single .pdf file using the "Integrated Contractor Exchange (iCX)" application within the Department's "EBids System".

The Department will not accept a Utilization Plan if it does not meet the bidding procedures set forth herein and the bid will be declared not responsive. In the event the bid is declared not responsive, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty and may deny authorization to bid the project if re-advertised for bids.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan is approved. All information submitted by the bidder must be complete, accurate and adequately document enough DBE participation has been obtained or document the 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 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. This means 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 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 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. In accordance with the above Bidding Procedures, the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.

(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 the 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 it is otherwise eligible for award. If the Department determines 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 will also include a statement of reasons for the adverse determination. If the Utilization Plan is not approved because it is deficient as a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no more than a five calendar day period to cure the deficiency.

(c) The bidder may request administrative reconsideration of an adverse determination by emailing the Department at "DOT.DBE.UP@illinois.gov" within the five calendar days after the receipt of the notification of the determination. The determination shall become final if a request is not made on or before the fifth calendar day. A request may provide additional written documentation 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 reviewed by the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person 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 reconsideration, 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 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 DBE regular dealer or DBE 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 DBE Participation Commitment 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 emailed to the Department at DOT.DBE.UP@illinois.gov.

(b) 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 or AER 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, a new Request for Approval of Subcontractor will not be required. However, the Contractor must document efforts to assure the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.

(c) SUBCONTRACT. The Contractor must provide copies of DBE subcontracts to the Department upon request. Subcontractors shall ensure that all lower tier subcontracts or agreements with DBEs to supply labor or materials be performed in accordance with this Special Provision.

(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) 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) The DBE is aware 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) 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 listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in this Special Provision. The Contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the Contractor obtains the Department's written consent as provided in subsection (a) of this part. Unless Department consent is provided for termination of a DBE subcontractor, the Contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the DBE in the Utilization Plan.

As stated above, 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 Contractor;

(3) The listed DBE subcontractor fails or refuses to meet the 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 1200 or applicable state law.

(6) The Contractor has determined the listed DBE subcontractor is not a responsible contractor;

(7) The listed DBE subcontractor voluntarily withdraws from the projects and provides written notice to the Contractor 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 subcontractor 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 Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the Contractor can self-perform the work for which the DBE contractor was engaged or so that the 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. The good faith efforts shall be documented by the Contractor. If the Department requests documentation under this provision, the Contractor shall submit the documentation within seven days, which may be extended for an additional seven days if necessary at the request of the Contractor. The Department will provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated.

(f) FINAL PAYMENT. 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 30 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 Resident 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 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 DBE 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. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

HOT-MIX ASPHALT (BDE)

Effective: January 1, 2024

Revise the second paragraph of Articles 1030.07(a)(11) and 1030.08(a)(9) of the Standard Specifications to read:

"When establishing the target density, the HMA maximum theoretical specific gravity (G_{mm}) will be based on the running average of four available Department test results for that project. If less than four G_{mm} test results are available, an average of all available Department test results for that project will be used. The initial G_{mm} will be the last available Department test result from a QMP project. If there is no available Department test result from a QMP project, the Department mix design verification test result will be used as the initial G_{mm}."

In the Supplemental Specifications, replace the revision for the end of the third paragraph of Article 1030.09(h)(2) with the following:

"When establishing the target density, the HMA maximum theoretical specific gravity (G_{mm}) will be the Department mix design verification test result."

Revise the tenth paragraph of Article 1030.10 of the Standard Specifications to read:

"Production is not required to stop after a test strip has been constructed."

PERFORMANCE GRADED ASPHALT BINDER (BDE)

Effective: January 1, 2023

Revise Article 1032.05 of the Standard Specifications to read:

"**1032.05 Performance Graded Asphalt Binder.** These materials will be accepted according to the Bureau of Materials Policy Memorandum, "Performance Graded Asphalt Binder Qualification Procedure." The Department will maintain a qualified producer list. These materials shall be free from water and shall not foam when heated to any temperature below the actual flash point. Air blown asphalt, recycle engine oil bottoms (ReOB), and polyphosphoric acid (PPA) modification shall not be used.

When requested, producers shall provide the Engineer with viscosity/temperature relationships for the performance graded asphalt binders delivered and incorporated in the work.

(a) Performance Graded (PG) Asphalt Binder. The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans and the following.

Test	Parameter
Small Strain Parameter (AASHTO PP 113) BBR, ΔTc, 40 hrs PAV (40 hrs continuous or 2 PAV at 20 hrs)	-5 °C min.

(b) Modified Performance Graded (PG) Asphalt Binder. The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans.

Asphalt binder modification shall be performed at the source, as defined in the Bureau of Materials Policy Memorandum, "Performance Graded Asphalt Binder Qualification Procedure."

Modified asphalt binder shall be safe to handle at asphalt binder production and storage temperatures or HMA construction temperatures. Safety Data Sheets (SDS) shall be provided for all asphalt modifiers.

(1) Polymer Modification (SB/SBS or SBR). Elastomers shall be added to the base asphalt binder to achieve the specified performance grade and shall be either a styrene-butadiene diblock, triblock copolymer without oil extension, or a styrene-butadiene rubber. The polymer modified asphalt binder shall be smooth, homogeneous, and be according to the requirements shown in Table 1 or 2 for the grade shown on the plans.

Table 1 - Requirements for Styrene-Butadiene Copolymer (SB/SBS) Modified Asphalt Binders		
Test	Asphalt Grade SB/SBS PG 64-28 SB/SBS PG 70-22	Asphalt Grade SB/SBS PG 64-34 SB/SBS PG 70-28 SB/SBS PG 76-22 SB/SBS PG 76-28
Separation of Polymer ITP, "Separation of Polymer from Asphalt Binder" Difference in °F (°C) of the softening point between top and bottom portions	4 (2) max.	4 (2) max.
TESTS ON RESIDUE FROM ROLLING THIN FILM OVEN TEST (AASHTO T 240)		
Elastic Recovery ASTM D 6084, Procedure A, 77 °F (25 °C), 100 mm elongation, %	60 min.	70 min.

Table 2 - Requirements for Styrene-Butadiene Rubber (SBR) Modified Asphalt Binders		
Test	Asphalt Grade SBR PG 64-28 SBR PG 70-22	Asphalt Grade SB/SBS PG 64-34 SB/SBS PG 70-28 SBR PG 76-22 SBR PG 76-28
Separation of Polymer ITP, "Separation of Polymer from Asphalt Binder" Difference in °F (°C) of the softening point between top and bottom portions	4 (2) max.	4 (2) max.
Toughness ASTM D 5801, 77 °F (25 °C), 20 in./min. (500 mm/min.), in.-lbs (N-m)	110 (12.5) min.	110 (12.5) min.
Tenacity ASTM D 5801, 77 °F (25 °C), 20 in./min. (500 mm/min.), in.-lbs (N-m)	75 (8.5) min.	75 (8.5) min.
TESTS ON RESIDUE FROM ROLLING THIN FILM OVEN TEST (AASHTO T 240)		
Elastic Recovery ASTM D 6084, Procedure A, 77 °F (25 °C), 100 mm elongation, %	40 min.	50 min.

(2) Ground Tire Rubber (GTR) Modification. GTR modification is the addition of recycled ground tire rubber to liquid asphalt binder to achieve the specified performance grade. GTR shall be produced from processing automobile and/or truck tires by the ambient grinding method or micronizing through a cryogenic process. GTR shall not exceed 1/16 in. (2 mm) in any dimension and shall not contain free metal particles, moisture that would cause foaming of the asphalt, or other foreign materials. A mineral powder (such as talc) meeting the requirements of AASHTO M 17 may be added, up to a maximum of four percent by weight of GTR to reduce sticking and caking of the GTR particles. When tested in accordance with Illinois Modified AASHTO T 27 "Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates" or AASHTO PP 74 "Standard Practice for Determination of Size and Shape of Glass Beads Used in Traffic Markings by Means of Computerized Optical Method", a 50 g sample of the GTR shall conform to the following gradation requirements.

Sieve Size	Percent Passing
No. 16 (1.18 mm)	100
No. 30 (600 µm)	95 ± 5
No. 50 (300 µm)	> 20

GTR modified asphalt binder shall be tested for rotational viscosity according to AASHTO T 316 using spindle S27. GTR modified asphalt binder shall be tested for original dynamic shear and RTFO dynamic shear according to AASHTO T 315 using a gap of 2 mm.

The GTR modified asphalt binder shall meet the requirements of Table 3.

Table 3 - Requirements for Ground Tire Rubber (GTR) Modified Asphalt Binders

Test	Asphalt Grade GTR PG 64-28 GTR PG 70-22	Asphalt Grade GTR PG 76-22 GTR PG 76-28 GTR PG 70-28
TESTS ON RESIDUE FROM ROLLING THIN FILM OVEN TEST (AASHTO T 240)		
Elastic Recovery ASTM D 6084, Procedure A, 77 °F (25 °C), 100 mm elongation, %	60 min.	70 min.

(3) Softener Modification (SM). Softener modification is the addition of organic compounds, such as engineered flux, bio-oil blends, modified vegetable oils, glycol amines, and fatty acid derivatives, to the base asphalt binder to achieve the specified performance grade. Softeners shall be dissolved, dispersed, or reacted in the asphalt binder to enhance its performance and shall remain compatible with the asphalt binder with no separation. Softeners shall not be added to modified PG asphalt binder as defined in Articles 1032.05(b)(1) or 1032.05(b)(2).

An Attenuated Total Reflectance-Fourier Transform Infrared spectrum (ATR-FTIR) shall be collected for both the softening compound as well as the softener modified asphalt binder at the dose intended for qualification. The ATR-FTIR spectra shall be collected on unaged softener modified binder, 20-hour Pressurized Aging Vessel (PAV) aged softener modified binder, and 40-hour PAV aged softener modified binder. The ATR-FTIR shall be collected in accordance with Illinois Test Procedure 601. The electronic files spectral files (in one of the following extensions or equivalent: *.SPA, *.SPG, *.IRD, *.IFG, *.CSV, *.SP, *.IRS, *.GAML, *.[0-9], *.IGM, *.ABS, *.DRT, *.SBM, *.RAS) shall be submitted to the Central Bureau of Materials.

Softener modified asphalt binders shall meet the requirements in Table 4.

Table 4 - Requirements for Softener Modified Asphalt Binders	
Test	Asphalt Grade SM PG 46-28 SM PG 46-34 SM PG 52-28 SM PG 52-34 SM PG 58-22 SM PG 58-28 SM PG 64-22
Small Strain Parameter (AASHTO PP 113) BBR, ΔTc, 40 hrs PAV (40 hrs continuous or 2 PAV at 20 hrs)	-5°C min.
Large Strain Parameter (Illinois Modified AASHTO T 391) DSR/LAS Fatigue Property, Δ|G*|peak τ, 40 hrs PAV (40 hrs continuous or 2 PAV at 20 hrs)	≥ 54 %

The following grades may be specified as tack coats.

Asphalt Grade	Use
PG 58-22, PG 58-28, PG 64-22	Tack Coat”

Revise Article 1031.06(c)(1) and 1031.06(c)(2) of the Standard Specifications to read:

“(1) RAP/RAS. When RAP is used alone or RAP is used in conjunction with RAS, the percentage of virgin ABR shall not exceed the amounts listed in the following table.

HMA Mixtures - RAP/RAS Maximum ABR % 1/ 2/			
Ndesign	Binder	Surface	Polymer Modified Binder or Surface 3/
30	30	30	10
50	25	15	10
70	15	10	10
90	10	10	10

1/ For Low ESAL HMA shoulder and stabilized subbase, the RAP/RAS ABR shall not exceed 50 percent of the mixture.

2/ When RAP/RAS ABR exceeds 20 percent, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent ABR would require a virgin asphalt binder grade of PG 64-22 to be reduced to a PG 58-28).

3/ The maximum ABR percentages for ground tire rubber (GTR) modified mixes shall be equivalent to the percentages specified for SBS/SBR polymer modified mixes.

(2) FRAP/RAS. When FRAP is used alone or FRAP is used in conjunction with RAS, the percentage of virgin asphalt binder replacement shall not exceed the amounts listed in the following table.

HMA Mixtures - FRAP/RAS Maximum ABR % 1/ 2/			
Ndesign	Binder	Surface	Polymer Modified Binder or Surface 3/
30	55	45	15
50	45	40	15
70	45	35	15
90	45	35	15
SMA	- -	- -	25
IL-4.75	- -	- -	35

1/ For Low ESAL HMA shoulder and stabilized subbase, the FRAP/RAS ABR shall not exceed 50 percent of the mixture.

2/ When FRAP/RAS ABR exceeds 20 percent for all mixes, the high and low virgin asphalt binder grades shall each be reduced by one grade (i.e. 25 percent ABR would require a virgin asphalt binder grade of PG 64-22 to be reduced to a PG 58-28).

3/ The maximum ABR percentages for GTR modified mixes shall be equivalent to the percentages specified for SBS/SBR polymer modified mixes."

Add the following to the end of Note 2 of Article 1030.03 of the Standard Specifications.

"A dedicated storage tank for the ground tire rubber (GTR) modified asphalt binder shall be provided. This tank shall be capable of providing continuous mechanical mixing throughout and/or recirculation of the asphalt binder to provide a uniform mixture. The tank shall be heated and capable of maintaining the temperature of the asphalt binder at 300 °F to 350 °F (149 °C to 177 °C). The asphalt binder metering systems of dryer drum plants shall be calibrated with the actual GTR modified asphalt binder material with an accuracy of ±0.40 percent."

PORTLAND CEMENT CONCRETE (BDE)

Effective: August 1, 2023

Revise the second paragraph of Article 1103.03(a)(4) the Standard Specifications to read:

"The dispenser system shall provide a visual indication that the liquid admixture is actually entering admixtures dosed at rates of 25 oz/cwt (1630 mL/100 kg) or greater, such as accelerating admixtures, corrosion inhibitors, and viscosity modifying admixtures."

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (BDE)

Effective: January 1, 2024 Revised: April 1, 2024

Revise the first paragraph of Article 669.04 of the Standard Specifications to read:

"**669.04 Regulated Substances Monitoring.** Regulated substances monitoring includes environmental observation and field screening during regulated substances management activities. The excavated soil and groundwater within the work areas shall be managed as either uncontaminated soil, hazardous waste, special waste, or non-special waste.

As part of the regulated substances monitoring, the monitoring personnel shall perform and document the applicable duties listed on form BDE 2732 "Regulated Substances Monitoring Daily Record (RSMDR)"."

Revise the first two sentences of the nineteenth paragraph of Article 669.05 of the Standard Specifications to read:

"The Contractor shall coordinate waste disposal approvals with the disposal facility and provide the specific analytical testing requirements of that facility. The Contractor shall make all arrangements for collection, transportation, and analysis of landfill acceptance testing."

Revise the last paragraph of Article 669.05 of the Standard Specifications to read:

"The Contractor shall select a permitted landfill facility or CCDD/USFO facility meeting the requirements of 35 Ill. Admin. Code Parts 810-814 or Part 1100, respectively. The Department will review and approve or reject the facility proposed by the Contractor based upon information provided in BDE 2730. The Contractor shall verify whether the selected facility is compliant with those applicable standards as mandated by their permit and whether the facility is presently, has previously been, or has never been, on the United States Environmental Protection Agency (U.S. EPA) National Priorities List or the Resource Conservation and Recovery Act (RCRA) List of Violating Facilities. The use of a Contractor selected facility shall in no manner delay the construction schedule or alter the Contractor's responsibilities as set forth."

Revise the first paragraph of Article 669.07 of the Standard Specifications to read:

"**669.07 Temporary Staging.** Soil classified according to Articles 669.05(a)(2), (b)(1), or (c) may be temporarily staged at the Contractor's option. All other soil classified according to Articles 669.05(a)(1), (a)(3), (a)(4), (a)(5), (a)(6), or (b)(2) shall be managed and disposed of without temporary staging to the greatest extent practicable. If circumstances beyond the Contractor's control require temporary staging of these latter materials, the Contractor shall request approval from the Engineer in writing.

Topsoil for re-use as final cover which has been field screened and found not to exhibit PID readings over daily background readings as documented on the BDE 2732, visual staining or odors, and is classified according to Articles 669.05(a)(2), (a)(3), (a)(4), (b)(1), or (c) may be temporarily staged at the Contractor's option."

Add the following paragraph after the sixth paragraph of Article 669.11 of the Standard Specifications.

"The sampling and testing of effluent water derived from dewatering discharges for priority pollutants volatile organic compounds (VOCs), priority pollutants semi-volatile organic compounds (SVOCs), or priority pollutants metals, will be paid for at the contract unit price per each for VOCS GROUNDWATER ANALYSIS using EPA Method 8260B, SVOCS GROUNDWATER ANALYSIS using EPA Method 8270C, or RCRA METALS GROUNDWATER ANALYSIS using EPA Methods 6010B and 7471A. This price shall include transporting the sample from the job site to the laboratory."

Revise the first sentence of the eight paragraph of Article 669.11 of the Standard Specifications to read:

"Payment for temporary staging of soil classified according to Articles 669.05(a)(1), (a)(3), (a)(4), (a)(5), (a)(6), or (b)(2) to be managed and disposed of, if required and approved by the Engineer, will be paid according to Article 109.04."

SEEDING (BDE)

Effective: November 1, 2022

Revise Article 250.07 of the Standard Specifications to read:

"**250.07 Seeding Mixtures.** The classes of seeding mixtures and combinations of mixtures will be designated in the plans.

When an area is to be seeded with two or more seeding classes, those mixtures shall be applied separately on the designated area within a seven day period. Seeding shall occur prior to placement of mulch cover. A Class 7 mixture can be applied at any time prior to applying any seeding class or added to them and applied at the same time.

TABLE 1 - SEEDING MIXTURES			
Class - Type		Seeds	lb/acre (kg/hectare)
1	Lawn Mixture 1/	Kentucky Bluegrass	100 (110)
		Perennial Ryegrass	60 (70)
		Festuca rubra ssp. r*ubra* (Creeping Red Fescue)	40 (50)
1A	Salt Tolerant Lawn Mixture 1/	Kentucky Bluegrass	60 (70)
		Perennial Ryegrass	20 (20)
		Festuca rubra ssp. *rubra* (Creeping Red Fescue)	20 (20)
		Festuca brevipilla (Hard Fescue)	20 (20)
		Puccinellia distans (Fults Saltgrass or Salty Alkaligrass)	60 (70)
1B	Low Maintenance Lawn Mixture 1/	Turf-Type Fine Fescue 3/	150 (170)
		Perennial Ryegrass	20 (20)
		Red Top	10 (10)
		Festuca rubra ssp. *rubra* (Creeping Red Fescue)	20 (20)
2	Roadside Mixture 1/	*Lolium arundinaceum* (Tall Fescue)	100 (110)
		Perennial Ryegrass	50 (55)
		Festuca rubra ssp. r*ubra* (Creeping Red Fescue)	40 (50)
		Red Top	10 (10)
2A	Salt Tolerant Roadside Mixture 1/	*Lolium arundinaceum* (Tall Fescue)	60 (70)
		Perennial Ryegrass	20 (20)
		Festuca rubra ssp. *rubra* (Creeping Red Fescue)	30 (20)
		Festuca brevipila (Hard Fescue)	30 (20)
		Puccinellia distans (Fults Saltgrass or Salty Alkaligrass)	60 (70)
3	Northern Illinois Slope Mixture 1/	*Elymus canadensis* (Canada Wild Rye) 5/	5 (5)
		Perennial Ryegrass	20 (20)
		Alsike Clover 4/	5 (5)
		Desmanthus illinoensis (Illinois Bundleflower) 4/ 5/	2 (2)
		Schizachyrium scoparium (Little Bluestem) 5/	12 (12)
		Bouteloua curtipendula (Side-Oats Grama) 5/	10 (10)
		Puccinellia distans (Fults Saltgrass or Salty Alkaligrass)	30 (35)
		Oats, Spring	50 (55)
		Slender Wheat Grass 5/	15 (15)
		Buffalo Grass 5/ 7/	5 (5)
3A	Southern Illinois Slope Mixture 1/	Perennial Ryegrass	20 (20)
		Elymus canadensis (Canada Wild Rye) 5/	20 (20)
		Panicum virgatum (Switchgrass) 5/	10 (10)
		Schizachyrium scoparium (Little Blue Stem) 5/	12 (12)
		Bouteloua curtipendula (Side-Oats Grama) 5/	10 (10)
		Dalea candida (White Prairie Clover) 4/ 5/	5 (5)
		Rudbeckia hirta (Black-Eyed Susan) 5/	5 (5)
		Oats, Spring	50 (55)

Class – Type		Seeds	lb/acre (kg/hectare)
4	Native Grass 2/ 6/	*Andropogon gerardi* (Big Blue Stem) 5/	4 (4)
		Schizachyrium scoparium (Little Blue Stem) 5/	5 (5)
		Bouteloua curtipendula (Side-Oats Grama) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	1 (1)
		Panicum virgatum (Switch Grass) 5/	1 (1)
		Sorghastrum nutans (Indian Grass) 5/	2 (2)
		Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Perennial Ryegrass	15 (15)
4A	Low Profile Native Grass 2/ 6/	*Schizachyrium scoparium* (Little Blue Stem) 5/	5 (5)
		Bouteloua curtipendula (Side-Oats Grama) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	1 (1)
		Sporobolus heterolepis (Prairie Dropseed) 5/	0.5 (0.5)
		Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Perennial Ryegrass	15 (15)
4B	Wetland Grass and Sedge Mixture 2/ 6/	Annual Ryegrass	25 (25)
		Oats, Spring	25 (25)
		Wetland Grasses (species below) 5/	6 (6)

Species:	% By Weight
Calamagrostis canadensis (Blue Joint Grass)	12
Carex lacustris (Lake-Bank Sedge)	6
Carex slipata (Awl-Fruited Sedge)	6
Carex stricta (Tussock Sedge)	6
Carex vulpinoidea (Fox Sedge)	6
Eleocharis acicularis (Needle Spike Rush)	3
Eleocharis obtusa (Blunt Spike Rush)	3
Glyceria striata (Fowl Manna Grass)	14
Juncus effusus (Common Rush)	6
Juncus tenuis (Slender Rush)	6
Juncus torreyi (Torrey's Rush)	6
Leersia oryzoides (Rice Cut Grass)	10
Scirpus acutus (Hard-Stemmed Bulrush)	3
Scirpus atrovirens (Dark Green Rush)	3
Bolboschoenus fluviatilis (River Bulrush)	3
Schoenoplectus tabernaemontani (Softstem Bulrush)	3
Spartina pectinata (Cord Grass)	4

Class – Type	Seeds	lb/acre (kg/hectare)
5 Forb with Annuals Mixture 2/ 5/ 6/	Annuals Mixture (Below)	1 (1)
	Forb Mixture (Below)	10 (10)

Annuals Mixture - Mixture not exceeding 25 % by weight of any one species, of the following:

Coreopsis lanceolata (Sand Coreopsis)
Leucanthemum maximum (Shasta Daisy)
Gaillardia pulchella (Blanket Flower)
Ratibida columnifera (Prairie Coneflower)
Rudbeckia hirta (Black-Eyed Susan)

Forb Mixture - Mixture not exceeding 5 % by weight PLS of any one species, of the following:

Amorpha canescens (Lead Plant) 4/
Anemone cylindrica (Thimble Weed)
Asclepias tuberosa (Butterfly Weed)
Aster azureus (Sky Blue Aster)
Symphyotrichum leave (Smooth Aster)
Aster novae-angliae (New England Aster)
Baptisia leucantha (White Wild Indigo) 4/
Coreopsis palmata (Prairie Coreopsis)
Echinacea pallida (Pale Purple Coneflower)
Eryngium yuccifolium (Rattlesnake Master)
Helianthus mollis (Downy Sunflower)
Heliopsis helianthoides (Ox-Eye)
Liatris aspera (Rough Blazing Star)
Liatris pycnostachya (Prairie Blazing Star)
Monarda fistulosa (Prairie Bergamot)
Parthenium integrifolium (Wild Quinine)
Dalea candida (White Prairie Clover) 4/
Dalea purpurea (Purple Prairie Clover) 4/
Physostegia virginiana (False Dragonhead)
Potentilla arguta (Prairie Cinquefoil)
Ratibida pinnata (Yellow Coneflower)
Rudbeckia subtomentosa (Fragrant Coneflower)
Silphium laciniatum (Compass Plant)
Silphium terebinthinaceum (Prairie Dock)
Oligoneuron rigidum (Rigid Goldenrod)
Tradescantia ohiensis (Spiderwort)
Veronicastrum virginicum (Culver's Root)

Class – Type		Seeds	lb/acre (kg/hectare)
5A	Large Flower Native Forb Mixture 2/ 5/ 6/	Forb Mixture (see below)	5 (5)
		Species:	% By Weight
		Aster novae-angliae (New England Aster)	5
		Echinacea pallida (Pale Purple Coneflower)	10
		Helianthus mollis (Downy Sunflower)	10
		Heliopsis helianthoides (Ox-Eye)	10
		Liatris pycnostachya (Prairie Blazing Star)	10
		Ratibida pinnata (Yellow Coneflower)	5
		Rudbeckia hirta (Black-Eyed Susan)	10
		Silphium laciniatum (Compass Plant)	10
		Silphium terebinthinaceum (Prairie Dock)	20
		Oligoneuron rigidum (Rigid Goldenrod)	10
5B	Wetland Forb 2/ 5/ 6/	Forb Mixture (see below)	2 (2)
		Species:	% By Weight
		Acorus calamus (Sweet Flag)	3
		Angelica atropurpurea (Angelica)	6
		Asclepias incarnata (Swamp Milkweed)	2
		Aster puniceus (Purple Stemmed Aster)	10
		Bidens cernua (Beggarticks)	7
		Eutrochium maculatum (Spotted Joe Pye Weed)	7
		Eupatorium perfoliatum (Boneset)	7
		Helenium autumnale (Autumn Sneeze Weed)	2
		Iris virginica shrevei (Blue Flag Iris)	2
		Lobelia cardinalis (Cardinal Flower)	5
		Lobelia siphilitica (Great Blue Lobelia)	5
		Lythrum alatum (Winged Loosestrife)	2
		Physostegia virginiana (False Dragonhead)	5
		Persicaria pensylvanica (Pennsylvania Smartweed)	10
		Persicaria lapathifolia (Curlytop Knotweed)	10
		Pychanthemum virginianum (Mountain Mint)	5
		Rudbeckia laciniata (Cut-leaf Coneflower)	5
		Oligoneuron riddellii (Riddell Goldenrod)	2
		Sparganium eurycarpum (Giant Burreed)	5
6	Conservation Mixture 2/ 6/	*Schizachyrium scoparium* (Little Blue Stem) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	2 (2)
		Buffalo Grass 5/ 7/	5 (5)
		Vernal Alfalfa 4/	15 (15)
		Oats, Spring	48 (55)
6A	Salt Tolerant Conservation Mixture 2/ 6/	*Schizachyrium scoparium* (Little Blue Stem) 5/	5 (5)
		Elymus canadensis (Canada Wild Rye) 5/	2 (2)
		Buffalo Grass 5/ 7/	5 (5)
		Vernal Alfalfa 4/	15 (15)
		Oats, Spring	48 (55)
		Puccinellia distans (Fults Saltgrass or Salty Alkaligrass)	20 (20)
7	Temporary Turf Cover Mixture	Perennial Ryegrass	50 (55)
		Oats, Spring	64 (70)

Notes:

1/ Seeding shall be performed when the ambient temperature has been between 45 ºF (7 ºC) and 80 ºF (27 ºC) for a minimum of seven (7) consecutive days and is forecasted to be the same for the next five (5) days according to the National Weather Service.
2/ Seeding shall be performed in late fall through spring beginning when the ambient temperature has been below 45 ºF (7 ºC) for a minimum of seven (7) consecutive days and ending when the ambient temperature exceeds 80 ºF (27 ºC) according to the National Weather Service.
3/ Specific variety as shown in the plans or approved by the Engineer.
4/ Inoculation required.
5/ Pure Live Seed (PLS) shall be used.
6/ Fertilizer shall not be used.
7/ Seed shall be primed with KNO_3 to break dormancy and dyed to indicate such.

Seeding will be inspected after a period of establishment. The period of establishment shall be six (6) months minimum, but not to exceed nine (9) months. After the period of establishment, areas not exhibiting 75 percent uniform growth shall be interseeded or reseeded, as determined by the Engineer, at no additional cost to the Department."

SHORT TERM AND TEMPORARY PAVEMENT MARKINGS (BDE)

Effective: April 1, 2024 Revised: April 2, 2024

Revise Article 701.02(d) of the Standard Specifications to read:

"(d) Pavement Marking Tapes (Note 3) .....1095.06"

Add the following Note to the end of Article 701.02 of the Standard Specifications:

"Note 3. White or yellow pavement marking tape that is to remain in place longer than 14 days shall be Type IV tape."

Revise Article 703.02(c) of the Standard Specifications to read:

"(c) Pavement Marking Tapes (Note 1) .....1095.06"

Add the following Note to the end of Article 703.02 of the Standard Specifications:

"Note 1. White or yellow pavement marking tape that is to remain in place longer than 14 days shall be Type IV tape."

Revise Article 1095.06 of the Standard Specifications to read:

"**1095.06 Pavement Marking Tapes.** Type I white or yellow marking tape shall consist of glass spheres embedded into a binder on a foil backing that is precoated with a pressure sensitive adhesive. The spheres shall be of uniform gradation and distributed evenly over the surface of the tape.

Type IV tape shall consist of white or yellow tape with wet reflective media incorporated to provide immediate and continuing retroreflection in wet and dry conditions. The wet retroreflective media shall be bonded to a durable polyurethane surface. The patterned surface shall have approximately 40 ± 10 percent of the surface area raised and presenting a near vertical face to traffic from any direction. The channels between the raised areas shall be substantially free of exposed reflective elements or particles.

Blackout tape shall consist of a matte black, non-reflective, patterned surface that is precoated with a pressure sensitive adhesive.

(a) Color. The white and yellow markings shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degrees circumferential/zero degree geometry, illuminant D65, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

Color	Daylight Reflectance %Y
White	65 min.
Yellow *	36 - 59

*Shall match Aerospace Material Specification Standard 595 33538 (Orange Yellow) and the chromaticity limits as follows.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

(b) Retroreflectivity. The white and yellow markings shall be retroreflective. Reflective values measured in accordance with the photometric testing procedure of ASTM D 4061 shall not be less than those listed in the table below. The coefficient of retroreflected luminance, R_L, shall be expressed as average millicandelas/footcandle/sq ft (millicandelas/lux/sq m), measured on a 3.0 x 0.5 ft (900 mm x 150 mm) panel at 86 degree entrance angle.

Coefficient of Retroreflected Luminance, R_L, Dry					
Type I			Type IV		
Observation Angle	White	Yellow	Observation Angle	White	Yellow
0.2°	2700	2400	0.2°	1300	1200
0.5°	2250	2000	0.5°	1100	1000

Wet retroreflectance shall be measured for Type IV under wet conditions according to ASTM E 2177 and meet the following.

Wet Retroreflectance, Initial R_L	
Color	R_L 1.05/88.76
White	300
Yellow	200

(c) Skid Resistance. The surface of Type IV and blackout markings shall provide a minimum skid resistance of 45 BPN when tested according to ASTM E 303.

(d) Application. The pavement marking tape shall have a precoated pressure sensitive adhesive and shall require no activation procedures. Test pieces of the tape shall be applied according to the manufacturer's instructions and tested according to ASTM D 1000, Method A, except that a stiff, short bristle roller brush and heavy hand pressure will be substituted for the weighted rubber roller in applying the test pieces to the metal test panel. Material tested as directed above shall show a minimum adhesion value of 750 g/in. (30 g/mm) width at the temperatures specified in ASTM D 1000. The adhesive shall be resistant to oils, acids, solvents, and water, and shall not leave objectionable stains or residue after removal. The material shall be flexible and conformable to the texture of the pavement.

(e) Durability. Type IV and blackout tape shall be capable of performing for the duration of a normal construction season and shall then be capable of being removed intact or in large sections at pavement temperatures above 40 °F (4 °C) either manually or with a roll-up device without the use of sandblasting, solvents, or grinding. The Contractor shall provide a manufacturer’s certification that the material meets the requirements for being removed after the following minimum traffic exposure based on transverse test decks with rolling traffic.

(1) Time in place - 400 days
(2) ADT per lane - 9,000 (28 percent trucks)
(3) Axle hits - 10,000,000 minimum

Samples of the material applied to standard specimen plates will be measured for thickness and tested for durability in accordance with ASTM D 4060, using a CS-17 wheel and 1000-gram load, and shall meet the following criteria showing no significant change in color after being tested for the number of cycles indicated.

Test	Type I	Type IV	Blackout
Minimum Initial Thickness, mils (mm)	20 (0.51)	65 (1.65) 1/ 20 (0.51) 2/	65 (1.65) 1/ 20 (0.51) 2/
Durability (cycles)	5,000	1,500	1,500

1/ Measured at the thickest point of the patterned surface.

2/ Measured at the thinnest point of the patterned surface.

The pavement marking tape, when applied according to the manufacturer's recommended procedures, shall be weather resistant and shall show no appreciable fading, lifting, or shrinkage during the useful life of the marking. The tape, as applied, shall be of good appearance, free of cracks, and edges shall be true, straight, and unbroken.

(f) Sampling and Inspection.

(1) Sample. Prior to approval and use of Type IV pavement marking tape, the manufacturer shall submit a notarized certification from an independent laboratory, together with the results of all tests, stating that the material meets the requirements as set forth herein. The independent laboratory test report shall state the lot tested, the manufacturer’s name, and the date of manufacture.

After initial approval by the Department, samples and certification by the manufacturer shall be submitted for each subsequent batch of Type IV tape used. The manufacturer shall submit a certification stating that the material meets the requirements as set forth herein and is essentially identical to the material sent for qualification. The certification shall state the lot tested, the manufacturer’s name, and the date of manufacture.

(2) Inspection. The Contractor shall provide a manufacturer’s certification to the Engineer stating the material meets all requirements of this specification. All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and shall be submitted to the Engineer of Materials, 126 East Ash Street, Springfield, Illinois 62704-4766 at least 30 days in advance of the pavement marking operations.”

SOURCE OF SUPPLY AND QUALITY REQUIREMENTS (BDE)

Effective: January 2, 2023

Add the following to Article 106.01 of the Standard Specifications:

"The final manufacturing process for construction materials and the immediately preceding manufacturing stage for construction materials shall occur within the United States. Construction materials shall include an article, material, or supply that is or consists primarily of the following.

(a) Non-ferrous metals;

(b) Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);

(c) Glass (including optic glass);

(d) Lumber;

(e) Drywall.

Items consisting of two or more of the listed construction materials that have been combined through a manufacturing process, and items including at least one of the listed materials combined with a material that is not listed through a manufacturing process shall be exempt."

SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)
Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

"**109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.** The Contractor shall report all payments made to the following parties:

(a) first tier subcontractors;

(b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;

(c) material suppliers or trucking firms that are part of the Contractor's submitted DBE utilization plan.

The report shall be made through the Department's on-line subcontractor payment reporting system within 21 days of making the payment."

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: November 2, 2017
Revised: April 1, 2019

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

"This mobilization payment shall be made at least seven days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor's work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than $10,000	25%
$10,000 to less than $20,000	20%
$20,000 to less than $40,000	18%
$40,000 to less than $60,000	16%
$60,000 to less than $80,000	14%
$80,000 to less than $100,000	12%
$100,000 to less than $250,000	10%
$250,000 to less than $500,000	9%
$500,000 to $750,000	8%
Over $750,000	7%"

SUBMISSION OF PAYROLL RECORDS (BDE)

Effective: April 1, 2021 Revised: November 2, 2023

FEDERAL AID CONTRACTS. Revise the following section of Check Sheet #1 of the Recurring Special Provisions to read:

"STATEMENTS AND PAYROLLS

The payroll records shall include the worker's name, social security number, last known address, telephone number, email address, classification(s) of work actually performed, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof), daily and weekly number of hours actually worked in total, deductions made, and actual wages paid.

The Contractor and each subcontractor shall submit certified payroll records to the Department each week from the start to the completion of their respective work, except that full social security numbers, last known addresses, telephone numbers, and email addresses shall not be included on weekly submittals. Instead, the payrolls need only include an identification number for each employee (e.g., the last four digits of the employee's social security number). The submittals shall be made using LCPtracker Pro software. The software is web-based and can be accessed at https://lcptracker.com/. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate option ("No Work", "Suspended", or "Complete") selected."

STATE CONTRACTS. Revise Item 3 of Section IV of Check Sheet #5 of the Recurring Special Provisions to read:

"3. Submission of Payroll Records. The Contractor and each subcontractor shall, no later than the 15th day of each calendar month, file a certified payroll for the immediately preceding month to the Illinois Department of Labor (IDOL) through the Illinois Prevailing Wage Portal in compliance with the State Prevailing Wage Act (820 ILCS 130). The portal can be found on the IDOL website at https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx. Payrolls shall be submitted in the format prescribed by the IDOL.

In addition to filing certified payroll(s) with the IDOL, the Contractor and each subcontractor shall certify and submit payroll records to the Department each week from the start to the completion of their respective work, except that full social security numbers shall not be included on weekly submittals. Instead, the payrolls shall include an identification number for each employee (e.g., the last four digits of the employee's social security number). In addition, starting and ending times of work each day may be omitted from the payroll records submitted. The submittals shall be made using LCPtracker Pro software. The software is web-based and can be accessed at https://lcptracker.com/. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate option ("No Work", "Suspended", or "Complete") selected."

TRAINING SPECIAL PROVISIONS (BDE)

Effective: October 15, 1975 Revised: September 2, 2021

This Training Special Provision supersedes Section 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities," and is in implementation of 23 U.S.C. 140(a).

As part of the Contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under this contract will be **8**. In the event the Contractor subcontracts a portion of the contract work, it shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The Contractor shall also ensure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The number of trainees shall be distributed among the work classifications on the basis of the Contractor's needs and the availability of journeymen in the various classifications within the reasonable area of recruitment. Prior to commencing construction, the Contractor shall submit to the Illinois Department of Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the Contractor shall specify the starting time for training in each of the classifications. The Contractor will be credited for each trainee it employs on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the Contractor shall make every effort to enroll minority trainees and women (e.g. by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent such persons are available within a reasonable area of recruitment. The Contractor will be responsible for demonstrating the steps it has taken in pursuance thereof, prior to a determination as to whether the Contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he or she has successfully completed a training course leading to journeyman status or in which he or she has been employed as a journeyman. The Contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used, the Contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Illinois Department of Transportation and the Federal Highway Administration. The Illinois Department of Transportation and the Federal Highway Administration shall approve a program, if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved by not necessarily sponsored by the U.S. Department of Labor Employment Training Administration shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the Illinois Department of Transportation and the Federal Highway Administration. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the Contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the Engineer, reimbursement will be made for training of persons in excess of the number specified herein. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the Contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee’s wages during the offsite training period.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of good faith on the part of the Contractor in meeting the requirement of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program.

It is not required that all trainees be on board for the entire length of the contract. A Contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program he will follow in providing the training. The Contractor shall provide each trainee with a certification showing the type and length of training satisfactorily complete.

The Contractor shall provide for the maintenance of records and furnish periodic reports documenting its performance under this Training Special Provision.

For contracts with an awarded contract value of $500,000 or more, the Contractor is required to comply with the Illinois Works Apprenticeship Initiative (30 ILCS 559/20-20 to 20-25) and all applicable administrative rules to the extent permitted by Section 20-20(g). For federally funded projects, the number of trainees to be trained under this contract, as stated in the Training Special Provisions, will be the established goal for the Illinois Works Apprenticeship Initiative 30 ILCS 559/20-20(g). The Contractor shall make a good faith effort to meet this goal. For federally funded projects, the Illinois Works Apprenticeship Initiative will be implemented using the FHWA approved OJT procedures. The Contractor must comply with the recordkeeping and reporting obligations of the Illinois Works Apprenticeship Initiative for the life of the project, including the certification as to whether the trainee/apprentice labor hour goals were met.

Method of Measurement. The unit of measurement is in hours.

Basis of Payment. This work will be paid for at the contract unit price of 80 cents per hour for TRAINEES. The estimated total number of hours, unit price, and total price have been included in the schedule of prices.

IDOT TRAINING PROGRAM GRADUATE ON-THE-JOB TRAINING SPECIAL PROVISION

Effective: August 1, 2012 Revised: February 2, 2017

In addition to the Contractor's equal employment opportunity (EEO) affirmative action efforts undertaken as required by this Contract, the Contractor is encouraged to participate in the incentive program described below to provide additional on-the-job training to certified graduates of the IDOT pre-apprenticeship training program, as outlined in this Special Provision.

IDOT funds, and various Illinois community colleges operate, pre-apprenticeship training programs throughout the State to provide training and skill-improvement opportunities to promote the increased employment of minority groups, disadvantaged persons and women in all aspects of the highway construction industry. The intent of this IDOT Pre-Apprenticeship Training Program Graduate (TPG) special provision (Special Provision) is to place these certified program graduates on the project site for this Contract in order to provide the graduates with meaningful on-the-job training. Pursuant to this Special Provision, the Contractor must make every reasonable effort to recruit and employ certified TPG trainees to the extent such individuals are available within a practicable distance of the project site.

Specifically, participation of the Contractor or its subcontractor in the Program entitles the participant to reimbursement for graduates' hourly wages at $15.00 per hour per utilized TPG trainee, subject to the terms of this Special Provision. Reimbursement payment will be made even though the Contractor or subcontractor may also receive additional training program funds from other non-IDOT sources for other non-TPG trainees on the Contract, provided such other source does not specifically prohibit the Contractor or subcontractor from receiving reimbursement from another entity through another program, such as IDOT through the TPG program. With regard to any IDOT funded construction training program other than TPG, however, additional reimbursement for other IDOT programs will not be made beyond the TPG Program described in this Special Provision when the TPG Program is utilized.

No payment will be made to the Contractor if the Contractor or subcontractor fails to provide the required on-site training to TPG trainees, as solely determined by IDOT. A TPG trainee must begin training on the project as soon as the start of work that utilizes the relevant trade skill and the TPG trainee must remain on the project site through completion of the Contract, so long as training opportunities continue to exist in the relevant work classification. Should a TPG trainee's employment end in advance of the completion of the Contract, the Contractor must promptly notify the IDOT District EEO Officer for the Contract that the TPG's involvement in the Contract has ended. The Contractor must supply a written report for the reason the TPG trainee involvement terminated, the hours completed by the TPG trainee on the Contract, and the number of hours for which the incentive payment provided under this Special Provision will be, or has been claimed for the separated TPG trainee.

Finally, the Contractor must maintain all records it creates as a result of participation in the Program on the Contract, and furnish periodic written reports to the IDOT District EEO Officer that document its contractual performance under and compliance with this Special Provision. Finally, through participation in the Program and reimbursement of wages, the Contractor is not relieved of, and IDOT has not waived, the requirements of any federal or state labor or employment law applicable to TPG workers, including compliance with the Illinois Prevailing Wage Act.

Method of Measurement: The unit of measurement is in hours.

Basis of Payment: This work will be paid for at the contract unit price of $15.00 per hour for each utilized certified TPG Program trainee (TRAINEES TRAINING PROGRAM GRADUATE). The estimated total number of hours, unit price, and total price must be included in the schedule of prices for the Contract submitted by Contractor prior to beginning work. The initial number of TPG trainees for which the incentive is available for this contract is **8**.

The Department has contracted with several educational institutions to provide screening, tutoring and pre-training to individuals interested in working as a TPG trainee in various areas of common construction trade work. Only individuals who have successfully completed a Pre-Apprenticeship Training Program at these IDOT approved institutions are eligible to be TPG trainees. To obtain a list of institutions that can connect the Contractor with eligible TPG trainees, the Contractor may contact: HCCTP TPG Program Coordinator, Office of Business and Workforce Diversity (IDOT OBWD), Room 319, Illinois Department of Transportation, 2300 S. Dirksen Parkway, Springfield, Illinois 62764. Prior to commencing construction with the utilization of a TPG trainee, the Contractor must submit documentation to the IDOT District EEO Officer for the Contract that provides the names and contact information of the TPG trainee(s) to be trained in each selected work classification, proof that that the TPG trainee(s) has successfully completed a Pre-Apprenticeship Training Program, proof that the TPG is in an Apprenticeship Training Program approved by the U.S. Department of Labor Bureau of Apprenticeship Training, and the start date for training in each of the applicable work classifications.

To receive payment, the Contractor must provide training opportunities aimed at developing a full journeyworker in the type of trade or job classification involved. During the course of performance of the Contract, the Contractor may seek approval from the IDOT District EEO Officer to employ additional eligible TPG trainees. In the event the Contractor subcontracts a portion of the contracted work, it must determine how many, if any, of the TPGs will be trained by the subcontractor. Though a subcontractor may conduct training, the Contractor retains the responsibility for meeting all requirements imposed by this Special Provision. The Contractor must also include this Special Provision in any subcontract where payment for contracted work performed by a TPG trainee will be passed on to a subcontractor.

Training through the Program is intended to move TPGs toward journeyman status, which is the primary objective of this Special Provision. Accordingly, the Contractor must make every effort to enroll TPG trainees by recruitment through the Program participant educational institutions to the extent eligible TPGs are available within a reasonable geographic area of the project. The Contractor is responsible for demonstrating, through documentation, the recruitment efforts it has undertaken prior to the determination by IDOT whether the Contractor is in compliance with this Special Provision, and therefore, entitled to the Training Program Graduate reimbursement of $15.00 per hour.

Notwithstanding the on-the-job training requirement of this TPG Special Provision, some minimal off-site training is permissible as long as the offsite training is an integral part of the work of the contract, and does not compromise or conflict with the required on-site training that is central to the purpose of the Program. No individual may be employed as a TPG trainee in any work classification in which he/she has previously successfully completed a training program leading to journeyman status in any trade, or in which he/she has worked at a journeyman level or higher.

VEHICLE AND EQUIPMENT WARNING LIGHTS (BDE)

Effective: November 1, 2021
Revised: November 1, 2022

Add the following paragraph after the first paragraph of Article 701.08 of the Standard Specifications:

"The Contractor shall equip all vehicles and equipment with high-intensity oscillating, rotating, or flashing, amber or amber-and-white, warning lights which are visible from all directions. In accordance with 625 ILCS 5/12-215, the lights may only be in operation while the vehicle or equipment is engaged in construction operations."

WEEKLY DBE TRUCKING REPORTS (BDE)

Effective: June 2, 2012 Revised: November 1, 2021

The Contractor shall submit a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used for DBE goal credit.

The report shall be submitted to the Engineer on Department form "SBE 723" within ten business days following the reporting period. The reporting period shall be Sunday through Saturday for each week reportable trucking activities occur.

Any costs associated with providing weekly DBE trucking reports 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.

WORK ZONE TRAFFIC CONTROL DEVICES (BDE)

Effective: March 2, 2020

Add the following to Article 701.03 of the Standard Specifications:

"(q) Temporary Sign Supports .....1106.02"

Revise the third paragraph of Article 701.14 of the Standard Specifications to read:

"For temporary sign supports, the Contractor shall provide a FHWA eligibility letter for each device used on the contract. The letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device. The signs shall be supported within 20 degrees of vertical. Weights used to stabilize signs shall be attached to the sign support per the manufacturer's specifications."

Revise the first paragraph of Article 701.15 of the Standard Specifications to read:

"**701.15 Traffic Control Devices.** For devices that must meet crashworthiness standards, the Contractor shall provide a manufacturer's self-certification or a FHWA eligibility letter for each Category 1 device and a FHWA eligibility letter for each Category 2 and Category 3 device used on the contract. The self-certification or letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device."

Revise the first six paragraphs of Article 1106.02 of the Standard Specifications to read:

"**1106.02 Devices.** Work zone traffic control devices and combinations of devices shall meet crashworthiness standards for their respective categories. The categories are as follows.

Category 1 includes small, lightweight, channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These include cones, tubular markers, plastic drums, and delineators, with no attachments (e.g. lights). Category 1 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 1 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 2 includes devices that are not expected to produce significant vehicular velocity change but may otherwise be hazardous. These include vertical panels with lights, barricades, temporary sign supports, and Category 1 devices with attachments (e.g. drums with lights). Category 2 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 2 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 3 includes devices that are expected to cause significant velocity changes or other potentially harmful reactions to impacting vehicles. These include crash cushions (impact attenuators), truck mounted attenuators, and other devices not meeting the definitions of Category 1 or 2. Category 3 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 3 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2029. Category 3 devices shall be crash tested for Test Level 3 or the test level specified.

Category 4 includes portable or trailer-mounted devices such as arrow boards, changeable message signs, temporary traffic signals, and area lighting supports. It is preferable for Category 4 devices manufactured after December 31, 2019 to be MASH-16 compliant; however, there are currently no crash tested devices in this category, so it remains exempt from the NCHRP 350 or MASH compliance requirement.

For each type of device, when no more than one MASH-16 compliant is available, an NCHRP 350 or MASH-2009 compliant device may be used, even if manufactured after December 31, 2019."

Revise Articles 1106.02(g), 1106.02(k), and 1106.02(l) to read:

"(g) Truck Mounted/Trailer Mounted Attenuators. The attenuator shall be approved for use at Test Level 3. Test Level 2 may be used for normal posted speeds less than or equal to 45 mph.

(k) Temporary Water Filled Barrier. The water filled barrier shall be a lightweight plastic shell designed to accept water ballast and be on the Department's qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings.

(l) Movable Traffic Barrier. The movable traffic barrier shall be on the Department's qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings. The barrier shall be capable of being moved on and off the roadway on a daily basis."

PROJECT LABOR AGREEMENT
Effective: May 18, 2007 Revised: August 1, 2019

Description. The Illinois Project Labor Agreements Act, 30 ILCS 571, states that the State of Illinois has a compelling interest in awarding public works contracts so as to ensure the highest standards of quality and efficiency at the lowest responsible cost. A project labor agreement (PLA) is a form of pre-hire collective bargaining agreement covering all terms and conditions of employment on a specific project that is intended to support this compelling interest. It has been determined by the Department that a PLA is appropriate for the project that is the subject of this contract. The PLA document, provided below, only applies to the construction site for this contract. It is the policy of the Department on this contract, and all construction projects, to allow all contractors and subcontractors to compete for contracts and subcontracts without regard to whether they are otherwise parties to collective bargaining agreements.

Execution of Letter of Assent. A copy of the PLA applicable to this project is included as part of this special provision. As a condition of the award of the contract, the successful bidder and each of its subcontractors shall execute a "Contractor Letter of Assent", in the form attached to the PLA as Exhibit A. The successful bidder shall submit a Subcontractor's Contractor Letter of Assent to the Department prior to the subcontractor's performance of work on the project. Upon request, copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization at the pre-job conference.

Quarterly Reporting. Section 37 of the Illinois Project Labor Agreements Act requires the Department to submit quarterly reports regarding the number of minorities and females employed under PLAs. To assist in this reporting effort, the Contractor shall provide a quarterly workforce participation report for all minority and female employees working under the PLA 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.idot.illinois.gov/Assets/uploads/files/IDOT-Forms/BC/BC%20820.docx.

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" or "Agreement") is entered into this day of , 2024, by and between the Illinois Department of Transportation ("IDOT" or "Department") in its proprietary capacity, and each relevant Illinois AFL-CIO Building Trades signatory hereto as determined by the Illinois AFL-CIO Statewide Project Labor Agreement Committee on behalf of each of its affiliated members (individually and collectively, the "Unions"). This PLA shall apply to Construction Work (as defined herein) to be performed by IDOT's Prime Contractor and each of its subcontractors of whatever tier ("Subcontractor" or "Subcontractors") on Contract No. 62B66 (hereinafter, the "Project").

ARTICLE 1 - INTENT AND PURPOSES

1.1 This PLA is entered into in accordance with the Project Labor Agreement Act ("Act", 30 ILCS 571). 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. The parties acknowledge the obligations of the Contractors and Subcontractors to comply with the provisions of the Act. The parties will work with the Contractors and Subcontractors within the parameters of other statutory and regulatory requirements to implement the Act's goals and objectives.

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 execute a "Contractor Letter of Assent", in the form attached hereto as Exhibit A, prior to commencing Construction Work on the Project. The Contractor shall submit a Subcontractor's Contractor Letter of Assent to the Department prior to the Subcontractor's performance of Construction Work on the Project. Upon request copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization consistent with this Agreement and at the pre-job conference referenced in Article III, Section 3.1.

1.3 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 Contractor 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 for the term of this Project by the terms of this PLA prior to commencing such work and to the applicable area-wide collective bargaining agreement(s) with the Union(s) signatory hereto.

1.4 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.

1.5 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.

1.6 Subject to the provisions of paragraph 1.5 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 or Subcontractors 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.

1.7 Subject to the limitations of paragraphs 1.4 to 1.6 of this Article, the terms of each applicable collective bargaining agreement as determined in accordance with paragraph 1.6 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.

1.8 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 in the form of a lien of a Contractor's or Subcontractor's delinquency from any applicable fringe benefit fund, IDOT will withhold from the Contractor's periodic pay request an amount sufficient to extinguish any delinquency obligation of the Contractor or Subcontractor arising out of the Project.

1.9 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, demolition, rehabilitation, renovation, 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 and Illinois labor laws.

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 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.

2.6 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.

2.7 All parties to this PLA agree that they will not discriminate against any employee based on race, creed, religion, color, national origin, union activity, age, gender or sexual orientation and shall comply with all applicable federal, state, and local laws.

2.8 In accordance with the Act and to promote diversity in employment, IDOT will establish, in cooperation with the other parties, the apprenticeship hours which are to be performed by minorities and females on the Project. IDOT shall consider the total hours to be performed by these underrepresented groups, as a percentage of the workforce, and create aspirational goals for each Project, based on the level of underutilization for the service area of the Project (together "Project Employment Objectives"). IDOT shall provide a quarterly report regarding the racial and gender composition of the workforce on the Project.

Persons currently lacking qualifications to enter apprenticeship programs will have the opportunity to obtain skills through basic training programs as have been established by the Department. The parties will endeavor to support such training programs to allow participants to obtain the requisite qualifications for the Project Employment Objectives.

The parties agree that all Contractors and Subcontractors working on the Project shall be encouraged to utilize the maximum number of apprentices as permitted under the terms of the applicable collective bargaining agreements to realize the Project Employment Objectives.

The Unions shall assist the Contractor and each Subcontractor in efforts to satisfy Project Employment Objectives. A Contractor or Subcontractor may request from a Union specific categories of workers necessary to satisfy Project Employment Objectives. The application of this section shall be consistent with all local Union collective bargaining agreements, and the hiring hall rules and regulations established for the hiring of personnel, as well as the apprenticeship standards set forth by each individual Union.

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.

2.10 This Agreement shall not apply to IDOT employees or employees of any other governmental entity.

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, at the request of the Unions 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 Any notice contemplated under Article VI and VII of this Agreement to a signatory labor organization shall be made in writing to the Local Union with copies to the local union's International Representative.

ARTICLE IV - HOURS OF WORK AND GENERAL CONDITIONS

4.1 The standard work day and work week for Construction Work on the Project shall be consistent with the respective collective bargaining agreements. 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 PROCEDURES FOR DISPUTES ARISING UNDER A PARTICULAR COLLECTIVE BARGAINING AGREEMENT

5.1 In the event a dispute arises under a particular collective bargaining agreement specifically not including jurisdictional disputes referenced in Article VI below, said dispute shall be resolved by the Grievance/Arbitration procedure of the applicable collective bargaining agreement. The resulting determination from this process shall be final and binding on all parties bound to its process.

5.2 Employers covered under this Agreement shall have the right to discharge or discipline any employee who violates the provisions of this Agreement. Such discharge or discipline by a contractor or subcontractor shall be subject to Grievance/Arbitration procedure of the applicable collective bargaining agreement only as to the fact of such violation of this agreement. If such fact is established, the penalty imposed shall not be disturbed. Work at the Project site shall continue without disruption or hindrance of

any kind as a result of a Grievance/Arbitration procedure under this Article.

5.3 In the event there is a deadlock in the foregoing procedure, the parties agree that the matter shall be submitted to arbitration for the selection and decision of an Arbitrator governed under paragraph 6.8.

ARTICLE VI –DISPUTES: GENERAL PRINCIPLES

6.1 This Agreement is entered into to prevent strikes, lost time, lockouts and to facilitate the peaceful adjustment of jurisdictional disputes in the building and construction industry and to prevent waste and unnecessary avoidable delays and expense, and for the further purpose of at all times securing for the employer sufficient skilled workers.

6.2 A panel of Permanent Arbitrators are attached as addendum (A) to this agreement. By mutual agreement between IDOT and the Unions, the parties can open this section of the agreement as needed to make changes to the list of permanent arbitrators.

The arbitrator is not authorized to award back pay or any other damages for a miss 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 PLA Jurisdictional Dispute Resolution Process ("Process") sets forth the procedures below to resolve jurisdictional disputes between and among Contractors, Subcontractors, and Unions engaged in the building and construction industry. Further, the Process will be followed for any grievance or dispute arising out of the interpretation or application of this PLA by the parties except for the prohibition on attorneys contained in 6.11. All decisions made through the Process are final and binding upon all parties.

DISPUTE PROCESS

6.4 Administrative functions under the Process shall be performed through the offices of the President and/or Secretary-Treasurer of the Illinois State Federation of Labor, or their designated representative, called the Administrator. In no event shall any officer, employee, agent, attorney, or other representative of the Illinois Federation of Labor, AFL- CIO be subject to any subpoena to appear or testify at any jurisdictional dispute hearing.

6.5 There shall be no abandonment of work during any case participating in this Process or in violation of the arbitration decision. All parties to this Process release the Illinois State Federation of Labor ("Federation") from any liability arising from its action or inaction and covenant not to sue the Federation, nor its officers, employees, agents or

attorneys.

6.6 In the event of a dispute relating to trade or work jurisdiction, all parties, including the employers, Contractors or Subcontractors, agree that a final and binding resolution of the

dispute shall be resolved as follows:

(a) Representatives of the affected trades and the Contractor or Subcontractor shall meet on the job site within two (2) business days after receiving written notice in an effort to resolve the dispute. (In the event there is a dispute between local unions affiliated with the same International Union, the decision of the General President, or his/her designee, as the internal jurisdictional authority of that International Union, shall constitute a final and binding decision and determination as to the jurisdiction of work.)

(b) If no settlement is achieved subsequent to the preceding Paragraph, the matter shall be referred to the local area Building & Construction Trades Council, which shall meet with the affected trades within two (2) business days subsequent to receiving written notice. In the event the parties do not wish to avail themselves of the local Building & Construction Trades Council, the parties may elect to invoke the services of their respective International Representatives with no extension of the time limitations. An agreement reached at this Step shall be final and binding upon all parties.

(c) If no settlement agreement is reached during the proceedings contemplated by Paragraphs “a” or “b” above, the matter shall be immediately referred to the Illinois Jurisdictional Dispute Process for final and binding resolution of said dispute. Said referral submission shall be in writing and served upon the Illinois State Federation of Labor, or the Administrator, pursuant to paragraph 6.4 of this agreement. The Administrator shall, within three (3) days, provide for the selection of an available Arbitrator to hear said dispute within this time period. Upon good cause shown and determined by the Administrator, an additional three (3) day extension for said hearing shall be granted at the sole discretion of the Administrator. Only upon mutual agreement of all parties may the Administrator extend the hearing for a period in excess of the time frames contemplated under this Paragraph. Business days are defined as Monday through Friday, excluding contract holidays.

6.7 The primary concern of the Process shall be the adjustment of jurisdictional disputes arising out of the Project. A sufficient number of Arbitrators shall be selected from list of approved Arbitrators as referenced Sec. 6.2 and shall be assigned per Sec. 6.8. Decisions shall be only for the Project and shall become effective immediately upon issuance and complied with by all parties. The authority of the Arbitrator shall be restricted and limited specifically to the terms and provisions of Article VI and generally to this Agreement as a whole.

6.8 Arbitrator chosen shall be randomly selected based on the list of Arbitrators in Sec. 6.2 and geographical location of the jurisdictional dispute and upon his/her availability, and ability to conduct a Hearing within two (2) business days of said notice. The Arbitrator may issue a "bench" decision immediately following the Hearing or he/she may elect to only issue a written decision, said decision must be issued within two (2) business days subsequent to the completion of the Hearing. Copies of all notices, pleadings, supporting memoranda, decisions, etc. shall be provided to all disputing parties and the Illinois State Federation of Labor.

Any written decision shall be in accordance with this Process and shall be final and binding upon all parties to the dispute and may be a "short form" decision. Fees and costs of the arbitrator shall be divided evenly between the contesting parties except that any party wishing a full opinion and decision beyond the short form decision shall bear the reasonable fees and costs of such full opinion. The decision of the Arbitrator shall be final and binding upon the parties hereto, their members, and affiliates.

In cases of jurisdictional disputes or other disputes between a signatory labor organization and another labor organization, both of which is an affiliate or member of the same International Union, the matter or dispute shall be settled in the manner set forth by their International Constitution and/or as determined by the International Union's General President whose decision shall be final and binding upon all parties. In no event shall there be an abandonment of work.

6.9 In rendering a decision, the Arbitrator shall determine:

(a) First, whether a previous agreement of record or applicable agreement, including a disclaimer agreement, between National or International Unions to the dispute or agreements between local unions involved in the dispute, governs;

(b) 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 the established trade practice in the industry and prevailing practice in the locality. Where there is a previous decision of record governing the case, the Arbitrator shall give equal weight to such decision of record, unless the prevailing practice in the locality in the past ten years favors one craft. In that case, the Arbitrator shall base his decision on the prevailing practice in the locality. Except, that if the Arbitrator finds that a craft has improperly obtained the prevailing practice in the locality through raiding, the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely on the decision of record and established trade practice in the industry rather than the prevailing practice in the locality; and,

(c) 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 interests of the consumer or the past practices of the employer shall not be ignored.

(d) 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.

6.10 The Arbitrator shall set forth the basis for his/her decision and shall explain his/her 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 Project. Agreements of Record, for other PLA projects, are applicable only to those parties signatory to such agreements. Decisions of Record are those that were either attested to by the former Impartial Jurisdictional Disputes Board or adopted by the National Arbitration Panel.

6.11 All interested parties, as determined by the Arbitrator, shall be entitled to make presentations to the Arbitrator. Any interested labor organization affiliated to the PLA Committee and party present at the Hearing, whether making a presentation or not, by such presence shall be deemed to accept the jurisdiction of the Arbitrator and to agree to be bound by its decision. In addition to the representative of the local labor organization, a representative of the labor organization's International Union may appear on behalf of the parties. Each party is responsible for arranging for its witnesses. In the event an Arbitrator's subpoena is required, the party requiring said subpoena shall prepare the subpoena for the Arbitrator to execute. Service of the subpoena upon any witness shall be the responsibility of the issuing party.

Attorneys shall not be permitted to attend or participate in any portion of a Hearing.

The parties are encouraged to determine, prior to Hearing, documentary evidence which may be presented to the Arbitrator on a joint basis.

6.12 The Order of Presentation in all Hearings before an Arbitrator shall be

I. Identification and Stipulation of the Parties
II. Unions(s) claiming the disputed work presents its case
III. Union(s) assigned the disputed work presents its case
IV. Employer assigning the disputed work presents its case
V. Evidence from other interested parties (i.e., general contractor, project manager, owner)
VI. Rebuttal by union(s) claiming the disputed work

VII. Additional submissions permitted and requested by Arbitrator VIII.Closing arguments by the parties

6.13 All parties bound to the provisions of this Process hereby release the Illinois State Federation of Labor and IDOT, their respective officers, agents, employees or designated representatives, specifically including any Arbitrator participating in said Process, from any and all liability or claim, of whatsoever nature, and specifically incorporating the protections provided in the Illinois Arbitration Act, as amended from time to time.

6.14 The Process, as an arbitration panel, nor its Administrator, shall have any authority to undertake any action to enforce its decision(s). Rather, it shall be the responsibility of the prevailing party to seek appropriate enforcement of a decision, including findings, orders or awards of the Arbitrator or Administrator determining non-compliance with a prior award or decision.

6.15 If at any time there is a question as to the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process, the primary responsibility for any determination of the arbitrability of a dispute and the jurisdiction of the Arbitrator shall be borne by the party requesting the Arbitrator to hear the underlying jurisdictional dispute. The affected party or parties may proceed before the Arbitrator even in the absence or one or more stipulated parties with the issue of jurisdiction as an additional item to be decided by the Arbitrator. The Administrator may participate in proceedings seeking a declaration or determination that the underlying dispute is subject to the jurisdiction and process of the Illinois Jurisdictional Dispute Resolution Process. In any such proceedings, the non-prevailing party and/or the party challenging the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process shall bear all the costs, expenses and attorneys' fees incurred by the Illinois Jurisdictional Dispute Resolution Process and/or its Administrator in establishing its jurisdiction.

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.

7.2.A 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 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.

7.2.B Neither the PLA Committee nor its affiliates shall be liable for acts of employees for which it has no responsibility. The principal officer or officers of the PLA Committee will immediately instruct, order and use the best efforts of his office to cause the affiliated union or unions to cease any violations of this Article. The PLA Committee in its compliance with this obligation shall not liable for acts of its affiliates. The principal officer or officers of any involved affiliate will immediately instruct, order or use the best effort of his office to cause the employees the union represents to cease any violations of this Article. A union complying with this obligation shall not be liable for unauthorized acts of employees it represents. The failure of the Contractor to exercise its rights in any instance shall not be deemed a waiver of its rights in any other instance.

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.

7.3 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.

7.4 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 7.5 of this Article.

7.5 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:

7.5.A The party invoking this procedure shall notify the individual designated as the Permanent Arbitrator pursuant to paragraph 6.8 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.

7.5.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.

7.5.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.

7.5.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.

7.5.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.

7.6 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.

7.7 Any rights created by statue 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.

7.8 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 – TERMS OF AGREEMENT

8.1 If any Article or provision of this Agreement shall be declared invalid, inoperative or unenforceable by operation of law or by any of the above mentioned tribunals of competent jurisdiction, the remainder of this Agreement 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 This Agreement shall be in full force as of and from the date of the Notice of Award until the Project contract is closed.

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.

[The Balance of This Page Intentionally Left Blank]

Addendum A

IDOT Slate of Permanent Arbitrators

1. Bruce Feldacker
2. Thomas F. Gibbons
3. Edward J. Harrick
4. Brent L. Motchan
5. Robert Perkovich
6. Byron Yaffee
7. Glenn A. Zipp

Exhibit A - Contractor Letter of Assent

(Date)

To All Parties:

In accordance with the terms and conditions of the contract for Construction Work on [Contract No. 62B66], 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)

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, 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. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

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 (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) 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 provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 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 contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its 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, sexual orientation, gender identity, 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, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program 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 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 or other knowledgeable company official.

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 minorities and women.

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 minorities and women 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 employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women 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, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such 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, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure 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 its 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 their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

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). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

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 employees who are minorities and women 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 good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. 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 good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith 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, sexual orientation, gender identity, 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 contracting agency 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 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, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. 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 contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. 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 DOT-assisted contracts. 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, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. 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 the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours 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; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency 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. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA- 1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), 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 issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, 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 must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. 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. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must 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.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), 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 will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The 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.

(4) In the event the contractor, the laborers or mechanics to be employed in the 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 will, by email to *DBAconformance@dol.gov*, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The 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.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* 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 may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs 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, in accordance with the criteria set forth in § 5.28, 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.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and 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.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section 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 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working 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 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action 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, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must 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 determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on 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 this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with

the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

c. 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. 23 CFR 230.111(e)(2). 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 journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 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 U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. 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 or

mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, 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 that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

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 contracting agency. 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 contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased 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 or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

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 or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI 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. Pursuant to 23 CFR 635.116(c), 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 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 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 contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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 Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the 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. 23 CFR 635.108.

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 Part 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. 3704). 29 CFR 1926.10.

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. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

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 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1. **Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier 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 first tier 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 first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first 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 entering into this transaction. 2 CFR 180.330.

g. The prospective first tier 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 Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

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. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective 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. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-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, 2 CFR 180.800;

(3) 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 (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant 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. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

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. 2 CFR 1200.220 and 1200.332.

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 exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

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 dealings.

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. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

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 its bid or proposal that the participant 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.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, ‘on-board’ commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B) This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.