ADDENDUM NO. 6 RETURN WITH BID

April 5, 2019

TO THE CONTRACT DOCUMENTS FOR

BID #615 NORTHWEST SANITARY SEWER AREA RECONSTRUCTION
FOR THE CITY OF DANVILLE, ILLINOIS

PREPARED BY: HANSON PROFESSIONAL SERVICES / CITY OF DANVILLE

Note: This Addendum is hereby declared a part of the Contract Documents for the project designated above and in case of conflict, the following Addendum shall govern. Bidders shall state in their Bid Form that this Addendum has been received and is reflected in the Bid submitted.

CLARIFICATIONS:
1. The bid opening date is 10:00 AM on April 11, 2019.

CONTRACT DRAWINGS
1. Remove and replace the following plan sheets with the attached sheets 106, 107, 109, 110, 111, 112, 113, and 130.

CONTRACT SPECIFICATIONS
1. Remove the Addendum 5 Special Provision for BRACED EXCAVATION BORING OPTION SPECIAL.
2. Remove and replace the project specifications with the attached Sections 13341, 16269, 16421, 16495, 16620, and the attached updated BID SCHEDULE.
3. Add the following Special Provisions to the contract documents:

CONSTRUCTION SEQUENCE AND SCHEDULE

The Contractor shall prepare a progress schedule as required by Section 108 of the SSRBC. The Contractor shall coordinate items of work in order to keep hazards, traffic inconvenience and limited access to residences and businesses along Denmark Road and Old Ottawa Road to a minimum. In particular, construction shall be staged as shown on the plans and as listed below to meet the following requirements:

Portions of the Work shall be constructed in stages to maintain the functionality of the existing infrastructure. The staging is outlined here and discussed in greater detail in the respective specification sections.
1. The Old Ottawa and Chateau sanitary forcemain shall be constructed first. Chateau lift station construction can occur concurrently with the forcemain work. There is upcoming work on the dam to Lake Vermillion that will eliminate the existing forcemain to the lift station. A pay item for temporary bypass pumping has been added to the plans in the event the station needs to be bypassed before the new station can be placed into service. (Construction Stage 5)

2. Construction of the Denmark Road lift station and forcemain is required to be completed next in order to have a location for the new flow to be rerouted. (Construction Stages 1B and 2)

3. The Denmark Road gravity sewer can be constructed concurrent to the lift station to a point short of the manhole connection to the sewer on Old Ottawa Road but cannot be connected until the station is operational. (Construction Stages 1A and 1B)

4. Upon the commissioning of the Denmark Road lift station, the gravity sewer can be connected to the system at Old Ottawa Road and continue to the termination with a connection to Country Club Estates. (Construction Stage 1C)

5. Once the connection is made to the gravity sewer on Old Ottawa Road, the Rose Hill lift station and forcemain construction can proceed. (Construction Stage 4)

6. Sanitary flows for the Rose Hill lift station will need to be bypass pumped for the duration of the lift station construction. (Construction Stage 4)

7. The public restroom at the Denmark Road lift station site can be installed concurrent to the Denmark Road lift station construction but cannot be placed into service until the lift station is operational. (Construction Stage 1B)

**TEMPORARY SOIL RETENTION AND SEWER INSTALLATION SYSTEM**

**Description:** This work shall consist of providing a temporary soil retention system at the locations identified on the plans and/or installing the gravity sewer utilizing directional drilling in lieu of conventional open cut.

**General:** This item of work covers the gravity sewer installation from Manhole 14 to Manhole 3505C. The existing utility constraints along with the depth of the sewer will require the use of a temporary soil retention system which is covered under this special provision. This item of work also covers an alternative installation method for the gravity sewer using directional drilling between Manholes 14 and 3505C in lieu of open cut with braced excavation.

**Option 1: Temporary Soil Retention System**
The contractor shall familiarize himself with the proposed locations requiring temporary soil retention systems. The retention systems shall conform to Section 522.07 of the SSRBC and as modified herein. The work shall consist of designing, installing and maintaining the soil retention system for the duration required to construct the infrastructure within the excavated area. The retention systems shall provide protection to the excavation as well as to the adjacent utilities and pavement. The horizontal limits of the retention system shall be assumed at the excavation limits (hashed area) outlined on the plan view of the gravity sewer plan and profile sheets. The depth of the excavation requiring the retention system shall be assumed to be from existing grade to the invert of the proposed sewer. The exposed bracing system as would be measured according to Section 522 of the SSRBC is estimated to be 55,719 square feet.

**Option 2: Directional Drilled Gravity Sewer System**
The contractor shall familiarize himself with the proposed alignment and staging for the drilling rig, pipe staging and drilling fluid management. At no time will drilling fluid be allowed to enter waterways or Lake Vermillion.
Where gravity sewer is directionally drilled, the pipe shall be HDPE manufactured of 100% virgin HDPE material conforming to ASTM D 3350 with butt heat fusion joints in accordance with ASTM D 3261. The pipe shall be DIPS sized and shall have a DR11 wall thickness. The contractor shall install a 20” diameter sewer instead of the 15” and 18” to maintain an internal diameter similar to the 18” diameter PVC sewer and eliminate a size change in the directional bore. The gravity sewer shall be installed per the SANITARY FORCEMAIN DIRECTIONALLY DRILLED special provision. The HDPE sewer shall be fusion welded and staged for the pullback operation. The pipe shall be supported with rollers to prevent damage during installation. Once the gravity sewer is installed and the manholes cut in, the sewer shall be televised in addition to being air tested and mandrel tested to witness slope and variations in the grade of the pipe.

The sewer grades and manhole inverts on the plans are based on the temporary soil retention system. If the sewer is directionally drilled, the inverts will need to be adjusted and approved by the engineer. Manhole installation will occur post directional drill installation utilizing a poured concrete base around the gravity sewer to the springline of the pipe and a doghouse cutout for the manhole sections. The contractor shall seal the doghouse opening between the manhole and the pipe by pouring stiff Class SI concrete from the outside of the manhole and finishing the concrete on the inside of the manhole.

The item TEMPORARY SOIL RETENTION AND SEWER INSTALLATION SYSTEM shall be paid for per linear foot along the alignment of the sewer. The cost shall include the retention system on both sides of the excavation or the efforts associated with the directional drilling of the gravity sewer. If the sewer is installed via directional drilling, the braced excavations associated with the later manhole installations shall be included in the unit price and no additional compensation will be allowed.

Select granular backfill quantities along the alignment between Manholes 14 and 3505C will be adjusted based on actual quantity installed at the manhole locations if the directional drill option is selected.

**Basis of Payment:** This work shall be paid for at the contract unit price per linear foot for TEMPORARY SOIL RETENTION AND SEWER INSTALLATION SYSTEM.

**ANSWERS TO CONTRACTOR QUESTIONS**

Question: The stages of construction listed in the plans and also on page 6 of the proposal do not match up. Which also does not match up with the roadway stages if page 6 is correct.

Response: The construction staging is listed in the plans as Stages 1 through 5. The narrative on construction sequencing in the specifications is the sequence to be followed. The narrative has been modified to identify the stages associated with the work for each portion of the sequence.

Question: Addendum #4 states Guardrail removal is now not in this project but there is still a pay item for it on the bid sheets. How are we to handle that item?

Response: Guardrail removal is still in the sewer contract for the south side of Denmark Road. The initial placement of temporary concrete barrier is still part of the roadway contract.
Question: I have for the Schedule of Qtys in Addendum #5. On page 79 of 128 it shows the following. 8” Dia Gravity Sanitary Sewer 0-8’ Deep qty of 345/lf but on the 7th page in the addendum it shows that qty to be 478/lf. 8” Dia Gravity Sanitary Sewer 8-14’ Deep qty of 588/lf but on the 7th page in the addendum it shows that qty to be 215/lf.

Response: Quantities were adjusted after the gravity sewer along Old Ottawa was swapped out for sanitary forcemain. There are two locations on the plans for 8” gravity sewer; plan sheet 16 and plan sheet 40. The gravity sewer between Manhole 20 and Existing Manhole 499 has both sewer at 0-8’ of depth and sewer from 8-14’ depth. The correct quantities are shown on page 7. Please find the attached revised bid schedule.

ADDENDUM NO. 6 ACKNOWLEDGEMENT

________________________ Company acknowledged receipt of above addenda:

Acknowledged by: ________________________________

Title: ________________________________

Date: ________________________________

RETURN WITH BID
ELECTRICAL NOTES FOR DENMARK PUMP STATION

1. All electrical work shall comply with the requirements of the NFPA 70 NATIONAL ELECTRICAL CODE (NEC) most current issue in force, and all other applicable local codes, laws, ordinances, and requirements in force. Electrical equipment and materials shall be installed in compliance with the applicable local codes, laws, and ordinances. Work shall be performed by electricians and electrical contractors licensed and certified to perform electrical work as required by the jurisdiction. The contractor shall submit a list of electricians and electrical contractors with their certification numbers for approval by the owner's representative.

2. Contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

3. All underground utility cables and lines shall be protected during construction. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

4. Contractor shall provide a list of electricians and electrical contractors with their certification numbers for approval by the owner's representative. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

5. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

6. All underground utility cables and lines shall be protected during construction. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

7. All underground utility cables and lines shall be protected during construction. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.

8. All underground utility cables and lines shall be protected during construction. The contractor shall coordinate with all underground utilities and notify the utility company of jurisdiction immediately if any underground utility is encountered during construction. The owner's representative shall be notified in the event an unexpected utility interference is encountered during construction. Onsite joint utility locating services shall be scheduled and utilized by the contractor to locate underground utilities. The contractor shall coordinate with the owner's representative for assistance in locating underground utilities. The contractor shall provide and post all necessary signs, including "Do Not Dig" signs, and any other signs required by the owner's representative.
GENERAL NOTES:
1. See "DENMARK HILL - PUMP STATION BUILDING ELECTRICAL PLAN" for conduit and power wiring sizes and requirements.
2. See details on splice boxes for additional conduit routing information.
3. See details on Sheets 113 & 114 for additional conduit routing information.

KEYED NOTES:
- 240/208 VAC 3 PH, 4 WIRE ELECTRIC SERVICE CONDUCTORS IN 2-3" SCHEDULE 80 PVC CONDUIT TO UTILITY TRANSFORMER.
- ELECTRIC UTILITY METERING EQUIPMENT PER THE SERVING ELECTRIC UTILITY COMPANY REQUIREMENTS.
- SERVICE DISCONNECT MAIN BREAKER.
- AUTO TRANSFER SWITCH.
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FINISHED GRADE 5'-6" NOMINAL (TYP.)

STEEL HUB (TYP.) NEMA 4X STAINLESS

SHEET LEGEND:

1. PROVIDE NEMA 4X STAINLESS STEEL JUNCTION BOX WITH HINGED COVER FOR INTRINSICALLY SAFE BEARING. MAXIMUM SIZE 24" Wx24" Hx8" D INTO PUMP STATION BUILDING INTERIOR TO PUMP CONTROL PANEL.

2. PROVIDE NEMA 4X STAINLESS STEEL HUBS AT ALL CONDUIT ENTRIES INTO PUMP STATION BUILDING.

3. PROVIDE STAINLESS STEEL STRUT SUPPORTS AND HARDWARE FOR INSTALL TO NEMA 4X STAINLESS STEEL ENCLOSURES.

4. SUBMERSIBLE PUMP MOTOR POWER CABLES IN 2.5" PVC COATED ALUMINUM. CONDUIT SHALL BE SIZED FOR 25% MAXIMUM FILL TO CONFORM TO EXPLOSION PROOF CONDUIT SEAL REQUIREMENTS. ADJUST (ENLARGE) AS REQUIRED.

5. EXPLOSION PROOF CONDUIT SEAL SUITABLE FOR CLASS I DIVISION 2 GROUP A MAXIMUM LOCATION OR FIRE PROOF EYE APPLIED ETU, ET, EXALINE, ET, ET OR D-Z DEUCE ECT. ET, OR E2S SERIES REQUIRED FOR ALL CONDUITS ENTERING OR LEAVING THE WET WELL OR VALVE VAULT INSTALLED IN CONFORMANCE WITH NEC 504.30 "SEPARATION OF INTRINSICALLY SAFE CONDUCTORS".

6. INTRINSICALLY SAFE CONDUCTORS SHALL MAINTAIN SEPARATION FROM POWER AND NON-INTRINSICALLY SAFE CONDUCTORS IN ACCORDANCE WITH NEC 504.30 "SEPARATION OF INTRINSICALLY SAFE CONDUCTORS".

7. SUBMERSIBLE PRESSURE TRANSDUCER CABLE IN 2" PVC COATED ALUMINUM. CONDUIT SHALL BE SIZED FOR 25% MAXIMUM FILL TO CONFORM TO EXPLOSION PROOF CONDUIT SEAL REQUIREMENTS. ADJUST (ENLARGE) AS REQUIRED.

8. SUBMERSIBLE PUMP MOTOR CONTROL CABLE IN 2" PVC COATED ALUMINUM. CONDUIT SHALL BE SIZED FOR 25% MAXIMUM FILL TO CONFORM TO EXPLOSION PROOF CONDUIT SEAL REQUIREMENTS. ADJUST (ENLARGE) AS REQUIRED.

INSTALL CONDUIT UNDER THIS CONTRACT FOR FUTURE VFD BETWEEN JUNCTION BOXES & WET WELL & JUNCTION BOXES & BUILDING

NOTES:

1. PROVIDE NEMA 4X STAINLESS STEEL JUNCTION BOX WITH HINGED COVER FOR INTRINSICALLY SAFE BEARING. MAXIMUM SIZE 24" Wx24" Hx8" D INTO PUMP STATION BUILDING INTERIOR TO PUMP CONTROL PANEL.

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1. Panelboard shall be braced for 65,000 Amps symmetrical minimum at 240VAC.
2. Panel shall have copper bus, copper neutral & copper equipment ground bar.
3. All service, feeder & branch breakers shall have an interrupting rating of 65,000 Amps minimum at 240VAC.
4. Include phenolic engraved legend plate labeled "Main Distribution Panel, A" 240/120VAC, 3 phase, 4 wire.
5. Include phenolic engraved legend plates to identify each breaker.
6. Circuit breakers and wiring shall be sized for the actual equipment furnished in conformance with the respective manufacturer's recommendations and NEC. Contractor shall adjust circuit breakers sizes in wiring where applicable to conform with the manufacturer's recommendations and NEC.
7. Post color coding legend plate on panelboard as follows:
   'COLOR CODE
   240/120VAC conductors
   AS FOLLOWING:
   PHASE A - BLACK
   PHASE B - ORANGE (HIGH LED)
   PHASE C - BLUE
   NEUTRAL - WHITE
   GROUND - GREEN.
8. Single phase 120/240VAC 3-wire feeder breakers shall be connected to "A" phase and "C" phase. Do not connect 120/240 single phase circuits to the "L" LED.

NOTES
1. Panelboard breakers shall be copper. Neutral bus shall be copper. Equipment ground bar shall be copper.
2. 2 pole branch and feeder breakers shall be bolt-on type with 22,000 Amps at 120/240 Vac.
3. Include phenolic engraved legend plate labeled "Panel B 120/240VAC 1 phase, 3-wire".
4. Circuit breakers and wiring shall be sized for the actual equipment furnished in conformance with the respective manufacturer's recommendations and NEC. Contractor shall adjust circuit breakers sizes in wiring where applicable to conform with the manufacturer's recommendations and NEC.
5. Post color coding legend plate on panelboard as follows:
   'COLOR CODE
   120/240VAC conductors
   AS FOLLOWING:
   PHASE A - BLACK
   PHASE B - BLUE
   NEUTRAL - WHITE
   GROUND - GREEN.
6. Panelboard and breakers shall have 240VAC series short circuit current rating of 65,000 Amps at 120/240VAC when protected by a feeder breaker rated 65,000 Amps at 240VAC.
<table>
<thead>
<tr>
<th>Device</th>
<th>Legend Plate Schedule</th>
<th>Device</th>
<th>Legend Plate Schedule</th>
</tr>
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<tbody>
<tr>
<td>Service Disconnect for Pump Station</td>
<td>Service main Disconnect 240/120VAC, 3PH, 4 WIRE</td>
<td>Circuit Breaker for HVAC Unit in Main Distribution Panel A</td>
<td>HVAC Unit</td>
</tr>
<tr>
<td>Service Disconnect for Pump Station</td>
<td>Note electric service is backed up by an engine generator set located on site</td>
<td>Circuit Breaker for VFD #1 in Main Distribution Panel A</td>
<td>VFD #1</td>
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<tr>
<td>Service Disconnect for Pump Station</td>
<td>Warning shock hazard exists if grounding electrode conductor or bonding jumper connection in this equipment is removed</td>
<td>Circuit Breaker for VFD #2 in Main Distribution Panel A</td>
<td>VFD #2</td>
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<td>Service Disconnect for Pump Station</td>
<td>Appropriate labels on electrical and all contractor to provide an arc flash report</td>
<td>Circuit Breaker for VFD #3 in Main Distribution Panel A</td>
<td>VFD #3</td>
</tr>
</tbody>
</table>

### 1. **Equipment Prior to Acceptance and Operation**

1. **Electrical System**
   - 240/120VAC, 3PH, 4W
2. **Identification of Persons of Potential Electric Arc Flash Hazards**, per the requirements of NEC 110.16
3. **Equipment shall be weatherproof/waterproof corrosion resistant material**.
4. **Disconnector**.

### 2. **Legend Plates for Equipment That Is Not Shown Up in the Engine Generator Set**

1. **Legend Plate** shall be weatherproof engraved plastic or polyurethane material 1/8" thick black letters on a red background unless noted otherwise. Secure with weatherproof adhesive, and maintain loose. Legend plates shall be furnished in red and in black letters on a white background. See the special provision specifications.
2. **Legend plates for equipment that is not shown up in the engine generator set** shall have 1/8" high black letters on a white background, for example, "disconnect.

### 3. **Safety Switch, Panelboard, Load Center, Cutout**

- Furnish & install a weatherproof warning label for each safety switch, panelboard, load center, and cutout to warn of the potential electric and thermal hazards. The requirements of NEC 110.16 "arc flash hazard warning".

### 4. **All Power and Control Cables in Manholes, Manholes, and Junction Boxes Shall Be Taped to Identify the Protective Cable**

- Tag each protective cable/tag that shall be weatherproof, corrosion resistant material.

### 5. **Legend Plates to be Provided by Service Electric Utility Company, Contractor**

- Contractor to provide an arc flash report and all appropriate labels on electrical equipment prior to acceptance and operation.
THROUGH THE WALL HEAT PUMP UNIT SCHEDULE

<table>
<thead>
<tr>
<th>UNIT</th>
<th>SERVICE</th>
<th>CAPACITY (TONS)</th>
<th>FAN</th>
<th>TOTAL</th>
<th>SEND</th>
<th>HEAT</th>
<th>ELECTRIC</th>
<th>ENERGY</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>AC-1</td>
<td>ELECTRICAL</td>
<td>149</td>
<td>27</td>
<td>24</td>
<td>65</td>
<td>2</td>
<td>40</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. UNITS WILL SEE A SINGLE STAGE SELF CONTAINED THROUGH THE WALL HEAT PUMP WITH INTERNAL ELECTRIC HEAT. PROVIDE LISTED MAKE AND MODEL OR COAG.
2. PROVIDE UNIT WITH SUITABLE SUPPLY AND RETURN VENT.
3. PROVIDE UNIT WITH SUCTION HEAD DOWN TO 0 DEGREES F.
4. PROVIDE UNIT WITH BULK-OFF PLATE FOR VENTILATION OPENING.

**DENMARK BUILDING MECHANICAL PLAN**

- CABINET
- AC-1
- ENGINE GENERATOR SET WITH SUB BASE FUEL TANK

**Scale:** 1/2" = 1'-0"

**State of Illinois Department of Transportation**

**Denmark Road-Pump Station Building Mechanical Plan**

**Addendum 6**

**Denmark, Illinois**

**Northwest Sanitary Service Area Reconstruction**

**File Name:** M-101-Denmark-Bldg_Mech_Plan.dgn

**Plot Date:** 4/5/2019

**Plot Scale:** 4.0000' / in.

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**Total Sheet:** 1/28/19

**City:** DANVILLE, ILLINOIS

**Scale:**

- 2
- 4
- 6

HANSON
SECTION 1 – GENERAL

1.1 WORK INCLUDED

Contractor to furnish a precast concrete building to be field assembled by manufacturer on a cast-in-place foundation as indicated on contract plans and in accordance with manufacturer’s recommendations. Building shall be provided by manufacturer with all necessary openings as specified by contractor in conformance with manufacturer’s structural requirements.

1.2 REFERENCES

A. ACI-318-11: Building Code Requirements for Structural Concrete and Commentary
B. ASCE/SEI 7-10: Minimum Design Loads for Buildings and Other Structures
D. PCI Design Handbook, 7th Edition
E. Concrete Reinforcing Institute, Manual of Standard Practice
F. UL-752 (Test Method level 5) for bullet resistance certified by a military approved laboratory.

1.3 SYSTEM DESCRIPTION

DESIGN REQUIREMENTS

A. Building Dimensions:

   Exterior:   20’ x 20’ x 10’-0” (Not including floor)

   Interior: 19’-4” x 19’-4” x 9’ 0”

B. Design Loads:

   1. Seismic Design Category ‘C’, Risk Design Category II
   2. Roof Live Load (Snow) – 30 PSF
   3. Floor Live Load – 150 PSF (if precast floor is provided)
   4. Wind Loading* – 115 MPH

*Design loads relate to precast components only, not accessories (i.e. doors,
C. Roof: Roof panel shall be flat. The roof shall extend 4” beyond the wall panel with the exception of the shared wall with the precast concrete bathroom facility and have a turndown design which extends ½” minimum below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.

D. Roof Joint Keyway: Grout in keyways shall be a magnesium phosphate material or equal, prepared and placed per the manufacturer’s recommendations. Apply a polysulfide, elastomeric joint sealant to the top of the grouted keyway, installed per manufacturer’s recommendations.

E. Contractor supplied cast-in-place slab must have a ½” step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

F. Building shall be supplied with a hand railing system around the perimeter of the roof as well as a matching stairs and landing to access the roof. The system shall be supplied loose for field installation.

1.4 SUBMITTALS

A. Engineering calculations that are designed and sealed by a professional engineer, licensed to practice in the state where the project is located, shall be submitted for approval.

B. Manufacturers’ product literature shall be provided for any plumbing, electrical, and miscellaneous installed fixtures demonstrating compliance with these specifications.

1.5 QUALITY ASSURANCE

A. The precast concrete building producer shall be a plant-certified member of either the National Precast Concrete Association (NPCA), The Precast/Prestressed Concrete Institute (PCI), or equal.

B. The precast concrete building producer shall demonstrate product knowledge and must have a minimum of 5 years experience manufacturing and setting precast concrete.

C. The manufacturer must be a licensed producer of Easi-Set Buildings

D. No alternate building designs to the pre-engineered EASI-SPAN® building will be allowed unless pre-approved by the owner 10 days prior to the bid date.

SECTION 2 – PRODUCTS

2.1 MATERIALS

A. Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, air-entrained (ASTM C260).
B. Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified. 
   Welded Wire Fabric: ASTM 185, Grade 65

C. Post-tensioning Strand: Roof and floor (if required) sections shall be post-tensioned in 
   the field after grout keyway is filled and has cured to the required PSI strength. Post-
   tensioning strand shall be 41K Polystrand CP50, ½” 270 KSI Seven-Wire strand, 
   enclosed within a greased plastic sheath (ASTM A416). There will be a minimum of 
   three transverse post-tensioning cables connecting roof and floor (if provided) sections 
   together to provide a watertight joint. To ensure a watertight design, no alternate 
   methods shall be substituted for the post-tensioning.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface 
   of the joints. Caulking shall be DOW CORNING 790 silicone sealant or equal. Exterior 
   caulk reveal to be 3/8” x 3/4” deep so that sides of joint are parallel for proper caulk 
   adhesion. Back of the joint to be taped with bond breaking tape to ensure adhesion of 
   caulk to parallel sides of joint and not the back.

E. Panel Connections: All panels shall be securely fastened together with 3/8” thick steel 
   brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM 
   A36 and hot dipped galvanized after fabrication. All fasteners to be ½” diameter bolts 
   complying with ASTM A325 for carbon steel bolts. Cast-in anchors used for panel 
   connections to be Dayton-Superior F-63 coil inserts, or equal. All inserts for corner 
   connections must be secured directly to form before casting panels. No floating-in of 
   connection inserts shall be allowed. Wall panels shall be connected to cast-in-place floor 
   slab using expansion anchors providing adequate embedment by manufacturer.

F. Brick Facade:
   
   a. The exterior facade of the restroom shall have a “thin brick” veneer brick 
      applied. The veneer brick shall match the local “Danville Brick” with final 
      color selection made by the Owner.
      
      i. Thin brick shall be Standard sized (¾” thick molded brick 2 ¼” tall by 
         7-5/8” wide.)
      
      ii. Conform to ASTM C-1088, Grade Exterior, Type TBS.

   b. Air Water Barrier: Single component, load bearing, fluid applied, waterproofing, 
      crack isolation and air barriers membrane. Product shall meet the requirements 
      of ICC-ED AC38: Acceptance criteria for water resistive barriers; ICC-ES 
      AC212: Acceptance criteria for resistive coatings used as water resistive barrier 
      over exterior sheeting; and ASTM E-2357: Standard test method for determining 
      air leakage of air barrier assemblies.

   c. Thin Brick Mortar: Multi-use, polymer fortified adhesive mortar for use on 
      exterior thin brick. Mortar shall have an extra heavy rating per ASTM C627.
      The mortar shall meet the shear bond strength requirements of ANSI A118.4, 
      118.15, and 118.11. The mortar shall be designed to adhere to a water barrier 
      prepared concrete substrate.

   d. Pointing Mortar: Product shall be a mortar designed for adhered stone, think 
      brick and manufactured masonry veneers. The mortar shall be formulated from
a blend of high strength Portland cement, graded aggregates and color fast pigments that provide a joint that is hard and durable.

e. Anti-Graffiti Coating: The anti-graffiti product shall be a silicone based product that penetrates brick and mortar pores and prevent water intrusion and paint adhesion. Product shall have a minimum 5 year warranty against paint adhesion.

G. Control Joint Sealant: Sealant between the precast concrete building and the precast concrete bathroom. Sealant shall be a non-sagging, two part, solvent free, flexible epoxy control joint sealer and adhesive designed for filling vertical and overhead non-moving control joints.

2.2 ACCESSORIES

A. Doors and Frames: Shall comply with Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100) and as herein specified. All door and frame galvanizing shall be in accordance with ASTM A924 and A653, A60 minimum coating thickness.

a. The building shall be equipped with a single 3'0" x 6'8" x 1-3/4” thick insulated, 18 gauge, metal doors with 16-gauge frame (to meet wall thickness). Door to have flush top cap. Doors and frames shall be factory bonderized and painted with one coat of rust inhibitive primer and one finish coat of enamel paint; color to be Owner specified otherwise.

b. Doors and frames shall meet SDI standard Level 2, 1¾” heavy duty.

B. Door Hardware:

1. Pull Handle: Shall meet requirements of ANSI A156.2. Shall be thru bolt attached and constructed of a minimum ¾” diameter stainless pull handle sized 8” center to center with a stainless backer plate, minimum 0.053” on both sides.

2. Hinges: Shall comply with ANSI A156.1 and be of the ball bearing, non-removable pin type (3 per door minimum). Hinges shall be 4¼” x 4½” US26D (652) brushed chrome finish. Manufacturer shall provide a lifetime limited warranty.

3. Deadbolt: Commercial Grade Deadbolt conforming to ANSI 156.5 furnished with a 2 ¼” face plate and a 1” projecting deadbolt with hardened steel pins. Dead bolts shall be UL and ADA approved. Finish shall be US26D (626) brushed chrome finish. Manufacturer shall provide a lifetime limited warranty.

4. Surface Bolt: 8” Surface bolt UL listed. Finish US26D (626) brushed chrome finish. (2 per inactive leaf)

5. Threshold: Bumper Seal type threshold with a maximum 1” rise to prevent water intrusion. Thresholds shall be approved for UL 10B suitable for use with fire doors rated up to three hours.

7. **Drip Cap**: Aluminum drip cap with minimum projection of 2 ½” shall be furnished.

9. **Door Stop**: ANSI 156.16 approved wall mounted door stop with keeper constructed of a corrosion resistant cast brass material. Finish US26D (626) brushed chrome finish.

C. **Through Wall Heat Pump**:
   1. Provide a single stage self-contained through the wall heat pump with integral electric heat.
   2. Unit sizing and electrical requirements are located on the Denmark Road Pump Station Building Mechanical Plan.

2.3 **FINISHES**

A. Interior of Building: Smooth form finish on all interior panel surfaces unless exterior finish is produced using a form liner, then smooth hand-troweled.

B. Exterior of Building: The exterior of the building shall be a scratchcoat texture coordinated with the brick veneer supplier to provide a key to the brick adhesion system.

C. Brick veneer system shall be factory installed with the exception of key joining areas that require field installation. Point mortar and anti-graffiti coating shall be repaired and/or touched up in the field.

2.4 **RAILING AND STAIRS**

A. The proposed railing and stairs shall be supplied by a single manufacturer. Provide components, products and materials specified in this section from a single American Institute of Steel Construction (AISC) certified manufacturer.
   a. Unitized Flight Assemblies.
   b. Unitized Landing Frames.
   c. Manufactures standard rail products (Picket, Panel, and Rod) as detailed or indicated on drawings.
   d. Treads (Checker Plate) as detailed or indicated on drawings.

B. Design Criteria:
   a. Structural Performance of Stairs: Stairs shall withstand the following structural loads without exceeding the allowable design working stress of materials, including anchors and connections. Apply each load to produce the maximum stress in each component:
      i. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 psf (4.8kN/m²) and concentrated load of 300 lbf (1.33kN) applied on an area of 4 square inches (2581 square mm). Concentrated and uniform loads need not be assumed to act concurrently.
      ii. Stair Framing: Capable of withstanding stresses resulting from loads specified, in addition to stresses resulting from railing system loads.
C. Standard Stair and Rail System:

a. Manufacturer’s standard prefabricated, pre-engineered straight run stair and landing system, consisting of hot rolled steel sheet risers, treads, landings and structural plate, channel or angle frames, stringers or connection devices with fasteners/supports and railings.

i. Stringers:
   1. Steel plate or channel with side mounted and/or top mounted railing frame attachment as detailed on drawings and/or in accordance with manufactures system recommendations.
   2. Minimum thickness or weight as determined by structural design calculations, structural grade steel plate or channel.

b. Risers: Closed riser, minimum 14 gage (1.9mm) hot rolled mild steel sheet, sloped maximum 1 ½ inches (38.1mm) and conforming to Americans with Disabilities Act (ADA) nosing requirements.

c. Treads: Manufacturer’s standard tread system, 14 gage (1.9mm) minimum hot rolled mild steel sheet or as determined by structural design calculations. All welds on the underside of tread assemblies to be exposed for proper inspection during the service life and/or after seismic, fire, flood, or potentially damaging event. Provide treads as indicated and noted on drawings for each stair.

   i. Checker Plate Tread: Pattern per manufacturer’s standard.

d. Landings: A combination of structural plate, channel and angles for the frame with 1 ½” B-36 Composite Floor Decking x 20 gage and 10 gage (minimum) bent sheet lateral pour stops. Decking to be attached to frame by plug welding or other mechanical means provided recommended and engineered by the stair manufacturer.

   i. Flight and landing assemblies fabricated by the stair manufacturer shall be connected by splined “Twist-Off” tension control bolts, grade to be A325 & A490 as engineered and specified by the stair manufacturer.

ii. All pre-tensioning methods are to be conformant to the AISC Steel Construction Manual, Chapter 16; Section #3 Bolted Parts. Subsection 3.2.1 “pre-tensioned joints and related sections noted thereafter”.

e. Additional Fastener and Supports: Sized by the manufacturer to meet structural design criteria. If hanger rod connections are applicable to any of the landing connections, they shall be threaded rod type, size and grade as determined by stair manufacturer’s structural design calculations.

f. Railings: Design style as shown on drawings for each stair, selected from manufacturer’s standard pre-fabricated, pre-engineered rail styles.

   i. Picket Rail: 1.5” x 1.5” x 11 gage HSS Top and Bottom Line Frame and Posts with 1.25” I.D. pipe Hand Grab with 0.187” x 1.25” flat bar
bracket and 0.5” Square Bar Pickets spaced not more than 4” on center. Weld Prep to equal NOMMA #3 or better.

ii. Hand Grabs: 1.25” I.D. pipe Code Conforming 34” to 38” above plane of nosings and wrapped continuously past space between flights with pre-formed bend(s) which shall be field fitted with weld prep to equal NOMMA #1.

g. Stringer Rail Mounting:
   i. Structural Plate Stringer: Railings to be Side Mounted. Rail Frame: In-Line or Side assembly, see drawings.
   ii. Structural Channel: Railing to be Top Mounted to channel flange or Side Mounted with railing post knife-blade steel plate connection extender to be received inside the channel flanges below the top flange. Rail Frame: In-Line or Side Assembly.

h. Materials:
   i. Steel Shapes and Plates: To ASTM A36.
   ii. Steel Pipe: To ASTM A53 Type E or S, Grade B.
   iii. Steel Tubing:
      1. Structural Use: To ASTM A500, Grade B or C.
      2. Non-Structural Use: To ASTM A513, hot rolled or coiled rolled (mill option).
   iv. Steel Sheet:
      1. Structural Use: To ASTM A1011 (hot rolled), Checker Plate ASTM A786.
      2. Non-Structural Use: To ASTM A786, ASTM A1008.
   v. Fasteners: As recommended by manufacturer.
   vi. Welding Rods: In accordance with AWS code and AWS filler metal specifications.

i. Fabrication:
   i. Use same material finish as parts being joined. Use stainless steel between dissimilar metals and non-corrosive fasteners at exterior connections or joints.
   ii. Provide fasteners of sufficient strength to support connected members and loads, and to develop full strength of parts fastened or connected.
   iii. Construct stair and rails with all components necessary for support and anchorage, and for a complete installation.

j. Finishes:
   i. Rails, flights, landings and other stair components: Remove oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter from steel surface in accordance with SSPC-SP2 and/or SSPC-SP3.
   ii. Shop Primer: Immediately after fabrication and cleaning, spray apply primer to dry film thickness recommended by the primer manufacturer, but not less than 2.0 mil thickness. Apply one coat High Solids Red Oxide Anticorrosive Primer meeting SSPC-15 Paint.
   iii. Post Delivery: Primer coating offers minimal protection against rust and corrosion during transport and while stored at project site. Proper handling and care before during and after installation shall be taken to maintain effectiveness of primer coating prior to receiving final coats of finish paint.
iv. Finish coat for railings and stairs shall be Series 73 Endurashield or approved equal. Two coats, each 4 mils.

SECTION 3 – EXECUTION

3.1 SITE PREPARATION

A. The precast concrete building will be placed on a cast in place concrete foundation per the plans. The building shall be secured using 3/8” thick steel angle brackets and anchor bolts per the plans. The slab is to be level within 1/8” in both directions and capable of supporting loads imposed by the structure. Floor slab must have a ½” step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels. A ring of butyl rope shall be placed around the perimeter of the foundation prior to setting the building in place.

3.2 BUILDING COORDINATION

A. The precast concrete building and a precast concrete bathroom building will be installed adjacent to each other with a common wall. The two foundations will be continuous and the joining walls will be touching each other. The brick patterns of the two structures shall be in the same horizontal plane with the same mortar joint spacing. Variations in casting may require the contractor to shim one of the buildings for a correct brick pattern alignment. The precast concrete bathroom building will be taller than the precast concrete building. Color matched powder coated steel flashing and control joint caulking will be required at the roof seam to seal the joint between the two buildings and shed water away from the edge of the concrete building roof. The flashing and control joint caulking shall be included in the cost of the precast concrete building.

B. If the City elects not to construct the bathroom building adjacent to the precast concrete building, the brick façade will need to be installed on all four sides. The base bid shall assume brick on all four sides and the reduction in cost for the third side be incorporated into the alternate bid for the restroom building.

3.3 SITE ACCESS

A. Contractor must provide a level, unobstructed area large enough for a crane and a tractor-trailer to park adjacent to the pad. Crane must be able to place outriggers within 5'-0” of edge of pad; truck and crane must be able to get side by side under their own power. Contractor shall coordinate with the local power company to provide protection for the overhead power lines adjacent to the site. Firm roadbed with turns that allow 65’ lowbed tractor-trailer must be provided directly to site.

3.4 RAILING AND STAIRS

A. Preparation
a. Ensure structure being connected to is stable, and complete enough in the construction phase to commence the installation of the Steel Stair System(s).
b. Remove all construction debris from work area and properly barricade the stair shaft(s) from general construction traffic while the Steel Stair System is being installed. Do not allow general construction traffic to use the stairs until all flight and landing frames are securely connected, and temporary railing is in place per approved OSHA guidelines or permanent railing is installed.

B. Installation
a. Coordinate installation of metal stairs and railing with the General Contractor.
b. Coordinate metal stairs and railings installation with the work of other trades for proper time and sequence to avoid construction delays.
c. Install stairs, landings and handrails in accordance with manufacturer’s instructions. Install square, plumb, straight, and true to line and level, with neatly fitted joints and intersections.
d. Minimum Tolerances:
   i. Maximum variation of vertical alignment = 0.25” per floor, non-accumulative.
   ii. Maximum differential of true elevation bench mark(s) = › 0.50” per floor, non-accumulative.

e. Field Fitting:
   i. Do not cut or alter stair system assemblies or structural components without written authorization.
   ii. Field welding and joining shall conform to AWS D1.1 and AWS D1.3.
   iii. Grind and remove weld splatter. Prepare welds the same as the manufacturer’s for item being fitted, except that continuous rail wraps to be ground smooth. Touch-up shop-primed areas with same primer as used by stair system manufacturer.

C. Adjusting
a. Upon completion of stair(s) installation remove all tools, debris and surplus materials from the stair shaft(s).
b. Remove any debris from stair assemblies which was acquired during transit and storage, leave ready for final finish coat preparation by the painting contractor.

D. Field Painting
a. Prepare the primed substrate per the paint supplier’s requirements. In addition to the railings and stairs, the building frames and doors shall also be coated with the same product.
b. Apply two coats of the final coat according to the manufacturer’s requirements. Recoat windows must be adhered to. Two 4 mil coats are required.
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes solid-state, PWM, VFDs for speed control of three-phase, submersible pump motors. VFDs to be furnished as part of control system package.

B. Related Sections include the following:
   1. Division 11 Section 11302 - Sewage Pump Station.
   2. Division 16 Section 16010 – Basic Electrical Requirements.
   3. Division 16 Section 16111 - Conduit and Raceway.
   4. Division 16 Section 16120 - Wire and Cable
   5. Division 16 Section 16190 - Supporting Devices.
   6. Division 16 Section 16195 - Electrical Identification.
   7. Division 16 Section 16450 - Grounding and Bonding
   8. Division 16 Section 16900 – Control and Instrumentation

1.3 DEFINITIONS

A. BMS: Building management system.

B. IGBT: Integrated gate bipolar transistor.

C. LAN: Local area network.

D. PID: Control action, proportional plus integral plus derivative.

E. PWM: Pulse-width modulated.

F. VFD: Variable frequency drive controller.

1.4 SUBMITTALS

A. Product Data: For each type of VFD. Include dimensions, mounting arrangements, location for conduit entries, shipping and operating weights, and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.
B. Shop Drawings: For each VFD:
   1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Each installed unit's type and details.
      b. Nameplate legends.
      c. Short-circuit current rating of integrated unit.
      d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
      e. Features, characteristics, ratings, and factory settings of each motor-control center unit.
   2. Wiring Diagrams: Power, signal, and control wiring for VFDs. Provide schematic wiring diagram for each type of VFD.

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For VFDs, all installed devices, and components to include in operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Routine maintenance requirements for VFDs and all installed components.
   2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction:
   1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
C. Source Limitations: Obtain VFDs of a single type through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFDs, minimum clearances between VFDs, and adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store VFDs indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFDs from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover VFDs to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:

1. Ambient Temperature: 0 to 40°C.
2. Humidity: Less than 90 percent (noncondensing).
3. Altitude: Not exceeding 3,300 ft.

1.8 COORDINATION

A. Coordinate layout and installation of VFDs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features of VFDs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
1. Spare Fuses: Furnish one spare for every three installed, but no fewer than one (1) set of three (3) of each type and rating.
2. Indicating Lights: Two (2) of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Eaton Corporation; Cutler-Hammer Products Model SVX-9000 VFDs or a comparable product by one of the following:
   2. Danfoss Inc.; Danfoss Electronic Drives Div.
   3. Eaton Cutler-Hammer
   5. Square D; a brand of Schneider Electric.

2.2 VARIABLE FREQUENCY MOTOR CONTROLLERS (DRIVES)

A. All VFD’s shall utilize a voltage source inverter (VSI) design with a pulse width modulated (PWM) output waveform. The VFD shall generate a sine-coded, adjustable voltage/frequency three (3) phase output for complete speed control of any 3 phase, NEMA Design B, squirrel cage induction motor.

B. Provide each VFD with 3 contactor electrical bypass feature for ease of maintenance.

C. The VFD shall have the following basic design:
   1. Converter: Converter shall consist of a 3 percent AC line reactor as minimum per IEEE 519, a diode rectifier, and a capacitor bank which will first filter, convert AC to DC, and maintain a fixed DC voltage source from the fixed voltage and frequency input. The minimum impedance of the line reactor shall be 3 percent. If DC Buss Choke’s are standard by a given manufacturer, an AC line reactor shall also be provided (see paragraph 2.2.B.1.c below):
      a. The VFD shall be 95 percent efficient of 100 percent rated output power at 60 Hz.
      b. The VFD shall maintain a power factor of not less than 0.95 throughout its speed range.
      c. AC line reactors with 3 percent impedance on the input power line are required to protect the converter section from transient voltage spikes and to reduce the line side harmonic emissions (EMI) to conform with the requirements of IEEE 519.
   2. Inverter: Inverter shall use Insulated Gate Bipolar Transistors (IGBT’s) with a minimum rating of 1000 VDC on 240-VAC controls to invert the converter fixed DC voltage into a pulse width modulated output.
3. Control Logic: Consists of a single printed circuit board and incorporates an 8 bit, or larger, microcomputer central processing unit to control all inverter, converter, base drive, and external interface functions.

4. NEMA 1 enclosure with a full capacity, door interlocked input heavy duty motor circuit protector (MCP) (IEC not acceptable), sized to meet NEC requirements. This disconnect will remove all power to the VFD and any components located within the enclosure. The enclosure shall be of sufficient size to allow mounting of additional relays, signal conditioners, etc. when necessary.

5. Fast acting semiconductor fusing is required to protect the input diode bridge of the converter section.

6. Fusing in the VFD shall be as manufactured by Bussman.

7. All VFD’s shall have a dust-tight, rotary speed potentiometer mounted on the front cover that can be used to control the speed of the VFD while in “Hand” mode.

8. All VFD’s shall have an oil-tight, heavy duty Hand-Off-Auto switch on the front cover. When the Hand-Off-Auto switch is in the “Hand” position, the VFD gets its speed reference signal from the door mounted speed potentiometer. The “Hand” start command shall come from the Hand-Off-Auto switch.

9. When the Hand-Off-Auto switch is in the “Auto” position, the VFD gets its speed reference signal from the Pump Control Panel in the form of a 0-10 VDC, 4-20 mA or serial communication signal. The “Auto” start command shall come from the Pump Control Panel.

10. 120-Volt Control transformer as required plus 100 VA for users external devices. The minimum size of this transformer shall be 150 VA.

11. VFD External Fault and Auto Start circuits shall be able to supply 115 VAC to customer supplied dry contact closures. The 115 VAC power source shall originate within the VFD enclosure and shall only be present when the input circuit breaker is in the “ON” or closed position.

   a. Auto Start signal (from Pump Control Panel). Once the Auto Start contact is closed, a 115 VAC relay located within the VFD enclosure shall be energized. A dry set of contacts from the 115 VAC Auto Start relay shall be used to start the VFD in “Auto”. In “Hand”, the VFD shall ignore the Auto Start command.

12. External Fault signal (from customer supplied safety devices). Once the External Fault contact is closed (normal operation), a 115 VAC relay located within the VFD enclosure shall be energized. A dry set of contacts from the 115 VAC

   a. External Fault relay shall be used to enable the VFD to operate when a start command is present. Loss of the External Fault input signal shall cause the VFD to stop operating, whether the VFD is in “Hand” or “Auto”.

13. Terminal Blocks for Input and Output power and common customer connections shall be provided. Customer connections shall be clearly labeled and shall include the following terminals as a minimum and function as follows:

   a. 115 VAC power (hot and neutral) from control transformer.
   b. External Fault (Safety or Run Enable) input signal.
   c. “Auto” start signal from Pump Control Panel.
   d. “Auto” speed reference signal (from Pump Control Panel).
   e. Motor run status (contact from VFD).
D. The VFD shall have, as a minimum, the following design features as standard:

1. 2-12 kHz sine-coded carrier frequency with a pulse width modulated output. VFD’s with an asynchronous PWM signal that limit or can not change the carrier frequency may be accepted, pending final decision by Owner.
2. Minimum and maximum speed adjustment capability.
3. Controlled speed range of 20:1, or greater.
4. Overload capability of 110 percent for sixty (60) seconds.
5. Critical frequency jump control.
7. A back lighted LCD alphanumeric display capable of providing in complete English words the following information: Output Frequency, Output Speed, VFD Status, Output Current (AMPS), Output Voltage, DC Bus Voltage, Percent Response Signal, Energy (kWh and MWH), Output Power (kW or HP), Elapsed Time (VFD running hours), Heat Sink Temperature, Input Reference Values and all Fault and Warning Messages.
8. Coast or ramp to stop.
10. Adjustable acceleration and deceleration.
11. On loss of speed reference signal, the VFD shall operate at a preset minimum speed so that the VFD will not drive the pump at a speed capable of causing system problems.
12. VFD shall be provided with an isolation contactor to electrically isolate the drive from the motor feeder.

E. The VFD shall have, as a minimum, the following protective features:

1. Ground fault protection, active at start and while running.
2. Current limit adjustable 60 – 100 percent.
3. Current limited stall prevention during acceleration, deceleration, and run conditions.
4. Automatic voltage boost to prevent nuisance tripping during load or line side transient conditions.
5. Automatic restart after momentary power loss or momentary over-voltage. No restart into ground fault.
6. Start into a rotating motor (flying start). The VFD shall be able to start the motor in the correct direction when it is freewheeling backwards.
7. Anti-windmill protection.
9. Heat sink over temperature protection.

F. The VFD shall have the following adjustments available:

1. Acceleration - 0.1 to 300 seconds.
2. Deceleration - 0.1 to 300 seconds.
3. Volts/hertz adjustments.
4. Maximum frequency range.
5. Minimum frequency or speed.
6. Maximum frequency or speed.
7. Carrier frequency (2 kHz to 12 kHz) adjustable to tenths.

G. The VFD shall have the following minimum I/O requirements:

1. Software and Programming setup:
a. Shall have at minimum, a high speed interface service port (for an individual manufacturers laptop service tools) to permit uploading and downloading of VFD configuration parameters. All necessary software and service port to computer interface hardware shall be provided by the VFD Manufacturer.
b. Programming software shall allow setup of all system parameters.
c. Programming software shall allow monitoring of any VFD tests and allow proper operation to be verified.

2. Analog inputs shall be able to be inverted (direct or indirect acting), and have the ability to be programmed for a minimum and maximum input. The VFD shall have provisions for:

   a. One (1) 0-10 VDC analog input.
   b. One (1) 4-20 mA analog input.

3. Analog outputs shall be programmable to provide the following signals from the VFD as a minimum: Output Frequency, Output Speed, and Output Current. Analog outputs shall be programmable for a minimum and maximum output. The VFD shall have provisions for:

   a. Two (2) 0-10 VDC or two (2) 4-20 mA analog outputs.

4. The VFD shall have six (6) digital inputs capable of accepting a dry contact closure as an input. The digital inputs shall be programmable to represent the following functions as a minimum:

   a. Start signal when in “Hand” (contact from Hand-Off-Auto switch).
   b. “Auto” selected signal (contact from Hand-Off-Auto switch).
   c. Start signal when in “Auto” (contact from 115 VAC Auto Start relay).
   d. External Fault signal (contact from 115 VAC safety circuit).

5. Three (3) separate preset speed selections using three separate digital inputs. Each digital input shall be programmable to represent one (1) of three (3) preset speeds:

   a. High, Medium and Low (100, 80, and 60 percent respectively).

6. The VFD shall have three (3) digital outputs, each capable of providing a 2 Amp SPDT relay contact as an output. The digital outputs shall be programmable to represent the following functions as a minimum:

   a. Ready (VFD ready to run safety contacts are made and no fault conditions exist. Contacts close when VFD is “Ready”).
   b. Run (VFD has started and is running. Contacts closed when VFD is running).
   c. Fault (VFD Fault condition that has stopped VFD operation. Contacts close when VFD has tripped on a fault condition).

H. The VFD shall be designed to operate within the following environmental and service conditions:

   1. Ambient service temperature: 0°C to 40°C.
   2. Ambient storage temperature: 0°C to 60°C.
   3. Humidity: Non-condensing to 95 percent.
4. Altitude to 3,300 ft.
5. Input voltage: three phase, 240 VAC +/- 10% for 240 VAC series.
6. Input frequency: 60 hertz +/- 3 percent.

I. Software Programming and Setup:

1. Provide VFD programming software and any adapters necessary for operation. As a minimum, software shall allow parameter up/downloading capability from an IBM compatible PC. Software shall be Y2K compliant and support operation on multiple operating systems, i.e. Windows XP, Windows 7.
2. Programming software shall allow setup of all system parameters.
3. Programming software shall allow monitoring of any VFD tests and allow proper operation to be verified.
4. The VFD shall have an RS-485 serial communication port capable of communicating with a laptop PC with the appropriate manufacturer’s software.

J. Long Lead Filter (where required by drive manufacturer):

1. LCR filter for excessive motor lead lengths between VFD and motor exceeding 75 feet for motors below 25 hp and 100 feet for all other motors.
2. Filter manufactured by TCI (Trans-Coil. Inc. - Milwaukee, WI), part number KLCxxBE, where xx is equal to or greater than the motor Full Load Amps.
3. Locate filter within 10 (wire) feet from the VFD that it services.
4. Set the VFD carrier frequency to 8 kHz or below and operating frequency to 60 Hz or below.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested VFDs before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFDs for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. Anchor each VFD assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and grout sills flush with mounting surface.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."

C. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

D. Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 16 Section "Fuses."

3.4 IDENTIFICATION

A. Identify VFDs, components, and control wiring according to Division 16 Section "Electrical Identification."

3.5 CONNECTIONS

A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.6 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate
3. compliance; otherwise, replace with new units and retest.

4. Motors:
   a. Inspect each motor installed under all divisions of the Specifications for damage, moisture, alignment, proper lubrication, oil leaks, phase identification and cleanliness. Each motor shall be given a megger test. All motors shall be tested as specified herein and the results transmitted to the Engineer.
   b. All motors shall pass a minimum megger reading with windings at ambient temperature. Any motor not meeting this minimum test shall be conditioned and retested until it passes or replaced if it cannot meet the test requirements.
   c. Test Voltage: 500V; Minimum Acceptable Resistance in Megohms: 5.
   d. Apply megger test on three phase motors between all phases tied together and ground. For single phase motors, apply megger test between phase and neutral conductor tied together and ground.
   e. Hold all megger tests for one minute or until the reading maintains a constant value for 15 seconds.
   f. All non-induction type motors or special application motors shall be megger tested as recommended by the motor manufacturer.
   g. Each motor shall be tested for correct rotation, where reverse rotation could damage equipment, the motor shall be mechanically uncoupled before testing.
   h. An operating load test shall be conducted on all motors and the individual phase current readings taken. Under no condition shall the load current exceed the nameplate rating of the motor. If this condition exists, the Engineer shall be notified immediately.
   i. Each motor shall be run long enough to prove satisfactory performance under operating load including but not limited to operating temperature, lubrication, alignment and vibration.
   j. Refer to Division 16 Section "Control and Instrumentation" for Motor Startup Certification and Testing Report.

3.7 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain variable frequency controllers. Provide minimum one – two (2) hour session.

END OF SECTION 16269
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work included in this section is the supply and installation of electric service entrance from the utility transformer bank to the service entrance meter and disconnect. Included in this work shall be the utility transformation equipment to provide the service voltage and capacity for the facility. This section shall include all labor, coordination, equipment and materials necessary to provide a complete and operational electric service entrance.

1.2 REFERENCE TO STANDARDS

A. NFPA 70 – National Electrical Code (most current issue in force).
B. NFPA 70E – Standard for Electrical Safety in the Workplace.
D. Contractor shall confirm the requirements and standards as specified by the respective serving electric utility company.
E. Ameren Electric Service Manual (current issue in effect)

1.3 RELATED WORK

A. 16010 – Basic Electrical Requirements.
B. 16110 – Raceways.
C. 16120 – Building Wire and Cable.
D. 16410 – Enclosed Circuit Breakers.
E. 16450 – Grounding.
PART 2 - PRODUCTS

2.1 GENERAL

A. Products for the new electric service entrance shall be as detailed on the Plans and specified herein.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall coordinate the work with the serving electric utility company; Ameren Call Center Phone: 1-888-672-5252 and Mr. Tyler Rodeffer, Ameren Illinois, 1155 East Voorhees Street, Danville, IL, Phone: (217) 431-9726, Email: TRodeffer@ameren.com Installation of the new service entrance shall be as detailed on the Plans, per the serving electric utility requirements, and as specified herein.

B. The Contractor shall coordinate and obtain the required permit(s) for new electric service from the local city building/electrical inspector as applicable.

C. The Contractor shall coordinate new electric service work with the City of Danville, Illinois.

D. The City of Danville, Illinois will pay for all associated electric utility company charges required to provide electric service to the pump stations. The Contractor is not responsible for electric utility company charges associated with the proposed electric service to the pump station. The Contractor shall coordinate the new electric service with the serving electric utility company and the Owner’s Representative. The service entrance shall include, but not be limited to, all service entrance equipment, labor, and materials, as detailed on the Plans and specified herein, in order to provide a complete and operational electrical system.

E. Contractor shall coordinate work and any power outages with the Owner’s Representative. Any shutdown of existing systems shall be scheduled with and approved by the Owner’s Representative prior to shutdown. Once shut down, the circuits shall be labeled as such to prevent accidental energizing of the respective circuits. All personnel shall follow U.S. Department of Labor Occupational Safety & Health Administration (OSHA) 29 CFR Part 1910 Occupational Safety and Health Standards for electrical safety and lockout/tagout procedures, including, but not limited to, 29 CFR Section 1910.147 The Control of Hazardous Energy (lockout/tagout).

F. Contractor shall comply with the applicable requirements of NFPA 70E – Standard for Electrical Safety in the Workplace.

3.2 UTILITY

A. Will provide and install a 240/120 VAC, 3 phase, 4 wire solidly grounded power sufficient to handle the connected loads for a 600 Amp service or as required for the respective equipment loads at the Denmark Pump Station at Danville, Illinois.
B. Will provide and install a 480/277 VAC, 3 phase, 4 wire solidly grounded power sufficient to handle the connected loads for a 100 Amp service or as required for the respective equipment loads at the Rose Hill Pump Station at Danville, Illinois.

C. Will provide and install a 240/120 VAC, 3 phase, 4 wire solidly grounded power sufficient to handle the connected loads for a 200 Amp service or as required for the respective equipment loads at the Chateau Pump Station at Danville, Illinois.

D. Will install metering.

E. Will retain the right to review and approve drawings prior to installation.

3.3 CONTRACTOR

A. Shall coordinate work and verify requirements with the serving electric utility.

B. Shall coordinate work with the Owner’s Representative. This will include coordinating the electric service entrance work and billing arrangements with the serving electric utility company.

C. Shall coordinate work and verify requirements with the City Electrical Inspector and applicable local codes.

D. Shall provide the necessary equipment, conduit, interface, coordination, load data, etc. for utility service as required by the serving electric utility.

E. Shall furnish and install a meter base, current transformer cabinet, and/or other metering equipment conforming to the serving electric utility company’s requirements and as detailed on the Plans.

F. Shall furnish and install conduit and fittings to interface to the respective service equipment and extend to the utility transformer.

G. Shall furnish and install service conductors from the utility transformer to the metering equipment and service disconnect.

H. Shall furnish and install a service disconnect as detailed on the Plans and as specified herein.

I. Shall provide grounding as detailed on the Plans, specified herein and in conformance with the serving electric utility company requirements. The service entrance neutral shall be solidly grounded in the service disconnect enclosure.

J. Shall provide additional work as required by the serving electric utility and as required to provide a complete and operational electric service entrance system.

END OF SECTION 16421
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section includes the supply and installation of electrically operated, mechanically held, automatic transfer switches, and all required work to provide a complete and operational electrical system, as detailed on the Plans and Specified herein.

1.2 RELATED SECTIONS

A. Section 16010 – Basic Electrical Requirements.

B. Section 16111 – Conduit and Raceway.

C. Section 16120 – Wire and Cable.

D. Section 16190 - Supporting Devices.

E. Section 16195 – Electrical Identification.

F. Section 16450 – Grounding.

G. Section 16620 – Standby Power Generator Systems

1.3 REFERENCE TO STANDARDS

A. NEMA ICS 1 – General Standards for Industrial Control Devices, Controllers, and Assemblies.

B. NEMA ICS 2 – Standards for Industrial Control Devices, Controllers, and Assemblies.

C. NEMA ICS 6 – Enclosures for Industrial Controls and Systems.

D. NFPA 70 – National Electrical Code (most current issue in force).

E. NFPA 70E – Standard for Electrical Safety in the Workplace.


G. UL 1008 – Standard for Safety Transfer Switch Equipment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transfer switches shall be stored indoors from time of delivery to job site, protected from weather and construction.

1.5 SUBMITTALS

A. The Contractor shall furnish shop drawings for approval before ordering equipment and/or materials. Shop drawings are required for panelboards to be used on the project. Shop drawings shall be clear and legible. Copies that are illegible will be rejected. The preferred shop drawing submittal format shall be electronic (PDF) copies. Contractor may submit hard copies of shop drawings instead of electronic copies where applicable. In the event that the Contractor provides hard copies of shop drawings he shall submit sufficient quantities to meet the needs of his personnel, sub-contractor personnel, and equipment suppliers plus four (4) copies to be retained by the Project Engineer. Shop drawings shall include the following information:

1. In order to expedite the shop drawing review, inspection and/or testing of materials and equipment, the Contractor shall furnish complete statements to the Project Engineer as to the origin and manufacturer of all materials and equipment to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials and equipment.

2. Provide catalog sheets and showing manufacturer, model number, voltage, switch size, Amperage ratings, number of poles, operating logic, withstand and closing ratings, dimensions, and enclosure details. Coordinate auto transfer switch withstand and closing ratings with the service entrance breaker/disconnect and the generator breaker/disconnect to maintain the withstand and closing ratings of the switch. Include this information with the submittal.

3. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

4. Operation and Maintenance Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running. List all factory settings of relays and provide relay setting and calibration instructions. Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.6 QUALITY ASSURANCE

A. Automatic transfer switches shall be manufactured and supplied by a company regularly engaged in the business of furnishing automatic transfer switches. If required by the Engineer, the manufacturer shall submit certification to a minimum of ten years experience in the manufacturer of automatic transfer switches.
1.7 MAINTENANCE SERVICE (WARRANTY)

A. Automatic transfer switches shall be warranted to be free from defects, material and workmanship for a period of one year from date of substantial completion by established by the Owner.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. Switch shall function to automatically transfer predetermined loads from the main service to the generator service in the event of a power failure and to retransfer these loads to normal source after restoration of power.

B. The automatic transfer switch for the Denmark Hill Pump Station at Danville, Illinois shall be a 600 Amp, 240/120 VAC, 3 Phase, 4-Wire, 3-Pole with solid neutral mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to insure only one (1) of two (2) possible positions - normal or emergency. Transfer switch shall have withstand and closing rating of 65,000 RMS Sym. Amps, minimum per UL Standard 1008.

C. The automatic transfer switch for the Chateau Pump Station at Danville, Illinois shall be a 200 Amp, 240/120 VAC, 3 Phase, 4-Wire, 3-Pole with solid neutral mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to insure only one (1) of two (2) possible positions - normal or emergency. Transfer switch shall have withstand and closing rating of 22,000 RMS Sym. Amps, minimum per UL Standard 1008.

D. All main contacts shall be the silver alloy wiping action type. They shall be protected by arcing contacts. The operating transfer time in either direction shall not exceed 1/6 of a second. All replaceable contacts, coils, springs and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

E. The automatic transfer switch shall conform to the requirements of NEMA Standard ICS2 and Underwriters' Laboratories UL-1008 and shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric-heating and tungsten-filament lamp loads. Voltage and current ratings shall be as shown on the drawings. Transfer switches shall have withstand and closing ratings as detailed on the plans and specified herein. Coordinate selection of the service entrance breaker/disconnect and the generator breaker/disconnect to maintain the withstand and closing ratings of the switch.

F. Automatic transfer switch controls shall be microprocessor based.
2.2 PRODUCT OPTIONS AND FEATURES

A. Voltage sensing for each phase of normal source. Pick-up voltage is adjustable from 85 percent to 100 percent nominal, and drop-out voltage is adjustable form 75 percent to 98 percent pick-up value. Factory set for pick-up at 90 percent and drop-out at 85 percent.

B. Time-delay override of normal source voltage-sensing delays transfer and engine start signals. Adjustable zero (0) to six (6) seconds, and factory set at one (1) second.

C. Voltage/Frequency Lockout Relay: Prevent premature transfer. Voltage pick-up is adjustable from 85 percent to 100 percent nominal. Factory set to pick-up at 90 percent. Pick-up frequency is adjustable from 90 percent to 100 percent nominal. Factory set to pick-up at 95 percent.

D. Retransfer Time Delay: Adjustable from zero (0) to thirty (30) minutes and factory set at ten (10) minutes. Provides automatic defeat of the delay upon loss of voltage or sustained undervoltage of the emergency source, provided the normal supply has been restored.

E. Bidirectional In-Phase Transfer System to control transfer operation between live sources. Shall provide variable transfer initiation which limits motor inrush current to magnitude or normal starting current ignoring unequal source voltages and wave shape distortion from solid state controlled loads. Operation shall be over a frequency difference range of ± 2 Hz. If voltage of the source carrying load drops below 70 percent, the in-phase function shall be automatically bypassed.

F. Test Switch: Simulates normal source failure.

G. Switch-Position Pilot Lights: Indicate source to which the load is connected.

H. Source-Available Indicating Lights: Supervise sources via the transfer switch normal and emergency source-sensing circuits:
   1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

I. Unassigned Auxiliary Contacts: Two (2) normally open SPDT contacts for each switch positions: Rating: 10 amperes at 240 VAC.

J. Transfer Override Switch: Overrides automatic retransfer control so the ATS will remain connected to the emergency power source regardless of the condition of the normal source. A pilot light indicates the override status.

K. Engine Starting Contacts: One isolated normally closed and 1 isolated normally open. Contacts are gold flashed or gold plates and rated 10 amperes at 32-Volt direct current minimum.

L. Engine Shut-Down Contacts: Instantaneous, to initiate shut-down sequence at engine-generator control panel after retransfer of the load to normal or preferred source. Provide manual engine disconnect switch.
M. Provide network card compatible with remote monitoring requirements in Section 16620 Standby Power Generation Systems.

N. Equipment ground bar adequately sized for all ground wires to and from the transfer switch.

2.3 ENCLOSURE

A. Enclosure for automatic transfer switch located indoors in a dry non-corrosive area shall be NEMA 12 steel with hinged cover.

B. Enclosure for automatic transfer switch located outdoors or in a damp or wet location shall be NEMA 4X stainless steel with hinged cover.

2.4 ACCEPTABLE PRODUCTS

A. Automatic Switch Co. 7000 Series.

B. Kohler KC Series

C. Onan/Cummins Model OHPCD Power Command.

D. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All electrical work shall comply with the requirements of NFPA 70 - National Electrical Code (NEC), most current issue in force, and all other applicable local codes, laws, ordinances, and requirements in force. Electrical equipment and materials shall be installed in conformance with the respective manufacturer's directions and recommendations for the respective application. Any installations which void the UL listing, Intertek Testing Services verification/ETL listing, FM approval, or other third party listing, and/or the manufacturer's warranty of a device will not be permitted.

B. Contractor shall coordinate work and any power outages with the Owner's Representative. Any shutdown of existing systems shall be scheduled with and approved by the Owner's Representative prior to shutdown. Once shut down, the circuits shall be labeled as such to prevent accidental energizing of the respective circuits. All personnel shall follow U.S. Department of Labor Occupational Safety & Health Administration (OSHA) 29 CFR Part 1910 Occupational Safety and Health Standards for electrical safety and lockout/tagout procedures including, but not limited to, 29 CFR section 1910.147 The Control of Hazardous Energy (lockout/tagout).

C. Contractor shall comply with the applicable requirements of NFPA 70E – Standard for Electrical Safety in the Workplace.
D. Verify all power sources prior to disconnecting, removing, reconnection, installing, connecting, or working on the respective switch or other device.

E. Mount transfer switches in accordance with manufacturer’s recommendations and as detailed on the Plans. Level and anchor unit.

F. Match the type and number of cables and conductors to the control and communications requirements of the transfer switch used. Mounting hardware shall be corrosion resistant stainless steel.

G. Tighten factory-made connections, including connectors, terminals, bus joints, mountings, and grounding. Tighten field-connected connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values. When manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A.

H. Make equipment grounding connections for transfer switch unit as indicated and as required by the NEC.

I. Provide NEMA 4 hubs for all conduit entries into boxes or enclosures rated NEMA 4 or NEMA 4X to maintain the NEMA 4, 4X rating of the respective enclosure. Provide NEMA 4X stainless steel hubs for NEMA 4X stainless steel enclosures.

J. Coordinate selection of the electric service breaker or disconnect and the engine generator feeder breaker or disconnect to maintain the withstand and closing ratings of the transfer switch.

K. Identify the normal and/or utility power source and identify the standby and/or engine generator power source and connections on the transfer switch.

L. Equipment and Testing:

1. The services of a qualified representative of the equipment supplier shall be provided to check the installation, perform start-up adjustments, and instruct maintenance personnel in the care and proper operation of the equipment.

2. Contractor shall notify the Owner a minimum of seven (7) days prior to conducting test. The Owner must be present during testing to validate results.

3. Instruct Owner personnel on the complete operation and maintenance of transfer switch. Provide minimum of one (1) two (2) hour session.

END SECTION 16495
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section consists of furnishing and installing a standby diesel engine generator system for the **Denmark Hill Pump Station, Danville, Illinois** as detailed on the Plans and specified herein. The engine generator set shall be a legally required standby system as defined by National Electrical Code Article 701. The engine generator set shall be classified as a Class X (capable of providing 24 hours of continuous backup power without being refueled), Type 60 (power restoration within 60 seconds), Level 2 as defined by NFPA 110, Chapter 4. This item shall include all labor, equipment, fuel, lubricants, fluids, weatherproof housing, start battery, battery charger, muffler, sub-base fuel tank, fuel piping, concrete pad, wiring, raceways, grounding, materials, tools, utility coordination, operational instructions, labeling, startup and check out services, testing and all incidentals required to place the engine generator system, automatic transfer switch, and all associated accessories into proper working order as a completed unit to the satisfaction of the Owner and Engineer. Contractor shall also include three copies of instruction manuals, operation and maintenance manuals, and parts list bound in a durable plastic binder for the engine generator set and automatic transfer switch.

1.2 RELATED SECTIONS

A. Section 16010 – Basic Electrical Requirements.

B. Section 16111 – Conduit and Raceway.

C. Section 16120 – Wire and Cable.

D. Section 16195 – Electrical Identification.

E. Section 16450 – Grounding.

F. Section 16495 – Automatic Transfer Switches

1.3 REFERENCE TO STANDARDS

A. NFPA 30 - Flammable and Combustible Liquids Code.

B. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines.

C. NFPA 70 - National Electrical Code (most current issue in force).

D. NFPA 70E – Standard for Electrical Safety in the Workplace.

F. UL 142 Standard for Safety- Steel Aboveground Tanks for Flammable and Combustible Liquids.

G. UL 2200 Standard for Stationary Engine Generator Assemblies


J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.4 SUBMITTALS

A. The Contractor shall furnish shop drawings for approval before ordering equipment and/or materials. Shop drawings are required for panelboards to be used on the project. Shop drawings shall be clear and legible. Copies that are illegible will be rejected. The preferred shop drawing submittal format shall be electronic (PDF) copies. Contractor may submit hard copies of shop drawings instead of electronic copies where applicable. In the event that the Contractor provides hard copies of shop drawings he shall submit sufficient quantities to meet the needs of his personnel, sub-contractor personnel, and equipment suppliers plus four (4) copies to be retained by the Project Engineer. Shop drawings shall include the following information:

1. In order to expedite the shop drawing review, inspection and/or testing of materials and equipment, the Contractor shall furnish complete statements to the Project Engineer as to the origin and manufacturer of all materials and equipment to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials and equipment.

2. Certified outline and installation drawings.

3. Performance data and operating characteristics.

4. Arrangement drawings showing piping, controls and accessory equipment.

5. Drawings on non-standard components and accessories.

6. Drawings on fuel system and fuel tank.

7. Product data: Catalog data marked to indicate materials being furnished.
8. Drawings detailing point to point wiring and type, diagram specific to the components being supplied on the project.

9. Manufacturers specific sizing file detailing the results on the generator being supplied for the loads and voltage dips specified.

10. Operating and Maintenance Data: Instructions Manuals, Maintenance and Operational Manuals. Provide three copies of bound manuals in durable plastic binders (8-1/2 in. x 11 in.). The manuals shall include manufacturer’s maintenance and operating instructions and parts list and serial numbers for equipment.

1.5 QUALITY ASSURANCE

A. Comply with specified ANSI, NEMA, NFPA, and UL requirements for engine generator set components and installation.

1.6 MAINTENANCE SERVICE (WARRANTY)

A. Engine generator set shall be warranted to be free from defects, material and workmanship for a period of **five years** from date of substantial completion as established by the Owner. Defective parts shall be repaired or replaced at the respective manufacturer’s options, free of charge including travel and labor. Warranty level shall include engine generator set components at shipped from the excluding filters, fluids, belts, hoses, paint, and batteries. Any damage to the engine generator set during installation shall also be repaired and corrected.

PART 2 - PRODUCTS

2.1 STANDBY POWER ENGINE GENERATOR SET

A. Generator shall be rated 150 KW/188 KVA minimum at 1,800 RPM, 60 Hz, 0.8 PF, and 125° C maximum temperature rise. Unit shall be UL 2200 listed. The generator output voltage shall be 240/120 Volt, 3 phase, 4 wire, 60 Hz. The generator shall be capable of delivering rated output (KVA) at rated frequency and power factor, at any voltage not more than five percent above or below rated voltage. The diesel engine-generator set shall be capable of single step load pick of 100 percent nameplate kW and power factor. Generator maximum allowable transient momentary voltage dip shall be 20 percent for the following loads in a two-step application:

1. Step 1: One 50 HP, 230 VAC, thee phase, submersible pump, KVA Code Letter F, 127.7 Full load Amps, Locked rotor 690.4 Amps, with a Variable Frequency Drive controller,

25 KVA, 120/240 VAC, single phase heating loads, lights, receptacles, ventilation fans, and control power circuits.

HVAC Unit 230 VAC, 3 Phase, with 2.5 Tons cooling capacity and 9 KW of electric heating,
2. Step 2: One 50 HP, 230 VAC, thee phase, submersible pump, KVA Code Letter F, 127.7 Full load Amps, Locked rotor 690.4 Amps, with a Variable Frequency Drive controller,

Note where the actual equipment loads exceed the above loads, the engine generator set rating shall be adjusted to meet the demand loads for the actual equipment furnished and comply with the Specifications.

B. Engine shall be diesel fueled, four cycle, water-cooled with integral mounted radiator, fan and water pump. Engine shall have six (6) cylinders or eight (8) cylinders and a minimum rating of 1.5 HP/KW at its operating speed of 1,800 rpm when corrected to the altitude and temperature conditions of the respective location. Intake and exhaust valves shall be heat resisting alloy steel. Exhaust valve seat inserts shall be provided. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have air cleaners and fuel and oil filters with replaceable elements. Engine speed shall be governed by an electronic governor to maintain automatic isochronous frequency regulation. The engine governing system shall not utilize any exposed operating linkage. Remote 2-wire, starting shall be by a 12-Volt or 24-Volt solenoid shift, electric starter. Engine shall comply with and be certified to U.S. EPA New Source Performance Standards, 40 CFR 60 Subpart III, Tier 3 exhaust emission levels for emergency standby rated engine generator.

C. The engine control panel shall contain an oil pressure gauge, coolant temperature gauge, and battery charger rate ammeter and non-resettable service hour meter.

D. The fuel system shall be integral with the engine. It shall consist of fuel filter, injection pumps, lines, and nozzles. The injection pumps shall obtain fuel from basin fuel tank. The injection pumps shall be driven from the camshaft and simultaneously controlled by a rack and pinion assembly that is hydraulically actuated by signals from the engine governor. The pumps shall be of a variable displacement type to alter the volume of fuel delivered to the spray nozzles according to load demand. The nozzles shall inject fuel directly into the cylinder in the optimum spray pattern for efficient combustion. A manual fuel priming pump shall facilitate priming and bleeding air from the system.

E. Generating set shall contain a complete engine start-stop control which starts engine on closing contact and stops engine on opening contact. A cycle cranking system shall be provided to open the starting circuit if the engine is not started within the selected periods. System shall be set for three (3) cranking periods of fifteen (15) seconds each with fifteen (15) second rest period between cranking periods. All settings shall be adjustable. The engine controls shall also include provisions for remote starting. High engine temperature, low coolant temperature, high coolant temperature, low coolant level, low oil pressure, overcrank and overspeed shutdown with signal light and alarm terminals shall also be provided.

F. Generator shall be four-pole, 2/3 pitch winding, revolving field design with temperature compensated solid-state voltage regulator and Permanent Magnet exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semi-flexible driving flange to insure permanent alignment. The insulation system shall be Class H as defined by NEMA MG1-1.65. The alternator shall have a 125°C Temperature rise at full load for a standby system.

G. Frequency regulation shall not exceed 0.25 percent from no load to rated load for any steady load. Voltage regulation shall be within plus or minus 0.5 percent of rated voltage, from no
load to full rated load. The instantaneous voltage dip shall be less than 26 percent of rated voltage when full, three-phase, load and rated power factor is applied to alternator. Recovery to stable operation shall occur within two (2) seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage. Temperature rise shall be within NEMA MG1-22.40, B5-4999 Part 32 and IEC 34-1.

H. The generator shall include a 600 Amp, 3 pole, 4 wire, 240 VAC, main circuit breaker in a NEMA 1 enclosure with solid neutral ground bar. Circuit breaker enclosure shall include provisions for pad locking the circuit breaker in the “off” position. The generator breaker shall be selected to have an Amp Interrupting Current rating that exceeds the available fault current from the generator. The generator breaker shall be selected and coordinated with the respective automatic transfer switch to maintain the withstand and closing ratings of the respective transfer switch. The generator breaker must be on the transfer switch manufacturer’s approved list to maintain the switch withstand and closing ratings as detailed on the Plans and specified herein. Confirm generator breaker size with the respective engine generator manufacturer. Include legend plates labeled “GENERATOR BREAKER, 240/120 VAC, 3 PHASE, 4 WIRE”.

I. The generator control panel shall contain frequency display; non-resettable running time meter; AC voltmeter display with phase selector, and AC ammeter display with phase selector.

J. The engine jacket water cooling system shall be a closed circuit design with provision for filling, expansion, and de-aeration. The cooling pump shall be driven by the engine. The cooling system shall tolerate at least 25 PSI static head. Coolant recirculation shall begin when generator starts, coolant temperature shall be regulated by thermostat.

K. Engine coolant heat shall be discharged to the atmosphere by means of a unit-mounted radiator.

L. Jacket water heater(s) shall be provided to maintain coolant temperature above 90°F while the engine is idle. Heaters shall be powered at 120 VAC or 240 VAC, single phase, and include thermostatic controls. Hoses to and from the heater shall be industrial quality which exhibit long life in operational environments. Manual shutoff valves shall be incorporated to isolate the heater during servicing, including before and after heater and bleed/vent line.

M. The engine and generator shall be assembled to a common base. The generator set base shall be designed and built to resist deflection, maintain alignment, and minimize resonant linear vibration. The base shall be of heavy duty steel construction with rolled "C" channel structural members reinforced to maintain engine and generator alignment during lifting, installing, and generator operation. Structural side members shall have sufficient bottom mounting holes to locate vibration isolators. Restricted motion steel spring isolators or integral restricted rubber isolation shall be provided between the engine/generator set and its subbase frame or mounting surface. The pads shall be resistant to heat and age, and impervious to oil, water, antifreeze, and cleaning compounds. The base shall incorporate a battery tray with hold-down clamps within the rails.

N. Provide muffler for unit. Muffler shall be "critical" type capable of attenuation of a minimum of 28 dB throughout the range of 60 through 8,000 hertz. Provide seamless stainless steel flexible exhaust tube and rain cap. Exhaust discharge shall be vertical.

O. Batteries for starting and control shall be heavy duty SLI lead acid type with battery cables and connectors. Battery tray shall be located within the frame. Starting batteries shall be rated 12-
Volt DC or 24 Volt DC with a minimum of 180 ampere-hour and 700 CCA. Sizing shall consider specific application requirements of engine oil viscosity, ambient starting temperature, control voltage, overcharging and vibration. Batteries shall be located as close to the starting motor as practical, away from spark sources, in a relatively cool ambient, and permit easy inspection and maintenance.

P. Battery charger shall provide a rated output voltage of plus/minus 1 percent from no load to full load with A.C. variation of plus/minus 10 percent, minimum of 10 ampere output. Unit shall have automatic adjustable float and equalize ranges, overload protection, and automatic d.c. voltage regulation. Unit shall be solid state type employing silicone diode full wave rectifiers and shall have d.c. ammeter and voltmeter. Unit shall have fused input and output and shall be mounted on wall. Alarm circuits per NFPA 110, for low battery voltage, high battery voltage, and battery charger malfunction. Battery charger shall be located inside the engine generator set enclosure.

Q. Provide a weather protective, level 2 quiet, tamperproof, enclosure rated for a maximum of 73 to 75 dBA at 23 feet. Enclosure shall be constructed of reinforced sheet steel, prime coated, and finish painted. Enclosure wind load rating shall be not less than 150 mph. Provide enclosure for engine, generator, control panel, engine safety control, start batteries, battery charger and accessories. Enclosure shall have sufficient louvered openings to allow entrance of outside air for engine and generator cooling at full load. Louvered openings shall be designed to exclude driving rain and snow. Provide properly arranged and sized hinged panels in the enclosure to allow convenient access to engine, generator, and control equipment for maintenance and operation. Provide lockable, hinged panels with spring latches to hold panels closed securely and not allow panels to vibrate. Brace housing internally to prevent excessive vibration when generator set is in operation. All exterior bolts shall be tamper-proof. Enclosure shall be rodent proofed. Provide a GFCI receptacle inside the enclosure for maintenance.

R. Include an emergency stop red mushroom head type push button on the engine generator control panel and a second emergency stop station located remote from the engine generator set per the requirements of NFPA 37. Include all associated control and interface wiring and conduit. Remote emergency stop push button shall be front operated red mushroom knob, with “PUSH EMERGENCY STOP” printed on the knob, maintained contact push pull type with two (2) universal contact blocks (one (1) normally open and one (1) normally closed for each block), with contacts rated 10 Amps at 120 VAC and 125 VDC, Square D, Class 9001, SKR9RO5H2, or equal. Include extra deep push button enclosure rated NEMA 12, Hoffman E1PBX or approved equal. Contractor shall verify push button enclosure is adequately sized for the respective operator and contact blocks. Verify quantity of contact blocks required as detailed on the plans or as recommended by the engine generator set manufacturer. Provide guard for emergency stop push button to prevent accidental activation, Square D Class 9001, Type K56YM, or similar type guard. Include weatherproof engraved phenolic legend plate with red background labeled:

“ENGINE GENERATOR
EMERGENCY STOP
PUSH TO STOP
PULL TO RESET”
S. Radiator Exhaust Duct Adapter. Contractor shall include a radiator exhaust duct adapter as recommended by the respective engine generator set manufacturer, and as required to interface to the respective exhaust air system.

T. The generator set shall be built, tested and shipped by one (1) manufacturer so there is one (1) source of supply and responsibility. The performance of the generating set shall be certified by an independent testing laboratory as to the set's full power rating, stability and voltage and frequency regulation.

U. Acceptable Manufacturers:
   1. Caterpillar
   2. Cummins Power Generation, Inc.
   3. Kohler
   4. Or approved equal.

2.2 FUEL TANK

A. Generator set shall be furnished with sub-base mounted fuel tank, minimum usable fuel capacity to operate the engine generator set at full load for 24 hours. The tank shall be dual wall corrosion resistant steel channel and sheet construction, with all welded seams. The tank shall be manufactured to UL 142 standards and shall be UL 142 listed and bear the UL label on tank. The engine generator set with base mounted tank will be located outdoors. The tank volume shall not be greater than 660 gallons. Where necessary provide a custom size tank to accommodate the available space.

B. The tank shall be installed and anchored within a steel secondary containment basin having a minimum capacity of 100 percent that of the tank. The containment shall be protected against intrusion of debris, falling water. The containment shall be equipped with a leak detector that shall activate the "rupture" alarm described below. A drain with ball valve shall be supplied.

C. Fuel tank shall include float and alarm bell with silence pushbutton to alert the operator when tank is full. Floats shall activate and deactivate the sounding of the bell. Set high level float at 90 percent full. Provide float switch for low and high level remote alarms.

D. Tank accessories shall include liquid level fuel gage, pressure relief vents, foot/check valve and locking gas cap.

E. Tank shall have a rupture basin float switch to activate remote alarm when liquid is sensed in tank containment basin.

F. Provide fill port. Include lockable lid or lockable access and associated fuel piping to accommodate fuel filling.

G. Provide flexible fuel lines and engine supply and return piping and shut off valves.
H. Capacity: Fuel for twenty-four (24) hours continuous operation at 100 percent rated power output. Adjust/increase tank capacity indicated in Item 2.02-A above, if required, to ensure the engine generator set will have a minimum fuel capacity of twenty-four (24) hours' continuous operation at 100 percent rated load.

I. The fuel tank shall be painted in accordance with tank manufacturer recommendations.

J. Contractor is responsible for coordination and assisting with application of permit for the base mounted fuel tank with the Office of the State Fire Marshal.

2.3 CONCRETE

A. Concrete for engine generator pad shall conform to Section 03300 – CAST IN PLACE CONCRETE.

B. Concrete for electrical work shall be composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded from 3/16 to 1 in. The fine and coarse aggregates shall be free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete shall have a compressive strength of 4,500 psi at the age of twenty-eight (28) days. Slump shall not exceed 3 in. Re-tempering of concrete will not be permitted. Exposed, unformed concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than seven (7) days, and concrete made with high early strength portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Architect/Engineer. Air entrain concrete exposed to weather using and air-entraining admixture conforming to ASTM C 260. Air content shall be between 4 and 6 percent.

2.4 REMOTE ANNUNCIATOR PANEL

1. Annunciator panel shall be in accord with NFPA 110, surface mounted and provide as a minimum audible and visual signals for the following:

   a. High Battery Voltage
   b. Low Battery Voltage
   c. Generator Running
   d. Generator on Load
   e. Pre-Low Oil Pressure
   f. Low Oil Pressure
   g. Pre-High Engine/Coolant Temperature
   h. High Engine/Coolant Temperature
   i. Low Engine/Coolant Temperature
   j. Overspeed
   k. Overcrank
1. Control switch not in "Auto" position (This alarm shall also be activated in the event that an emergency stop push button is pressed.)
   m. Battery Charger Malfunction
   n. Low Coolant Level

2. Panel shall contain Silence Switch and Lamp Test Switch.

3. Output alarm contacts shall be provided for the following:
   a. Engine Generator Running
   b. Engine Generator Pre-alarm Condition. This alarm shall be activated for the following conditions:
      (1) High Battery Voltage
      (2) Low Battery Voltage
      (3) Pre-Low Oil Pressure
      (4) Pre-High Engine/Coolant Temperature
      (5) Low Engine/Coolant Temperature
      (6) Battery Charger Malfunction
      (7) Other conditions as recommended by the engine generator rep
   c. Engine Generator Failure Condition. This alarm shall be activated for the following conditions:
      (1) Low oil pressure
      (2) High Engine/Coolant Temperature
      (3) Overspeed
      (4) Overcrank
      (5) Control switch not in "Auto" position
      (6) Any other failure or shut down conditions

2.5 FIRE EXTINGUISHERS

A. Furnish and install two fire extinguishers. Fire extinguishers shall be UL rating of at least 4A:60B:C, 10 pound dry chemical, Amerex Model B456 or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall coordinate the work associated with the engine generator set with the serving electric utility company. The electric utility might require inspection of the standby power system prior to connection the respective electric service.
B. The Contractor shall coordinate and obtain the required permit(s) for engine generator set installation from the local city building/electrical inspector as applicable.

C. All electrical work shall comply with the requirements of NFPA 70 - National Electrical Code (NEC), most current issue in force, and all other applicable local codes, laws, ordinances, and requirements in force. Electrical equipment and materials shall be installed in conformance with the respective manufacturer’s directions and recommendations for the respective application. Any installations which void the UL listing, Intertek Testing Services verification/ETL listing, FM approval (or other third party listing), and/or the manufacturer’s warranty of a device will not be permitted.

D. Contractor shall coordinate work and any power outages with the Owner’s Representative. Any shutdown of existing systems shall be scheduled with and approved by the Owner’s Representative prior to shutdown. Once shut down, the circuits shall be labeled as such to prevent accidental energizing of the respective circuits. All personnel shall follow U.S. Department of Labor Occupational Safety & Health Administration (OSHA) 29 CFR Part 1910 Occupational Safety and Health Standards for electrical safety and lockout/tagout procedures including, but not limited to, 29 CFR section 1910.147 The Control of Hazardous Energy (lockout/tagout).

E. Contractor shall comply with the applicable requirements of NFPA 70E – Standard for Electrical Safety in the Workplace.

F. Contractor shall install unit to conform to manufacturers written installation requirements and in accord with NFPA 30, 37, 70, 110 and all applicable local codes.

G. Maintain 10 feet minimum separation between the engine generator fuel tank and combustible materials.

H. Base mounted fuel tank and fill supply piping shall be installed in accordance with manufacturer's written instructions and in accord with applicable referenced standards, code and ordinances.

I. The engine exhaust system shall be installed to discharge combustion gases quickly and silently with minimum restriction. System including silencer shall be designed for minimum restriction and, in no case, shall back pressure exceed 29 in. H2O.

J. Generator set shall be shimmed and leveled and bolted to concrete base.

K. Concrete work shall conform to the requirements of these specifications and as detailed on the Plans.

L. All final conduit connections to the engine generator set shall be with UL listed liquid tight flexible metal conduit. Liquid-tight, flexible metal conduit and associated fittings shall be UL-listed to meet the requirements of NEC 350.6. Do not install liquid-tight, flexible metal conduit that is not UL listed. Contractor shall confirm liquid-tight, flexible metal conduit bears the UL label prior to installation.

M. Bond the engine generator set frame, battery support rack, and the base mounted fuel tank to the building grounding electrode system as detailed on the Plans.
N. Provide start-up services as recommended by manufacturer, including but not limited to, fill coolant system with anti-freeze solution for freeze protection to -20°F, all oil reservoirs filled, fuel system filled and checked.

O. Demonstrate at site in presence of Owner full functional capability under manual and automatic modes of operation. Perform a full load test using building load and resistive load banks to provide 100 percent specified KW rating for a four (4) hour test period. Correct all defects that occur during load testing. Contractor shall notify the Owner a minimum of seven (7) days prior to conducting test:

1. Test the operation of the unit at 100 percent full load rating for four (4) hours.

2. After the first half-hour operation and at 100 percent full load, record the following:
   Voltage and amperage (3-phase), frequency, fuel pressure, oil pressure, water temperature, and exhaust gas temperature at engine exhaust outlet.

3. Include cost of fuel for testing and fill engine generator fuel tank to normal full level upon completion of testing.

P. Contractor shall fill the fuel tank and system with No. 2 diesel fuel meeting manufacturer’s recommendations as part of this contract.

Q. Clean interior of engine generator set.

R. Include the services of the manufacturer’s representative to check final connections, inspect the installation, and supervise start-up and testing of the system.

S. Instruct Owner's personnel on the complete operation and maintenance of system:

1. Instruction shall consist of minimum two (2), two (2) hour sessions.

2. Contractor shall notify the Owner a minimum of seven (7) days prior to conducting instruction sessions.

END OF SECTION 16620
BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum:

**BID SCHEDULE**

NOTE: BIDS shall include sales tax and all other applicable taxes and fees.

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**BASE BID SUBTOTAL**

**ALTERNATE A DEDUCTS - ELIMINATION OF CHATEAU ESTATES LIFT STATION**

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**ALTERNATE A DEDUCT SUBTOTAL**

**ALTERNATE B DEDUCTS - ELIMINATION OF THE RESTROOM BUILDING**

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**ALTERNATE B DEDUCT SUBTOTAL**
Bidder's Proposal for making entire improvement, Base Bid .................................$_________________
Bidder’s Proposal for making entire improvement, Base Bid plus Alternate A............$_________________
Bidder’s Proposal for making entire improvement, Base Bid plus Alternate B ..........$_________________
Bidder’s Proposal for making entire improvement, Base Bid plus Alternate A and B $_________________

Bidder is currently certified as an MBE or WBE under EPA’s DBE Program?  Yes ___ No ____

Respectfully submitted:

______________________________________________
Signature  Address

______________________________________________
Title  Date

______________________________________________
Telephone #  E-mail Address

(SEAL - if BID is by a corporation)

Attest  ____________________________________________