1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Contractor provide:

a. Pumps, motors, controls, fittings, accessories, and electrical apparatus necessary to build the pump stations as shown on the plans and specified herein.
b. Pump station tests.
c. Electrical power connection to pumps, float switches and control panel.
d. Demolition and modification of existing station.
e. Electric meter socket, disconnect switch, service pole and electrical feeders from service pole to control panel.

1.2. QUALITY ASSURANCE

A. The manufacturer furnishing the pumping equipment shall certify that all of the equipment and materials proposed meet or exceed the requirements as specified. The pumps shall be factory tested under the specified operating conditions in accordance with the Hydraulic Institute and factory certified pump test curves shall be provided for each pump.

B. The pump manufacturer shall warrant the pumps being supplied to the Owner against defects in workmanship and materials on a progressive schedule of costs for a period of five years under normal use, operation, and service. The warranty shall be published.

C. Field Supervision: The service of a factory trained, qualified representative shall be provided for one full day minimum, to inspect the completed installation, make all adjustment necessary to place the system in trouble-free operation and instruct the Owner's operating personnel in the proper care and operation of the equipment.

D. All motors and other electrical equipment associated with the pumping station wet well shall be suitable for operation within a Class I, Division I, Group D, environment in accordance with the National Electrical Code (N.E.C.) regulations and requirements.

E. All pumps shall be made by the same manufacturer.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle all equipment, components, and assemblies in a manner to prevent damage. Store off the ground in a clean dry area.

B. All damaged, broken or otherwise defective materials will be rejected.

C. Keep all separate components in the manufacturer's shipping crates or packages with name, brand and all other applicable data plainly marked thereon.

1.4 SUBMITTALS

A. Make submittals in accordance with Specification Section 01340.

B. Submit shop drawings and product data for:

1. Pumps, including factory certified curves.
2. Pumping station controls and electrical diagrams.
3. Manufacturer's installation instructions.

C. Submit start-up reports in accordance with manufacturer's guidelines.

D. Two (2) copies of Operation and Maintenance Manuals for all pumping station equipment and accessories.

1. Manufacturer's operating and maintenance instructions.
2. Parts list.
3. Bound together in a book or folder with complete index.
4. Warranties.

2. PRODUCTS

2.1 SUBMERSIBLE PUMPS

A. General

1. Furnish and install submersible non-clog wastewater pumps capable of handling raw, unscreened sewage. Pumps shall be capable of passing a minimum 3-inch diameter deformable solid. Each pump shall be equipped with a submersible electric motor connected with submersible cable suitable for submersible pump applications.
2. There shall be no need for operating personnel to enter the wetwell.
3. Each pump shall be supplied with a mating cast iron discharge connection.
4. Each pump shall be fitted with sufficient length of stainless steel cable for lifting. The working load of the lifting system shall be 50% greater than the pump unit weight.
5. The units shall be suitable for operation within a Class I, Division I, Group D, environment in accordance with NEC requirements.
6. Pumps to be manufactured by Flygt, or equal.

B. Pump station characteristics for each location shall be as follows:

1. Pump Station Location: Beachland (5651 Lake Drive)

a.	Number of Pumps:	2
b.	Capacity (GPM @ TDH):	109 gpm @ 11.8’ TDH
c.	Electrical Requirements:	240 VACS, 3 Phase, 4 Wire

d. Design Basis: Flygt Concertor N100-700, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

2. Pump Station Location: 63rd & Laura (339 N. 63rd Street)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 125 gpm @ 15.0' TDH
c. Electrical Requirements: 240 VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-950, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

3. Pump Station Location: 71st & Ames (7101 Ames Drive)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 162 gpm @ 13.5' TDH
c. Electrical Requirements: 240 VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-900, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

4. Pump Station Location: 73rd Street (490 N. 73rd Street)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 182 gpm @ 9.5' TDH
c. Electrical Requirements: 240 VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-700, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

5. Pump Station Location: 73rd & Oakland (456 N. 73rd Street - Rear)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 342 gpm @ 9.8' TDH
c. Electrical Requirements: 240 VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-1100, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System

f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

6. Pump Station Location: 75th & Pershing (100 N. 75th Street)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 94 gpm @ 9.6' TDH
c. Electrical Requirements: 240 VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-550, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

7. Pump Station Location: Willie Holmes Pill Box (6951 Ames Drive)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 100 gpm @ 12.5' TDH
c. Electrical Requirements: 240 VAC, 1 Phase, 3 Wire
d. Design Basis: Flygt Concertor N100-750, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

8. Pump Station Location: Lake Drive Pill Box (7100 Park Place - Rear)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): 100 gpm @ 12.2' TDH
c. Electrical Requirements: 240 VAC, 1 Phase, 3 Wire
d. Design Basis: Flygt Concertor N100-750, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

9. Pump Station Location: Cooper Drive (1001 Camp Jackson Road)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

10. Pump Station Location: LaSalle (617 Range Lane)

    a. Number of Pumps: 2
    b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
    c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
    d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
    e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
    f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

11. Pump Station Location: Williams & Ellen (1201 Williams Street)

    a. Number of Pumps: 2
    b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
    c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
    d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
    e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
    f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

12. Pump Station Location: Williams & Kay (1227 Williams Street)

    a. Number of Pumps: 2
    b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
    c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
    d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
    e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
    f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

13. Pump Station Location: Ellen & Richard (1202 Richard Drive)

    a. Number of Pumps: 2
    b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
    c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
    d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
    e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
    f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

14. Pump Station Location: Hutchings Street (215 Hutchings Drive)

    a. Number of Pumps: 2
    b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH

c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

15. Pump Station Location: Donald Street (210 Donald Street)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

16. Pump Station Location: Miskell Blvd. (222 Miskell Boulevard)

a. Number of Pumps: 2
b. Capacity (GPM @ TDH): xxx gpm @ xx.x' TDH
c. Electrical Requirements: xxx VAC, 3 Phase, 4 Wire
d. Design Basis: Flygt Concertor N100-xxxx, Explosion Proof, 5.5 HP, 200 mm Adaptive Impeller, 50' SUBCAB Power Cable
e. Primary Control: Flygt Nexicon - Modular Programmable Pump Control System
f. Backup Control: MTR3/MTRA3 Relay Logic Control with Submersible Probe

C. Pump Design

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by stainless steel guide bars extending from the top of the station to the discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

D. Pump Construction

1. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of two-part oxirane-ester Duasolid 50. The total thickness shall be at least 120 microns. A zinc dust primer shall not be considered equal.

2. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
3. No secondary sealing compounds, grease or other devices shall be used.

E. Cooling System

1. Each unit shall be provided with an adequately designed cooling system to provide for continuous pump operation with liquid temperature of up to 104 Degrees F and submergence only enough to maintain a flooded impeller. Restrictions below this temperature are not acceptable.

F. Cable Entry Seal

1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The assembly shall provide ease of changing the cable when necessary.

G. Motor

1. The pump, the motor and the integrated control system shall be submersible a minimum of 65 feet (20m) according IEC 60034 and protection class IP 68. Motors which only can be submerged for a limited time (IP 67) shall not be considered as equal. The motor shall be capable to operate the pump at continuous duty (S1) in an ambient temperature up to 104°F. Operational restrictions or the demand of auxiliary cooling systems like fans or blowers are not acceptable.
2. The pump shall be operated by a synchronous motor and an integrated control system and be capable to run at constant power at any point of the performance field without being overloaded. Motor shall utilize a permanent magnet rotor to maintain synchronous speed.
3. An integrated pump control system installed in the pump/motor housing shall start the pump by gradually increasing the pump speed. The starting current shall not be higher than the rated current.
4. An integrated pump control system installed in the pump/motor housing shall secure that the direction of the impeller rotation is always correct. There shall be no need for any human intervention to ensure that the impeller is rotating in the correct direction within the volute. The integrated control system shall be inside the motor and encapsulated to protect it against moisture ingress, and vibration.
5. The motor and the pump control system shall receive sufficient cooling from the pumped liquid to operate the pump at continuous duty in a liquid with a temperature with 104°F. Operational restrictions on the liquid temperature below 104°F or the demand of auxiliary cooling systems like fans or blowers are not acceptable. The Stator shall be inverter duty rated in accordance with NEMA MG1, Part 31 and be insulated according class H (356°F).
6. Motor, pump, and control system shall be designed and supplied by the pump manufacturer.

7. The control system shall continuously monitor the leakage sensor in the stator housing and the temperature of the motor. It shall be impossible to overload the motor. If the motor temperature is too high, the pump shall continue to operate at reduced power until conditions are normalized. External trips or overload devices for motor protection shall not be required.
8. The operator shall be able to modify the setting of the control system to decide if the active leakage signal shall stop or not stop the pump.
9. The pump shall incorporate a “pump-cleaning” function to remove debris from the impeller. The cleaning function shall be initiated when the integral control system senses an increase in current draw due to debris in the pump. The cleaning function shall consist of forced stopping, reversal and forward runs timed to allow for debris to fall from the impeller. After the cleaning cycle is complete, the pump shall resume to automatic operation. If the pump impeller/volute does not clear itself after the programmed number of attempts, the control shall initiate an alarm to notify that the pump inlet / volute is blocked by large debris.
10. It shall be possible to access and adjust the pump system with a Human Machine Interface (HMI) ranging from basic monochrome displays to full-color touch screen units and smartphone or tablet. It shall enable the operator to view and control entire pump system and logged operational data like number of starts, avoided clogging instances, pump run-time, motor power, motor current, power factor, temperature, pump leakage etc.
11. The motor shall be designed for continuous duty handling pumped media or in an air-cooled environment of 40°C (104°F) and capable of up to 60 evenly spaced starts per hour. Thermal switches set to open at approximately 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding.
12. The combined service factor (combined effect of voltage, frequency, and specific gravity) shall be a minimum of 0.15. The motor shall be capable of operating at full design capacity within a voltage range of 380 VAC to 480 VAC, 50 Hz or 60 Hz. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting current and torque.
13. The motor shall be able to operate dry without damage while pumping under load. The motor shall be cooled by contact of the pump media with the outboard side of the oil housing. An internal circulation of coolant shall transfer the heat generated by the stator to the oil housing – media interface. Coolant shall be environmentally safe and non-toxic.
14. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the control panel without the need of any splices. The outer jacket of the cable shall be oil resistant. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

H. Bearings

1. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall compensate for axial thrust and radial forces. Single row lower bearings are not acceptable. The minimum L10

bearing life shall be 50,000 hours at any useable portion of the pump performance field.

I. Mechanical Seal

1. Each pump shall be provided with mechanical shaft seals. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The outer seal shall consist of one stationary and one rotating element, both faces to be tungsten carbide WCCR (TC/TC). The inner seal shall consist of one stationary and one rotating element, both faces to be tungsten carbide WCCR (TC/TC).
2. The motor shall be able to operate dry without damage while pumping under load.
3. Seal lubricant shall be FDA Approved, non-toxic.

J. Impeller

1. The impeller and insert ring shall be of A-532 Alloy III A (25% chrome), dynamically balanced, with self-cleaning vanes upon each rotation across a sharp relief groove in the insert ring. This in conjunction with a horizontal leading edge shall keep the impeller free of debris. The insert ring shall have a guide pin which moves fibers from the center of the inlet to the edges of the impeller. The impeller shall be able of moving axially upwards to allow larger debris to pass through and immediately return to normal position. The clearance between the impeller edges and the insert ring shall be field adjustable. The impeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in wastewater. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller shall be capable of passing a minimum 3-inch diameter deformable solid. All impellers shall be coated with a factory applied spray coating of two-part oxirane-ester Duasolid 50. The total thickness shall be at least 120 microns. A zinc dust primer shall not be considered equal.

K. Volute

1. Pump volute shall be single-piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

L. Guarantee

1. In addition to the manufacturer's warranty, the Contractor shall guarantee for one year from the date of final acceptance that the station and all equipment will be free from defects in design, materials, and workmanship, and shall furnish immediate replacement parts for any component proven defective during the guarantee period.

2.2 ELECTRICAL WORK

A. General

1. The Contractor shall provide all labor, materials, equipment, and services necessary for the construction of complete electrical system for the pumping station.

B. Regulations and Code Requirements

1. All work shall conform to the requirements of the latest editions of the following codes, regulations, and specifications:

   a. Local Electric Company.
   b. National Electrical Code.
   c. National Electrical Manufacturer's Association.
   d. Underwriter's Laboratories, Inc.
   e. Applicable Building Codes.

2. In addition, all work shall be installed in accordance with the requirements of all local codes and regulations of authorities having jurisdiction over this work.

C. Material and Equipment

1. Materials and equipment installed as a part of the permanent installation shall be new and be approved by the Underwriters' Laboratories, Inc., for installation on each particular case where standards have been established.
2. Any item substituted for that specified shall be equal or better in quality, capacity, and performance, and be suitable for the available space and required arrangement. It shall be the responsibility of the Contractor to furnish any and all data that the Engineer may require for him to determine the suitability of any substituted item. The acceptance by the Engineer of any item shall not relieve the Contractor of his responsibility for compliance with the specific requirements of the Contract Drawings and Specification.

D. Tests

1. The Contractor shall provide all equipment, instruments, and power necessary for testing the complete wiring systems during the progress of the work and after installation. The tests shall demonstrate to the satisfaction of the Engineer, the following:

   a. That all power and control circuits are continuous and free from short circuits.
   b. That all circuits are free from unspecified grounds.

2. Any defects shall be repaired at once, and the test repeated at the Contractor's expense.

E. Guarantee

1. The Contractor shall guarantee the complete electrical system installation, as embraced by this specification; free from all mechanical and electrical

defects for the period of one (1) year beginning from the date of final acceptance of the installation.

F. Control Panel

1. Electrical control equipment shall be free standing as detailed on the drawings within a single NEMA Type 4X enclosure, fabricated of 304 stainless steel, painted white, and provided with a heavy door having a stainless steel handle and suitable latching and locking devices and an inner hinged dead front panel. All components, devices, etc., shall be labeled using engraved lamicoid nameplates mounted with screws and a color coded wiring diagram shall be provided. The panel shall be furnished with a condensation heater (200 watt minimum) and adjustable thermostat. Pilot lights shall be provided for all running conditions and alarms. All cabinet penetrations shall be through the bottom except for the alarm light and generator receptacle.
2. On the inside door of the control panel shall be located the circuit breaker handles, the Hand-Off-Automatic selector switches, elapsed time meters, and indicating lights for each pump.
3. An elapsed time meter of the odometer type that records the time each pump unless otherwise directed by the Owner. The meters shall be similar in every respect to the Westinghouse Elapsed Time Meter Type BH-351, without reset knob.
4. A power convenience outlet shall be provided within the Control Panel for operation of portable equipment such as electrical hoist, drop lights, or other equipment and tools as may be necessary. A 120V control circuit with disconnect circuit breaker overload protection and properly sized transformer shall be included for operation of control circuit, convenience outlet and sump pump.

5. Station Control:

    a. Primary Controller - Flygt Nexicon

        1) The pump station controller shall consist of a modular system of components where each module is configured to control specific equipment. New modules shall be able to added the initial set without compromise of the operational functionality.
        2) The pump station controller shall be pre-programmed with advanced pumping functions.
        3) The pump station controller shall be provided with pre-programmed support for water level measurement from analog level sensors, digital level switches or conductive probe with the optional Probe Module (XLM 411).
        4) The pump station controller shall be provided with a CODESYS license to allow programming if additional functions are needed. CODESYS WebVisu shall be provided as a part of the license to allow creation of custom screens on the HMI.
        5) The pump station controller shall be able to be used on any manufactures VFDs and or pumps.

6) The pump station controller shall be able to communicate via IEC 60870-5-104, DNP3 and Modbus protocols.

7) The pump station controller shall be able to upgraded in the field via a USB drive connected to the application manager.

8) General Features:

i. Modular system up managing up to 4 pumps, Concertor (integrated VFD), DOL (direct-on-line), and VFD controlled pumps.
ii. Easy commissioning thanks to the set-up wizard.
iii. Regional settings (language, units, date and time) selectable via the HMI.
iv. User administration: four access levels with different rights and password.
v. Possibility to export the system configuration at any time via USB or SD card.
vi. Software update via USB drive connected to the application manager.
vii. Local and remote control with automatic logout after 5 hours.
viii. Application manager provides configurable I/O's.
ix. Additional I/O's can be achieved with Digital/Analog I/O modules.
x. Water level can be monitored by either analog level sensor, digital float switches or conductive probe.
xi. Real time clock with battery backup.
xii. Cybersecurity certified according to IEC62443-4-1 ML2.
xiii. Programmable in CODESYS environment (IEC61131-3).
xiv. Customizable user interface with CODESYS WebVisu.
xv. Service notifications based on calendar or run time.
xvi. Alarms and fault management by priority, with alarm log.
xvii. Possibility to connect external backup battery for the system.
xviii. Alarm types: system, configuration, station, module, machine, FPM 711, and CODESYS.
xix. Personnel alarm for additional safety of operators on-site.

9) System Monitoring:

i. Level devices management.
ii. Flow and volume calculation.
iii. Overflow detection and overflow calculation.
iv. Energy consumption and specific energy calculation.
v. Event log.

10) Pump Control Functions:

i. Start and stop: Start and stop signal priority/ Pump running feedback.
ii. Maximum number of pumps to run.
iii. Pump alternation.
iv. Stop delay between pumps.
v. High inflow control.
vi. Overflow protection.
vii. Single pump control relay.
viii. Maintenance run.
ix. Dual wells
x. Custom alternation order.
xi. Add/remove pumps from the pumping cycle.
xii. Pump start/stop delay.
xiii. Maximum duration of the pumping cycle.

11) Pump Protection:

i. Dry-run protection.
ii. Leakage or overheating protection.
iii. Motor protection.
iv. Maximum run time.

12) Cleaning functions including:

i. Wet well clean out and pipe cleaning.
ii. Grease stripe minimization.

13) FPM 711 (Concertor module) & FPM 611 (VFD module) additional functions:

i. Set power, set speed, and displayed current.
ii. Automatic start when the power is turned on.
iii. Soft start and stop.
iv. Energy minimizer.
v. Pipe flushing at pump cycle start.

14) FPM 711 (Concertor module) additional functions:

i. Automatic pump cleaning.
ii. Pump blockage.
iii. Time-based pump cleaning.

15) Cybersecurity features including:

i. Identification and Auth control (IAC) & Use control (UC)

- Mandatory change password on first login
- Strong passwords required (unless override)

- 4 different roles with different privileges
    - Level 1: Default observer (no login required)
    - Level 2: Operator (observer + start/stop + ACK alarms; logged out after 300 minutes of inactive)
    - Level 3: Engineer (operator + change settings)
    - Level 4: Administrator (engineer + administration of accounts, settings; logged out after 10 min inactivity)
- Timeout after multiple password failures
- No restricted data available through RTU interface
- Access data logged
- Credentials and access processes protected

ii. System Integrity (SI) & Data confidentiality (DC)

- Signed firmware
- Secure software update mechanism
- Resilient boot process
- Modern OS and non-deprecated function decrease buffer overflow and memory issues
- Upgrades & failed validations are logged
- Strong encryption algorithms
- Input validation on all data received before usage
- Crypto certificate for device identity

iii. Restricted data flow (RDF), Timely response to events (TRE), & Resource availability (RA)

- Logs are persistent and protected for troubleshooting and analysis
- Logs restricted to elevated roles
- Logs can be exported for forensics/troubleshoot
- Ports and protocols disabled by default (secure by default)
- Extensive testing on communication
- Watchdog timers to improve resilience and decrease unresponsiveness
- Backup to SD card or USB
- VPN capable

16) User interface

i. Pump and well information.
ii. Alarms: Active alarms and alarm log.

iii. System overview: Information about the installed modules.
iv. History: Station statistics and event logs.
v. CODESYS: Overview of the CODESYS parameters.
vi. Settings: The settings for the system, station, pumps, alarms, I/O, communication, and CODESYS.
vii. USB options: The options that are available when a USB drive is connected.

- Software update
- Import or export of files
- Backup or restoration of the system configuration

viii. User level: The current user level and the option to sign in at another user level.
ix. Pump information: Pump status, run status, control source, and operating data.
x. Tabs: option to switch between the different tabs.

- Pump information
- Station information
- WebVisu

xi. Local mode: The HMI is used to send commands and change configuration parameters. No external control system can command or change configuration parameters.
xii. Remote mode: An external control system such as SCADA is used to send commands and change configuration parameters. The HMI cannot command or change configuration parameters.
Limited HMI: A remote HMI that is connected to the application manager is used to monitor the statistics and parameters. It is not possible to command or change configuration parameters.
xiii. Start or stop the pumping cycle.
xiv. Wet well information: Indication of liquid level, overflow, or measurement.

Power supply	24V
Interface	2* RS 485 - USB - Ethernet (IPv4)
Protocols	- Modbus TCP/IP and RTU • DNP3 • IEC-104 (IEC 60870–5-104)
Ambient temp.	-20°C +60°C/(-4F -+ 140F)
Enclosure	IP20

Certificates	CE, UL, CSA, RCM, UKCA	
Cybersecurity	IEC 62443-4-1	
		Dimensions mm/*in* (WxHxL)
Application manager	• 2 Analogue Inputs (configurable) • 4 Digital Outputs(configurable) • 6 Digital Inputs (configurable)	107x120x60 *4.2x4.7x1.2*
Digital I/O	• 4 digital outputs (configurable) • 6 digital inputs (configurable)	107x120x30 *4.2x4.7x1.2*
Analogue I/O	• 4 analog outputs (configurable) • 4 analog inputs (configurable)	107x120x30 *4.2x4.7x1.2*
DOL pump module	• 1 analogue input (dedicated) , • 2 digital outputs(dedicated) • Pump interface (leakage/temperature) • 5 digital inputs	107x120x30 *4.2x4.7x1.2*
Concertor module	• 1 analog input (dedicated), • 3 digital outputs (dedicated) • Machine interface (leakage/ temperature / pump communication) • 3 digital inputs	107x120x30 *4.2x4.7x1.2*
VFD module	• 1 analog input (dedicated) • 1 analog output (dedicated) • 4 digital inputs (dedicated) • 3 digital outputs (dedicated) • 1 digital output reserved for further use • Pump interface (leakage/temperature)	107x120x30 *4.2x4.7x1.2*
Backplane supply module	• 24V input/24 V 1A output. • 12 V battery connector (battery not provided) • 2 ethernet ports dedicated to HMI	107x120x30 *4.2x4.7x1.2*
Probe module	• 10 probe inputs • 2 analogue inputs (dedicated) • 1 digital output (dedicated)	107x120x30 *4.2x4.7x1.2*
5 slots backplane	Fully populated	117x120x180 *4.6x4.7x7*

b. Back-Up Controller

1) MTR3/MTRA3 Relay Logic Control shall consist of the following:

i. Features and Functions:

- 120 VAC Control Power
- DIN Rail or Screw Mounted
- Pump-Up or Pump-Down Programmable
- Green LED Power Indication
- Red LED Relay Active Indication

- One NO Dry Contact Output
- One NC Dry Contact Output
- One Alarm Output (MTRA3)
- Sensitivity DIP Switches (2K, 4K, 20K, 80K)
- Time Delay DIP Switches (2.5, 5, 10, 20, 40, 80, 160 Second)

ii. MTIC3 - LED Level Indicator
iii. MTISB10 - Intrinsically Safe Relay

G. Level Control (Wet Well)

1. The level control system shall provide a wet well level-responsive automatic pump control system to provide for pump-down operation and high water alarm annunciation in the wet. The system shall consist of a submersible level sensor probe AND a submersible pressure transducer in the wet well. The same controller shall be capable of accepting either method without any alterations or additions.
2. Submersible Level Sensor Probe:

a. The probe shall be constructed from uPVC 1.25-inch tubing with molded sensor units at regular intervals along the probe. Each sensor unit will be PVC injected to prohibit ingress of moisture, and the sensor material will be Avesta SMO254 stainless steel.
b. An MTIC-3 shall be provided to indicate a visual representation of the liquid level in the well.
c. The probe will be mounted in a turbulent area of the wet well, suspended on its own cable and connected to a 6mm stainless steel hook which would hang from a 1.25-inch stainless steel angle containing a polyurethane squeegee pad positioned in the opening into the wet well, so that the probe can be removed without entering the wet well.
d. The squeegee will have a 1.2-inch hole and slot, enabling the probe to be pulled through and cleaned.
e. The probe cable shall be run in a separate conduit away from any high voltage cables.
f. Ten sensors will be spaced along the length of the probe assembly, and each will be individually connected to a correspondingly numbered PVC/PVC flexible cable. The sensor unit will contain 2 sensors mounted on opposite sides of sensor unit.
g. The probe shall be pressure injected with an epoxy resin to encapsulate all internal components and connections to form a rigid, homogenous unit.
h. Each sensor unit containing the 2 sensors will be rotated 90 degrees to the previous sensor unit to eliminate tracking between sensors.
i. The cable will be encoded with number and text along the entirety of the cable and at intervals not greater than 8 inches for identification. This cable will be dark blue in color, with the cores light blue.
j. The flexible cables shall be capable of supporting the weight of the probe and cable, without the need for additional support. The cable

shall be secured to the top of the probe by a synthetic rubber compression fitting.

3. Submersible Pressure Transducer:

a. The submersible pressure transducer shall be MJK Expert 3400 and shall be designed for use in wastewater lift station wet wells.
b. The transducer shall have a built-In breather tube for direct air pressure compensation.
c. The transducer shall have an accuracy of +/- 0.1% with long term stability.
d. The transducer shall have a Ceramic Diaphragm and PPS Body, and be suitable for applications in rough environments with aggressive chemicals and fluids.
e. The transducer shall be 2-wire, 4-20mA loop powered, 10-30V DC.
f. The transducer shall have built-in surge resistance.
g. The transducer shall be field re-programmable for custom ranges and zero offset calibration.
h. The transducer shall have a steel reinforced PUR cable with high tensile strength.
i. The Measuring Range shall be project specific.

H. High Water Audible & Visual Alarm: A high water alarm light shall be mounted through the side of the enclosure and shall not violate the integrity of the NEMA 4X rating. The alarm light shall be the flashing red type capable of operating on 12V DC power in normal conditions and battery power in emergencies. An audible alarm (as described above) shall be mounted in the deadfront panel. Provide a gelled electrolytic battery and charger, 12V DC, capable of operating the alarm for at least four hours.

I. Lightning Arrester: A 3-phase lightning arrester shall be installed at the main incoming lugs. The arrester shall be protected per the manufacturer's recommendations.

2.3 ACCESSORIES

A. A pressure gauge with 0-40 psi scale shall be installed on each pump discharge piping of the pump station, as shown on the plans. Also provide valve cock to allow removal of pressure gauge during pump operation.

B. Valve Vault Sump Pump

1. The sump pump shall be submersible type with a capacity of 30 gpm at 10 ft. TDH for 110 Volt, 1-phase electrical service. The submersible motor shall be constructed with open windings and shall operate in clean dielectric oil for cooling and bearing lubrication. The motor shaft shall be sealed with mechanical shaft seal, having lapped seal rings of carbon and ceramic. The integral motor and pump shaft shall be stainless steel. Pump and motor housing shall be cast iron. Impeller shall be cast iron of the non-clog type. No suction strainers or screens are to be used. All fasteners shall be 18-8 stainless steel. The pump shall have oil isolated diaphragm-type level control switch to control sump water level. Sump water shall not

come in contact with pressure diaphragm switch inside of control. The switch shall be set to operate at 8-inch water depth.

3. EXECUTION

3.1 INSTALLATION

A. Pumps and controls shall be installed in accordance with these specifications, the manufacturer's recommendations, and as shown on the plans. All pumps shall be mounted, aligned, and installed level.

3.2 FINAL PUMPING STATION TEST

A. The Contractor shall provide a sufficient quantity of water and perform a full operational wet test of the pumping station operation after installation.

B. Test shall not begin until the force main piping and gravity sewer mains have been tested and approved for service.

C. Inspection shall be made for leaks in all piping or seals, and for correct operation and adjustment of all equipment including the automatic control systems, both primary and emergency alarm systems, to start and stop the pumps at the levels as shown on the drawings, and proper cycling and performance of the pumps.

D. The wet test shall be continuously performed until the Engineer and the manufacturer's representative are fully satisfied that the wet well levels, cycling of the pumps, all automatic controls, and equipment are in proper adjustment and in full operational order.

END 11310.