

SEWER LIFT STATION

SPECIFICATIONS

**ST. CHARLES COUNTY
PUBLIC WATER SUPPLY DISTRICT
NO. 2**

**100 WATER DRIVE
P.O. BOX 967
O'FALLON, MISSOURI 63368**

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SECTION 1 – MATERIALS OF CONSTRUCTION

1. GENERAL

Lift stations shall consist of a wet well, submersible pumps, dry valve vault, control panel and other related accessories. The lift stations shall conform to MDNR Design Guide per 10 CSR 20.8.130. Design calculations of maximum flow shall be submitted with detailed specifications and flows shall be determined in accordance with the requirements of MDNR Design Guide per 10 CSR 10.8.120. All stations shall contain at least two (2) pumps, each with 100% design capacity.

2. WET WELL

The wet well shall consist of a circular basin, minimum 7 feet in diameter and minimum 10 feet in depth. The wet well shall be constructed of reinforced concrete and have walls designed to withstand the external earth loadings when the wet well is empty. The wet well shall have a reinforced concrete bottom and top, with access hatch. The base of the wet well shall be grouted at the joints on the inside at a 1:1 slope to prevent the accumulation of solids. All pipe openings for flow into and out of the wet well shall have the pipes grouted in place, inside and outside with non-shrink grout.

The wet well shall contain stainless steel guide rails for the pumps, securely fastened at the top opening of the wet well to allow the pumps to accurately mate with the pump bases, which shall be secured to the bottom with stainless steel bolts.

All joints in the wet well shall be sealed with a sealant material in compliance with Federal Specification SS-S-00210. The entire wet well shall be sealed on the outside with a two part urethane asphalt applied to provide a dry film thickness of 20 mils.

The pump bases shall be as specified by the pump manufacturer and have minimum 4” ductile iron (Class 200) discharge pipes, which run through the valve vault. There shall be provided stainless steel lifting chains and floats for control of the pumps as called for hereinafter and as recommended by the pump manufacturer. Floats shall be provided for the control of the pumps and alarms, and floats shall be located such that they are not affected by incoming flow.

The wet well shall have a 3” minimum diameter ductile iron or stainless steel air vent extending through the top slab with a 180 degree turn sealed by an approved insect screen. There shall be a stainless steel or aluminum trash basket located at the inlet pipe with a stainless steel lifting chain to provide for periodic removal and cleaning.

Access to the wet well shall be through an aluminum hatch, rated for a 300 pound load, Halliday R2R or approved equal. The top elevation of the wet well shall be 12” higher than the

surrounding ground and the grades around the wet well shall be such that all runoff will be diverted away from the top. The hatch frame and cover shall be flush with the top of the concrete complete with hinges and flush locking mechanism, upper guide holder and level sensor cable holder. Doors shall open and automatically lock with stainless steel “hold open” arm with aluminum release handles.

Human access to the wet well will not normally be required but steps shall be provided, embedded in the wall of the wet well at 16” vertical spacing and the steps shall be the polypropylene plastic type as manufactured by M.A Industries or approved equal.

3. PUMPS AND MOTORS

The pump and motor units shall be the submersible type to deliver the design flow through minimum 4” discharge force mains. The pumps shall be capable of passing spheres of at least 3” in diameter and shall be driven by 3 phase, 460 volt, 60 Hz. motors. The units shall be as manufactured by Flygt, Fairbanks Morse, ABS or approved equal. No grinder pumps will be allowed.

The discharge connection elbows shall be permanently installed in the wet well and the pumps shall be automatically connected to the discharge connection when lowered into place and shall be easily removed for inspection or service by means of stainless steel lifting chains. There shall be no need for personnel to enter the wet well.

Major pump components shall be gray cast iron, Class 30, with smooth surfaces devoid of blowholes or other irregularities. Thermal sensors shall be used to monitor stator temperatures and specialized relays/sensors shall be supplied to the control panel manufacturer prior to panel construction. Impellers shall be of gray cast iron, Class 30, dynamically balanced, single or double shrouded non clogging design, with stainless steels shafts, and be capable of handling solids, fibrous materials, heavy sludge and be capable of passing a sold 3” diameter sphere.

4. VALVE VAULT

The valve vault for each lift station shall be a poured concrete or pre-cast box with an approved aluminum access hatch and steps, the same as for the wet well. The valve vault shall contain two 4” (min.) discharge lines from the pumps and each line shall have a horizontal swing check valve with an outside rotating arm indicator and a gate valve with a hand wheel operator. All piping and all fittings shall be flanged ductile iron and all piping shall be properly supported. In one of the discharge lines there shall be a tee and valve and a “cam lock” connection for emergency pumping to a tank truck. Immediately beyond the valve vault, there shall be two 90 degree bends to bring the piping to a tee and then to the force main with a valve immediately beyond the tee, with a valve box for operation from the ground surface. There shall be provided a

minimum 2" schedule 40 PVC drain pipe from the valve vault to the wet well and the floor of the valve vault shall be grouted to provide a slope to the drain line.

5. CONTROL PANELS AND ELECTRICAL

A. General - Description of Work

The Contractor shall provide and install all hardware, software, labor, materials, and equipment required to provide a complete control panel, in strict accordance with the requirements of these plans and specifications. The control panel shall be located from 3 feet to 8 feet from the wet well.

B. Quality Assurance

(1) Manufacturer's Qualifications

It is the intent of these specifications that all motor control and control components be supplied by a single supplier. Controls shall not be assembled on site. System supplier shall be a UL 508 certified facility and shall be regularly engaged in the manufacture of controls for the municipal water industry. The system specified herein shall be the product of a manufacturer having at least ten years experience in the construction of such control equipment.

(2) Submittals

Complete submittals shall be provided to the Engineer/Owner for review and approval prior to purchasing of equipment or equipment fabrication. Submittal data shall include the following:

A. Drawings

A master wiring diagram for the control panel(s) shall be submitted for Engineer's review and approval before beginning construction. This diagram shall be drawn in standard ladder logic format. All ladder rungs shall be numbered in the left hand margin, and all relay contacts referenced to these numbers in the right hand margin. Each electrical node in the control schematic shall have a different wire number. A bill of materials and a layout drawing of the enclosure door/inner door/inner bracket components shall appear on this drawing with a listing of nameplates pertaining to the components. Submittal drawings may be on 11" x 17" paper.

B. Product Data

Included in the submittal package shall be data sheets of all equipment used in the control panel, as listed in the bill of materials.

(3) As-Builts

Final As-Built drawings shall be on full-size 24” x 36” paper. Two (2) sets shall be provided. An additional full-size as-built drawing shall be placed in the control panel.

A waterproof reduced copy of the master "as built" wiring diagram shall be laminated in clear plastic and permanently fastened to the inside of the panel door.

(4) Start-up and Training

Provide on-site start-up of supplied equipment and provide an on-site training program shall be provided to employees as selected by the Owner. The objective of the training is to provide a common working knowledge concerning the operation of the system. Training shall include one (1) two-hour training session provided at the completion of start-up.

(5) Warranty

System warranty shall be for a period of 3 years commencing upon successful completion of startup. Warranty includes parts and labor for all equipment/software/services provided.

Warranty excludes surge/transient damage.

C. Operation

(1) Demand

Basic operation of the pumps shall be as a pump-down, lead/lag, common off system with high level alarm. Panel shall accommodate connection of floats, with the following functionality:

High Level	Lag Demand
Lead Demand	Stop

(2) Control

Each pump shall be controlled through a “Hand-Off-Auto” selector switch.

Hand: Pump shall be demanded and shall run continuously until the selector switch is turned to Off or Auto.

Off: Pump shall not be demanded.

Auto: Pump shall be controlled by the floats in the wetwell. A demand for each pump shall be delayed through adjustable time delay relays with a range of .1 - 10 seconds. Initially, the time delay for the first pump demand shall be set at 8 seconds, with required additional pump demand time delays being staggered 8 seconds apart. Operation of the lag pump(s) shall not be dependant on the lead demand float.

D. Alarms

The alarm system shall operate individual pilot lights as described under General Control Panel Equipment, and a common general alarm for the external horn/light (as indicated by asterisk *) upon the following faults:

(1) High Wetwell Level *

A contact closure from the high level float shall indicate a high level alarm condition. This alarm shall automatically reset.

(2) Pump Fail (No Pressure) *

A time delay shall begin when the pump is demanded. If the pump pressure switch does not indicate pressure prior to the time expiring, a "No Flow" alarm shall exist. This alarm shall latch and prevent the pump from running. Alarm annunciation shall remain on until manually reset.

(3) Pump Seal Fail

A pump seal failure shall be annunciated only by the individual pilot light. This alarm shall not stop the pump from running.

E. Equipment

Pump control panels shall meet the following specifications:

(1) Enclosure

Enclosure shall be NEMA 12 basic construction modified with a dripshield to have a NEMA 3R rating, and shall have a swing-out inner door and separate subpanel. A standard NEMA 3R enclosure shall not be acceptable. Enclosure shall be constructed from 12 gauge 304 stainless steel with a #4 finish. All hardware on exterior of panel shall be stainless steel. Exterior door shall be held shut with padlockable, 3-point door latch shall be Austin #48-5655SSX, or equal. The padlock is to be provided by the owner. Inner door shall be held shut with latch, Emka wingknob #1000-U78 and cam #1000-50, or equal. All doors shall be mounted to the enclosure with continuous hinges. Exterior door shall be gasketed to provide a watertight seal to the enclosure. Subpanel and inner door shall be 12 gauge mild steel primed and painted white. All control switches, pushbuttons, elapsed time meters, and indicator lights shall be mounted on or through the inner door. All panel wiring and equipment layout shall be performed per N.E.M.A. and J.I.C. specifications. N.E.C. gutter spacing shall be observed. A minimum of 6" additional D.I.N. rail shall be provided for future mounting expansion.

(2) Power Distribution Block

Provide a main power distribution block sized for incoming power to the panel. Each pole of the block shall be supplied with a clear cover for operator protection. Power distribution block shall be Gould 63000, 67000, or 69,000 series or approved equal, as required.

(3) Surge Suppression

Provide a silicon oxide varistor surge/lightning suppressor connected to the power distribution block and sized for incoming voltage. Minimum ratings shall be 60,000 amps, 1500 Joules. Suppressor shall be Delta LA series, or approved equal.

(4) Phase Monitor

Where three-phase motors are controlled, provide a plug-in style phase monitor designed to monitor phase loss, under voltage, and phase sequence with a SPDT contact to interrupt all control power in the event of phase loss. Phase monitor shall be supplied with fused protection of the three phase sensing circuit. Phase monitor shall be Diversified Electronics SLA series, Symcom model #250A, or approved equal. Fuseholder shall be three-pole Gould USM_I series, or approved equal. Fuses shall be fast-acting Gould ATM series, or approved equal.

(5) Circuit Breakers

Provide individual, properly sized, thermal-magnetic circuit breaker for each load served. Combination circuit breaker and overload mechanism shall not be allowed. Circuit breakers for motors and other loads shall have a minimum rating of 10,000 AIC (230 vac breakers) or 14,000 AIC (480 vac breakers).

Provide individual, properly sized, thermal-magnetic circuit breaker for each of the following:

- (A) Transformer
- (B) Each motor load

Provide 1-pole, 15-amp circuit breakers for the following loads:

- (A) Control circuit
- (B) Panel receptacle/condensation heater/service light.

(6) Contactors/Overload Relay

A magnetic across the line horsepower/current rated motor contactor with ambient temperature compensated overload relay shall be provided for each motor load served. Contactor shall be Cutler Hammer CE 15 Series, ABB Series A, or approved equal. Overload relay shall be Cutler-Hammer #C316, ABB Series TA, or approved equal.

Pumps 20 HP and larger shall be provided with a reduced voltage solid state starter with overload protection and across-the-line bypass contactor for each motor load served. Solid state starter shall be Cutler-Hammer IT series with line side surge protector, ABB PSS series, or approved equal.

(7) Transformer

If 120 volt, single phase is not available, a minimum 2KVA dry-type transformer shall be supplied with primary and secondary short circuit protection. Control power shall be 120 volt. Control circuit shall be connected so that a power outage of any duration does not require manual re-start of system.

(8) Fuseholders and Fuses

Provide a fuseholder and fuse for the control circuit, minimum rating 5 amps (ampacity not to exceed relay contact rating). Fuseholders for control fuses shall be fingersafe with neon light indication for a blown fuse. Control fuse fuseholders shall be Gould USM_I series, Entrelec, or approved equal.

(9) Terminal Blocks

Numbered terminal blocks shall be supplied for all field terminations. Current capacity of terminal strips shall be equal to the load served. Terminal blocks shall be suitable for minimum 12 AWG wire at not less than 300 volts. Terminal blocks for control interface shall be Entrelec model 115116.07, or approved equal.

(10) Interior Service Light:

Provide an interior fluorescent service light w/ safety lens fastened to the top of the enclosure with two-position "Off-On" selector knob to control. Incandescent light fixtures shall not be acceptable. Light shall be mounted without penetrating the panel outer skin with screws or fasteners.

(11) Entry Switch

An entry switch shall be mounted in the panel, which shall close a contact wired to the telemetry unit when the exterior door of the enclosure is not closed. Switch shall be Microswitch #1AC2, or equal.

(12) Receptacle

Provide a 15-amp G.F.I. duplex receptacle connected to a separate circuit breaker, as described elsewhere, and mounted on the control panel inner door.

(13) Condensation Heater

Provide a 100 watt, 120 vac silicone rubber self-adhesive condensation heater mounted on a flange with integral 40 degree thermostat. Heater shall be Watlow #020100C1-EV11B, or approved equal.

(14) Alternator

Provide an automatic electronic alternator for alternating pump operation on successive automatic cycles. Relay shall incorporate LED position indicators and a toggle switch to select pump #1 or pump #2 as the lead pump, or to allow automatic alternation. Alternator shall be Diversified Electronics ARB series or approved equal.

(15) Relays

Relays shall be general purpose plug-in relays with standard mounting configurations. The relays shall have the number of poles as shown on the drawings with neon indicating lamp and test button integral to each relay. Relay contact ratings shall be minimum 5 amps.

(16) Time Delay Relays

Time delay relays shall be dial or D.I.P. switch selectable, and shall have contact ratings of not less than 10 amps. Switch settings shall be labeled on the relay. Time delay relays shall be Diversified Electronics TB series, or approved equal.

(17) Selector Switches

Selector switches shall be 30 mm oil tight type with lever operators and 10 amp contacts. Knob operators shall not be accepted. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control switches shall be Cutler-Hammer Series E34 or equal. Contact blocks shall be Cutler-Hammer type 10250T. Provide selector switches for the following functions (per pump where applicable):

Pump "Hand-Off-Auto" Three-position

(18) Pilot Lights

Pilot lights shall be push-to-test, oil-tight industrial units utilizing 120 volt bulbs (unless otherwise specified). Lenses shall be colored as shown on the drawings. Control panel lights shall be modular construction as manufactured by Cutler Hammer E34RPB or approved equal. Contact blocks shall be Cutler-Hammer type 10250T or approved equal. LED type lights shall not be acceptable. Provide pilot lights for the following functions (per pump where applicable):

- | | |
|--------------------|-------|
| (A) High Level | Red |
| (C) Pump Run | Green |
| (D) Pump Fail | Red |
| (E) Pump Seal Fail | Amber |

(19) Pushbuttons

Pushbuttons shall be oil-tight industrial units. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control panel pushbuttons shall be modular construction as manufactured by Cutler Hammer Series E34 or approved equal. Provide push-buttons for the following functions:

- (A) Alarm horn silence
- (B) Pump Fail Reset

(20) Elapsed Time Meters

Provide an elapsed time meter for each pump controlled. Meter shall be 6-digit, non-resettable, reading in hours and tenths of hours. Elapsed time meter shall be Fourth Dimension, or approved equal.

(21) Seal Fail Relay

Provide a conductance actuated moisture sensing relay for each submersible pump controlled with field adjustable sensitivity. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the panel manufacturer by the pump manufacturer prior to panel construction. Seal Fail Relay shall be Diversified Electronics, Syrelec, or approved equal.

(22) Alarm Light

Provide a red strobe light mounted to the top, exterior of the enclosure. Minimum ratings shall be 1.5 Joules at 70 flashes per minute. The strobe light shall be fully sealed to prevent water from entering the enclosure and be attached by mounting screws from inside the enclosure to prevent tampering.

(23) Alarm Dialer

Provide a 4-channel automatic alarm dialer mounted in the control panel. Dialer shall be Microtel, or as approved by the District. Dialer shall be mounted in a 15" x 15" space. The dialer shall be configured by the District.

The following alarms shall be wired to terminal blocks in the control panel, then connected to the dialer:

- (A) Wetwell High Level
- (B) Pump #1 Fail
- (C) Pump #2 Fail
- (D) Power Failure

(24) Ground Buss/Lugs

Provide a ground lug sized for incoming power ground near the power distribution block. Provide a ground lug sized for pump ground near pump power wire terminations. Provide a ground buss for control equipment grounding, minimum 6 termination points.

(25) Corrosion Inhibitor

Provide a corrosion inhibitor mounted inside the control panel. Corrosion inhibitor shall be Hoffman #A-HCI-5E, or approved equal.

(26) Wiring

Power distribution wiring on the line side of panel fuses or circuit breakers shall be sized for the load served, minimum 12 AWG. Control wiring shall be minimum #16 gauge SIS type stranded wire for internal control panel circuits. All control wires shall be numbered at each termination corresponding to the master wiring diagram with clip-sleeve or heat-shrink type wire markers. Wrap-on or adhesive wire markers shall not be allowed. 120 vac wiring (except for neutrals) shall have red insulation. 120 vac neutral wiring shall have white insulation. 50 vac or less shall have yellow insulation. 12/24 vdc wiring shall have blue insulation.

(27) Nameplates

Provide adhesive backed printed nameplates for all internal devices such as contactors, circuit breakers, and relays. Provide engraved phenolic nameplates, black letters on white background, for door-mounted devices such as selector switches, push-buttons, circuit breaker toggles, and pilot lights. Nameplates shall be secured firmly to the panel.

F. Control Panel Electrical Rack

An electrical equipment rack, as shown on drawings, shall be supplied by the manufacturer of the control panel for installation by the electrical contractor. The equipment rack shall be constructed of double-back Unistrut™, hot dipped galvanized material with required conduit connecting meterbase, fused disconnect switch, control panel, seal fittings, and FRP (fiberglass reinforced plastic) junction box. If a lightning arrester for the control panel is specified elsewhere in the control panel specifications, it may be mounted on the exterior of the disconnect switch, in lieu of the control panel, if desired.

All wiring between components on the electrical rack shall be run in galvanized heavy wall conduit, minimum ½" diameter.

All wire shall be not less than 12 AWG stranded type THHN/THWN, except control wiring, which may be 14 or 16 AWG stranded type THHN/THWN. All wiring shall be color coded by wire insulation, or colored tape on each end of the wire.

6. STORAGE CAPACITY

The station shall have additional storage capacity to handle flows during peak demand period, during a power failure or other malfunction, of at least two hours. This excess capacity may be in the wet well if possible, or may be an external concrete storage tank, designed to flow back into the wet well upon correction of the lift station malfunction or power failure.

7. PIPING AND VALVING

All piping in the wet well and the valve vault shall be ductile iron pipe, class 250 in accordance with AWWA C-151. The connection to the PVC force main outside the valve vault shall be made with a ductile iron mechanical joint solid sleeve. Valving shall be as specified hereinafter and in Item 4 Valve Vault. Provisions shall be made for the removal and replacement of all piping, valves and fittings. The force mains between the wet well and valve vault shall be inside schedule 40 PVC casing pipes which shall be 4" larger in diameter than the force mains and which shall be properly sealed on each end.

8. PAVEMENT FOR LIFT STATION AND DRIVE

The roadway to the lift station and all areas within the fencing shall be constructed with a sub-base of 6” of compacted 3/4” minus crushed limestone and screenings and the finished pavement shall be constructed with 4” of asphaltic concrete or 6” fiber mesh concrete. The paved area shall be large enough to accommodate District trucks and a paved turn around area shall be provided.

9. ENTRANCE ROAD BARRIER

There shall be provided two 36” high barrier post, vinyl clad schedule 40 steel pipe at the entrance road to the lift station. There shall also be provided a 5/16” diameter galvanized chain locked on one end and attached to the other, run between the posts. For safety purposes, a 4” x 12” reflective plate shall be attached to the chain at the center of the span.

10. FENCING

Fencing around the lift station, including the wet well, valve vault and control panel, shall consist of a 6’ high chain link fence with a barbed wire security top and a 12’ wide entrance gate. Wire fabric for the fence shall be a vinyl clad chain link fence fabric and wire shall be No. 11 gauge woven into a 2” mesh. The barbed wire top shall consist of three strands of No. 12-1/2 gauge line wires with No. 14 gauge barbs spaced at approximately 5” centers. Posts shall be vinyl clad schedule 40 pipe and post shall be equipped with suitable tops. All fencing must conform to local ordinances.

Posts shall be sized and set as follows:

<u>TYPE</u>	<u>SIZE</u>	<u>PULL</u>
Top Rails and Brace	1-1/4” Min.	2.27 lbs.
Line Posts and Gate Frame	1-1/2” Min.	2.72 lbs.
End Corner or Pull Post	2” Min.	5.79 lbs.

CONCRETE BASES

<u>TYPE</u>	<u>DIAMETER</u>	<u>DEPTH</u>
Line Post	12”	3’-6”
End Corner Gate	16”	4’
Pull Post	16”	4’

Poles shall be set in 30” deep concrete bases so that the pole bottom rests 6” higher than the concrete base bottom. Horizontal support bars shall be installed half way between the top rail and the ground. A #7 tension wire shall be installed at the bottom of the fencing fabric and stretched taught so as not to allow the bottom of the fencing fabric to be lifted away from the fencing poles and/or the ground.

SECTION 2 – METHODS OF CONSTRUCTION

1. GENERAL

The work covered by this Section of the specifications, shall consist of furnishing all specified materials with all necessary equipment, machinery, tools, and labor, and performing all work required to install and/or construct the sewer lift stations or changes with all directives or modifications and these specifications, all to be; complete, in place, accepted, and ready for use. Failure to comply with these specifications will result in the rejection of the work by the District. All work shall be in accordance with MDNR Rules under Title 10 CSR 20.8-120 and 130.

2. INSTALLATION OF STRUCTURES

All structures such as the wet well, valve vault and the control panel base shall be constructed as detailed on the plans and as called for in these specifications. All access frames and covers shall be properly set and installed as recommended by the manufacturer.

3. PUMP AND MOTOR INSTALLATION

The pump and motor units shall be carefully installed as recommended by the manufacturer and the seals between pumps and pump bases must mate as intended. The pump and motor units shall be properly wired and field checked to see that they can be easily removed and replaced by means of the lifting chains and do not bind on the guide rails. Actual pump tests may be required by placing water in the wet well and timing the withdrawal rates.

4. ELECTRICAL AND CONTROLS

The electrical and control system shall be as specified hereinbefore and shall all be installed in accordance with the National Electrical Code. The complete system shall be provided and installed by a single supplier. The Contractor shall contact the local power supplier and install all lines to the control panel, including metering in accordance with their requirements. The electric meter shall be installed as close to the station as allowed by the power utility.

5. INSTALLATION OF PIPING

Piping shall be installed as shown on the plans and basically in accordance with the standard Water System Specification of Public Water District No.2 of St. Charles County.

6. PAVING

Paving shall be provided for the access road and for all areas inside the fence and shall consist of materials as specified hereinbefore. Paving shall be to a smooth grade and sloped to provide proper drainage, especially away from the lift station facilities.

7. FENCING AND BARRIER

Fencing and the access road barrier shall be installed as shown on the plans and using materials as specified herein.

8. TESTING

Testing shall consist of introducing water into the wet well to ensure that the pumps operate as proposed and that all controls and alarms shall be operated in the presence of a District representative to demonstrate that they operate as intended. All alarm conditions shall be simulated and the dialer shall be programmed and shown to operate as intended.

9. SITE CLEANUP, RESTORATION AND GRADING

After work is completed, the site of the lift station installation shall be cleared of all construction material and other debris. Grading shall consist of providing proper drainage and all sites shall be left in a neat, clean and acceptable condition. For all property the site shall be restored to a condition equal to, or better than, it's condition before the work was started. In any existing or proposed lawn areas, the final restoration shall include sodding.

10. GUARANTEE

The Contract shall guarantee all material and workmanship for a period of a minimum of three (3) years following acceptance of the work by the District.