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**EASTERN MUNICIPAL WATER DISTRICT
SMALL SEWAGE LIFT STATION GUIDELINES,
STANDARD DRAWINGS, AND SPECIFICATIONS**

Prepared by



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DETAILED PROVISIONS

Refer to the latest Standard Detailed Provision Sections located at the following web site
(<https://www.emwd.org/rfp-post/emwd-standard-detailed-provisions>)
(<https://www.emwd.org/sewer-standard-drawings>)

Section 01000	General Safety Requirements
Section 01430	Maintenance Manual Requirements
Section 02051	Temporary Sewage Lift Station Demolition
Section 02201	Construction Methods & Earthwork
Section 02252	Control Density Fill
Section 02513	Asphalt Concrete Paving
Section 03150	Formwork for Cast-in-Place Concrete
Section 03200	Reinforcing
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Section 04220	Concrete Masonry Units
Section 09811	Chemical Resistant Coatings
Section 11200	Small Submersible Sewage Lift Station
Section 11250	Outdoor Standby Power Diesel Engine Generator Set
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GUIDELINES

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**EASTERN MUNICIPAL WATER DISTRICT
SMALL SEWAGE LIFT STATION GUIDELINES**

I. INTRODUCTION

Sewage collection within the District service area shall be provided by the construction of gravity sewers, except where it is demonstrated unfeasible and pumping is required. If a sewage lift station is proposed, it shall be the developer's responsibility to provide the services of a licensed civil engineer to demonstrate to the District that a sewage lift station is the most feasible method for sewage conveyance.

These guidelines present basic concepts and general criteria for small sewage lift station facilities with capacities not exceeding 500 gpm. Each lift station shall be reviewed and approved by the District from concept through design, construction, and start-up. Detailed Provision Sections 11200, 11250, and 13123 and the Standard Drawings are provided to present lift station construction requirements. Detailed Provision Section 02051 and the Standard Drawings are provided to present demolition requirements for temporary lift stations. The District reserves the right to modify and supplement these guidelines, specifications, and drawings to require additional facilities, depending upon the specific project location, limitations, and changes in government regulations and standards.

II. GENERAL

- A. Raw sewage lift stations shall be designed and constructed in accordance with District guidelines herein, District standards (drawings and specifications), good engineering practice, applicable government regulations, Riverside County Health Services Department and State Water Resources Control Board, Division of Drinking Water (SWRCB DDW), Cal OSHA, Standard Specifications for Public Works Construction (Standard Specification), California Building Code, National Electric Code, Uniform Fire Code, and as approved by the District.
- B. Facilities shall be designed by a licensed civil engineer, registered in the State of California, experienced in the design of wastewater lift station facilities. Prior to commencing design, the Engineer shall submit to the District a statement of qualifications showing that he has designed a minimum of five sewage lift stations. The statement of qualifications shall include the name, client, capacity, and construction cost for each sewage lift station. Drawings and specifications shall be submitted for review and approval by the District.
- C. Sewer, force main, and lift station construction drawings shall be submitted simultaneously; sewer and force main shall include plan (1"=40') and profile (vertical 1"=4', horizontal 1"=40'), and lift station shall include site plan and

standard drawings showing structural, mechanical, and electrical plans, sections, and details with project specific requirements. Sewer and force main plans shall be prepared in accordance with the District's "Guidelines for Sewer System Plans".

- D. All costs of temporary facilities shall be borne by the developer.
- E. Soils investigation shall be performed for the lift station site and related interceptor sewer and force main.
- F. A site-specific noise study shall be completed to ensure the outdoor emergency standby generator's maximum noise level conforms to the city and/or county noise ordinance at the property line. Noise study shall be submitted to the District for review.
- G. Upon approval and acceptance by the District, facilities shall be owned by the District. Ownership shall include the lift station site and right-of-way for force main and gravity sewers. Gravity sewers and force main shall be constructed on District property, District right-of-way, or within public right-of-way whenever possible. Easements for gravity sewers and force main will only be considered under special conditions. All right-of-way and easement documents shall be submitted and approved by District prior to approval of the construction drawings. All right-of-way and easement documents shall be conveyed to the District and recorded prior to acceptance of facilities.
- H. Prior to completion of the facility and District acceptance, complete records shall be furnished to the District including:
 - 1. As-built record drawings.
 - 2. Final approved shop drawings and submittals for all equipment and materials.
 - 3. As-built electrical and control diagrams.
 - 4. Minimum three copies of Operation and Maintenance Manuals for all equipment.
 - 5. District staff training for station operation and equipment operation and maintenance.
 - 6. Right-of-way, grant deed, and easement records.
 - 7. All construction and operating permits.

III. PROCEDURES

A. Concept Meeting

1. Developer and developer's engineer shall have approved design conditions before design and construction of a Temporary or Permanent Small Sewage Lift Station. After the District has approved design conditions, the Developer and Developer's engineer shall schedule and attend a concept meeting with the District to review the requirements, guidelines, criteria, right-of-way, and location of specific project facilities. District will provide a list of approved materials.
2. Developer's engineer shall acquire and review these guidelines; Detailed Provision Sections 11200, 11250 and 13123, and other Detailed Provision Sections referenced in these guidelines; and the Standard Drawings.

B. Preliminary Design Documentation

Developer shall submit the following documentation to the District during the preliminary design phase:

1. Complete calculations for sewage flows within the entire drainage area tributary to the proposed lift station. See Section IV, Minimum Requirements for details.
2. Preliminary Drawings (See Section IV Minimum Requirements)
 - a. Preliminary Site Layout include boundary limits, and existing and proposed facilities within the surrounding area.
 - b. Preliminary drawings showing planned gravity collection system within the lift station drainage area, including point(s) of connection to existing or future gravity interceptor sewers, if any.
 - c. Preliminary drawings showing the proposed force main alignment for the lift station including point of discharge.
3. Determination whether the proposed lift station will be temporary or permanent.
4. Hydraulic Analysis, Pump Selection and Capacity (see Section IV Minimum Requirements)

- a. Calculations establishing the required lift station capacity for initial planned development and ultimate development.
- b. Preliminary design calculations and information including required capacity, hydraulic analyses, pump selections, and system curves, and preliminary site layout. Sample design calculations are included in Appendix A.

5. Flood Control Map

Flood control maps of proposed sewage lift station site. The sewage lift station pad elevation shall be one foot higher than the 100-year flood elevation.

6. Emergency Bypass Calculations

Developer's engineer shall submit calculations demonstrating that the gravity sewer will not surcharge into the nearest sewer lateral while bypassing the station from the onsite manhole.

C. 75% Submittal Design Phase

1. 75% Lift Station Construction Drawings

- a. Submit 75% complete lift station construction drawings. Lift station standard drawings shall include deltas revision symbols next to all modifications to the lift station standard drawings.
- b. Site plan shall be clearly legible. If site facilities, piping, and electrical conduits cannot fit on one construction sheet legibly, create two sheets. One sheet for above grade facilities and the other sheet for below grade piping and electrical conduits.
- c. Preliminary Site Plan shall show adjacent facilities i.e., street grades, retention basins, proposed or existing pad elevations, schools, etc.
- d. Site Drainage shall flow away from wet well at a minimum fall of 0.5%.
- e. Any modifications to the preliminary design documentation.

2. Demolition of Temporary Small Sewage Lift Stations

Plans for temporary lift stations shall include construction drawings and demolition drawings. Submittal of demolition documents (drawings and specifications) for District review shall coincide with submittal of the corresponding construction documents. Procedures required for District approval of temporary lift station demolition documents are as follows:

- a. Developer's engineer shall acquire and review Detailed Provision Section 02051 and the Standard Drawings.
- b. Developer and engineer shall request a concept meeting with District staff to discuss future diversion of sewage flow from the temporary lift station to a gravity sewer, de-activation and demolition of lift station facilities, and the anticipated schedule for performing the work.
- c. Submit 75% complete demolition drawings and specifications (if requested by District).

3. Noise Study

A site-specific noise study shall be completed to ensure the outdoor emergency standby generator's maximum noise level conforms to the city and/or county noise ordinance at the property line.

4. Geotechnical Report

Submit geotechnical report including information of site groundwater depth, bearing pressure, and seismic design parameters.

5. Legal and Plat

- a. Submit legal plat and description for proposed property in fee title and/or easements for lift station site and force main (if applicable). Legal plats and description shall conform to EMWD's standards. Contact District's Right-of-Way Department for details. **Note, final plans will not be signed until this information is received and reviewed for conformance to site plan.** Site plan shall show coordinates or bearings and distances of the property boundary per the legal plats and description.

- b. All permanent sewage lift station sites require the parcel to be deeded to the District. Before construction, a Grant Deed with legal description and plat map must be prepared, approved, and recorded by the District. Refer to District typical layout drawings for plat map preparation.

6. Antenna Tower Survey

Developer shall provide site coordinates (latitude and longitude) at 75% design for District survey. District survey will determine required antenna tower height. Developer will pay all costs for construction of antenna tower. Antenna tower shall be positioned to ensure tower can lay down for maintenance or removal.

7. SCE and Leased Cable Line Service Plans

Submit signed final design "approved for construction" SCE service plan and leased cable line service plan to District. The SCE service transformer location shall be per Section IV Minimum Requirements.

8. Supplemental Drawings

Submit Force Main, Sewer, Mass Grading, Water, and Street Improvement Plans.

9. Safety Pre-Use Analysis

After 75% review comments are returned, developer's engineer shall schedule a safety pre-use meeting with the District.

D. 100% Complete Design

1. Construction Drawings

- a. Submit final design and 100% complete construction drawings. As a minimum, construction drawings prepared by the developer shall include a title sheet and detailed site plan. The title sheet shall include a summary of project specific requirements and data (see sample title sheet provided herein).

2. Demolition of Temporary Small Sewage Lift Stations

- a. Submit 100% complete demolition drawings. As a minimum, demolition drawings prepared by the developer shall include a detailed site plan. A sample demolition site plan is included herein for reference. The demolition site plan shall show the removal of all facilities not addressed by the Standard Drawings. As a minimum, the site plan shall show demolition of site improvements including fencing, walls, gates, paving, driveways, lighting, electrical, and drainage facilities.
- b. Submit a detailed cost estimate for performing the lift station demolition work.
- c. Demolition requirements shown on the Standard Drawings, and contained in Detailed Provision Section 02051 represent minimum District requirements. Depending upon the proposed re-use of the temporary lift station site, developer may elect to require more extensive demolition, including the complete removal of all below grade facilities.

E. During Construction

1. Prior to construction (installation), shop drawing submittals for all proposed equipment and materials shall be submitted to the District for approval.
2. Construction of facilities shall be in accordance with approved construction drawings and District specifications. District will provide inspection of facilities, witness start-up, and provide final inspection of facilities. District staff shall receive final operation and maintenance manuals for all equipment a minimum of 10 working days prior to receiving training for station operation and equipment operation. A factory trained equipment manufacturer's representative shall provide the training.

F. Prior to Project Completion

Prior to completion of the facility and District acceptance, complete records shall be furnished to the District including:

1. As-built record drawings.
2. Final approved shop drawings and submittals for all equipment and materials.

3. As-built electrical and control diagrams.
4. Minimum three copies of Operation and Maintenance Manuals for all equipment.
5. District staff training for station operation and equipment operation and maintenance.
6. Right-of-way, grant deed, and easement records.

IV. MINIMUM REQUIREMENTS

A. Capacity, Hydraulic Analysis, and Pump Selection

1. The theoretical calculated peak flow shall be based on the development to be serviced with consideration of the entire drainage area and master planned facilities. The design flow shall be determined by increasing the theoretical calculated dry weather peak flow determined from entire drainage area by 20% (i.e. peak flow x 1.20 = design flow). Pumping units and wet well size shall be selected based on the design flow. Flows shall be provided for initial and ultimate conditions. If necessary, lift stations shall be located to maximize sewage collection for the entire drainage area and shall conform to the District's Wastewater Master Plan. Lift station pumping capacity may be dictated by minimum acceptable force main size and velocity criteria herein.
2. Where Master Plan facilities have not been established, the developer shall be responsible to prepare wastewater flow projections for the drainage area.
3. Hydraulic calculations and system/pump curves for pump sizing and required capacity shall be submitted for both initial and ultimate peak flows. System curves shall be developed for friction coefficients of C=120 and C=140. System curves shall include minor friction losses (i.e. fittings and valves in discharge piping at wet well and fittings in force main). Pumps shall be selected based on friction coefficient of C=140. Developer's engineer shall select a minimum of three District-approved pump manufacturers and plot C=120 and C=140 system curves on each pump curve.
4. Downstream sewers shall be evaluated to ensure adequate capacity is available for receiving lift station sewage flow.

5. Developer's engineer shall specify the pumping unit performance with a design point, two operating conditions and a minimum shut off head.

B. Emergency Bypass Calculations

Developer's engineer shall submit calculations showing the gravity sewer soffit elevation at the nearest sewer lateral and the onsite manhole invert elevation.

If the gravity sewer soffit elevation is more than 5' above the onsite manhole invert elevation, the onsite manhole shall be used as a bypass manhole. If the gravity sewer soffit elevation is less than 5' above the onsite manhole invert elevation, the onsite manhole shall be used as a diversion manhole and a bypass wet well shall also be provided (see Section IV, Part D).

C. Force Main Design Requirements

1. **Force Main Diameter** - Force main size (diameter) shall be based on the following:
 - a. Lift station design flow rate (one pump operating) with minimum velocity of 3 fps and maximum velocity of 6 fps.
 - b. Minimum size shall be 4-inch inside diameter. Where 4-inch mains are required, two (2) parallel pipelines shall be constructed for system reliability. Each force main shall be provided with the necessary valves and fittings to allow operation of either force main or both force mains.
 - c. Where a single 4-inch force main is inadequate to convey the peak flow rate (i.e. force main velocity exceeds maximum allowable velocity), the next larger size pipe diameter shall be used.
 - d. Where force main length exceeds 6,000 L.F., two (2) parallel pipelines shall be constructed for system reliability. Each force main shall be provided with the necessary valves and fittings to allow for operation of either force main or both force mains.
2. **Force Main Material** - Material shall be PVC per ANSI/AWWA C900 (minimum DR-18). Pipeline shall be constructed using restrained joints per District Standard Drawing B-663.

3. **Force Main Profile** - Force main profile shall avoid intermediate high points if feasible. All high points shall be provided with combination sewage air and vacuum valve installation and special corrosive resistant pipeline materials.
4. **Force Main Minimum Cover** - Onsite pipe cover shall be minimum 48-inches.
5. **Force Main Connection Manhole** - Where force main connects to an existing discharge manhole, the discharge manhole shall be lined per Standard Detailed Provision Section 09811 at developer's expense. The District may require multiple manholes be lined at developer's expense.

Where force main connects to a new discharge manhole, the discharge manhole shall be polymer concrete manufactured by Armorock or equal at the developer's expense.

D. Site Layout of Proposed Facilities

Location of all proposed facilities shall be in reference to site property lines or easement boundary. As a minimum, the lift station site plan shall show the following:

1. Site Fence or Block Wall

Location of all site improvements, including site fencing or masonry block walls and access gate(s) shall be shown on the drawings. Fence or block wall shall be provided with coordinates or bearing and distances on the site layout. Provide construction details for site fencing, access gate(s) or block wall if District standard fencing and gate(s) are not specified.

All lift stations shall have a street address sign affixed to the fence or access gate at the front of the station.

- a. Fence

As a minimum, site shall be secured by commercial grade 8-foot high chainlink fence with 3-strand barbed wire or an 8-foot high masonry block wall. Access gate(s) shall include minimum 20-foot wide double gate for vehicles. 8-foot rail chainlink fencing and gates shall be provided in accordance with District Standard Drawing D-672.

b. Block Wall

1. Where masonry block walls are selected for site security, label top of wall and top of footing for each wall segment. Walls and wall footings shall be constructed level.
2. Walls shall step as required to provide a minimum of 8'-0" height from outside finished grade. Provide a construction detail for masonry block wall and concrete footing showing all dimensions, reinforcing steel, block type, construction joints, and grouting requirements.
3. Construction joints shall be placed every 30 feet.
4. Footing shall be "T" or "L" type. Edge of footing shall be placed on the edge of the property line.
5. The block type shall be precision faced. If the developer prefers a different block type (split face, slump, etc.), the developer shall submit the proposed block type to the District's maintenance department for approval.
6. Provide cap on top of the block wall.
7. Block wall shall be coated with an anti-graffiti coating.
8. Block wall shall be fully grouted.
9. Submit Structural Design Calculations in accordance with the seismic design requirements on Construction Drawing G-1 and Detailed Provisions, Section 04220, Concrete Masonry Units.

2. Site Grading

Finished grades for all proposed facilities and site improvements. As a minimum, grades (elevations) shall be provided for all concrete slabs and roofs, asphalt concrete paving (along pavement edges and flow lines, adjacent to concrete slabs and roofs, etc.), masonry block walls and footings, and finish grading adjacent to site improvements.

Entire site shall be provided with asphalt concrete pavement or concrete pavement, and adequate drainage facilities (minimum fall of 0.5%). Access driveway(s) to the site shall be 20-foot wide (minimum) and constructed

of asphalt concrete pavement or reinforced concrete pavement. Asphalt concrete pavement or reinforced concrete pavement shall be designed to accommodate AASHTO H20-44 vehicle loading.

If required by the District, based on proximity of the facility to other public facilities, residences, or buildings, hardscape shall be provided in accordance with the surrounding area. Landscaping shall be avoided.

3. Design Vehicle

Site shall be of adequate size to operate, maintain, and repair the lift station facilities incorporating access for truck cranes and sewer cleaning trucks (Vactor trucks). Design AASHTO-2018 SU-40.

4. Potable Water

Potable water shall be provided to the site by hose bibs with antisiphon devices, water meter per Standard Drawing B-342 and a backflow prevention device per Standard Drawing No. B-597A as approved by the District and SWRCB DDW. Potable water service shall be hot tapped or provided with a tapping sleeve in accordance with the District's Standard Drawings. See typical site plan for more information.

Separation from water lines shall be in accordance with SWRCB DDW. Additionally, a minimum 10-foot horizontal clearance shall be provided from site walls, site fencing, electrical facilities, storm drain facilities, and gravity sewer.

5. Sewer Facilities

a. **Gravity Sewer and Manholes** - Location of gravity sewer and manholes. Provide bearings and distances along each gravity sewer segment shown on the Site Plan. Provide invert elevations (inlet and outlet) at each manhole. Gravity sewers shall be labeled with pipe size and material. Gravity sewer pipe material shall be the same as the gravity sewer pipe material from the first offsite manhole to the lift station manhole. Manholes shall be labeled with size and Standard Drawing reference.

b. **Force Main and Emergency Bypass Connection** - Location of force main and emergency bypass connection. Provide bearings and distances along each force main segment shown on the Site Plan. Provide center grade elevations at each horizontal and vertical point of inflection (HPI and VPI). Force main shall be labeled with

pipe size, material, and class. If the force main crosses a significant number of utilities, the District may request for a pipe profile demonstrating adequate clearances between utilities.

c. **Emergency Bypass System**

Based on the results of the emergency bypass calculations, the lift station shall be provided with one of the following:

- i. Gravity sewer soffit elevation at nearest sewer lateral greater than 5' above onsite manhole invert elevation.
 - 5' ID Bypass Manhole per Lift Station Standard Drawing C-1.
- ii. Gravity sewer soffit elevation at nearest sewer lateral less than 5' above onsite manhole invert elevation.
 - 5' ID Diversion Manhole per Lift Station Standard Drawing C-1 with stop logs.
 - Bypass Wet Well per Lift Station Standard Drawing S-3 (diameter of Bypass Wet Well shall match diameter of Wet Well).

6. **Electrical Facilities and Appurtenances**

- a. **Motor Control Center**- The motor control center (MCC) Panel shall be oriented north or east to avoid excessive sun exposure.
- b. **Radio Antenna Tower**- A radio antenna tower shall be provided for District SCADA and network communications at developer's expense.
- c. **Site Lighting** - Site shall be provided with a lighting system designed to minimize off site impacts while maintaining functionality for maintenance personnel working on lift station components. As a minimum, each site shall be provided with two (2) pole mounted site fixtures. Each pole mounted light fixture shall have two lights an area light and a work light. The "area light" shall be LED (light emitting diode) type activated by a photocell and the "work light" shall be an LED type activated by a manual switch located in the Main Control Panel. "Area lights" shall comply with County of Riverside Ordinance Number 655 - Regulating Light Pollution.

- d. **SCE Service Transformer-** Utility transformer and metering section shall be located in a separate fenced-in area (see Typical Site Plans).
- e. **Electrical Conduit, Pull Boxes, Junction Boxes-** Location of each electrical conduit, pull box, junction box, and SCE service and transformer. Refer to Conduit Schedule on Electrical Drawings for conduit destinations. Label all conduits shown in the Conduit Schedule.

7. Odor Control Components

Odor control components shall include: concrete slab for emergency shower and eyewash station, concrete pad for District furnished chemical storage tank, 120v receptacle for District furnished chemical feed pump, and conduit sleeve from receptacle stanchion to wet well. Emergency shower and eyewash station slab shall be located on the side of the chemical tank pad where the chemical delivery truck will be logically positioned.

8. Site Security System

If required by District, a site security system (cameras, intrusion switches, etc.) shall be provided. The site security system may require connection to a leased cable line in lieu of a microwave system in order to transmit security data to the District. Developer shall coordinate and obtain leased cable line service to the lift station site, if required by District.

E. Lift Station Components

- 1. Raw sewage lift station shall be the submersible type with 100% redundancy, electrical service, switchgear, emergency power, and appurtenances. Standard Drawings M-1A, M-1B, M-2, ME-1, and ME-2 are provided to present equipment and piping plans, sections, and details for the lift station.
- 2. Raw Sewage Pump Requirements
 - a. Number of pumps furnished shall provide complete redundancy. Minimum of two identical pumps each sized for 100% station capacity shall be installed. Typically, constant speed pumps will be provided; however, discharge to the downstream system may require use of variable speed drives.

- b. Raw sewage non-clog submersible pumps. Pump impellers shall be enclosed single port, recessed vortex, or grinder type. The specific pump impeller type to be used for the project will be determined by the District based on application and availability.
- c. Minimum 4-inch discharge.
- d. Ability to pass minimum 3-inch diameter sphere.
- e. Maximum 1800 rpm explosion-proof submersible motor with moisture and temperature sensors.
- f. Motor and cooling rating suitable to run dry for 15 minutes without damage to the pump.
- g. UL or Factory Mutual explosion-proof rating without being submerged.
- h. Constructed of corrosion resistant materials and provided with corrosion resistant factory coating.
- i. Acceptable manufacturers are Essco, Wilo-EMU, Fairbanks--Nijhuis, Wemco Flowserve, Xylem-Flygt, and ABS.

3. Wet Well Requirements

- a. **Wet Well Material** - Class IV reinforced concrete pipe (RCP) per ASTM C76 with two circular reinforcement cages (quadrant or elliptical cages will not be allowed) and flush bell and spigot joints. Bell and spigot joints shall be provided with rubber gaskets and shall be suitable for a hydrostatic head of 50 feet per ASTM C361. Wet well shall also include reinforced concrete base and cover. Wet well reinforced concrete base shall be placed on a 12-inch thick mat of crushed miscellaneous base per SSPWC Section 200-2.4, Fine Gradation. Interior concrete surfaces (including wall and roof) shall be coated. Wet well bottom shall be provided with concrete fillets sloping towards the pumps.
- b. **Wet Well Sizing** - Wet well shall be sized based on maximum pump motor cycling time of six starts per hour at 1/2 design capacity and to provide adequate spacing for installation of two pumping units (see Table on Standard Drawing G-1 for wet well size versus flow capacity).

- c. **Wet Well Roof** - Concrete roof shall have a hatch opening (one hatch for both pumps) for pump removal/installation. Equipment access hatches shall be constructed of Type 316 stainless steel as manufactured by U.S.F. Fabrication, Flygt, Bilco, or equal, with lockable diamond plate covers, safety chain, spring assisted hinges, and swing-out interior safety grating. A removable handrail system shall be provided around hatch opening (Railguard 200 by Garlock Safety Systems, or equal).
 - d. **Wet Well Discharge Piping** - Discharge piping inside the wet well shall be flanged, Schedule 40 316 stainless steel. All stainless steel piping, fittings, and flanges shall be shop welded (field welding not permitted except where noted on District Standard Drawings). All welds shall be pickled and passivated in the shop (pickling paste shall be applied to District approved field welds). Discharge piping shall be designed for a maximum velocity of 6 to 8 feet per second. Discharge piping shall be properly supported with pipe supports. Pipe supports, brackets, and all other equipment and fasteners within the wet well shall be 316 stainless steel.
 - e. **Onsite Manhole** - All collection sewers shall join and enter a single manhole just prior to entering the wet well. Only one sewer shall enter the wet well to allow the District to plug influent sewer and bypass around wet well for maintenance and repairs.
 - f. **Bypass Wet Well** - The bypass wet well shall be provided with a single inlet for bypass events.
4. Pump Discharge Piping Out of Wet Well
- a. **Discharge Piping Location** - Discharge from each pump shall exit the wet well below grade, then rise above grade for location of check valves and isolation plug valves.
 - b. **Valves** - Each pump shall be provided with 150 lb swing check valve (AWWA C508 with bronze trim) and shut-off valves (eccentric non-lubricated plug valve). Sewage combination air and vacuum valves shall be provided at high points.
 - c. **Bypass Connection** - A bypass connection to the force main shall be provided for station bypass with portable pumps.
 - d. **Piping Alignment** - Whenever possible, influent and effluent piping shall be perpendicular or parallel.

- e. **Gooseneck** - For lift stations with force main discharge elevation lower than the lift station elevation (downhill force mains), the abovegrade discharge piping shall include a gooseneck to keep the flow meter full.

5. Laser Level System

A laser level system shall be provided to control the operation of the pumps.

6. Davit Crane

A permanent davit crane shall be provided.

F. Electrical Components

1. **Code Requirements** - All electrical equipment shall be in accordance with the NEC and, where applicable, meet all requirements for hazardous locations. Developer shall coordinate with the electrical utility providing electrical service. Station shall be provided with a separate utility transformer and metering section with main circuit breaker. Primary power to the station shall be 480 volt, 60 Hz, 3-phase service per utility providers' standards. Single-phase 120-volt power shall be provided for lights, controls, convenience receptacles, and miscellaneous equipment. Provide a minimum of four spare 20A, 120-volt circuit breakers. All conduit shall be run concealed below grade or in concrete slabs, and shall not impose tripping or maintenance hazards. All exposed conduit shall be pvc-coated rigid steel pipe.
2. **Electric Switchgear** - Electric switchgear shall be mounted in a NEMA 1 gasketed enclosure (with NEMA 3R wrapper) Motor Control Center with removable buckets, and shall include, as a minimum, main circuit breaker, motor starters with thermal overload protection, selector switch (hand-off-auto), run and fail lights, and elapsed time meter. Switchgear shall be General Electric, Eaton/Cutler Hammer, Allen-Bradley, or Schneider Electric/Square D (no substitutes). The MCC doors shall face north or east.
3. **Pump Controls** - Complete controls for automatic pump operation shall be provided per Standard Drawing E-4.
4. **Sunshade Structure** - An electrical panel sunshade structure shall be provided.

5. An electrical short circuit/coordination study, arc flash hazard study, and field testing of the electrical system shall be performed.

G. Emergency Power

1. Lift station facilities shall include permanent emergency power generation facilities.
2. Generator set shall be "pre-certified"/"pre-approved" by South Coast Air Quality Management District (SCAQMD) for emergency standby power service, and shall meet all current SCAQMD air emission regulations. The Standby Generator Set shall meet the applicable tier standards required by SCAQMD Best Available Control Technology (BACT) requirements and SCAQMD Rule 1470.

A Level 3 diesel particulate filter (DPF) system verified by California Air Resources Board shall be provided at the developer's expense if required to meet the emission requirements of SCAQMD Rule 1470. A load bank system shall be supplied with all generator sets. Load bank system shall include an automatic load controller capable of auto-loading at multiple load steps and dropping the generator load. Developer's engineer shall determine whether a passive DPF system is required.

All SCAQMD permits, including payment of fees for the first year of operation shall be furnished by developer. Permits shall have no less than a 200-hour annual operating limit with no less than 50 hours for maintenance and testing. The SCAQMD permit to construct shall be transferred into a permit to operate prior to acceptance by the District.

3. The emergency standby generator shall be supplied by Caterpillar, Cummins, or Generac.
4. If the District requires the developer to provide a standby generator that is larger than what is necessary to support the proposed lift station equipment (based on future development flows to the lift station), then the developer shall provide a load bank sized to provide the difference between the proposed equipment load and the future equipment load.
5. Automatic transfer switch (ATS) shall be provided to switch from normal utility power to standby emergency power upon normal power fail, and switch back to normal power when restored. ATS shall have indicating lights for normal power, emergency power, and a digital panel indicating volts and amps. Acceptable manufacturers are Olympian, ASCO, or Russelectric.

H. Telemetry Equipment

District will furnish, install, and program telemetry equipment system, including remote telemetry unit (RTU) to transmit alarm conditions to existing SCADA system. Contractor shall terminate all alarm signals on terminal blocks in the Main Control Panel (MCP). Contractor shall connect from MCP terminal blocks to District furnished RTU terminal block.

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APPENDIX A

SAMPLE DESIGN CALCULATIONS

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SAMPLE DESIGN CALCULATIONS

**SEWER LIFT STATION
TRACT 33691**

HYDRAULIC CALCULATIONS

April 11, 2008

Prepared by:

Engineering Company

Address

City, State Zip

Phone / Fax

Engineer's Stamp

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DESIGN FLOWRATE

Tract 33691 gross acreage = 59.6 ac
Sewage generation rate = 1,700 gpd/ac
Q(avg) = 101,320 gpd

Peak Factor = 2.5
Q(peak) = 253,300 gpd
= 176 gpm

Design safety factor = 20 %
Q(design) = 211 gpm

Use 4" force main, velocity = 5.4 fps

HYDRAULIC CALCULATIONS

FORCE MAIN LENGTH

Offsite force main from R/W to discharge = 3,065.00 ft
Onsite force main (longest length) from wet
well outside wall to R/W = 47.61 ft
Total length = 3,112.61 ft

STATIC HEAD - H(stat)

Minimum Static Head = Force Main High Point - Pump "on" elevation
H(stat,min) = 1343.97 - 1302.27 ft
H(stat,min) = 41.70 ft

Maximum Static Head = Force Main High Point - Pump "off" elevation
H(stat,max) = 1343.97 - 1299.77 ft
H(stat,max) = 44.20 ft

FRICITION LOSSES IN FORCE MAIN - H(f)

Hazen-Williams Formula
$$H_f = \frac{10.44 * \left(\frac{Q}{C}\right)^{1.852} * L}{D^{4.8655}}$$

H(f) = friction losses in ft
Q = 211 gpm
C = 140 for design
L = 3,112.61 ft
D = 4 in

Therefore, H(f) = 81.80 ft

MINOR LOSSES - H(m)

$$H_m = \sum K \frac{V^2}{2g}$$

H(m) = minor losses, ft
 $\sum K$ = sum of minor loss coefficients
V = 5.4 fps
g = gravitational constant
= 32.17 fps

Minor loss coefficients

<u>Description</u>	<u>Quantity</u>	<u>K-value</u>	<u>K-value.total</u>
90 degree bend	6	0.3	1.8
45 degree bend	8	0.2	1.6
Tee-thru, flanged	3	0.3	0.9
Plug valve	2	1.0	2.0
Tee-branch, flanged	1	0.8	0.8
Wye	1	0.5	0.5
Check valve	1	2.5	2.5
Exit Loss	1	1.0	1.0

$$\sum K = 11.1$$

Therefore, H(m) = 4.99 ft

DESIGN TOTAL DYNAMIC HEAD. TDH

$$\begin{aligned} \text{TDH} &= \text{SUM OF ALL LOSSES} \\ &= H(\text{stat, max}) + H(f) + H(m) \\ &= 44.20 + 81.80 + 4.99 \text{ ft} \\ &= 130.99 \text{ ft} \end{aligned}$$

PUMP DESIGN PARAMETERS

Q = 211 gpm
TDH = 131 ft

SYSTEM CURVE CALCULATIONS

Configuration

Pipe diameter, D = 4 in

Pipe length, L = 3112.61 ft

Sum of minor loss K-values = 11.1

C = 140 Maximum Static Head (ft) = 44.20

FLOW, gpm	VELOCITY, fps	MINOR LOSSES, ft	FRICTION LOSSES, ft	TOTAL DYNAMIC LOSSES, ft	TOTAL DYNAMIC HEAD, ft
0	0.0	0.00	0.00	0.00	44.2
25	0.6	0.07	1.57	1.64	45.8
50	1.3	0.28	5.68	5.96	50.2
100	2.6	1.12	20.51	21.63	65.8
125	3.2	1.75	31.00	32.75	76.9
150	3.8	2.52	43.45	45.97	90.2
175	4.5	3.43	57.81	61.24	105.4
200	5.1	4.48	74.03	78.51	122.7
211	5.4	4.99	81.74	86.73	130.9
225	5.7	5.67	92.07	97.74	141.9
250	6.4	7.00	111.91	118.91	163.1
275	7.0	8.48	133.51	141.99	186.2
300	7.7	10.09	156.86	166.94	211.1

C = 120 Maximum Static Head (ft) = 44.20

Flow, gpm	Velocity, fps	Minor losses	Friction losses	Total Dynamic Losses	Total Dynamic Head
0	0.0	0.00	0.00	0.00	44.2
25	0.6	0.07	2.09	2.16	46.4
50	1.3	0.28	7.56	7.84	52.0
75	1.9	0.63	16.01	16.64	60.8
100	2.6	1.12	27.28	28.40	72.6
125	3.2	1.75	41.24	42.99	87.2
150	3.8	2.52	57.81	60.33	104.5
175	4.5	3.43	76.91	80.34	124.5
200	5.1	4.48	98.48	102.97	147.2
211	5.4	4.99	108.75	113.74	157.9
225	5.7	5.67	122.49	128.16	172.4
250	6.4	7.00	148.88	155.89	200.1
275	7.0	8.48	177.62	186.10	230.3
300	7.7	10.09	208.68	218.77	263.0

WET WELL ELEVATIONS AND SET POINTS

GRAVITY SEWER INVERT ELEVATION

Invert elevation at Prop SMH, Sta. 16+13.00 =	1305.08 ft	
Pipe length to R/W =	70.71 ft	From manhole center to R/W
Slope =	1.09 %	
therefore, Invert Elev at R/W =	1304.31 ft	
Pipe to Emergency Manhole Inlet =	35.68 ft	
Slope =	1.09 %	
Emrg Manhole Inlet Invert Elev =	1303.92 ft	
Through Emergency Manhole =	6.00 ft	
Slope =	1.09 %	
Emrg Manhole Outlet Invert Elev =	1303.85 ft	
Pipe to Wet Well =	7.75 ft	
Slope =	1.09 %	
Gravity Sewer Wet Well Inlet Elev =	1303.77 ft	

PUMP "ON" ELEVATION

Gravity Sewer Wet Well Inlet Invert Elev =	1303.77 ft
Require distance between gravity sewer invert elev and pump "on" =	18 in
=	1.5 ft
Pump "on" elevation =	1302.27 ft

PUMP "OFF" ELEVATION

Design pumps for maximum of 6 starts per hour

Worst case time cycle occurs when flow into wet well
equals 1/2 of pump flow

In this case,
$$t = \frac{4V}{Q}$$

t = cycle time, min
= 10 at 6 starts per hour
Q = 211 gpm

therefore,
$$V = \frac{Qt}{4}$$

V = 528 gal
= 71 cubic feet

For a 6'-0" diameter wet well,

$$V = \frac{\pi}{4} D^2 H$$

$$D = 6 \text{ ft}$$

$$V = 71 \text{ cubic feet}$$

therefore, $H = 2.50 \text{ ft}$

$$\text{Pump "on" elevation} = 1302.27 \text{ ft}$$

therefore,

$$\text{Pump "off" elevation} = 1299.77 \text{ ft}$$

WET WELL INVERT ELEVATION

$$\text{Pump "off" elevation} = 1299.77 \text{ ft}$$

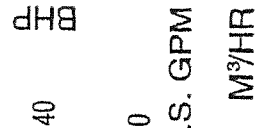
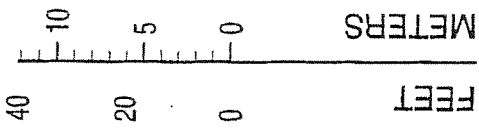
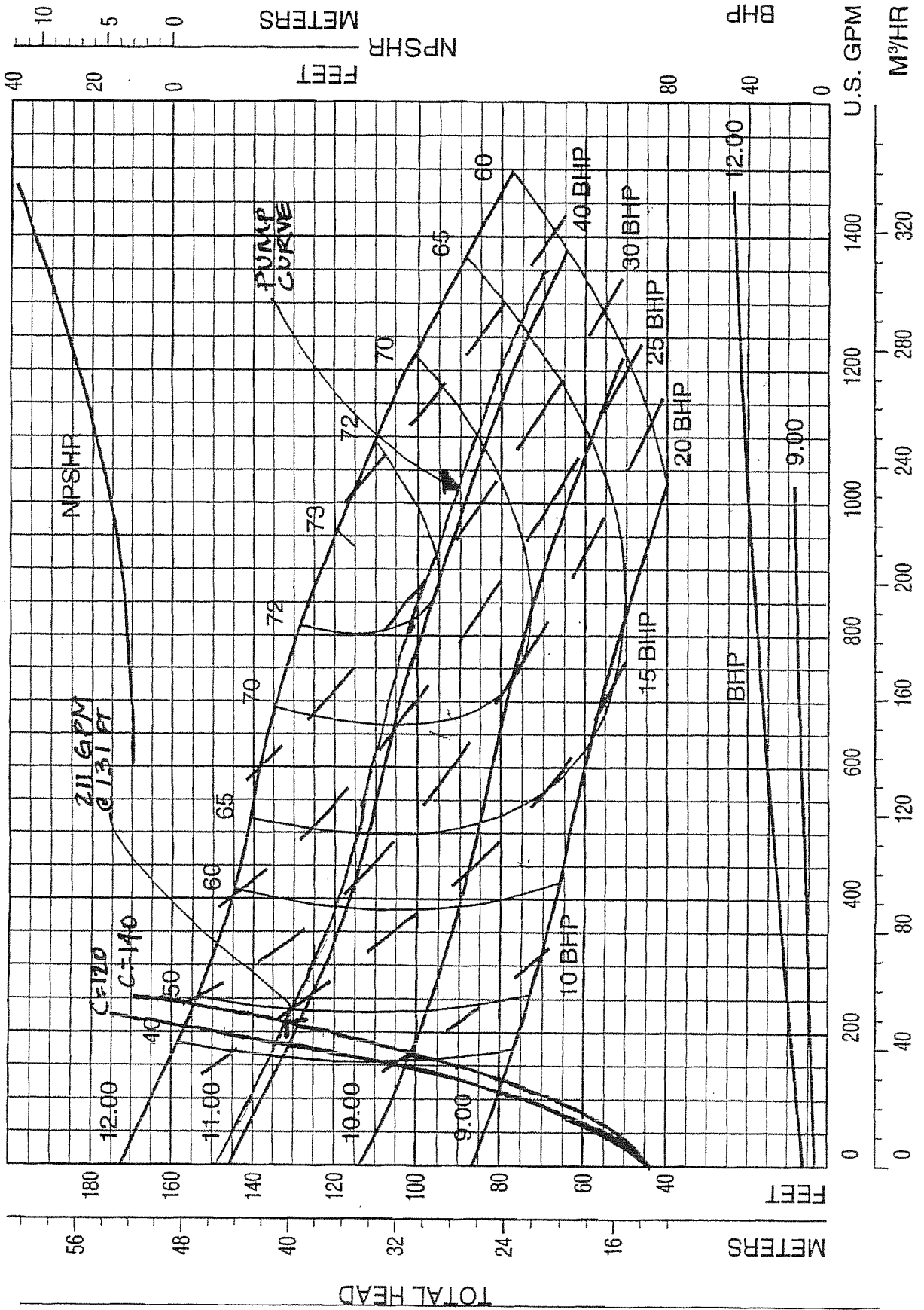
$$\begin{aligned} \text{Distance between "off"} \\ \text{and wet well invert} &= 30 \text{ in} \\ &= 2.5 \text{ ft} \end{aligned}$$

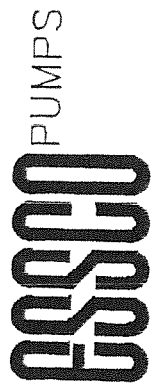
$$\text{Wet well invert elevation} = 1297.27 \text{ ft}$$

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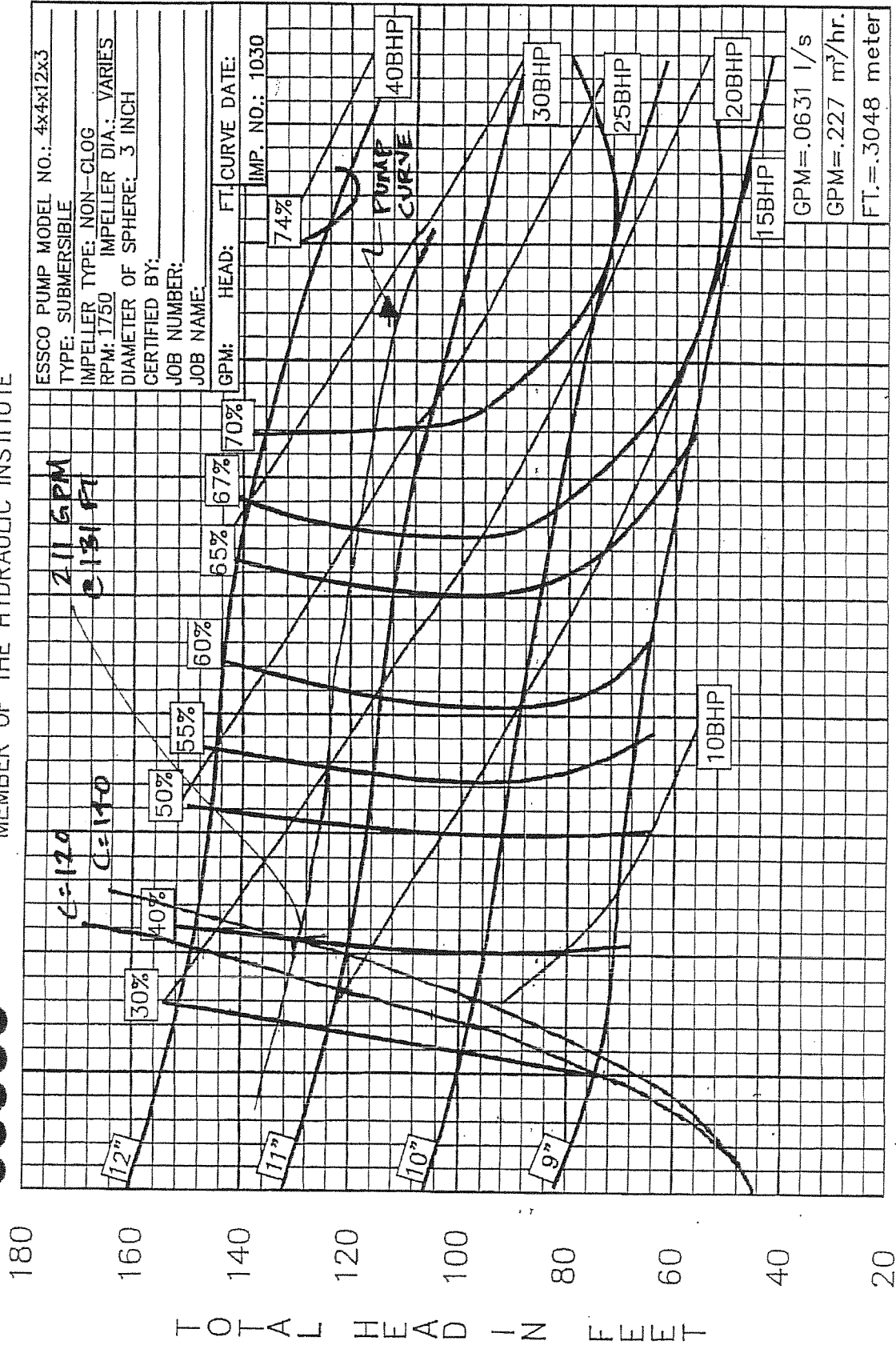
FAIRBANKS MORSE
5430 M&W Submersible Solids-Handling Pumps
Performance

4" 5433
MV
 SUBMERSIBLE
1770 RPM
 NO. OF VANES
 2
 SUCTION SIZE
 4"
 IMPELLER
 T4C1A
 INLET AREA
 26.22 SQ. IN.
 MAX. SPHERE
 3"





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TABLES

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TABLE 1

RELATED DISTRICT STANDARD DRAWINGS

Refer to the latest Standard Drawings located at the following web site

<https://www.emwd.org/water-standard-drawings>

<https://www.emwd.org/sewer-standard-drawings>

Standard Dwg. No.	Description
B-286B	Trench Backfill (for PVC forcemain)
B-342	1.5" Meter Installation
B-344A	2" Copper Service Connection
B-590	5/8" Meter Service Connection, 1" Copper Tubing
B-590A	5/8" Service Connection, 1" Copper Tubing
B-591	1" Meter Service Connection, 1" Copper Tubing
B-591A	1" Service connection, 1" Copper Tubing
B-597	Backflow Prevention Assembly Installation Diagram
B-597A	Reduced Pressure Backflow Preventer Assembly for sizes 3/4" through 2'
B-656	Location Wire Installation
B-658	Service Connection 1" through 4" on Water Appurtenance Lateral or Watermain 16" or Larger
B-663	Standard Restraint (Tee, Dead End, Bend)
B-665	Guard & Marker Posts
D-672	Chain Link Fence Details
SB-08	Locking Type Manhole Cover & Frame
SB-30	Reinforced Precast Shallow Manhole
SB-53	Precast Reinforced Concrete 60" & 72" ID Flat Top Manhole
SB-61	Manhole Cover & Frame
SB-157	Pipe Zone Bedding for Sewer Pipe
SB-158	Trench Backfill for Sewer Pipe
SB-159	Classification of Pipe Zone Bedding for Sewer Pipe

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