SACRAMENTO AREA
SEWER DISTRICT
SERVING YOU 24/7

# DESIGN STANDARDS

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**Version 1.00**

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# PURPOSE AND DEFINITIONS

## Chapter One

## 1. PURPOSE AND DEFINITIONS

### 1.1 Purpose

It is the purpose of these Standards to provide minimum standards to be applied to sewer and sewerage systems dedicated to the public for operation and maintenance, or requiring the approval of the Sacramento Area Sewer District, or to be installed within existing or new public rights-of-way or easements. These Standards are necessary to provide for the safety and general welfare of the public that will be using the sewer facilities. These Standards shall regulate and guide the planning, design, and construction of all sanitary sewer systems within the District service area. Appendix A includes a table of Standard Equipment and Requirements List; Appendix B includes the Standard Drawings.

#### 1.1.1 Modifications

The District reserves the right to modify or waive any design standard for a particular application. Any deviations from these design standards will require justification to, and the approval of, the District prior to plan approval. This justification must be submitted in written form, with appropriate calculations as needed for review. Approved deviations must be identified as such on the project plans and in the project specifications.

#### 1.1.2 Standard Drawings

The standard drawings are attached and take precedence over any other standards and specifications in the event of any conflict.

#### 1.1.3 Changes

The District Engineer may issue clarifications and amendments to these Standards and Drawings as required.

#### 1.1.4 Design Practice

It is recognized that it is not possible to anticipate all situations that may arise in the planning, design, and construction of sewer facilities or to prescribe standards applicable to every situation. Therefore, any items or situations not included in these Standards shall be designed and constructed in accordance with accepted engineering practice. All designs must be signed and/or stamped as appropriate by a Professional Engineer, licensed to practice in the State of California.

#### 1.1.5 Final Authority

The District Engineer shall be the final authority on all questions that may arise as to the interpretation of these Standards. The District Engineer's decision shall be final and he/she shall have authority to enforce and make effective such decisions.

### 1.2 Definitions

Whenever the following terms or titles are used in these Standards, or in any contract, agreement, document, or instrument where these Standards govern, the intent and meaning shall be as herein defined:

### 1.2.1 Air Release Valve (ARV)

A valve that enables air to be removed from a force main. The District uses only combination air and vacuum release valves (CARV).

### 1.2.2 As-builts

Standard Plan & Profile drawings of the project.

### 1.2.3 Board of Directors

The District's governing body, as set by the California State Code.

### 1.2.4 Cathodic Protection System

The system that protects metallic materials from corrosion damage due to stray electrical currents.

### 1.2.5 Collector

A sewer facility that is designed to carry flows of less than 1 MGD.

### 1.2.6 Collector Reimbursement Agreement

A mechanism that may be set in place to reimburse the parties that constructed sewer facilities as a condition of development, that are not reimbursable as trunk facilities, provided certain bid and construction processes are followed. The general terms and conditions of this type of reimbursement are set in the District's Ordinance. This agreement is set into place after construction takes place and is approved by the District's Board.

### 1.2.7 Combination Air Release Valve (CARV)

A combination air and vacuum valve that enables air to be removed from a pressurized pipe or force main.

### 1.2.8 Consulting Engineer

That person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of California who, acting as an agent for a client or developer, prepares or submits improvement plans and/or specifications to the District for approval. Called a Design Engineer in these Standards.

### 1.2.9 Contractor

Any person or persons, firm, partnership, corporation or combination thereof who has entered into a contract with any person, corporation, company, special district, city or the county as a party or parties of the second part, or his or their legal representative, for the construction of any approved sewer facilities within the District service area. All Contractors shall be licensed in accordance with the laws of the State of California.

### 1.2.10 Design Engineer

That person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of California who, prepares or submits improvement plans and/or specifications to the District for approval.

### 1.2.11 Developer

Any person, or persons, firm, partnership, corporation, or combination thereof, which is financially responsible for the construction of approved sewer facilities within the District.

### 1.2.12 District

The Sacramento Area Sewer District (SASD), formerly know as Sacramento County Sanitation District No. 1 (CSD-1), a public sewer agency.

### 1.2.13 District Engineer

The Engineer of SASD acting as agent of the District either directly or through authorized deputies or subordinates.

### 1.2.14 Force Main

The pressurized conveyance pipeline that carries sewage from a pump station into a gravity flow system.

### 1.2.15 Gravity Pipeline

The conveyance pipeline that carries sewage using natural gravity flow.

### 1.2.16 Interceptor Sewer

Sewer pipe designed to carry flows of 10 mgd or greater.

### 1.2.17 Jurisdictional Agency

The local public agency, typically the unincorporated county, a local city (i.e., Sacramento, Elk Grove, Rancho Cordova, Citrus Heights, etc.) or utility district (Fire Department, local water agency, Parks and Recreation, etc.), that has standards to which SASD defers.

### 1.2.18 Lateral Sewer

The pipe that collects sewage from an individual structure (typically residential or commercial) and transports it to the nearest SASD pipe or manhole (typically a collector). Also called “service lateral” and “service sewer”.

Upper Lateral: the portion of the pipe from the public cleanout to the structure. This portion is owned and maintained by the property owner.

Lower Lateral: the portion of the pipe from the public cleanout (at the property line) to the nearest SASD pipe or manhole. This portion is owned and maintained by SASD.

### 1.2.19 Lift Station

A pumping facility that pumps sewage through a short length of force main (less than 400 feet) into the nearest manhole, such that sewage can again flow by gravity.

### 1.2.20 Owner

The record owner of real property, residence, or business served by a sewer connection to District sewer facilities.

### 1.2.21 Pipe Casing

A pipe that encases a sewer pipe, used to separate sewer pipe from undesirable conditions or to enable construction using a trenchless method. Steel casings must be cathodically protected.

### 1.2.22 Private Sewer Maintenance Agreement

An agreement that is recorded against lots or parcels that allow them to maintain and use privately owned and operated sewer facilities. These facilities must be designed and constructed in accordance with the District's Standards. These agreements can be approved by the District Engineer.

### 1.2.23 Pump Station

A pumping facility that pumps sewage over a distance of 400 feet in order to convey it into a gravity system.

### 1.2.24 Record Drawings

The final, post-construction drawings that accurately represent the final condition of the project.

### 1.2.25 Sacramento Regional County Sanitation District (SRCSD)

The regional sanitation district that collects and treats sewage from multiple jurisdictions in the Sacramento area, including the Sacramento Area Sewer District. Generally, SRCSD owns and operates sewer facilities designed to carry flows of 10 MGD and greater.

### 1.2.26 Schematic Slope

A pipe slope used for planning purposes within a sewer study or design report. This is typically greater than design slope to allow for unknown factors.

### 1.2.27 State Standard Specifications or State Specifications

The Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, latest edition.

### 1.2.28 Transition Manhole

The manhole that a force main ties into and where the gravity sewage system begins.

### 1.2.29 Trunk

A sewer facility that is designed to carry flows greater than one mgd, but less than ten mgd.

### 1.2.30 Trunk Reimbursement Agreement

A contractual agreement that may be set in place between a Developer and the District to reimburse a developer for construction of trunk sewerage facilities. The general terms and conditions of this agreement are set in the District's Ordinance. This agreement must be set into place prior to plan approval and must be approved by the District's Board

## 1.3 List of Abbreviations

| | |
|---|---|
| AB | Aggregate Base |
| ABS | Acrylonitrile-Butadiene-Styrene |
| AC | Asphalt Concrete |
| ADWF | Average Dry Weather Flow |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| BC | Begin Curve |
| BEP | Best Efficiency Point |
| BM | Bench Mark |
| BMP | Best Management Practices |
| CARV | Combined Air and Vacuum Release Valve |
| CC&Rs | Covenants, Codes and Restrictions |
| CCTVI | Closed Circuit Television Inspection |
| CF | Cubic Feet |
| CFR | Code of Federal Regulations |
| CIP | Cast In Place |
| CL | Center Line |
| CSD-1 | County Sanitation District No. 1, Former name of SASD |
| Deg | Degree |
| Dia | Diameter |
| DIP | Ductile Iron Pipe |
| DIPRA | Ductile Iron Pipe Research Association |
| DNP3 | Distributed Network Protocol version3 |
| DWF | Dry Weather Flow |
| Dwg | Drawing |
| DWV | Drain Waste and Vent |
| EC | End Curve |
| Elev | Elevation |
| ESD | Equivalent Single Family Dwellings |
| EP | Edge of Pavement |
| FB | Flusher Branch |
| FL | Flow Line |
| FM | Force Main |
| FPS | Feet per second |
| gal | Gallons |
| gpm | Gallons per Minute |
| gpd | Gallons per Day |
| HDPE | High Density Polyethylene |
| HOA | Hand Off Auto |
| hp | Horse Power |
| ID | Inside Diameter |
| I/I | Inflow and Infiltration |

| | |
|---|---|
| IEEE | Institute of Electrical and Electronics Engineers |
| KW | Kilowatts |
| Lb | Pound |
| LF | Linear Foot |
| LPI | Lightning Protection Institute |
| LWL | Low Water Level |
| Max | Maximum |
| MCC | Motor Control Center |
| MGD | Million Gallons per Day |
| MCP | Motor Circuit Protector |
| MH | Manhole |
| Mi | Mile |
| Min | Minimum |
| MOV | Motor Operated Valve |
| NCPI | National Clay Pipe Institute |
| NEC | National Electric Code |
| NEMA | National Electrical Manufacturers' Association |
| NEPA | National Environmental Protection Agency |
| NFPA | National Fire Protection Association |
| NPSHA | Net Positive Suction Head Available |
| NPSHR | Net Positive Suction Head Required |
| NRS | National Electrical Manufactures Association |
| OC | On Center |
| OD | Outside Diameter |
| OIP | Operator interface Panel |
| OSHA | Occupational Safety and Health Administration |
| PF | Peaking Factor |
| PLC | Programmable Logic Controller |
| psi | Pounds per square inch |
| PUE | Public Utilities Easement |
| PVC | Polyvinyl Chloride |
| PWWF | Peak Wet Weather Flow |
| RCP | Reinforced Concrete Pipe |
| RS485 | OSI model physical layer electrical specification |
| RTU | Remote Terminal Unit |
| R/W | Right of Way |
| SASD | Sacramento Area Sewer District, formerly known as CSD-1 |
| SBR | Spectral Band Replication |
| SCADA | Supervisory Control And Data Acquisition |
| SD | Storm Drain |
| SF | Square Foot |
| Sq | Square |
| SRCSD | Sacramento Regional County Sanitation District |

| | |
|---|---|
| SS | Sanitary Sewer |
| SWPPP | Storm Water Pollution Prevention Plan |
| TDH | Total Dynamic Head |
| TVI | Television Inspection |
| TVSS | Transient Voltage Surge Suppressors |
| UL | Underwriters Laboratory Inc. |
| UPS | Uninterruptible Power Supply |
| UV | Ultraviolet |
| V | Velocity |
| VCP | Vitrified Clay Pipe |
| W/ | With |
| WEF | Water Environment Federation |
| WTS | Water Technical Sheets |
| Yd | Yard |

# GENERAL REQUIREMENTS AND PROCEDURES

## Chapter Two

## 2. General Requirements and Procedures

### 2.1 This Manual

This design manual outlines the design requirements for new and replacement sewer pipeline. Upgrades or modifications to existing pipelines shall meet these standards to the extent practical. The design standards apply to pipelines with flow up to 10.0 MGD. Design of pipelines with greater than 10.0 MGD capacity shall be designed per Sacramento Regional County Sanitation District (SRCSD) standards.

#### 2.1.1 Correspondence

Unless otherwise directed, all correspondence and requests for information on Development projects must be made through the Development Services Section, which shall route submittals and requests for information as appropriate.

#### 2.1.2 Jurisdiction

All facilities must satisfy the regulations of all agencies having jurisdiction. Other regulations governing facilities and construction shall be adhered to, including regulations published by the Occupational Safety and Health Administration, the National Fire Protection Association, National Electric Code, and others as applicable. Conflicts must be resolved by SASD on a case-by-case basis.

#### 2.1.3 Life-Cycle Cost Analysis

When evaluating costs SASD considers all life-cycle costs. This includes but is not limited to design and construction costs, lifetime maintenance costs, and upgrading and replacement costs. All project designs will be evaluated for life cycle costs as part of the review.

### 2.2 Submittals

#### 2.2.1 Requirements

The submittal requirements for the following are more specifically outlined on the SASD website:

a. Applications
b. Sewer Study
c. Design Report

### 2.2.2 Applications

Applications are filed per the local jurisdiction (city or county) requirements. SASD will review and comment on the application and identify any potential sewerage issues or concerns necessary for the project. This includes but is not limited to the requirement for a sewer study, the ability to use a gravity sewer solution, the need for pump stations, the lack of local downstream facilities available for use, and the lack of capacity within the SASD system.

## 2.3 Sewer Studies

A Sewer Study is a plan to provide sewer service to a specific portion of sub-service area of SASD. A Sewer Study will fully describe the area to be served by the local collection and trunk facilities, and will fully describe the facilities necessary to provide service to that area. The approved sewer study will become part of the organizational knowledge and historical documentation used by the District for future planning.

A Sewer Study shall be submitted and approved if the District determines there is a possibility that any of the following exist.

a. Upstream or adjacent areas might require sewer service through the subject property.
b. Downstream sewer capacity is limited.
c. It may not be possible to serve the project and / or surrounding area with gravity sewer service.
d. Interim sewer facilities may be required.
e. Off-site sewer facilities may be required.

When a Sewer Study is required, it shall be submitted and approved prior to submittal and approval of project improvement plans and prior to recordation of a project Final Map.

### 2.3.1 General Requirements

In order to develop a Sewer Study the minimum information that must be accumulated and presented includes an analysis of the regional setting, topographic information of the area to be served (delineated on the map and discussed), any specific projects that precipitated the study, relevant assumptions and special conditions, existing and proposed development, existing and proposed sewer infrastructure, ultimate development within the study area, and hydraulic grade line at the point of discharge into major facilities.

### 2.3.2 Flows

The flows generated within each sub-service area of the sub-area plan will be calculated in accordance with the procedures contained in these standards unless otherwise specified by the District Engineer.

### 2.3.3 Study Map

The method of providing sewer service to the entire service area, including pipe sizes, lengths, slopes, and inverts, shall be shown to the extent necessary to determine the requirements within the subject property. All areas to be serviced through the project site, per the CSD-1 Master Plan, must be included in the project flows.

### 2.3.4 Study Slopes

The minimum slopes for gravity pipe shall be determined using the design parameters outlined in the Hydraulic Design chapter. If the proposed pipe alignment will be in an existing or planned road and the study identifies accurate locations for manholes, then the fixed minimum slopes may be used. If

the proposed pipe alignment will be across undeveloped land and will be using nodes at a set spacing, then the minimum schematic slope shall be used.

### 2.3.5 Report Preparation

In order to insure that all Sewer Studies are compatible and easy to understand, they shall all be published using the Minimum Sewer Study Requirements posted on the SASD website.

## 2.4 Design Report

A Design Report is required for reimbursable projects, but only when a sewer study is not required. The reports shall meet all requirements of the SASD Project Manager, including - as a minimum - the following information:

### 2.4.1 Introduction and Background

Use an exhibit for a project location map and identify whether the proposed facilities will be used on an interim or permanent basis.

### 2.4.2 Previous Studies

Master Plan information, Specific Plans, Community Plans, and other Sewer Studies that pertain to this project should be referenced and built upon. If appropriate, those documents should be amended if the proposed project will require significant changes to previously approved documents. Environmental Document and Geotechnical Report findings must be referenced and incorporated to address the requirements. Incorporate and reference exhibits as necessary.

### 2.4.3 Existing Sanitary Sewer Facilities

Identify and briefly discuss whether or not the project is located within the District's service area. Discuss the existing sewer facilities available in the area. Incorporate and reference exhibits as necessary.

### 2.4.4 Planned Sewer Improvements

Discuss the proposed interim or permanent facilities. Identify outfalls and discuss any proposed alternatives and available options. Incorporate and reference exhibits as necessary.

### 2.4.5 Projected Wastewater Flows

Discuss all projected flows as identified from previous studies. Evaluate peak wet weather flows from the area to be served. Include a table that shows estimated ESD's, Average Dry Weather Flow, and the Peak Wet Weather Flow.

### 2.4.6 Phasing

Identify phases of proposed development referencing exhibits that depict the lots proposed to develop at each phase. Discuss the upgrades that are necessary at each phase and include a discussion on what triggers the necessity of implementing the upgrades. Expand the discussion of the upgrade to encompass the facilities, equipment, costs and timeline for implementation of triggers, design and construction aspects. If the station is an interim facility, discuss when and how the facility becomes unnecessary.

### 2.4.7 Pump Station Site

Provide a discussion of the proposed siting of the pump station with respect to the development constraints imposed by the jurisdictional agency. Incorporate the requirements for conveyance of deeds and easements. Incorporate and reference exhibits as necessary.

### 2.4.8 Wet Well and Pumping Alternative

Discuss alternatives for wet well and pump design. Include all appropriate information necessary to analyze the size and depth of the wet well as well as alternatives for the type, size, and number of pumps. A discussion on maintenance requirements of the proposed facilities must be included. Discuss any bypass pumping that may be needed during construction.

### 2.4.9 Recommended Force Main Design

Provide a recommendation and preliminary design for the force main that includes the type of material, the diameter of the pipe, alignment, and length. Identify any easements that will be necessary. Incorporate a discussion on implementing the standard requirements for locating the facility after construction. Identify any special cleaning and maintenance issues that may be needed for this facility, including discussion of future need for chemical feed.

### 2.4.10 Pump Station Site Design

Provide attachments as necessary for the preliminary design of the site, conforming to the Standards. Include specifics on the size, location, and materials for the building, fencing, gates and equipment on the site. Include the location and size of vaults that will encase air/vacuum valves, check valves, gate valves and specify the sizes and materials for these valves. Identify the location and size of the water service and the water district that will provide service. Discuss the need for a hoist or crane. Incorporate and reference exhibits as necessary.

### 2.4.11 Electrical and Controls

Identify the location of above and under ground electrical facilities to serve the site, including the size and location that is responsible for providing the transformer. Describe the equipment needed for the site, including lighting, PLC, SCADA, bubbler, pressure transducer and alarm systems, etc. Also describe the need for emergency power and generator design (if incorporated). Incorporate and reference exhibits as necessary.

### 2.4.12 Evaluation of Odor Control Alternatives

Discuss necessity and alternatives for odor control. Include an estimate of when it may be necessary to install these facilities.

### 2.4.13 Emergency Storage

Provide the calculations on the facilities that will be used for emergency storage of sewage in the event of a pump station outage. Identify the location and elevation of the lowest manhole rim in the storage system and any others in the existing or proposed sewer system that may be affected adversely. Incorporate and reference exhibits as necessary.

### 2.4.14 Cost Estimate

Provide an Engineer’s Estimate of design, construction, and lifecycle costs (including maintenance, operation, and replacement/abandonment costs).

### 2.4.15 Project Schedule

Provide the projected timeline for the project, focused on major start/stop and completion dates.

### 2.4.16 List of Tables

Provide a list of the tables used in the design report. At a minimum, this should include a summary of the projected sewage flows at build out and the design flows at various stages of build out.

### 2.4.17 List of Exhibits

Provide a list of the exhibits used in the design report. At a minimum, this shall include a location map, the overall sewer study area, existing and proposed sewer facilities, and the overall sewer layout proposed. This shall also include preliminary drawings for the pump station design such as the site plan, section through the pump station wet well, single line diagram and load calculations

### 2.4.18 Attachments

At a minimum, the attachments shall include a cost estimate, the pump manufacturer details and curve calculations (including a graph for the pump curve), wet well sizing calculations, emergency storage calculations, calculations for force main head and energy losses, calculations for vibration analysis, cut sheets from manufacturers of proposed facilities and equipment, air/vacuum release valve design sizing and project literature, and a site-specific geotechnical report.

## 2.5 Improvement Plan Requirements

### 2.5.1 Approved Plans

No construction of public or private sewer facilities shall be undertaken within the District or to serve properties within the District until plans and specifications for such facilities have been approved by the District. The approval shall be substantiated by the signature of the District Engineer on the plans obtained prior to initiation of construction. The District may order any Contractor to cease work on any project if said Contractor does not have properly approved plans in his possession at the job site.

### 2.5.2 Plans Signed by Engineer

All plans and specifications for sewer facilities, private or public, which are prepared for approval by the District shall be prepared, stamped, and signed by a Professional Engineer currently licensed to practice within the State of California.

### 2.5.3 Plan Sheet Format

All improvement plans shall be prepared on 22 or 24 x 36 plan and profile sheets or on special Design engineer's sheets, which have been accepted in writing by the District. Plan scales shall be as follows:

2.5.3.1 Horizontal: 1 = 20', 40' or 50'

2.5.3.2 Vertical: 1 = 2', 4' or 5'

2.5.3.3 Only the horizontal or vertical scale for which the sheet was intended and has been set up shall be used.

### 2.5.4 Drafting Standards

All plans submitted for approval to the District shall conform to that quality of drafting standard that will result in clear and legible prints. All lines shall be clear, sharp, and heavy. Letters and numerals shall be 1/8 inch minimum height, well formed, and sharp. Numerals showing profile elevations shall not be bisected by station grid lines. Dimension lines shall be terminated by sharp solid arrowheads.

### 2.5.5 Title Sheet

Improvement plans consisting of 3 or less sheets will not be required to provide a title sheet as such, but all information otherwise required to be included on the title sheet shall be provided on the other sheets of the plans. On all improvement plans exceeding 3 sheets in a set, a title sheet shall be included that shows the following:

2.5.5.1 The project or subdivision name, and the name and address of the developer/owner.

2.5.5.2 A plan of the overall subdivision, parcel, or project showing sewer line sizes, direction of flow, and manhole locations.

2.5.5.3 Boundaries of the District, cities, county, and assessment district (if any).

2.5.5.4 Street names and widths.

2.5.5.5 Section lines, grant lines, property lines, and corners.

2.5.5.6 Names of adjacent subdivisions, lot lines, and lot numbers.

2.5.5.7 Public easements.

2.5.5.8 Vicinity and location maps.

2.5.5.9 Scale of drawings and details.

2.5.5.10 North arrow where appropriate.

2.5.5.11 Index of sheets.

2.5.5.12 Legend of symbols and lines.

2.5.5.13 Standard and special notes.

2.5.5.14 Signature block for approval of SASD (Signature block format shall be in accordance with Standard Drawing No. 4C-1.).

### 2.5.6 Title Blocks

Every sheet of a set of plans submitted to the District for approval shall have a title block showing project or subdivision name, sheet title, sheet number, date, scale, Design Engineer's business address and phone number, and other pertinent information. The preferred location for the title block is along the right hand end of the sheet so that the title block information is visible when the plans are rolled up.

### 2.5.7 Sewer Improvement Plan Requirements

Plans for the construction of sanitary sewers, whether in conjunction with other improvements or for a sewer project only, shall conform to the following standards, as well as other standards contained in these Design Standards.

### 2.5.8 General Requirements

Plans for sewer improvement projects shall include a layout sheet, plan and profile of each sewer line, and any necessary detail drawings. The plans shall be clearly legible and conform to accepted practice with respect to drafting standards. All information, which, in the opinion of the District is necessary for the satisfactory design, review, construction, and maintenance of a project shall be provided and, where applicable, shall be shown on the plans.

2.5.8.1 Layout Sheet

All sewer improvement plans shall include an overall map which shows the project boundaries, sewer lines, manholes, flushing branches, and other important items of the work.

2.5.8.2 Overall Sheet

An overall sewer plan shall be submitted prior to plan approval showing the overall subdivision, parcel, or project including sewer line sizes, direction of flow, flushing branches and manhole locations. The overall plan scale shall be 1 inch = 400’ feet. The 400’ scale overall sheet does not need to be a part of the final improvement plans. The plan may be a reduced layout sheet as specified above.

### 2.5.9 Plan and Profile Sheets

Sewers that will be owned and maintained by the District shall be shown in both plan and profile views on District approved plan and profile sheets.

2.5.9.1 Sewer lines to be constructed shall be indicated on the profile by parallel lines spaced to scale for the pipe diameter. Manholes shall also be indicated by parallel lines spaced according to scale. Slope shall be printed 1/8 inch above, and preferably parallel to, the line or between the parallel lines. The length, size, and type of pipe between each manhole shall be printed parallel to the horizontal grid lines and approximately halfway between the ground surface and pipeline. All pipe invert elevations at manholes and other structures shall be indicated on the profile. The invert elevations shall be printed parallel to the horizontal grid lines and shall be underscored by a line that then runs at a 45-degree angle to the corresponding pipe invert. When manholes, manholes with drop connections, flushing branches, or other appurtenances are to be constructed, the profile shall be so noted with all elevations called out on the plans. Existing facilities shown on the profile shall be shown using dashed lines, with the word “existing” printed 1/8 inch above, and preferably parallel to, the line. Manhole identification on the plan view may be oblique. Manhole stationing shall appear at the lower edge of the profile grid directly under the manhole.

2.5.9.2 In improved areas, the location of each lateral sewer proposed to be constructed shall be indicated on the plans by stationing or by reference to a permanent, well-defined structure, if available. In new subdivisions, the lateral sewer shall be located by stationing, by dimension to lot line, or by notation to install at the center of the lot. The invert elevation of the lateral sewer at the property line shall be indicated on all plans.

2.5.9.3 Improvements or lots shown on a plan sheet but served by a line shown on another plan sheet shall have the direction of service shown by a small triangle and the letter “s”.

2.5.9.4 Both permanent and temporary construction easements shall be shown to scale on the plans. Easement dimensions shall be given and each easement shall be tied to both the property line and the sewer line. Each permanent easement shown on the plans shall be identified by the book and page number in which the easement is recorded. The Design Engineer shall provide the book and page number. In the event that the easements are submitted, but not yet recorded before the plans are approved, blank lines shall be left and the Consulting or Design Engineer shall fill in the recordation information into the Record or As-Built Drawings prior to submittal to the District.

2.5.9.5 Indicate the limiting maximum trench width, as measured at the top of the pipe, on the plans between well-defined points of application; the pipe material and class, if more than one class is available; and the bedding-backfill type. Type 1 bedding, when used, and unlimited trench width, when allowed, need not be shown on the plans. If more than one combination of pipe class, maximum limiting trench width, or bedding type is available, a practical range of such combinations shall be shown on the plans.

2.5.9.6 Proposed sewer line shall be adequately dimensioned from street centerline. If the sewer line is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.

2.5.9.7 Gas mains, water mains, storm drains, and all other main utility lines above or below

ground shall be determined and shown on the plans with accuracy as great as practicable. The location of any utility line which is parallel to and within 5 feet of the sewer line or which crosses the sewer line at an angle of 30 degrees or less shall be determined with an accuracy of +/-1.0 foot and the clearance shown on the plans. Water service lines shall be shown.

2.5.9.8 Trees and other objects within 10 feet of construction centerline shall have their correct location shown on the plans and the clearance from construction centerline shown. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted on the plans. The Design Engineer shall assume full responsibility for such notes as it is assumed that all necessary arrangements with the owner of the object to be handled have been made. Written documentation of any special arrangements regarding preservation of property made between property owners and the Design Engineer shall be supplied to the District if no easement document is involved. If an easement is negotiated, all special arrangements shall be included in the easement document. Tree removal within sewer easements shall be approved by the District.

2.5.9.9 Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. The size and type of all such culverts shall be indicated and when the culvert crosses or is perpendicular or nearly so and within 20 feet of the construction line, the invert of the culvert end nearest the construction line shall be shown.

2.5.9.10 In improved areas, addresses of buildings shall be shown on the plan view, within the outline of the building. Only the front line and indication of side lines of buildings need be shown.

### 2.5.10 Detail Drawings

Items of a special or unusual nature shall be shown with detail drawings, either on the plan sheets, or on a separate detail sheet.

### 2.5.11 Plan Details

In addition to the other requirements of these Design Standards, the following details shall be shown on plans submitted for approval. This does not in any way exempt the Design Engineer from the responsibility of preparing neat, accurate and comprehensive plans in keeping with the standards of the profession.

### 2.5.12 Record and Survey Information

Rights-of-way lines, the boundaries of lots fronting on the street, drainage easements, utility easements, planting easements, section lines and corners, land grant lines and temporary construction easements, both existing and proposed, shall be shown on the plans. All lines for record and survey information shall be properly dimensioned.

### 2.5.13 Topography

All pertinent topographic features shall be shown, such as street line, medians, driveways (on both sides of the street when within 40 feet of the median ending), curbs, sidewalks, shoulders, horizontal and vertical location and size of storm and sanitary sewer lines, high water and frequent inundation levels, water lines, gas lines, telephone conduits, other underground utilities, existing structures, houses, trees (6 inches and larger) and other foliage, traffic signals, street lights and pull boxes, underground electrical conduits, drainage ditches, utility poles, fire hydrants, retaining walls, masonry structures, and all other features of the area which may affect the design requirements for the area. When a potential utility conflict exists, ”as built” elevations of the utilities shall be verified by the Design Engineer.

### 2.5.14 Contours and Elevations

Existing contours or elevations shall be shown on all plans submitted for subdivisions, commercial improvements, or planned unit developments. The scale shall be such that the plans are both readable and representative of the existing or planned site.

### 2.5.15 Profiles

The plans shall show the profile of all roadway centerlines, edges of pavement, curb and gutter flow lines, drainage ditches, water lines, storm and sanitary sewers. All profiles of proposed sewer improvements shall show pipe slopes and other vertical alignment data and invert elevations at manhole pipe inlets and outlets. All manholes shall show finished grade, pipe inlet and outlet elevations and station number.

2.5.15.1 The plans shall show the existing ground profile along all alignments and for a minimum distance of 200 feet beyond temporary street endings to facilitate setting proper vertical alignment within the proposed improvement limits. The 200-foot minimum shall be increased when required by the District.

### 2.5.16 Stationing and Orientation

The stationing on plan and profile sheets shall read from left to right. Stationing shall increase from south to north or from west to east. Plans shall be so arranged that the North arrow points toward the top or right of the sheet, insofar as practical.

### 2.5.17 Bench Marks

The benchmarks and datum shall be clearly delineated on the plans as to location, description and elevations. The datum shall be 1929 North American Datum (U.S.G.S. or U.S.C. & G.S.)

### 2.5.18 Typical Sections

A typical section for each type of facility within the improvement, setting out the structural features, shall be a part of the plans. For example, a typical street section shall show the dimensioned right of way and easements (i.e. joint trench); dimensioned location of medians, sidewalk, pavement and other surface improvements; the location of the water, sewer and storm drain lines dimensioned from the center line of the road to the centerline of each pipe; etc.

### 2.5.19 Cross Sections

Cross sections shall be included in the plans where determined necessary by the District. When unusual topographic features or special conditions occur that would affect the work, individual cross sections shall be shown on the pertinent plan sheets.

### 2.5.20 Special Notes

Special notes shall be clearly indicated, and it shall be conspicuously noted on the plans that all construction work and installations shall conform to the District's Standards and that all work is subject to the approval of the District. Notes shall contain a statement regarding obtaining encroachment permits from other agencies when applicable.

### 2.5.21 Reference to District Design Standards

The General Notes and Special Provisions of all plans shall include the following note**:** "All sanitary sewer construction and materials shall be in accordance with the County Sanitation District No. 1 Design Standards, latest edition."

### 2.5.22 Construction

Construction may be initiated after approval of the plans. Construction shall be initiated and substantial progress made in the construction of the sewer facilities within one year of the date of approval of the plans. Projects or portions of projects which, in the judgment of the District, have not been initiated and substantial progress made in the construction of the sewer facilities within one year, will be voided as to the approval of plans and the Design Engineer shall resubmit the plans for re-approval in accordance with all the current procedures and standards, just as if the plans were never previously approved.

2.5.22.1 Sewer facilities shall be constructed in accordance with the approved plans. No change or deviation from the approved plans will be permitted except for revisions approved in writing by the District.

2.5.22.2 Upon completion of construction the Design Engineer shall submit the following items to the District:

a. Two bond paper sets of the original plans showing all changes made during construction and labeled “As-Built Plans” or “Record Drawings”.

b. One electronic copy, in a format acceptable to SASD, of the labeled “As-Built Plans” or “Record Drawings”.

2.5.22.3 The completed public sewer facilities shall be turned over to the District in a complete and ready for operation condition. For Capital Improvements Projects, formal acceptance of the public sewer facilities shall be made by the District Board of Directors; the District’s Inspector shall write a Letter of Substantial Completion to signify that the facilities are complete and ready to be accepted by the Board. For Development projects, a Letter of Acceptance shall be written by the District’s Inspector.

### 2.5.23 Improvement Plan Revisions During Construction

Should changes become necessary during construction, the Design Engineer shall first obtain the consent of the District and shall then resubmit the title sheet and the plan sheets affected for approval. Minor changes that do not affect the basic design or contract may be made in the As-Builts or Record Drawings upon the authorization of the District. The District may order changes in the plans in order to complete the necessary facilities. Changes in the plans ordered by the District shall conform to all of the above.

2.5.23.1 District approval shall be obtained by submitting, in a timely fashion, revised drawings, adequately and properly identified as to the number and content of the revision, to the District for review. District’s approval of the revision will be indicated by signature in the District’s standard revision approval signature block, to be provided on each such revised plan sheet by the Design Engineer. Changes involving revisions of specification text only will be approved by letter by the District.

2.5.23.2 The changes on the plans shall be made in the following manner:

a. The original proposal shall not be eradicated from the plans but shall be lined out.

b. In the event that eradicating the original proposal is necessary to maintain clarity of the plans, entire sheets may be replaced by designating the replacement sheets using sequential alphabetic numbering after each replaced sheet number and identifying it as superseding the original sheet accordingly on the title sheet.

c. The changes shall be clearly shown on the plans with the changes and approval noted on a revision signature block.

d. The changes shall be identified by the revision number in a triangle delineated on the plans adjacent to the change and on the revision signature block.

### 2.5.24 Conflicts, Errors, and Omissions

Excepted from approval are any features of the plans that are contrary to, in conflict with, or do not conform to California State Law, District Code or Resolution, conditions of approval, or generally accepted good engineering practice, in keeping with the standards of the profession, even though such errors, omissions or conflicts may have been overlooked in the District's review of the plans.

### 2.5.25 Sewer Annexations Requirements

When sanitary sewer plans are submitted for an area that is not within the District, said plans will not be approved until annexation has been approved by LAFCO or unless the service to an area outside the District or importation of flows is in accordance with an existing approved contract or agreement between the District and the agency having jurisdiction for sewer service in the area outside the District.

### 2.5.26 Existing Utilities

All existing utilities shall be shown on the plans. Potholing may be used if necessary to accurately identify the location of utilities. Field notes by a licensed surveyor shall be submitted to confirm the location of potholed utilities. In addition, the Design Engineer shall submit prints of the preliminary and approved plans to the utility companies involved. This is necessary for the utility companies to properly review the plans. Verification that the utility companies have been provided with preliminary plans and copies of all response letters from the utility companies shall be submitted to the District with the plans.

### 2.5.27 Partial Plans

Where the improvement plans submitted cover only a portion of the ultimate development, the plans submitted shall be accompanied by the approved tentative plan. If there is no approved tentative map then a study plan showing topographic features of the ultimate development at an adequate scale to clearly show the proposed improvements shall be submitted.

### 2.5.28 Other Agency Notifications

The Design Engineer is responsible for obtaining the approval and necessary permits of all governmental or municipal agencies when their facilities are involved.

# HYDRAULIC DESIGN

## Chapter Three

## 3. HYDRAULIC DESIGN

### 3.1 Design Flow

#### 3.1.1 Design

Sanitary sewer system design within a developing area must include provisions for size and capacity to adequately convey all domestic, commercial, institutional, and industrial waste that can be reasonably anticipated under conditions of full ultimate development. Design flow shall use the peak wet weather flow. The determination of average of dry weather flows for design purposes shall be based on the best available information concerning land use and density as estimated from land use plans under the jurisdiction of Sacramento County and Cities within the service area to form the basis for quantifying present and future wastewater design flows. This information may include approved land use and density in accordance with current zoning in the absence of more specific information pertaining to expected development.

#### 3.1.2 ESDs

Average dry weather flow is based upon Equivalent Single Family Dwellings (ESDs) equal to 310 gallons per day. The minimum flow is calculated as the larger of 6 ESDs/Gross Acre or:

a. The expected number of units for a project, or
b. The most recent zoning, if the number of units is unknown.

#### 3.1.3 Residential

Single-family units are considered 1 ESD/unit. Multi-Family units (i.e. duplexes, multi-plexes, condominiums and townhouses) will be considered at 75% of the number of residential units. For example, 10 duplexes will be designed as: 10 duplexes x 2 residential units/duplex x .75 = 15 ESDs.

#### 3.1.4 Commercial units

Commercial units will be considered at 6 ESDs/Gross Acre, minimum. Consideration for use type, number of employees, etc., shall be used if known, as long as it exceeds the minimum.

#### 3.1.5 Schools

The larger flow, as determined from one of the following methods, shall be used:

3.1.5.1 The entire school area considered as 6 ESDs/Gross Acre, or

3.1.5.2 Based on the type of school as follows, with the indicated capita limits including ultimate student population plus administration, teaching and operating personnel:

| Type of School | Avg. Flow | Capita Limit |
|---|---|---|
| Elementary (K-5, K-6 or K-B) | 0.025 mgd | 1,000 |
| Upper Elementary (6-8, 7-8 or 7-9) | 0.060 mgd | 1,500 |
| High School (9-12 or 10-12) | 0.080 mgd | 2,000 |

3.1.5.3 For enrollments and personnel in excess of that indicated above, there shall be added 25 gallons per day per additional capita in elementary schools and 40 gallons per day per

additional capita in upper elementary and high school.

### 3.1.6 Industrial

Every attempt should be made to base flows on specific, known industrial development. In the absence of specific information, the flow shall be determined as 6 ESDs/Gross Acre.

### 3.1.7 Open Space

Open space, recreational areas, parks, cemeteries and any other unidentified use shall use a minimum design flow of 6 ESDs/Gross Acre.

## 3.2 Wastewater Flows

### 3.2.1 Formula

The equations listed below are used to determine the Average Dry Weather Flow (ADWF) and Peak Wet Weather Flow (PWWF). The PWWF is the sum of the ADWF times a Peaking Factor (PF) plus Inflow and Infiltration (I/I)). The equations are

a. PWWF (in mgd) = ADWF (PF) + I/I
b. ADWF (in mgd) = (310 gpd/ESD) * (# ESDs/acre) * (# acres ) / 1,000,000
c. PF = $3.5\text{-}1.8Q^{0.05}$ where Q = average ADWF (in mgd), with a minimum value of 1.2.
d. I/I = 1400 gpd/acre for new pipelines (under 5 years old); I/I = 1600 GPD/acre for existing pipelines

## 3.3 Sewer Location and Alignment Requirements

### 3.3.1 Clearance from Water Mains

In no case shall the requirements be less than called for in the California Department of Health Services, as well as applicable State Codes and Regulations.

3.3.1.1 There shall be a minimum horizontal clearance of 10 feet between parallel water and sanitary sewer lines, and the elevation of a water main shall be higher than the elevation of the sewer line.

3.3.1.2 If a sewer force main must cross a water main, the sewer force main shall be installed a minimum of 12 inches below the water main unless otherwise approved by the governing Health Department and water purveyor.

### 3.3.2 General

All sanitary sewers shall be placed within rights of way dedicated for public streets unless the use of easements is specifically approved by the District Engineer. Consideration shall be given for future development when locating manholes in new lines. No manhole shall be located in an area where access would be restricted in a manner preventing routine maintenance. In some streets, dual collectors may be required. Sewer facilities shall not be placed in any joint trench with other utilities.

### 3.3.3 Location in Existing Streets

When sanitary sewers are to be installed in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvements plans, and existing utilities shall all be considered. The approval of the all appropriate jurisdictional entities and SASD shall be obtained in every instance. Alignment shall be parallel to the street centerline wherever possible. Minimum radius of the street centerline to accommodate installation of the sanitary sewers is approximately 200 feet. A larger street centerline radius shall be used whenever practical.

### 3.3.4 Location in New Subdivisions

In new subdivisions, sewers shall be located 6 feet south or east of street centerlines within minor and primary streets (as defined by Sacramento County Improvement Standards). If a street loops 180 degrees or more it is not necessary for the collector sewer to cross to the other side of the street to meet this requirement.

### 3.3.5 Location in Large Streets

In streets with more than one lane of traffic in each direction, sewers shall be located in the center of the drive lane south or east of street centerlines. If necessary, locate dual collectors centered in one or both outside lanes. Circumstances that could require this include the depth at invert of the sewer line in the first lane exceeding 19 feet, the capacity of the sewer line in the first lane exceeding 1 MGD in flow, conflicts with other utilities such as large storm drain lines, and any requirements to serve parcels fronting on large streets.

### 3.3.6 Easements

The minimum width of all easements shall be 20 feet. Wider easements may be required depending on location, type of soil, size of pipe, manhole location, depth of pipe or as determined necessary by the District. In no case shall the pipe be less than 5 feet from the edge of the easement and shall be centered within the easement unless approved by the Director.

3.3.6.1 Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement to be completed in a safe and reasonable manner.

3.3.6.2 Permanent sewer easements shall be granted to the District on all District maintained sewer lines, except when sewer lines are located in public streets or public rights-of-way. The sewer pipe shall be installed in the center of the permanent easement unless otherwise approved by the District.

3.3.6.3 Permanent sewer easements shall be granted to the District for all District maintained temporary or interim pump stations. The permanent easement shall be all on one side of the property line or fence line. Title for the property or Grant Deeds must be provided to the District for all District maintained permanent pump stations.

3.3.6.4 “Backyard” and “Side yard” easements are not permitted.

### 3.3.7 Water Well Clearance

No public sanitary sewer facilities shall be placed closer than 100 feet to any water well, public or private, unless the well has been abandoned in full accord with County Environmental Health Department standards, or the location otherwise approved in writing by the appropriate health agencies. If a clearance of less than 100 feet is approved, all pipe within that distance from the well shall be of material approved by the Director. In no case shall a clearance of less than 50 feet be allowed.

### 3.3.8 Utility Crossings

Alignment of all sewer pipe and structures shall be designed to provide a minimum 12-inch vertical clearance from all other utilities and/or improvements, unless otherwise approved by the District. Approval of crossings of less than 12 inches will require special design considerations.

### 3.3.9 Vertical Alignment

Alignment shall provide a constant slope. Vertical curves shall not be used unless specifically approved by the District.

### 3.3.10 Access Roads

Access to manholes not located within public right-of way shall be provided by 24-hour, all-weather access roads to each manhole, so that all sewer pipeline and manholes are accessible for District maintenance and cleaning equipment (use H-20 loading). At a minimum, this all-weather access road shall consist of 2 inch asphalt concrete surface over 4 inch compacted aggregate base, across a minimum 12 foot width of the drivable surface. Other all-weather surfacing may be used in place of asphalt concrete with the approval of the District. In situations where the sewer is aligned in a designated future roadway, and the access road is most likely a temporary facility, the temporary access road may consist of 12 inches of compacted AB placed over geotechnical fabric.

3.3.10.1 Permanent easements will be required for all maintenance access roads and turn around spaces. The hammerhead turnaround and right turn maintenance access road detail shall be reversed and used for left turn vehicular movements. Hammerhead or intermediate turn-around spaces shall be constructed at the end of all access roads exceeding 120 feet in length and at intermediate locations as determined by the District.

3.3.10.2 The maximum access road grade shall not exceed 10 percent and shall be shown in the profile view. The access road shall not block a natural or artificial drain and shall conform to the requirements of the governing agencies.

3.3.10.3 An access road shall be constructed to any lateral sewer cleanout located in unimproved areas, or other inaccessible locations as determined by the District.

3.3.10.4 On Development Projects, all associated costs for design, construction and easement acquisition will be at the expense of the Developer.

### 3.3.11 Grease Interceptors

Grease interceptors conforming to provisions of the Uniform Plumbing Code, latest edition as currently adopted by the State of California, shall be installed in all waste lines leading from sinks, drains and other fixtures or equipment in the following types of establishments:

3.3.11.1 Restaurants, cafes, lunch counters, cafeterias, bars and clubs.

3.3.11.2 Hotel, hospital, sanitarium, factory or school kitchens.

3.3.11.3 Other establishments where grease may be introduced into the sewage system in quantities that can effect line stoppage or hinder sewage treatment as determined by the District.

3.3.11.4 Grease interceptors shall be considered to be part of the building plumbing, therefore part of the upper lateral, subject to maintenance by the Owner and not by the District.

# GRAVITY PIPELINE

## Chapter Four

## 4. GRAVITY PIPELINE

### 4.1 Groundwater Requirements

#### 4.1.1 Trench Dams

Trench Dams shall be installed whenever the expected or known groundwater elevation is higher than the invert of the sewer and spaced in accordance with the recommendation of the Geotechnical Report and as follows:

4.1.1.1 In the event the Geotechnical Report does not make a specific recommendation a trench dam shall be constructed at a minimum of one location at approximately the mid-point of each section of sewer between each manhole.

4.1.1.2 A trench dam shall be constructed next to every flusher branch located at the end of a sewer line to enable tying into and continuing construction of that line in the future.

#### 4.1.2 Dewatering

When groundwater is expected or known to exist and is anticipated to be encountered during construction, the Design Engineer shall include information necessary for the contractor to provide equipment necessary to construct the facilities shown on the plans.

4.1.2.1 Dewatering for the installation of structures and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled and the pipe has passed all testing, including the TVI.

4.1.2.2 If hydrostatic testing is used, dewatering wells shall be left in place but turned off as appropriate for the testing process.

4.1.2.3 Disposal of water from dewatering operations shall be as required by the jurisdictional agency and in accordance with the SWPPP.

#### 4.1.3 Trench Foundation

In the event that groundwater is expected to be encountered during construction, provisions shall be made in the design and project specifications to ensure that the trench foundation has been adequately dewatered, over-excavated and re-compacted with appropriate material as needed to provide a firm foundation for the pipe to be laid and for the construction of the manholes. The Geotechnical Report shall make recommendations that will be followed for the design and through the construction. A geotechnical engineer shall be required to verify that the trench foundation is suitable during construction.

#### 4.1.4 Lime Treatment

In the event that the soil and groundwater conditions require use of lime in order to provide adequate foundation stability or backfill, recommendation for this treatment must be made by the geotechnical engineer. Lime treatment to expedite construction of a project will not be paid for by the District on a reimbursable project. The District prefers that the schedule allow for drying or conditioning or wet native material, prior to its use in backfill, unless a less costly method or material is available for backfill. The jurisdictional agency must approve use of lime outside of the pipe zone (2 feet above the pipe bedding) on all projects.

### 4.1.5 Geotechnical Reports

A Geotechnical Report shall be required for all plans installing sewer facilities. See the SASD website for current requirements. Borings and in-situ tests along the trench alignments shall be located where recommended by the geotechnical consultant, and at a minimum of every 1,000 feet. Borings shall extend a minim of 10 feet below the anticipated depth of the manholes and 5 feet below the anticipated depth of the pipe.

## 4.2 Gravity Pipe Slope, Velocity, and Size

### 4.2.1 Size

The minimum size of sewer laterals, also known as collector sewers, shall be 8-inch diameter VCP. In the case of existing 6" pipe, the District Engineer may approve 6" repair or replacement.

### 4.2.2 Slope and Velocity

Minimum velocity shall be 2.0 fps when the pipe is flowing half full or full. Maximum velocity shall be 8.0 fps. Manning's formula shall be used to determine the relation of slope, design flow, velocity, diameter, and "N" value. For design purposes, the "N" value shall be considered 0.013 for all pipe materials.

### 4.2.3 Slopes and Capacity

Following is a table of slopes and design flow capacities for various pipe diameters. Pipe slopes less than those listed in this table shall not be used. The slopes indicated are based on a minimum velocity of 2 fps. For pipes smaller than 12 inches in diameter, use a d/D of .7. For pipes 12 inches in diameter and larger, assume the pipe runs full (d/D of 1.0). The "Approximate ESD's Served" is only a guideline, and shall not be used for design purposes.

A Fixed slope shall be used for all construction and design plans when the location is known. A Schematic slope shall be used when only the area to be serviced is known (such as in a Sewer Study). SASD does not permit new construction with 6" pipes.

| Line Size | Min Fixed Slope | Min Schematic Slope | Design Capacity (MGD) | d/D | Approximate ESD's Served |
|---|---|---|---|---|---|
| 6 | 0.0050 | 0.0100 | 0.22 | 0.7 | 278 |
| 8 | 0.0035 | 0.0060 | 0.38 | 0.7 | 486 |
| 10 | 0.0025 | 0.0035 | 0.58 | 0.7 | 756 |
| 12 | 0.0020 | 0.0024 | 1.03 | 1.0 | 1122 |
| 15 | 0.0015 | 0.0018 | 1.60 | 1.0 | 2166 |
| 18 | 0.0012 | 0.0014 | 2.35 | 1.0 | 3232 |
| 21 | 0.0011 | 0.0012 | 3.40 | 1.0 | 4784 |
| 24 | 0.0010 | 0.0110 | 4.50 | 1.0 | 6359 |
| 27 | 0.0010 | 0.0010 | 6.20 | 1.0 | 8883 |
| 30 | 0.0010 | 0.0010 | 8.20 | 1.0 | 11895 |
| 33 | 0.0010 | 0.0010 | 10.50 | 1.0 | 15405 |
| 36 | 0.0010 | 0.0010 | 13.63 | 1.0 | 19764 |

### 4.2.4 Capacity

Pipe capacity, in all cases, shall be adequate to carry design flow from the entire tributary area, even if said area is not within the project boundaries. No sewer facilities in which proposed design flows exceed pipeline peak wet weather flow capacity will be approved. Exceptions for existing facilities or rehabilitation projects may be authorized by the District Engineer.

### 4.2.5 Depth

In the design of a system, the collector sewer shall be at sufficient depth to provide a minimum slope for the lateral sewer of 1/4 inch per foot, at the same time maintaining a minimum cover of 12 inches over the building sewer at any buildable location within the properties to be served.

### 4.2.6 Material

All sewer pipes shall be Vitrified Clay Pipe (VCP). Requests for exception must follow the requirements for the use of alternative materials as required on the SASD website.

4.2.6.1 Standard bell and spigot pipe shall be used unless circumstances such require use of higher axial strength, in which a jacking pipe with push fit joints may be used.

4.2.6.2 Flexible connections shall be used to accommodate any expected ground settling, including but not limited to, pipe connections into manholes, outside of encased pipe, changes from jacking pipe to bell and spigot, etc. These connections shall consist of a series of pipe lengths, sequenced as a 1-foot length short that is placed outside of the point of settlement, followed by a 2-foot length short, at which point the standard pipe lengths may then again be used.

4.2.6.3 In the event that there is a change between standard bell and spigot pipe and jacking pipe, a specially manufactured connector from a clay pipe manufacturer shall be used.

### 4.2.7 Horizontal Alignment

Pipe shall be parallel to the street centerline wherever possible. Minimum radius for sanitary sewers 8 inches through 12 inches in diameter shall be 194 feet. A larger radius shall be used wherever practicable or where necessary to avoid joint deflection in excess of 75% of the pipe manufacturers' recommended maximum. Only factory joints will be allowed.

### 4.2.8 Vertical Alignment

Pipe shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required unless the District approves the use of a vertical curve. In such case, elevations shall be shown at ten-foot intervals throughout the length of the vertical curve. Joint deflections in excess of 75% of the pipe manufacturers' recommended maximum will not be allowed. Only factory joints will be allowed.

## 4.3 Trench Loading Conditions and Pipe Design

The loading condition and pipe design criteria for conduits are as follows:

### 4.3.1 Rigid Conduit Loading

On rigid conduits, Marston's formula shall be used to determine the load placed on the pipe by backfill. The procedure for rigid pipe is described in the ASCE Manual and Report of Engineering Practice 60, the Clay Pipe Engineering Manual, and in similar handbooks. In the absence of specific soil mechanics data, as determined by a geotechnical consultant, a soil weight of 130 pcf and a Ku factor of 0.110 shall be used.

### 4.3.2 Safety Factor

On rigid conduits, a safety factor of 1.25 shall be used for all pipes. Only the three edge bearing strength of the pipe shall be used in the computations for rigid pipe.

### 4.3.3 Maximum Trench Width for VCP

The maximum trench width for VCP may be calculated using the computer program distributed by the National Clay Pipe Institute. Generally, for pipe sizes 12 inches diameter and under are as shown in Standard Drawing 4C-3. For all conditions where the Geotechnical Report determines that the maximum trench width is critical, the calculations must be submitted with the plans for review. Data print-outs from the NCPI program are acceptable submittals for this purpose. Trench width tables shall be shown on the plans to adequately identify the sections of pipe that have critical trench widths.

### 4.3.4 Flexible Conduit Loading

On flexible conduits, Marston's formula for flexible conduits as shown in the ASCE Manual and Report of Engineering Practice No. 60 and in other similar handbooks shall be used to determine the load placed on the pipe by the backfill. The maximum load allowable shall be determined by pipe deflections computed by the Iowa Deflection Formula (or Spangler's Formula). The soils reaction modulus (E') shall be estimated using a method acceptable to the District, and shall consider the modulus values of both the native and the bedding materials (ATV method). The bedding soils reaction modulus (E') used in the deflection calculation shall be 1,000 psi for Type I and Type II bedding, utilizing imported material to twelve inches above the top of the pipe. Deflection lag factor shall be 1.5. In the absence of specific soil data, as determined by a Soils Engineer, a soil weight of 130 pcf, a Ku factor of 0.110, and a bedding constant of 0.110 shall be used. Placement of flexible conduit within soils equivalent to Class V and types MH and CH of Class IV ASTM D2321 material will not be permitted unless approved by the District.

### 4.3.5 Allowable Deflection

On flexible conduits, the maximum allowable deflection shall be 3%. Deflection shall be measured as prescribed by industry standard, using the actual pipe Inside Diameter. Computations shall be submitted showing the ability of the conduit to withstand local buckling.

## 4.4 Bedding and Initial Backfill

Bedding types and factors shall conform to Standard Drawing No. 4C-2. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading. Special attention shall be given to backfill requirements for pipe located in State rights-of-way and for pipe placed in areas where trench width is excessive, such as in the vicinity of bore pits. Any special backfill requirements shall be noted on the plans and specified in the project construction specifications.

### 4.4.1 Type

Unless otherwise noted on the plans, bedding and initial backfill for all pipe sizes shall be Type I, II or III, with trench widths subject to limitations set forth in Standard Drawing No. 4C-3. The minimum trench width for all rigid collector sewer pipes shall be pipe O.D. plus 12 inches. The minimum trench width for rigid trunk sewer pipe shall be pipe O.D. plus 18 inches. Use of Type III bedding in the project must be documented in the record drawings.

### 4.4.2 Bedding and initial backfill

For flexible conduit, bedding and initial backfill shall be Type II utilizing imported material to twelve inches above the top of the pipe. Placement of native material between the spring line and twelve inches above the top of pipe will not be permitted. The minimum trench width for flexible pipe shall

be equal to a minimum of 5 pipe diameters. Alternatively, the manufacturer's recommendations for pipe bedding may be submitted with the plans for consideration and approval. If allowed, it must be noted appropriately on the plans. The plans shall contain a detail or trench width table addressing this design parameter.

### 4.4.3 Other types

Use of other types of bedding and initial backfill is intended primarily for emergency field conditions or due to special circumstance. Their use shall be specified on the plans and noted as an exception to standards and shall require specific written approval of the District before use.

## 4.5 Cathodic Protection

The Geotechnical Report shall provide a corrosivity analysis for all metallic structures such as steel casing, ductile iron pipe, steel reinforcement, etc., along the alignment of the pipeline and make recommendations for the design of the cathodic protection system. The cathodic protection system shall be designed such that the anode bed can sustain protection for a minimum of 50-years.

## 4.6 Manhole Criteria

See the SASD website for a list of pre-approved precast manhole manufacturers. The design criteria for manholes are as follows:

### 4.6.1 General

Sewer manholes are required to comply with ASTM C478. They shall be placed at the intersections of all sanitary sewer lines, at all changes in pipe size, at the end of any line terminating with a cul-de-sac which has five or more lots fronting on the cul-de-sac, at the end of all permanent lines 120 feet or more in length, and at the end of any temporary line more than 200 feet in length. Summit manholes, with two or more connecting sewer collectors that flow away from the manhole, are not allowed. "Saddle" manholes are not permitted. Manholes in PVC collector systems shall be located to reduce or eliminate the need to curve the collector pipes. Manholes shall be in the center of the drive lane.

### 4.6.2 Location in Street Intersections and Crosswalks

Manholes shall not be allowed within intersections of streets larger than "residential" (typically with a pavement width exceeding 36 feet). For these intersections, the manholes must be located outside of the intersection in a configuration that allows maintenance to be performed by blocking only 1 lane of traffic at any given time. Manholes are also prohibited from being located within a crosswalk or alignment designated for pedestrian travel, or in designated on-street parking spaces.

### 4.6.3 Spacing

Maximum spacing of manholes shall be 400 feet for all straight collector sewers lines, and 500 feet for trunk sewer lines. A collector sewer line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on lines which are on a continuous curve of 194-foot radius (min. allowable) shall be 200 feet. Manhole spacing on curved lines of radius between 194 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of tangency between the curves. A manhole shall be required at any change in vertical alignment, unless the use of a vertical curve is approved by the District. A manhole shall also be placed at any abrupt change in horizontal alignment and any change in pipe material.

### 4.6.4 Size Criteria

Generally, precast reinforced concrete manholes shall be 48-inch inside diameter when the largest size pipe entering the manhole is 21-inches in diameter, and 60-inch inside diameter for pipe sizes 24-inch and larger in diameter. See Standard Drawings for details.

4.6.4.1 For manholes that deviate from these standards, it is recommended that verification is obtained from an approved manhole manufacturer that the manhole may be produced. The manufacturer may recommend minor design modifications that will allow construction of a custom base that can accommodate the design.

a. When pipe sizes 18-inch and larger enter a manhole such that the flow of one must change direction by more than 20 degrees, a 60-inch or larger manhole shall be used, with confirmation that it may be constructed by an approved precast manhole manufacturer.

b. When 3 or more 12-inch or larger pipes intersect at a manhole, a 60-inch or larger manhole shall be used, with confirmation that it may be constructed by an approved precast manhole manufacturer

### 4.6.5 Elevation Criteria

Standard flow-through drops in manholes are as follows:

4.6.5.1 When two lines of the same size enter a manhole such that the flow does not change directions, or changes of 20 degrees and less, the invert grade at the exit must be at least 0.05 feet below that of the entrance pipe for pre-cast manhole bases.

4.6.5.2 When two lines of the same size enter a manhole such that the flow of one must change direction more than 20 degrees or if flow in a single line must change direction more than that amount, the invert grade at the exit must be at least 0.10 foot below that of the entrance pipe.

4.6.5.3 If the pipes entering and exiting any manhole are not of the same size, the pipes shall be matched crown to crown. Drop connections are not governed by the above elevation requirements.

4.6.5.4 If the exit pipe is 12-inch or larger and will not have any lower laterals tied into it, the minimum invert of all 6-inch and 8-inch pipe entering the manhole shall match the spring line of the exit pipe. Drop connections are not governed by the above requirements.

### 4.6.6 Elevation Criteria for Lateral Sewers

Any lower laterals entering a manhole shall be installed with the invert elevation of the lateral pipe matching the crown elevation of the exit pipe except when an internal drop connection is used. If the manhole at the end of a cul-de-sac is constructed with a pre-cast base, the invert of any stubs shall be a minimum of one inch above the invert elevation of the exit pipe.

### 4.6.7 Construction Requirements

Pre-cast manholes shall conform to the provisions of the Standard Drawings.

4.6.7.1 Within easements and areas that are subject to flooding, lock-type or pressure-type manhole covers shall be used as follows:

4.6.7.2 The bolt down type frames and covers with ¼” 0-ring secured with adhesive shall be used on manholes located in areas subject to flooding.

4.6.7.3 Bolt down type frames and covers shall be used on manholes located in unimproved or backyard easement areas.

4.6.7.4 Set the manhole cover flush with the final grade (i.e. paved road or access road). There shall be a 24-hour, all weather access road to all manholes and appurtences. The area adjacent to the manhole shall be designed and graded to drain away from the manhole.

4.6.7.5 Within easements and areas that are subject to flooding, where the manhole depth is less than four feet, an 18-inch high cone shall be used.

4.6.7.6 Within improved streets, if the distance from the crown of the pipe to the top of the rim is less than 6’ 8” a minimum 18-inch high cone shall be used.

4.6.7.7 Within improved streets, manholes which have through lines and less than 5’8” from the crown of the pipe to the rim shall use concentric 36” flat slab tops.

4.6.7.8 Manholes shall be designed such that flexing of the pipe does not result in infiltration or exfiltration at the interface between manhole and pipe. Integrally cast bells shall be used, and shall be installed such that they do not exceed 75% of the manufacturer’s recommended maximum deflection. In locations where groundwater elevation is expected to be higher than the pipe invert, special design consideration shall be required.

### 4.6.8 Connections to the Interceptor System

Improvement plans which require a connection to a SRCSD interceptor or interceptor structure shall be reviewed and approved by SRCSD. If required by SRCSD, a signature block for SCRSC approval shall be added to the plan title sheet. A note shall specify that an access request form shall be submitted to SRCSD staff at least 14 working days in advance of the start of intended construction or as required by SRCSD. This is necessary to allow for the special inspection procedures that will apply to such construction.

### 4.6.9 Vacuum Testing

Vacuum testing shall be performed per ASTM C1244-93 on all manholes.

## 4.7 Drop Connection Criteria

Drop connections shall conform to Standard Drawing 4C-52. The inside drop connection shall be used for inlets from 4- to 10-inch diameter collectors and lower laterals. If an elevation difference as measured from the invert in, to the spring line out, of at least 3 feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop. There shall be no more than two inside drop connections into a 48-inch diameter manhole. Drop connections on 10-inch inlet pipes may require a 60-inch diameter manhole, or larger is recommended by a precast manhole manufacturer. Drop connections on inlet pipe sizes larger than 10 inches shall be designed on a case-by-case basis, approved by the District, and, if approved, shall be installed in a five-foot diameter manhole or larger as recommended by the precast manhole manufacturer. The maximum change in flow direction shall not exceed 100 degrees.

## 4.8 Flushing Branch Criteria

A flushing branch may be used in lieu of a manhole at the end of any collector less than 120 feet in length. A flushing branch may also be used at the end of a collector less than 200 feet in length if the collector extends to a subdivision boundary and there are definite plans for its extension. Capping of any sewer pipe will not be allowed. Flushing branches shall conform to Standard Drawings 4C-16A and 4C-16B.

## 4.9 Lateral Sewer Design

The design criteria for lateral sewers are as follows:

### 4.9.1 General

Lateral sewers shall conform to the Standard Drawings 4C-13A and 4C-13B, and shall be constructed perpendicular to the main line unless otherwise approved by the District.

4.9.1.1 The lower lateral shall extend from the collector sewer to the edge of public right of way or edge of easement unless a water main is to be installed at the back of the sidewalk as part of the subdivision improvements. In such cases the lower lateral is to be extended to ten feet from back of the sidewalk.

4.9.1.2 The cleanout is to remain within three feet of the back of the sidewalk. Lower laterals shall extend one foot beyond the edge of the pavement of any private road. Easements of adequate width to accommodate the laterals shall be obtained.

4.9.1.3 A plan and profile of any lateral sewer shall be supplied to the District upon request.

4.9.1.4 On any collector, (whether it will be extended in the future or not) starting at the most upstream end, factory type "Y" connections to the collector shall be used for the first 20 or equivalent ESDs. Construction of the cleanout for all lower laterals is required. Construction of the top 1 foot of the cleanout riser may be delayed until the installation of the building sewer at the option of the developer, except where the water main is to be installed at the back of the sidewalk (refer to Note 9: Standard Drawing 4C-13A). If construction of the top 1 foot of the riser is delayed, the location shall be accurately staked with a 4"x 4" post which extends a minimum of three feet (3') above the finished grade and is painted dark green with permanent, non-degrading paint.

### 4.9.2 Sizing

Normal lateral sewer pipe diameter is four inches for residential and six inches for commercial. Six-inch or larger lateral sewers shall serve schools and other developments expected to contribute high sewage flows. In addition, lateral sewers shall be sized according to requirements of the Uniform Plumbing Code, SASD, and determinations by the Design Engineer. If the lateral sewer and collector are of the same size, a manhole must be constructed; if the collector is larger than the lateral sewer, a factory fitting at the connection is satisfactory. Lateral sewer connection to trunk sewer lines will not be allowed, except at a manhole. Collector sewers shall be allowed to connect to trunk sewer at a manhole.

### 4.9.3 Construction by County Forces

Upon application for permit and payment of required fees, SASD shall construct lower lateral sewers to existing sewers and manholes from individual residential lots and commercial, multiple residential and industrial developments, if the construction costs as approved by SASD are less than $6,500. A note to this effect shall be placed on any plan sheet which indicates a connection to the existing system. All costs shall be born by the Owner.

### 4.9.4 Connection Limitations

Lateral sewers shall not directly connect to trunk sized pipes (one MGD flow or greater) or to sewer lines designed to flow full or to lines more than 19 feet in depth without the approval of the District.

4.9.4.1 Generally, a separate and independent lateral sewer shall be provided for every lot, building and/or structure. Two or more buildings located on the same parcel may share a single lateral sewer connection. However, if at some future time the lot will be split, it may be prudent to design them with separate lateral sewers and that are independently connected to a District maintained collector sewer.

4.9.4.2 A Secondary Suite (ancillary dwelling), an additional separate dwelling unit on a property that would normally accommodate only one dwelling unit, may be connected through the primary residence.

4.9.4.3 No more than five 4-inch lateral sewer connections into a single precast manhole base will be allowed.

### 4.9.5 Material

The lateral sewer pipe and the connecting "T" or "Y" shall be of the same material as the collector to which it connects, except that ABS Schedule 40 per ASTM 2661 pipe may be connected to a VCP

"T" or "Y", as shown on Standard Drawing4C-13A. Also see below for special criteria based on the depth.

### 4.9.6 Location

When sanitary sewers are constructed as part of new subdivision improvements, a lower lateral sewer shall be constructed to each lot.

4.9.6.1 In new subdivisions or developed areas, unless specifically requested otherwise in writing by the property owner or Design Engineer, lateral sewers shall be placed on the low side of any subdivision lot or similar parcel with two percent or greater slope across the front. If approved by the District, the lateral sewer may be placed in the center of said lot or parcel. Consideration shall be given to trees, improvements, proposed driveways etc., so as to minimize interference when the upper lateral sewer is extended to service the house.

4.9.6.2 If the property is located such that service is available both to a line located in an easement and also in right of way, service shall be to the latter location unless otherwise approved by the District.

4.9.6.3 No lateral sewer shall be located such that future on site construction will result in the line being in such proximity to a water well or water main or service that applicable health standards will be violated.

### 4.9.7 Depth

The Design Engineer shall verify the adequacy of the normal upper lateral depth at the edge of easement or right of way to serve the intended parcel. A depth of five feet to crown of pipe, measured from existing ground surface or edge of adjacent roadway, whichever is lower, shall be considered normal upper lateral depth.

4.9.7.1 Whenever greater depth is required, the Design Engineer shall designate the invert elevation of the lower lateral at the edge of the right of way or easement on the construction plans. If the lower lateral has less than three feet of cover measured from the gutter flow line, Polyvinyl Chloride (PVC) SDR 26 conforming to ASTM D 3034 for pipes up to 15-inches, or other high strength pipe approved by the District, shall be used.

4.9.7.2 At locations where gravity service is impossible or impractical to obtain, the Design Engineer shall clearly indicate on the plans the parcels that will require a privately owned and maintained pump station.

4.9.7.3 It shall be the responsibility of the Design Engineer to arrange for coordination of the grade of utilities located in the joint trench and the lateral sewers. If a joint trench is being utilized for other utilities, the Design Engineer shall indicate on the plans that a joint trench will exist and shall adjust lateral sewer elevations as necessary. It shall be the responsibility of the Design Engineer to arrange for coordination of the grade of utilities located in the joint trench and the lateral sewers. Sewer pipes shall not be placed in the Joint Trench.

### 4.9.8 Slope

The 4-inch upper lateral sewer slope shall be per the Uniform Plumbing Code (2%). At locations with less than 4 feet of cover, 1% slope may be used with the approval of the District. Lateral sewer slope for 6-inch or larger laterals may be engineered slopes with a minimum velocity of 2 feet per second with the pipe flowing full or half full.

### 4.9.9 Regulations and Fees

For regulations and fees regarding the installation of an individual lower lateral, contact SASD.

### 4.9.10 Special Requirements in Developed Areas

In developed areas, a lower lateral shall be provided to each parcel participating in the project and having a property line less than 200 feet from a collector. A property owner's request for service location shall be honored whenever practicable. Parcels which have two or more sources of sewage may have an independent lateral sewers provided to each sewage source, which can be separated from the rest of the parcel and sold. A lower lateral sewer shall be provided to each subdivision lot or lot similar as to size and possible development.

### 4.9.11 Crossing Culvert Pipe

Sewer collectors and laterals shall have 12 inches vertical clearance minimum below any culvert unless ductile iron sewer pipe is used and approved by the governing agencies. The Design Engineer shall check all culvert crossing with the appropriate governing agency to determine if future changes in culvert size or location are anticipated. Encasement within steel pipe may be required by the District.

## 4.10 Creek Crossing Design

Advance approval of the District and of other appropriate agencies is necessary prior to initiating design. The criteria for creek crossing design are as follows:

### 4.10.1 General

In all cases, the proposed future creek bed elevation shall be used for design purposes. Crossing details of pipe, piers, anchorage, transition couplings, etc., shall be shown upon a detail sheet of the plans in large scale.

### 4.10.2 Design

Calculations shall be submitted which clearly indicate the design of the pipe and supports regarding impact, horizontal and vertical forces, overturning, pier and anchorage reactions, etc.

### 4.10.3 Construction and Material

Sewer under all creek crossings shall be encased within a steel casing for the full creek width (top-of-bank to top-of-bank), plus ten feet on each side. Special care shall be taken to provide a firm base for the pipe bedding. The plans shall specify that all soft or organic material within the creek banks shall be replaced with select imported backfill. The casing pipe shall be encased in concrete or soil cement if necessary to protect the pipe for the full width of the creek. Unless otherwise directed a clay plug shall be required at the top of the pipe at the downstream side of the crossing. The plug shall be a minimum of four feet in length, shall extend the full width of the trench, and shall extend twelve inches above and below the pipe or as approved by the District.

4.10.3.1 If the pipe must cross above the creek bed, the pipe shall be encased within steel casing pipe. Alternatively, ductile iron with approved lining or welded steel pipe may be used if approved by the District. Steel pipe shall be cement lined and coated, fusion epoxy lined and coated, or glass lined; the District shall approve the type of coating and lining specified, and the gauge, class, or thickness of the pipe. The District may specify which method is to be used.

4.10.3.2 At all above ground creek crossings, provisions shall be made to prevent pedestrian traffic on the pipeline.

4.10.3.3 Piers shall be located as necessary for adequate support of the pipe. The invert elevation at the point of maximum deflection of the suspended pipe shall be invert of the pipe at its downstream support.

### 4.10.4 Permits

The Developer and Contractor shall be in possession of all necessary state and/or federal regulatory agency permits prior to the construction of any creek crossing. Improvement plans that incorporate a creek crossing will not be approved for construction by the District until copies of the permits have been provided to the District.

## 4.11 Trenchless Requirements

Trenchless construction requires the approval of the District Engineer. Where use of conductor casing is specified, the casing shall be steel pipe, reinforced concrete pipe, or welded steel pipe. The casing shall be of sufficient diameter to allow dry sand to be blown into the void between the carrier and the conductor and to allow adjustment of the carrier pipe to grade. Normally, an inside diameter six inches greater than the outside diameter of the couplings and/or bells of the carrier pipe is sufficient. Welded steel conductor pipe shall have a minimum wall thickness of ¼ inch for sizes up to and including 24 inches in diameter and 5/16 inch for sizes 27 inches to 36 inches in diameter. Corrugated steel pipe conductor shall not be less than 10 gauge for sizes up to 36 inches and 8 gauge for diameters to 60 inches. Every R.C.P. conductor must be designed for the loading condition and, if jacked, the additional loading imposed by the jacking operation.

### 4.11.1 Direct Boring

Direct boring of the portion of sewers and lateral sewers, which pass beneath curbs and gutter, sidewalks, and other obstructions, up to a maximum length of 15 feet, is permissible where approved by the District. Installation and other material specifications shall conform to the requirements of the District.

### 4.11.2 Backfill in Bore Pits

This shall be given special attention with respect to preventing structural failure of the pipe entering or exiting the conductor, and adequate bedding and initial backfill shall be specified.

## 4.12 Private Multiple Ownership Residential Developments

The following design requirements shall apply to that portion of the sanitary sewer system within a privately owned multiple ownership development that is “on-site” and is not an outfall sewer for an upstream area, thereby being considered a private system and not subject to maintenance by County forces.

### 4.12.1 Planned Unit Developments and Townhouses

Residential developments where separate lots and structures are sold. These differ from usual subdivisions in that adjacent land is owned in common and a homeowner’s association performs maintenance.

### 4.12.2 General

Sanitary sewers within a privately owned multiple ownership development shall meet all requirements for public sewers contained in these Standards, except as specified below.

### 4.12.3 Manhole spacing

Maximum spacing of manholes on collectors shall be 400 feet for all straight runs of pipe.

### 4.12.4 Wyes

Wyes shall be used for all lateral sewers connecting to the “on-site” collectors.

### 4.12.5 Minimum Depth

All collectors located within vehicular traffic areas shall have a minimum cover of five feet to finish grade.

### 4.12.6 Plan and Profile Sheets

“On-site” improvement plans may be prepared without the sanitary sewer profile that is required by these Standards, unless otherwise instructed by the District. However, the final “on-site” grades and drainage facilities must be shown on the plans on the same sheet as the plan view of the sanitary sewers. Pipe dimensions shall be shown adjacent to the corresponding pipe section. The use of charts shall not be permitted for pipe dimensioning purposes.

### 4.12.7 Backwater Valves

Backwater valve requirements are as specified in standard drawing 4C-15A.

### 4.12.8 Location

Wherever possible, collectors shall be located in areas to be paved.

### 4.12.9 Review and Approval

Plans must be reviewed and approved by the District.

### 4.12.10 Condominiums or Cooperative Developments

Attached residential homes where shares of the total development are sold. The “on-site” sanitary sewers may be constructed as required by the most current edition of the Uniform Plumbing Code (UPC) adopted by the jurisdictional agency. These plans will require the approval of the District in addition to the standard approvals required by the jurisdictional agency.

### 4.12.11 Multi-structural commercial and industrial developments

The “on-site” sanitary sewers for all new commercial and industrial developments containing more than one structure shall be designed in accordance with the requirements contained in Section 4-14A of these standards unless otherwise specified by the District. Each separate building within a multi-building commercial or industrial development shall have its own separate connection to a sewer system designed to public standards.

# FORCE MAIN

## Chapter Five

## 5. FORCE MAIN

All pipes utilized for force mains shall be pressure rated pipes, as approved by the district. Pipes used in the construction of force mains shall be Ductile Iron Pipe (DIP), High Density Polyethylene (HDPE), or approved equal. Force mains shall be designed so that the pipeline is always full and that no point in the vertical alignment is located above the energy grade line. The design report shall address the entire force main system in the most feasible projected layout as practicable, starting from the pumps and for the full length of the force main to the outfall back to gravity system or treatment plant. In the event that plans are submitted that make changes to this layout, an amendment to the design report shall be required to verify that proposed changes will not affect the pump sizing or efficiency.

### 5.1 Easement Requirements

Unless otherwise approved by the District, “fee title” shall be granted to the Sacramento County Sanitation District No. 1.

### 5.2 Size and Velocity

The force main shall be sized to produce a fluid velocity of no less than three (3) feet per second and no more than eight (8) feet per second. Potential for expansion of the station shall be considered when sizing force main pipes.

### 5.3 Hydraulic “C” Factor

For determining the head loss, use the Hazen Williams equation using a C factor = 100.

### 5.4 Water Hammer

A water hammer (surge) analysis studying the force main and the related wastewater pump station shall be performed and submitted with the design report to the District for review and approval. Water hammer shall be evaluated for the normal operation of the pump station as well as for power outage while the pump(s) are running. The modulus of elasticity of the pipe material shall be considered when evaluating water hammer effects. The potential impact of water hammer shall be evaluated with special consideration given to cyclical loadings that are inherent in wastewater force mains. A safety factor of 1.5 shall be used when determining the adequacy of all piping system components with regard to withstanding system pressure, and at the minimum the following shall be addressed in surge analysis:

a. Transient pressures due to water hammer and the effect of these pressures on the entire system.
b. Cyclic loading of the force main.
c. Investigation of the pipe line profile to determine the possibility of the water column separation.
d. Shut-off characteristics of all proposed pump control valves, including check valves.
e. Substantiation for the use of surge control valves and other surge protection devices, when necessary, listing recommended size and computed discharge pressure.

### 5.5 Horizontal Location

Force mains shall be located within the public right-of-way or in appropriate easement. Appropriate clearances between other utilities shall be provided for as specified by the governing agencies. Force

main alignment shall be straight between structures unless the District approves of alternate alignment. For maximum deflection in Ductile Iron Pipe and HDPE force mains, the Design Engineer shall adhere to the manufacturer's recommendation. Force Main alignment shall also be parallel to curbs, street centerlines, property lines and/or easement lines.

## 5.6 Profile

The force main shall have a minimum depth cover of 4 feet as measured from final grade to the crown of the pipe. A continuous upward slope from the pump station to the discharge point is required. In the event that a high point cannot be avoided, and as allowed by the District, a combination air release valve shall be installed per Standard Detail 5C-70 (Standard 60" Air Release Valve Sewer Manhole).

## 5.7 Separation Distance

There shall be a minimum horizontal clearance of ten (10) feet between parallel water and sanitary sewer lines, and the water main shall be higher than the force main. Force mains crossing a water supply system shall comply with the California Department of Health Services requirements, with a minimum of 12" below the water main.

## 5.8 Force Main Locator

A pipe locator ribbon shall be centered in the trench and placed over the entire length of all sewer force mains. In addition, install and program locator balls for sewer (green) at the start, middle, and end of all vertical and horizontal bends including deflected sections, fittings absent of any valve, water crossings, road crossings, and trenching sections. On straight runs of pipe, locator balls shall be installed at a minimum of every 350 feet from the nearest change in direction. If the final grade is undetermined, place marker balls at every 3 feet of depth, starting 8 inches above the top of the pipe. See Standard Detail 5C-80 (Pipe Locator Ribbon and Locator Balls Installation) for proper installation.

### 5.8.1 Data

Contractor shall provide a copy of the programmed data in each marker ball in an electronic format to the district. The Contractor's record drawings shall show the location and GPS coordinates of all marker balls.

## 5.9 Cathodic Protection

All Ductile Iron Pipes shall be protected from corrosion. The District's required method is cathodic protection designed such that the anode bed can sustain protection for a minimum of 50 years; see Standard Detail 5C-30 (Cathodic Protection Ductile Iron Pipe).

## 5.10 Combination Air Release Valves

The force main shall be designed to minimize the use of Combination Air Release Valves (CARV's). Combination air release valves shall be installed so the air can be purged from the force main. Combination air release valves shall also be installed as close as possible to the check valves as needed to ensure the protection and maximize the operations of the pumps. CARV's shall be constructed within manholes in accordance with Standard Detail 5C-70 (Standard 60"Air Release Valve Sewer Manhole).

## 5.11 Thrust Forces and shearing

Calculations shall be submitted in the design report that addresses these forces and provides recommendation for mitigation in the onsite structures and the force main. Thrust forces in a force main shall be mitigated through joints that are restrained or anchored to prevent movement and separation. To avoid shearing due to differential settlement, flex coupling shall be installed on pipelines between pump station structure (i.e. wet well) and vaults, and between valve vaults and bypass vaults.

### 5.11.1 Bends

In terms of change in direction, multiple 45 degree or 22.5 degree bends shall be used in lieu of short radius 90 degree fittings, in addition thrust blocking shall be used on all the bends per Standard Detail 5C-40 (Thrust Blocking Detail).

## 5.12 Force Main Discharge

The force main shall enter the transition manhole with its center line horizontal and an invert elevation matching the spring line of the gravity line to ensure a smooth transition of flow to the gravity flow section: See Standard Detail 5C-50 (Force Main Tie-In at Manhole). A Drop Connection shall be used if the invert elevation of the force main is at a minimum of three (3) feet above the flow line of the receiving manhole (i.e. Gravity Line), using the District Standard Detail 5C-51 (Force Main Tie-In Drop Connection). If needed, the Design Engineer shall include some kind of energy dissipation device in conjunction with the drop bowl.

# PUMP STATIONS

## Chapter Six

## 6. PUMP STATIONS

### 6.1 General

#### 6.1.1 Requirements

These Standards outline the requirements for new and replacement sanitary wastewater pump and lift stations. Upgrades or modifications to existing wastewater pump stations shall meet these standards to the extent practicable. For simplicity, these standards use “pump station” to refer to both pump and lift stations.

#### 6.1.2 Size

These standards apply to wastewater pump stations pumping less than 10 million gallons per day (mgd). Design of wastewater pump stations with 10 mgd or greater capacity shall be designed per Sacramento Regional County Sanitation District (SRCSD) standards.

#### 6.1.3 Modifications

These standards are intended to guide the engineer in the design of wastewater pump stations. The District reserves the right to modify or waive any design standard for a particular application. Any deviations from these design standards will require a written justification to be submitted for the approval of the District prior to construction.

#### 6.1.4 Acceptance Process

The station is to be designed, constructed, and demonstrated as operational before acceptance by the Sacramento Area Sewer District. This process is controlled by the Pump Station Acceptance Checklist; see the SASD website.

#### 6.1.5 Naming Convention

The District has determined a naming convention to identify each station. A numerical designation shall be assigned by the District, generally when a design report is submitted. As soon as the street address for the site is known, the station title shall incorporate the street name. Also, the station is called either a lift station or a pump station, based on the length of the force main. On stations that use a force main exceeding 400 feet to the discharge manhole, the station is classified as “Pump Station”, while stations using a force main less than or equal to 400 feet to the discharge manhole the station is classified as “Lift Station”. This title shall be used on all design reports, plans, specifications, submittals, reimbursement agreements and any other documents submitted for review and approval of each pump station.

#### 6.1.6 Abandonment

6.1.6.1 The process for abandoning a pump station is on the SASD website.

#### 6.1.7 Applicable Regulations

6.1.7.1 Wastewater pump stations must satisfy the regulations of all agencies having jurisdiction. Wastewater pump stations, at a minimum, shall conform to this document.

6.1.7.2 Other regulations governing facilities and construction shall be adhered to, including but not

limited to regulations published by the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), Uniform Building Code (UBC), National Electric Manufacturers Association (NEMA), California Code of Regulations (CCR), and others as applicable.

### 6.1.8 Drawings and Details

The drawings and details for use in pump station design have been placed in Appendix B.

## 6.2 Siting Criteria

All of these factors shall be considered when selecting a pump station site.

### 6.2.1 Topography

Adjacent areas or sheds potentially served by the pump station must be considered. Site selection shall be compatible with suitable site access and soil capability with respect to land grading and site development.

### 6.2.2 Access

All pump stations shall be sited to allow access by all-weather surface roads capable of accommodating an H-20 design vehicle. Provisions shall be made for entry into traffic nose first. Center medians may require modification for ease of access to pump stations from all directions. Driveway widths must accommodate the Districts vehicles.

### 6.2.3 Flood Plain

Pump stations shall be sited to remain operational and permit access during 100 year return frequency flood. Pump station top slab, wet well rims and related vault lid elevations shall conform to the County of Sacramento Flood Hazard Ordinance and must be accessible to roadways that have a drivable surface that is at a minimum 1-foot above the 100-year flood Level.

### 6.2.4 Land Use

Pump stations sites shall conform to land use regulations for which the property is zoned and adhere to the setbacks required under such zoning.

### 6.2.5 Aesthetics

Natural screening and remoteness of the site are primary element of site selection wherever possible. Facilities shall be designed with architecture that blends into the local surroundings. All above ground pipes shall be colored “Gun Metal Gray.” All concrete surfaces shall have a “broom” finish.

### 6.2.6 Noise

Where pump stations are sited in proximity to developed areas, measures shall be taken to minimize the impact of noise to the neighboring properties. The design shall take into consideration the noise levels of all equipment and must meet minimum noise ordinance for night operation of said equipment. These issues should be fully discussed in the Environmental Review Document.

### 6.2.7 Odors

The effect of odor on the neighboring properties shall be assessed. Every effort shall be made in site selection to reduce the potential odor pollution; duration and intensity are all important considerations that must be evaluated. SASD reserves the right to require odor control facilities.

### 6.2.8 Overhead clearance

Adequate overhead clearance shall be provided over the entire wastewater pump stations site so that maintenance equipment does not interfere with overhead utilities or structures. In general pump stations shall not be sited where existing overhead interferences exists.

### 6.2.9 Protection from Vehicle Impact

Pump stations located adjacent to high speed roads, heavily traveled roads or in areas otherwise susceptible to vehicular impact shall be designed with impact mitigation devices (such as bollards spaced 3-4 feet apart) to protect the pump stations from errant vehicles. In addition, a turnout to allow District vehicles to safely access the site may be required.

### 6.2.10 Protection from Solar Damage/Heat

Shade covers shall be provided to panels containing electrical control system and instrumentation equipment that are susceptible to damage from heat generated by solar exposure. Typically these must be structurally designed to withstand wind and seismic loadings. The District requires that these designs be stamped by a registered Structural Engineer, licensed to practice in the State of California.

## 6.3 Hydraulic Design Consideration

### 6.3.1 Hydraulic Design

The design flows for the pump stations shall be determined in accordance with Chapter 3 of this Standard. Stations with flows greater than 10 MGD are considered Regional pump stations, and shall be designed per Sacramento Regional County Sanitation District (SRCSD) standards.

### 6.3.2 Station Classification

The amount of flow dictates the size of a pump station, which are classified as follows:

| | |
|---|---|
| Pre-Engineered | Less than 1.0 MGD |
| Medium Stations | Between 1.0 and 7.0 MGD |
| Large Station | Between 7.0 and up to 10.0 MGD |

### 6.3.3 Pre-engineered stations

Pre-engineered stations shall be used for stations with a flow of 1.0 MGD or less. Contact SASD for a list of pre-approved manufacturers.

### 6.3.4 Phasing

If the pump station is intended for development of a project being built in phases, consideration shall be given to the various flows that will occur at different project phases. Pump stations shall be based on the ultimate capacity requirement and on the interim phase flows. The design report shall clearly identify and outline the various flows and the corresponding triggers requiring the next level of expansion/upgrade. A summary of the phasing shall be noted on the improvement plans.

## 6.4 Civil

### 6.4.1 Site Design

Pump stations shall be designed and constructed with the necessary provisions to ensure adequate and reasonable access, security, drainage, and maintainability.

#### 6.4.1.1 Site Layout

A minimum of 50 ft separation from the pump station structure (i.e. wet well) shall be provided to the property line and/or adjacent facilities. Pump station site design shall include space to facilitate service equipment (including but not limited to big trucks, cranes, vacuum trucks, etc.). This is in addition to the permanent on-site equipment. Standard Drawing 6C-10 depicts a typical layout for a pump station; if the site of the pump station is a corner lot, it shall conform to Standard Drawing 6C-11.

#### 6.4.1.2 Vehicular Access

Pump stations shall be constructed with adequate access by maintenance vehicles. All surfaces, including temporary all-weather aggregate base roadways, asphalt concrete surfaces, concrete pads, and vaults and hatch covers shall be designed for H-20 loading. If a temporary access road is used for site access, at a minimum it shall conform to Standard Drawing 6C-14 (Access Road). The access road and route to the pump station from the maintenance yard must be accessible during a 100-year flood and have a drivable surface that is at a minimum elevation of 1-foot above the 100-year flood elevation. Driveways to the site shall conform to Standard Drawing 6C-12 (Commercial Driveways)

### 6.4.2 Perimeter Fence

All pump stations shall have a minimum 8 feet high fence designed to discourage unauthorized access. Fence shall be chain link fence with slats and architectural treatment surrounding the site. Concrete Masonry Units (CMU) or other types of fencing may be required if circumstances warrant.

### 6.4.3 Gates

A three (3) foot wide man-gate and two (2) double 10 feet wide (20 feet total) swinging gates shall be provided for access to the site. Twenty foot sliding gates may be allowed in lieu of swinging gates if circumstances warrant. All gates shall be capable of achieving full open position with one (1) human operator. All gates shall have a daisy-chain type of locking mechanism. In addition, all gates shall have Drop-Bolts type gates stops with receiver sleeves for both gates.

### 6.4.4 Potable Water

Service lines from the water distribution main to the property line or edge of the easement shall be installed at the time the main is constructed. Services from mains installed in private roads shall extend one foot beyond the edge of the pavement.

#### 6.4.4.1 Water Meters

Provide a water meter in accordance with the local water agency having jurisdiction. The size of water meter shall not be less than the size of the service line unless approved by the local water supply agency.

#### 6.4.4.2 Back Flow Device

A Reduced Pressure Backflow Preventer Assembly (RPPA) from the most recent list of approved RPPAs by the State of California Department of Health Services shall be provided; see Standard Drawing 6C-60 for typical RPPA requirements.

#### 6.4.4.3 Hose Bib

A potable water hose bib shall be provided near the wet well, and it shall be protected from vehicular traffic with removable bollards as shown on Standard Drawing 6C-10 and 6C-11 (Site Layout). The hose bib shall have a threaded spigot for a 1-inch diameter hose. The bollards shall be spaced between 3-5 feet apart.

### 6.4.5 Grading

Pump station site grading shall be designed to prevent local ponding and to provide positive drainage away from structures. The site shall be graded so as to not create a low-point in relation with the adjoining properties. A minimum slope of 1% shall be maintained for site drainage, and the slope shall not exceed 2 %.

### 6.4.6 Storm Water

Storm runoff from the pump station site shall be designed in compliance with the local jurisdiction. Storm water shall not drain into the wet well. Permanent Best Managements Practices (BMP) for permanent on-site storm water runoff shall conform to requirements of the local jurisdiction and the District.

### 6.4.7 Landscaping

The District does not pay associated cost to construct nor maintain on and/or off site landscaping. If a jurisdictional agency or the development community has some land use requirements that must be fulfilled with regard to landscaping, a local Homeowners Association, Landscaping District or other similar entity that will own landscaping easement and bear all the costs for construction and maintenance said landscaping must be existing or set up and funded. Then these requirements can be incorporated into the site design, but must not diminish the overall finished size of the site as required by the District. Any landscape design shall be appropriate such that it shall not impede the access to the pump station. In the event that the entity responsible for maintenance fails to maintain said landscaping, minimal weed abatement measures will be used by the District and the landscaping will most likely be replaced with weed fabric and gravel.

### 6.4.8 Exterior Lighting

Exterior light shall be provided to adequately light the equipment area. The lights shall be appropriately shielded to prevent spillage on the neighboring properties or in a skyward direction. Exterior light switching shall be manual, with photocell override for day-light shut-off. Timer or motion control of exterior lights is not allowed. Light poles within the pump station site shall conform to Standard Drawing 6E-15 (Pole Base Detail).

### 6.4.9 Approach Manhole and Pipe

Sewage shall be intercepted by an upstream manhole and an approach pipe laid on a gradient of 2% slope to the point of discharge. The approach pipe invert elevation shall be the same as the “lead pump on” elevation (see drawing 6C-20). The approach pipe be used for the sewer inlet to wet well, and considered part of the wet well and not part of the collector system. The approach pipe may also serve as supplemental emergency storage.

### 6.4.10 Wet Well

Wet wells shall be designed and constructed to be as hazard free as possible, and all materials and equipment used in wet wells shall be corrosion-resistant. No junction boxes shall be installed in the wet well. Dry well or dry-pit pump stations will not be used. All pump station wet wells shall be designed by a structural engineer registered in the State of California. Wet wells shall be constructed of precast reinforced concrete and shall be circular for all pump stations. See Standard Drawings 6C-20 and 6M-20.

6.4.10.1 The PVC liner shall be pre-cast into the concrete wall of the wet well at the manufacturer’s plant. Lifting holes and pipe protrusions, and damaged liner shall be sealed in accordance with liner manufacturer’s recommendations. Any repairs to the liner shall use a mechanical method to ensure adherence of the repair to the concrete wall, in accordance with the liner

manufacturer's recommendation.

6.4.10.2 Wet wells that are installed below the groundwater table shall be adequately designed to prevent floatation and water infiltration. Wet well size and depth shall be as required to accommodate the influent sewer and provide adequate volume to prevent the excessive cycling of pumps. For maximum number of pump starts per hour, refer to the section on pump selection.

6.4.10.3 The wet well shall be designed with a flat bottom, and shall only have a 6 inch fillet along the edge of the wet well to ensure the structural integrity of the wet well with respect to sealing against infiltration/leakage. The fillet shall be constructed with a material that is resistant to corrosion and will adhere adequately to the bottom and sides of the wet well.

6.4.10.4 Force main penetration in the wet well shall be core drilled. Mechanical link seal for penetration shall be provided as shown on Standard Detail 6C-20 (Circular Wet Well).

### 6.4.11 Access Hatch

The access hatch shall be integrally cast into the concrete wet well roof. The top of the access hatch shall be flush with the top of the concrete roof. The access hatch shall be preassembled from the manufacturer.

6.4.11.1 The access hatch covers and frames shall be aluminum; components and hardware shall be constructed of ANSI 316 stainless steel and shall be equipped for locking with a padlock. Each cover leaf shall be provided with a lift handle that remains flush with the cover when not in use. Each cover leaf shall be equipped with stainless steel hinges, spring assist hold-open arms, watertight gasket, and recessed pad-lockable hasps. The access hatches shall be the Flygt Safe-Hatch system H-20 Rated or approved equal. Hatch opening direction shall be approved by SASD.

### 6.4.12 Safety Grate

The wet well hatch shall be designed for fall through protection when covers are open; aluminum safety grates painted "safety orange" shall be provided beneath the hatch covers. Safety grates shall be provided with a permanent hinging system that will lock the grates in 90 degree position once opened and prevent the grates from falling into the wet well.

### 6.4.13 Sizing of Wet Well

The required operational wet well volume shall be calculated to optimize pump operation to meet peak hour design flow and minimum hour flow. The District's maximum pump start frequency shall be considered when determining the wet well volume. Every effort shall be made to design the system that prevents conditions that allow wastewater in the wet well from becoming septic. The wet well shall be sized based on the equation below:

$$V = Q * t / 4$$

Where V is Wet Well operational volume in gallons

Q: PWWF flow in gpm

t: Interval between pump starts in minutes

6.4.13.1 Wet well design shall utilize submersible, centrifugal, constant speed pumps. Use of other types of pumps shall require a more in depth review by the District before approval of the design report.

6.4.13.2 The wet well shall be designed to facilitate the operational levels for the pumps within the wet well such that the following operational parameters are met, and also as shown on Standard Drawings 6C-20and 6M-20.

a. The low level water alarm must meet the pump manufacturer's minimum recommended safety limits. The pump operational band (between pump on and pump off) must begin a minimum of 6-inches above the low water alarm, or larger if recommended by the pump manufacturer. The operational band must be large enough to accommodate the District's maximum number of pump starts allowed.
b. Inside width of the wet well shall be a minimum of 6 feet; however, retention time, pump configuration, and access may require a larger structure.

### 6.4.14 Vaults

Vaults shall have interior coating designed to protect against corrosion from hydrogen sulfide gas. When high groundwater is anticipated, exterior waterproofing shall be installed and vaults shall be designed to resist uplift forces with a factor of safety of 1.5. The floor of the vault shall slope to the drain.

6.4.14.1 CARV and Bypass Vault

CARV and bypass vaults shall be H-20 rated with aluminum single leaf doors with stainless steel hinges, spring assist hold-open arms, anti slam gasket, and recessed pad-lockable hasps and fitted with a safety net system. They shall be sized to provide 2 feet overall clearance (top, bottom, sides) between walls of the vaults and internal components for accessibility and routine maintenance. CARV and bypass vaults shall have three (3) inch ABS drain line that discharges to the wet well. See Standard Drawings 6M-30 and 6M-40 (Valve Vault and Bypass Vault).

6.4.14.2 Force main penetration shall be core drilled and grouted in place and flush on both sides of the wall. Force mains within the vaults shall have a flange support, or saddle support as approved by the district.

### 6.4.15 Safety Netting

For all hatches except the wet well, safety netting shall be designed for fall through protection when covers are open and shall be provided beneath the hatch covers.

### 6.4.16 Odor Control

Provide a six (6) feet by six (6) feet concrete pad for the odor control station with a PVC intake scrubber stubbed out and capped for future use. The depth of the intake duct in the wet well shall be set to avoid entry of wastewater into the duct during the periods of high water level. Provide an electrical connection for the air scrubber and 3-inch drain line as shown on Standard Drawing 6M-50 (Odor control pad).

### 6.4.17 Maintenance Pad

Provide a square concrete pad, 8-feet by 8-feet, with a 2% slope towards the floor drain. The site around the maintenance pad shall be graded to slope away from the wet well so that storm water does not have a natural path into the wet well from the pad.

### 6.4.18 Emergency Storage

The required emergency storage capacity shall be calculated using flows for 4 hours of PWWF. This can be provided either on-line or off-line.

6.4.18.1 On-line storage consists of additional capacity in the upstream gravity sewers that feeds the pump station, up to and including the wet well. The Design Engineer – with District approval - may oversize pipes in the local collection system to gain additional storage. Minimum pipe slopes will not change due to the upsized pipes. A maximum of 75 % of the volume in the collection system, up to 3-feet below the rim elevation of the lowest manhole, can be counted for storage purposes. The design report shall include an exhibit that depicts

the pipes used for calculating emergency storage and identifies the controlling manhole. Building pads or service lines that connect at an elevation lower than the controlling elevation must include a note that a backflow prevention device is required.

6.4.18.2 Off-line storage is as an on-site or off-site storage tank or pipe that is designed for this purpose. Preferably this system would operate with a gravity flow-design and flow directly into the wet well so that it remained in an empty condition when not utilized for emergency storage.

### 6.4.19 Bypass Pumping

There are two different methods to bypass pumping, generally depending on whether the station is a lift station or a pump station.

6.4.19.1 Lift stations shall have an overflow pipe installed between the wet well and the discharge manhole. The overflow pipe crown elevations shall be below the invert elevation of the air scrubber intake.

6.4.19.2 Pump stations shall have a bypass vault with an isolation check valves and bypass pumping assembly located inside the bypass vault between the wet well and the discharge manhole.

### 6.4.20 Bypass Pumping Plan

A bypass pumping plan shall be outlined in the design report and included in the plans. A plan sheet dedicated specifically to the emergency bypass plan shall contain the minimum information required, such that the District's staff has information necessary to evaluate and prioritize a response to emergency conditions. There are two scenarios that require information in the bypass plan: one including the condition that the pump station is not operational, and the other where the force main is not operational. The minimum information includes, but is not limited to, the design flows into the pump station, the emergency storage capacity and time, basic equipment information and piping layout. Any information that is unavailable at plan approval, or is modified during construction, shall be corrected or added to the as-built or record drawings prior to the pump station acceptance for maintenance by the District.

### 6.4.21 Plan Sheet

The Plans shall contain a sheet dedicated to the emergency bypass plan. At a minimum, it shall identify the layout of the sewer system so that all facilities used for the emergency storage are shown. This includes the lowest 3 manholes and any branches in the system leading into the pump station, and also the force main up to the outfall into the gravity system (including the location of any significant structures i.e. CARVs). This could encompass several details at various scales and more than one plan sheet if needed to visually show the minimum required information. The minimum information to be shown on the plan sheet includes the layout of the most likely location for bypass piping, emergency storage system, the upstream collection system, and the force main. Basic data shall be incorporated in a tabular form.

### 6.4.22 Bypass Piping Layout

A layout to identify the most likely location for placing bypass piping between the upstream gravity manhole and the bypass valve and the estimated lengths and distance information shall be shown and labeled appropriately.

### 6.4.23 Emergency Storage System Layout

A detail showing the layout and basic information for the emergency storage system shall include all pertinent information for any part of the gravity system, onsite structures/tanks, and the wet well that is used. This shall include the wet well diameter, rim elevation and depth. The gravity pipes shall include lengths, diameter, and invert elevations at the manholes. The manholes shall show diameter, rim elevation, and depth, and include District manhole numbering if it is known. The location of the lowest manhole and the rim elevation shall be clearly shown and labeled.

### 6.4.24 Lowest Upstream Manholes

A detail showing a schematic layout of the upstream collection system and any branches that will discharge into the pump station shall be shown and include the next 2 lowest manholes in the system and their rim elevations. The District numbers shall be used to identify these manholes and street name information shall also be included.

### 6.4.25 Force Main Layout

A detail of the force main layout shall be shown from the bypass valve to the outfall manhole into the downstream gravity system, and include all pertinent structures such as CARVs, etc. The pipe diameter and lengths between structures shall be labeled. The information for the outfall manhole shall identify the rim elevation, depth, invert of the force main and any other entry pipes as well as the exit pipe. The District manhole number and street name information shall also be included.

### 6.4.26 Data Table

The basic design information as outlined above shall be shown in tabular form. The design flows shall be shown in MGD for both the ADWF and the PWWF, and the emergency storage capacity and time for the entire system. The specific storage information for the wet well, upstream system, and any onsite storage structure that may be included in the design shall be incorporated. The basic pump information required includes the number, makes and models designed, the capacity, type of pump, type of drive, and the dynamic head for each pump both individually and combined.

## 6.5 Mechanical Standards

### 6.5.1 Pump Selection

Wastewater pumps shall be submersible, constant speed, centrifugal non-clog solids handling pumps specifically designed for handling raw, unscreened domestic sanitary wastewater. Pump motors shall operate on 460 volts, 3 phase, and 60 Hz electrical service and at a speed no higher than 1780 rpm. Pump motor horsepower selected shall be sufficient to prevent motor overload over the entire range of pump performance curve. Wastewater pumps shall be suitable for continuous duty. Pumps that are 100 horsepower or smaller can have up to 8 starts per hour. Larger submersible pumps shall be designed to maintain 6 starts per hour.

### 6.5.2 Pump Selection Criteria

Calculations and pump efficiency curves that conform to the industry standard conventions shall be incorporated as part of the design report to verify all the criteria are met for the force main and the pump station system in order to provide the best pump selection. This shall include the identifying the static head, the friction losses, total dynamic head (TDH), etc.

a. The required flow rates from ADWF to PWWF shall be between 60% to 115% of the capacity of the selected pump at its best efficiency point (BEP).
b. The required pump discharge head shall be achieved with an impeller diameter smaller than the maximum impeller diameter for the selected casing, thus future expansion will only require changing the impeller, rather than the entire pump.

c. The pump shall have a head-capacity curve that rises continuously from its BEP to shutoff. Avoid pumps with flat pump curves (i.e. where small change in total dynamic head will result in large change in pump flow).

d. The pump shall be capable of passing solids equivalent to a sphere of 3-inches in diameter.

e. The Net Positive Suction Head Available (NPSHA) shall exceed the Net Positive Suction Head Required (NPSHR) by a margin of at least 35% at the maximum flow condition.

f. Pump efficiency and "wire to water" efficiency shall be identified at the typical operating points.

g. The low level water alarm must meet the pump manufacturer's minimum recommended safety limits. The pump operational band (between pump on and pump off) must begin a minimum of 6-inches above the low water alarm, or as recommended by the pump manufacturer. The operational band must be large enough to accommodate the District's maximum number of pump starts allowed. The pumps shall not be set to start or stop at alarm points. The high water alarm must be set at the level that is calculated in the event of a 4-hour pump station outage.

### 6.5.3 Other Pumps

The District shall determine the acceptability of other pump types before the pump station design commences, and must be identified specifically as an exception to the standards in the design report as approved by the District.

### 6.5.4 Valves in Wastewater Service

Valve sizes shall comply with the maximum velocity criteria for pump suction and discharge piping.

### 6.5.5 Knife Gates

Usage shall be limited to isolated applications where the hydraulic head is less than 20 feet and space is restricted. Where in use, knife gates shall be resilient seated design of cast 316 stainless steel construction.

### 6.5.6 Gate Valves

Gate valves shall be manually operated isolation valves in horizontal lines with valve stems oriented vertically upwards. Various types of gate valves are described below.

a. Resilient Seat Gate Valves, 3 to 12 inches diameter, use an OS&Y NRS (exposed) or NRS (buried), full port, cast iron valve body and gate with Styrene Butadiene Rubber (SBR) resilient seats in sizes 3 inches to 12 inches. Gate valve shall comply with AWWA C509, Resilient-Seated Gate Valves for Water Supply Service. Fusion bonded epoxy is required on both interior and exterior surfaces.

b. Resilient Seat Gate Valves, 14 to 30 inch diameter, use an NRS, full port, ductile iron valve with bonded SBR ductile iron gate, and Buna N stem seals in sizes 14 inches to 30 inches. Valves shall comply with AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service, and AWWA C509, Resilient-Seated Gate Valves for Water Supply Service. Fusion bonded epoxy coating is required on both interior and exterior surfaces.

c. Rotating Double Disc Gate Valves: 14 to 60 inch diameter, full port, rotating, double disc valves, complying with AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service, with ductile iron body, bonnet and wedges, and low zinc body seat rings can be used for diameters of 14 inches to 60 inches as an alternative

to resilient seated gate valves. The valve shall be designed to permit replacement of discs without removal of the valve body from the line. A 6-inch flushing port, 2 inch blow off port and optional bypass valve port shall be cast into the body of the valve. The valve design shall allow complete replacement of the stem packing under pressure when the valve is either fully open or fully closed.

d. Swing Check Valves: counterbalanced swing check valve should generally be provided. The valves shall be either cast iron or stainless steel with replaceable bronze or Buna N seat ring. Swing check valves shall be mounted on horizontal piping only. Check valves shall be mounted outside the wet well.

### 6.5.7 Valve access requirement

All valves shall be easily accessible, with adequate clearances per the Standard Drawings, so that operators can work in and around them.

### 6.5.8 Piping System Material Selection

In selecting piping system materials, the Design Engineer shall use the piping materials currently used by the District as summarized in the following table. Larger diameter materials are listed in the event they are needed in the design for the additional storage capacity, or other incidental uses.

| Service | Material | Allowable Sizes |
|---|---|---|
| Gravity Sewer | Vitrified Clay (VCP) | Up to 42-inches |
| Force Mains | DIP, fused epoxy lining<br>High Density Polyethylene HDPE | Up to 48-inches |
| Potable Water | Copper Tubing, Type L (Exposed) | Up to 3-inches |
| Potable Water | Copper Tubing Type K (Buried) | Up to 3-inches |
| Foul Air | SCH 80 PVC | Up to 12-inches |
| Drain Lines | ABS or PVC | Up to 3-inches |

### 6.5.9 Additional Design Guidelines

Other piping system design guidelines shall include the following:

6.5.9.1 All piping consisting of similar metallic materials shall have bonding for continuity and shall be grounded as required by code.

6.5.9.2 Nylon insulation bushings shall be installed between all dissimilar metals in piping (i.e. brass fittings connected to manifolds), between pumps and inlet, pipes and valves, and discharge piping so as to insulate from the inductance current caused by motors.

6.5.9.3 Insulation couplings and flanges shall be installed to isolation piping and building if it applies.

6.5.9.4 Short-sweep 90 degree elbows shall not be allowed.

6.5.9.5 All piping designed for future use that penetrates the wet well shall be plugged as required by the District to prevent escape of hydrogen sulfide gas.

6.5.9.6 All above ground piping shall be painted “Gun Metal” Gray.

6.5.9.7 All exposed material that is susceptible to damage by UV rays shall be coated with material that will inhibit this action as required by the District.

6.5.9.8 All joined dissimilar metals require a connection that eliminates electrical conductivity.

6.5.9.9 Force Main design shall meet the criteria outlined more specifically in Chapter 5, Force Mains.

### 6.5.10 Pressure Gages

Pressure gauges shall be liquid filled direct reading 4 inch dial with a ½ inch connection. All gauges shall be provided with isolation valves, including oil isolation of the gauge from wastewater. Gauge connection ports shall be included on all pump discharge mains. The connection ports shall include a coated service saddle or welded tread-o-let for tapping of the main. Type 316 stainless steel nipples shall be provided.

## 6.6 Electrical

### 6.6.1 Nominal Voltage Selection

All pump stations nominal voltage shall be 480 volt, 4-wire, three phase, and 60 Hz electrical service.

### 6.6.2 Electrical Facilities Configurations

The following standard drawings are typical electrical facilities configurations. Alternative configurations may be considered or allowed by the District.

6E-10 Electrical Panel Layout

6E-11 Instrument Mounting Rack.

6E-12 JB Mounting Detail

6E-13 Conduit Riser from Ground & Duct Bank Section

6E-14 Grounding Details

6E-15 Pole Base Detail with Antenna

6E-20 Single Line Diagram – Small Pump Stations

6E-21Single Line Diagram – Medium Pump Stations

6E-22 Single Line Diagram – Large Pump Stations

6E-30 Pump Controls – Small Pump Stations

6E-31 Pump Controls – Medium and Large Pump Stations

### 6.6.3 Equipment Selection and Control Criteria

Electrical equipment shall be based primarily on the ability to meet the process demands of the pump station. All equipment will be required to meet the most recent applicable standard limits for vibration, audible noise, harmonic voltage and current and electrical surge immunity.

### 6.6.4 Control

Equipment shall have a minimum level of manual control in addition to automatic operation as addressed later in this chapter.

### 6.6.5 Enclosures

Electrical equipment to be located outdoors shall be housed in an enclosure suitable for the location. The enclosure shall provide complete access for all onsite maintenance and repair needs without requiring disassembly or removal of the enclosure. Motor junction boxes shall be rated NEMA 4X.

6.6.5.1 Main switchboards, motor control centers, automatic transfer switches, and similar equipment, when installed outdoors, shall be supplied in NEMA 3R non-walk-in,

weatherproof enclosures with dead-front, weatherproof, pad lockable outer doors providing complete access to interior mounted equipment and their components. The NEMA 3R enclosure vestibule shall be provided with fluorescent lighting and be sized to allow full opening of equipment interior doors. Wherever outdoor equipment is front and rear accessible, provide weatherproof, dead-front, pad lockable, outer doors on both the front and rear of the equipment (allowing full access to all interior mounted equipment components and terminations). Thermostatically controlled strip heaters shall be provided in all sections of interior mounted equipment.

6.6.5.2 Label all switches, breakers, and controls, to indicate their function.

6.6.5.3 When supplemental cooling equipment is required, the equipment shall be integrated with the overall equipment enclosure.

6.6.5.4 Emergency generator connection enclosure shall be NEMA 3R rated with enclosure thermostatically controlled strip heaters.

6.6.5.5 Other outdoor electrical enclosures shall be NEMA 3R, with exception of motor junction boxes and in a corrosive environment it shall be supplied in NEMA 4X stainless steel. See Standard Drawing 6E-12 (Motor JB Mounting Detail).

### 6.6.6 Audible Noise Criteria

Equipment placement can mitigate audible noise concerns. Audible noise generating equipment located inside buildings shall be segregated from desired low noise areas such as control rooms. Equipment located outdoors, such as diesel generators and large transformers, should be located based on generating minimum audible noise to adjacent properties.

### 6.6.7 Noise Limits

Design and verify compliance with audible noise limits at the property line imposed for night time requirements by local ordinance, under all pump station design operating conditions.

### 6.6.8 Noise Attenuation

The type of noise attenuation employed shall be reviewed with the District assuming compliance with all audible noise limits required by OSHA and local ordinances in effect at the site.

### 6.6.9 Harmonic Voltage/Current Limit and Monitoring Criteria

All new pump station facilities and pump station refurbishment projects shall be designed to IEEE 519 standard requirements at the point of common coupling with the utility. Final verification will be confirmed by witnessed field test under actual operating load conditions, with any additional measures to be designed, installed, and retested to verify compliance with IEEE 519.

### 6.6.10 Surge Protection Application at the Main Service

Install distribution class surge arresters of the Metal Oxide Varistor (MOV) type at the main service for the pump stations receiving service at 480 volts. The required location is at the load side terminal of the 480 volt main breaker.

### 6.6.11 Surge Monitoring on Normal and Emergency Power Services

All medium and large stations shall have individual surge monitors on both normal and emergency power sources. This surge monitoring shall be a function of the power monitoring system. The power monitoring system shall provide capture of sags, swells, and spikes on the monitored service.

### 6.6.12 Minimum Equipment Manual Controls

"Hands-off-Auto" (HOA) switches shall be applied for all main pump controls at all pump stations. The "hand" switch position shall not bypass any overloads relays, and the controlled pump shall be operable with only those interlocks that are determined to be critical in the circuit.

### 6.6.13 Pump Motor Breakers

Provide a motor circuit protector (MCP). Pump motor breakers shall have lockable handles.

### 6.6.14 Motor Starters

All motor starters shall be adjustable electronic overloads, and comply with NEMA standards.

6.6.14.1 Provide a reduced voltage non-reversing starter ("soft starter") for pump motors larger than 30 hp.

6.6.14.2 Provide a full voltage non-reversing starter for less than 30 hp, unless the Design Engineer demonstrates the need for a reduced voltage non-reversing starter.

6.6.14.3 Combination Motor Starters. Provide a circuit-breaker equipped with adjustable magnetic trip breaker (MCP).

### 6.6.15 Conduits

Exposed conduits and buried conduits shall meet the following requirements:

6.6.15.1 Install rigid galvanized steel conduits (colored or painted red) for all exposed conduits, as shown in Standard Detail 6E-13 A (Conduit Riser from Ground).

6.6.15.2 Install schedule 40 PVC conduits for all buried conduits, as shown in Standard Detail 6E-13 B (Duct Bank Section).

6.6.15.3 Install PVC coated rigid galvanized steel conduits in all underground/hazardous locations.

6.6.15.4 Show the conduit runs on the design plans.

## 6.7 SCADA, Controls and Instrumentations

### 6.7.1 RTU Layout Details & Control Power Distribution

The following standard drawings are typical RTU layout and diagrams for control power distribution.

a. 6I-30 P & ID
b. 6I-31 Bubbler Panel Schematic
c. 6I-32 Bubbler Tube Junction Box & Captive Air Tube Mounting Detail
d. 6I-33 Typical RTU Layout Detail
e. 6I-34 Typical RTU Elevation View
f. 6I-35 Typical Bill of Materials & Nameplate Schedule
g. 6I-36 Typical Diagram Control Power Distribution
h. 6I-37 Typical RTU/PLC Layout
i. 6I-38 Typical Wiring Diagram (Power Connections)

j. 6I-39 Typical Lower Board Diagram (Digital Input 0 to 7)
k. 6I-40 Typical Lower Board Wiring Diagram (Digital Input 16-23)
l. 6I-41 Typical Lower Board Wiring Diagram (Digital Input 24 to 36)
m. 6I-42 Typical Lower Board Wiring Diagram (Analog Input)
n. 6I-43 Typical Lower Board Wiring Diagram (Digital Output 0 to 7)
o. 6I-44 Typical RS 482 Upper Board Wiring Diagram

### 6.7.2 Process & Instrumentation Diagram (P&ID)

P&ID identifies major pieces of equipment, associated instrumentation, and PLC/RTU I/O points for all systems interfaced with the Pump station SCADA System. See Standard Drawing 6I-30.

### 6.7.3 Instrumentation Standardization and Control Components

Standardization of instrumentation and control components (I&C) and implementation significantly facilitates both operation and maintenance of the stations. With a standard I&C interface operators (both locally and via SCADA) can quickly adapt to each station with minimum effort or risk.

6.7.3.1 For consultant reference, the District may consider changes or upgrades to the standardized I&C components in the future, as chosen models become obsolete or new technology offers significant advantages. At this time, the District uses ModBus, HART, or foundation field bus protocol; other protocols require District approval. SCADA communications shall utilize DNP3 protocol.

### 6.7.4 Enclosures

Control and instrumentation equipments located outdoors shall be housed in an NEMA 3R enclosure suitable for the location. The enclosure shall provide complete access for all onsite maintenance and repair needs without requiring disassembly or removal of the enclosure. For corrosive environments provide NEMA 4X stainless steel enclosure.

6.7.4.1 Where electronic equipment, PLCs, PCs, power supplies, instrumentation, displays or other heat sensitive control equipment are located in an outdoor enclosure, the equipment shall be grouped together in a control panel or control section of the enclosure. All control panels, or sections with all supplied components, shall be designed for continuous functionality and full service life in the ambient internal temperatures the panels will experience when installed.

6.7.4.2 When supplemental cooling equipment is required, the equipment shall be integrated with the overall equipment enclosure.

### 6.7.5 Level Instrumentation

The District requires the use of a bubbler system. Each bubbler system shall consist of an air compressor served from a separate AC circuit breaker, dual 10 gallon air storage tanks, purge controls, and a pressure transmitter. See Standard Drawing 6I-31 (Bubbler Panel Schematic).

6.7.5.1 The system shall include a pressure switch to alarm on air tank low pressure. Wet well high and low alarms shall be generated by PLC logic, based on the bubbler pressure transmitter signal. All bubbler systems shall have a manual purge valve to allow an operator or technician to blow clear a clogged bubbler discharge tube.

6.7.5.2 Bubbler components shall be installed, piped, and wired in a common enclosure.

6.7.5.3 The wet well high-high alarm shall be reactive air type, with the reactive air bell located at the appropriate elevation for flood risk warning and in a location convenient for testing with a bucket of water.

### 6.7.6 Power Instrumentation Guidelines

Standardization of electric power instrumentation to facilitate use is required. See Appendix A for a list of standard equipment.

6.7.6.1 All pump station power metering shall be applied on utility service feeders. Metering with harmonics analysis capability shall be provided for pumps in medium and large stations. Provide power metering on individual pumps at medium and large stations.

6.7.6.2 Use RS 485 communication to examine meters on current conditions, and to download event logs and Oscillography Reports.

### 6.7.7 Hazardous Gas Instrumentation

Chlorine leak detection is required wherever chlorine gas or sodium hypochlorite is stored or handled. At stations where large quantities of chlorine or hypochlorite are stored, redundant sensors shall be furnished.

6.7.7.1 The District does not have a standard implementation for permanently installed hazardous gas monitoring of excess hydrogen sulfide or methane (combustible gas), or lack of oxygen. Where required, use an air sampler pump and tubing system.

### 6.7.8 Instrumentation Power Supply

Instrumentation and control systems shall be 24VDC powered wherever possible. Station main control panels should include 24VDC batteries. Batteries shall be sealed “valve regulated lead acid” (VRLA) type for optimal safety and minimal risk of acid spillage.

6.7.8.1 Stations without on-site emergency generators shall have enough backup battery capacity to support the PLC and SCADA communications equipment for 8 to 12 hours.

6.7.8.2 Where essential instruments are not available for 24VDC operation, then a 120VAC UPS should be applied, sized for a minimum of one hour operation. Acceptable manufacturers for power supplies are listed in the equipment list in Appendix A.

6.7.8.3 Surge protection with signal isolators (at the control panel) shall be applied on all control and instrument loops which extend beyond the confines of the control room or outdoor control panel. MOV arresters with sufficient threshold to eliminate signal bleed shall be installed on the field side of these isolators.

### 6.7.9 Programmable Logic Controller (PLC)

Each pump station is controlled and/or monitored by a PLC. See the Equipment List in Appendix A for the District list of pre-approved devices. The District will provide the program.

### 6.7.10 Operator Interface Panel (OIP)

See the Equipment List for the District pre-approved devices.

### 6.7.11 SCADA Communication

Pump stations shall be provided with standard components for SCADA communications. All pump stations shall be provided with cellular and radio communication with spare conduits for telephone communication dialup for backup.

### 6.7.12 Control Strategies

Because PLC, OIP, and SCADA programming will not be part of the construction documents, detailed strategies for primary pump station services will not be required during station design.

However, an outline of the intended control strategy for the station, along with a narrative of any hydraulic limitations is necessary.

### 6.7.13 Spare Conduit

A spare conduit shall be installed for ease of installing future instrumentation or controls (into the wet well, valve pits, between RTU cabinet and telephone service, etc.).

### 6.7.14 Surge Protection

6.7.14.1 Fusing shall be applied to segregate loads. Fuse holders should be blown-fuse-indicating type to further facilitate troubleshooting.

6.7.14.2 Metal Oxide Varistor (MOV) surge suppression shall be applied to all 24VDC circuits leaving the control panel. Standard terminal block arrangements should be applied.

# APPENDIX

## 7. APPENDIX A

### 7.1 Standard Equipment and Requirements List

| Equipment/ Category | Description |
|---|---|
| Breakers | All panel board breakers shall be provided with individual padlock hasps (lockable in the off position.) |
| Canopy/Control Buildings | Design canopy to prevent rain from entering control panels |
| Cathodic Protection | Shall be impressed system |
| Crane | Capable of removing all pumps from wet well. The hook shall hang freely over the pick point of the pump. |
| Discharge Connection | Provide necessary sliding guide bracket and discharge connection which when bolted to the floor and to the discharge piping will receive the pump discharge flange without need of adjustment, fasteners, clamps, or similar devices. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket will not be acceptable. |
| Guide Rail | Dual guide rail, 316 or 304 Stainless steel (Wire rope not acceptable). Split joints not allowed, joints to be welded. |
| Hatch Covers | Flygt Safe-Hatch system H-20 Rated, or approved equal |
| Level Monitoring | Rosemont 1151GP |
| Locks | SASD Will provide locks upon acceptance |
| Meter (Electrical) | Small Sta: Main Meter – Square D Power Logic ION 6200<br>Med & Large: Main meter-Square D Power Logic ION 7650, Pump Meters ION 7350 |
| Monitor( Hazardous Gas) | MSA |
| Motor Starters (FVNR) | Cutler Hammer, Farnas, w/ electronic overload |
| Motor Starters (RVSS) | Allan Bradley, Analog or flex drive w/ external keypad & bypass contactors |
| Odor Control | Peacemaker. Equipment pad with vent pipe and power conduit |
| OIP | Control Microsystems, Inc Vision 50 |
| PLC (Module) | Control Microsystems, Inc SCADA Pack 350/357 |
| PLC (Programming) | TelePace |
| Power Fail Relay | Time-Mark 258B with base and retaining strap |
| Power Supply | 24 VDC, Technical Dynamics, TCP-24-17-LVBD |
| Pressure Gage | Ashcroft |
| Pump | Flygt, ABS Submersible pumps, or approved equal (ABS may be with a flush valve) |
| Pump (Monitoring Units) | CAS or equal |

| Equipment/ Category | Description |
|---|---|
| SCADA (Antenna mounted on light pole) | Manufacturer: Antenex or approved equal. Part Number TRAB 806/17103P |
| SCADA (Cellular) | Airlink Raven X |
| SCADA (Lightning Arrester) | Manufacturer: ALTELICON or approved equal. Part number AL-NFNFB |
| SCADA (Mounting Bracket for Antenna) | Manufacturer: Larsen or Approved equal. Part number: FB3Bracket |
| SCADA (Radio) | MDS 9710A |
| Security System | SENTROL Door Switches |
| Transfer Switch (ATS) | Zenith |
| Transfer Switch (MTS) | Dual Breakers: 1 main, 1 generator power w/ lockable mechanical interlock - generator breaker to be wired to a termination box |
| Valve (Air Relief) | Air release/air vacuum valves shall be 2” ARI D-020 NS ST.ST as manufactured by A.R.I. Flow Control Accessories and distributed by T&T Valve and instrument, Inc., 1181 Quarry Lane, Suite 150, Pleasanton, CA, 94566 or approved equal |
| Valve (Backflow Preventor) | Galvanized rigid steel |
| Valve (Ball) | Ball valve shall be bronze body, ball, and stem. Seats, ball and stem housed in removable cartridge, full ports, screwed ends. Jamesbury A11TT, Crane 2330-TF, or approved equal |
| Valve (Check) | Check valves shall be Apco Valve and primer Corporation Series 6000CLS, Crispin Valve Series SWC, or approved equal. Check valve shall include side-mounted air cushions with adjustable speed control, and an outside weight and lever or outside spring and lever. Check Valve shall be comprised of the following material, body and Disk: ASTM A126 Grade B Cast Iron, Seat : Bronze/Buna-N, Hardware: A276 Stainless Steel (304) |
| Valve (Double Disk Gate) | Valves shall be manufactured by American Rotating Disk, 50 Line Series or Approved equal. Valves shall be comprised of the following material: Body, Bonnet, and Disk shall be ASTM A536 Ductile Iron. Stem and Stem Nut shall be bronze or stainless steel. Hardware shall be A276 Stainless steel (304) |
| Valve (Isolation) | Ball valve |
| Wet Well/Valve Vaults | Pre-Cast and H-20 Rated |

# 8. APPENDIX B

## 8.1 Standard Drawings

| | |
|---|---|
| 4C-01 | Signature Block |
| 4C-02 | Sewer Pipe Bedding & Initial Backfill |
| 4C-03 | Maximum Trench Width For High Strength Vitrified Clay Pipe |
| 4C-04 | Manhole Location Restriction |
| 4C-10 | Manhole Connection |
| 4C-11 | Lateral Sewer Replacement |
| 4C-12 | Utility Crossing |
| 4C-13A | Lower Lateral |
| 4C-13B | Alternate ABS Lateral Sewer WYE Connection Top View |
| 4C-14A | VCP, ABS, or PVC Cleanout To Grade |
| 4C-14B | Modified VCP, ABS or PVC Cleanout To Grade |
| 4C-15A | ABS/PVC Backwater Valve to Grade |
| 4C-15B | ABS/PVC Valve to Grade Multi-Story Structure |
| 4C-16A | Flusher Branch For Pipe Diameters 8” and Less |
| 4C-16B | Flusher Branch for Pipe Diameters Greater Than 8” |
| 4C-20 | Conductor Casing Detail |
| 4C-21 | Cathodic Protection Steel Casing |
| 4C-30 | Standard Precast Manhole 48” |
| 4C-31 | Standard Precast 60” & 72” Sewer Manholes |
| 4C-40 | 4 Way manhole Base Camera Channel Detail |
| 4C-41 | 90° Manhole Base Camera Channel Detail |
| 4C-50 | Flat Slab Top Detail |
| 4C-51 | Standard Precast 60” Slab Top Detail |
| 4C-52 | Drop Connection |
| 4C-53 | Stainless Steel Adjustable Clamping Brackets |
| 4C-60 | Cast-in-Place Manhole ( Don't have one yet) |
| 4C-70 | Standard Flusher Branch Frame and Cover |
| 4C-71 | Flat Slab Top Frame & Cover |
| 4C-72 | Grey Iron Standard 24” Manhole Frame & Cover |
| 4C-73 | Grey Iron Standard 36” Manhole Frame & Cover |
| 4C-74 | Ductile iron 24” Manhole Frame & Cover |
| 4C-80 | Trench Dam Detail |
| 4C-81 | Sampling Vault |
| 4C-82 | Flow Measuring Manhole |

| | |
|---|---|
| 4C-84 | Packaged Flow Measuring Vault |
| 5C-30 | Cathodic Protection Ductile iron Pipe |
| 5C-40 | Thrust Block Details |
| 5C-50 | Force Main Tie-In at Manhole |
| 5C-51 | Force Main Tie-In Drop Connection |
| 5C-70 | Standard 60” Air Release Valve Sewer Manhole |
| 5C-80 | Pipe Locator Ribbon and Locator Ball Installation |
| 6C-10 | Pump Station Site Layout |
| 6C-11 | Pump Station Site Layout Corner Lot |
| 6C-12 | Commercial Driveway to Pump Station Site |
| 6C-13 | Sidewalk Ramp Detail |
| 6C-14 | Access Road |
| 6C-20 | Circular Wet Well Section View |
| 6C-50 | Canopy Schematic |
| 6C-60 | Reducer Pressure Principal Assembly |
| 6C-90 | Removable Bollard Detail |
| 6M-20 | Circular Wet Well Plan View |
| 6M-30 | Valve Vault |
| 6M-40 | Bypass Vault |
| 6M-50 | Odor Control Pad |
| 6E-10 | Electrical Panel Layout |
| 6E-11 | Instrument Mounting Detail/Large Pedestal Instrument Mounting Rack |
| 6E-12 | Junction Box Mounting Detail |
| 6E-13 | Conduit Riser from Ground/Duct Bank Section |
| 6E-14 | Grounding Detail |
| 6E-15 | Pole Base Detail w/Antenna |
| 6E-20 | Single Line Diagram Small Pump Station |
| 6E-21 | Single Line Diagram Medium Pump Station |
| 6E-22 | Single Line Diagram Large Pump Station |
| 6E-30 | Pump Controls Small Pump Station |
| 6E-31 | Pump Controls Large and Medium Pump Station |
| 6I-30 | Process and Instrumentation Diagram |
| 6I-31 | Bubbler Panel Schematic |
| 6I-32 | Bubbler Tube Junction Box/Captive Air Tube Mounting Detail |
| 6I-33 | Typical RTU Layout Detail |
| 6I-34 | Typical RTU Elevation View |
| 6I-35 | Typical Details Bill of Materials & Nameplate Schedule |