Attachment A: Standard Design Guidelines

Standard Design Guidelines Summary

Wastewater Infrastructure Partnership

LAKE TAHOE BASIN, CALIFORNIA & NEVADA

Lake Tahoe
Wastewater
Infrastructure
Partnership

US Army Corps
of Engineers ®
Sacramento District

May 2007

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Acronyms and Abbreviations

ACP	Asbestos Cement Pipe
Amp	Ampere
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
ATV	Ability to Verify
AWWA	American Water Works Association
CCTV	Closed-Circuit Television
CD-ROM	Compact Disc-Read Only Memory
CEQA	California Environmental Quality Act
CFM	Cubic Feet per Minute
CIPP	Cured-In-Place Pipe
CIPM	Cured-In-Place Manhole
CLSM	Controlled Low-Strength Material
d/D	Depth Divided by Diameter
DC	Direct Current
DIP	Ductile Iron Pipe
Districts	Lake Tahoe Basin Wastewater Sewer Districts
E’	Modulus of Soil Reaction
ERP	Emergency Response Plan
F	Fahrenheit
FAT	Factory Acceptance Test
FPS	Feet per Second
FRP	Fiberglass Reinforced Pipe
FT	Feet
GFI	Ground Fault Interrupter
GPM	Gallons per Minute

HDPE	High Density Polyethelene
HPS	High Pressure Sodium
HVAC	Heating Ventilating and Air Conditioning
H20	Highway Loading 20
I/I	Infiltration/Inflow
IN/WC	Inch/Water Column
I/O	Input/Output
ISA	Instrument Society of America
LEL	Lower Explosive Limit
mA	milli-Ampere
MACP	Manhole Asessment and Certification Program
MH	Megahertz
MIN	Minimum
MM	Milimeter
M_s	Constrained Soil Modulus for Native and Backfill Material
MSDS	Material Safey Data Sheets
NASSCO	National Association of Sewer Service Companies
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NPT	National Pipe Thread
OAD	Operations Availability Demonstrations
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OZ	Ounce
PACP	Pipeline Assessment and Certification Program
Partnership	Lake Tahoe Basin Wastewater Infrastructure Partnership
PCF	Pounds per Cubic Foot
PF	Peaking Factor

P&ID	Piping and Instrumentation Diagram
PLC	Programmable Logic Controller
PPM	Parts per Million
PSI	Pound per Square Inch
PVC	Polyvinyl Chloride
Q	Flow
RCP	Reinforced Concrete Pipe
ROW	Right of Way
RPM	Revolutions per Minute
RTU	Remote Terminal Unit
SAT	Site Acceptance Test
SCADA	Supervisory Conrol and Data Aquisition
SPDT	Single Pull Double Throw
SS	Stainless Steel
SSOs	Sanitary Sewer Overflows
SPP	Spill Prevention Plan
TDH	Total Dynamic Head
TRPA	Tahoe Regional Planning Agency
UPC	Uniform Plumbing Code
UPS	Uninteruptable Power Supply
V	Volts
VAC	Volts Alternating Current
VFD	Variable Frequency Drive
VOCs	Volatile Organic Compounds
W	Watts
WEF	Water Environment Foundation

ATTACHMENT A: STANDARD DESIGN GUIDELINES
STANDARD DESIGN GUIDELINES SUMMARY
WASTEWATER INFRASTRUCTURE PARTNERSHIP
LAKE TAHOE BASIN, CALIFORNIA & NEVADA

This document presents design guidelines, material standards, and standard details (Standard Design Guidelines) developed for the Lake Tahoe Wastewater Infrastructure Partnership (Partnership) for wastewater infrastructure efforts in the Lake Tahoe Basin. The Partnership Standard Design Guidelines are based on general design guidelines and materials standards commonly used industry-wide. The Standard Design Guidelines presented herein are intended to serve as a reference tool for the sewer utility districts serving the Lake Tahoe Basin (Districts) No District is obligated to universally adopt these standards, and may issue amendments to these Standard Design Guidelines and/or apply its District-specific standards to projects located within its jurisdictional boundaries. Any person or company performing work for a District is responsible for obtaining the current version of applicable District-specific design standards. As such, code enforcement is subject to the authorization of the responsible District. Codes and ordinances, and the enforcement thereof, shall be in accordance with State laws and federal regulations where applicable.

For the purposes of this document:

- **Responsible District** is defined as the District that owns, operates, or maintains a specific wastewater infrastructure facility
- **Agency(ies)** refers to entities with regulatory authority

1.0 Standard Specifications

The following standard specifications are adopted by reference. When a facility type is not discussed in these Standard Design Guidelines, the appropriate section of these documents will be in effect:

- State of Nevada, Department of Transportation:
  - Standard Specification for Road and Bridge Construction, latest edition
- Public Works Standards, Inc.
  - "Orange Book" Standard Specifications for Public Works Construction, latest edition
  - "Orange Book" Standard Details for Public Works Construction, latest edition

- Design Criteria and Improvement Standards, Douglas County, Nevada, Division 5, Sewer Systems, latest edition

- Responsible District amendments to the Standard Specifications
  - Latest adopted Ordinance for Douglas County Sewer Improvement District No.1

2.0 Approved Materials

Approved materials shall be in compliance with the listed minimum values of the following applicable American Society for Testing Materials (ASTM) requirements and standard specifications:

Table 1. Approved Materials: ASTM Requirements and Standard Specifications Minimum Values

Size/Item	Material	Description
Gravity Pipes		
Less than or equal to 15”	PVC	ASTM D 3034, SDR 26 or less, elastomer bell and spigot joints, cell classification shall be 12454-B or 12454-C as defined in ASTM D 1784
Greater than 15”	RCP with approved internal lining or coating	ASTM C 14
	HDPE	ASTM F 2160, solid wall, butt-fusion welded joints
	FRP	ASTM D 3840, bell and spigot joints ASTM D 4161
Pressure Pipes – Forcemains		
Less than or equal to 15”	PVC	ASTM D 3034, SDR 35, fusable, butt-fusion welded joints
Greater than 18” or Under Heavy Loads	DIP with approved internal lining and external coating	ASTM A 377
Size/Item	Material	Description
Greater than 15”	Polymer concrete pipe	ASTM D 6783, glass reinforced plastic coupling
	HDPE, solid wall	ASTM D 3350, butt-fusion welded joints
Pipe Rehabilitation		
Leaking, multiple roots, cracks, holes	CIPP	Polyester resin for non-corrosive environments, vinylester resin for corrosive environments, ASTM F 1216
Isolated leaking or isolated roots at joint	Joint Seals	Mechanical seals or segmental CIPP

Size/Item	Material	Description
Manholes		
Castings	Gray Iron	ASTM A 48
Castings	Ductile Iron	ASTM A 536
Pipe connections	Concrete Sewer	ASTM C 14
Cement mortar	Compressive Strength	ASTM C 109
Cement mortar	Tensile Strength	ASTM C 190
Cement mortar	Time of Setting	ASTM C 191
Mortar and Concrete	Packaged, Dry, Combined Materials	ASTM C 387
Joints	Rubber Gasketed Joints	ASTM C 443
Manhole sections	Precast Reinforced Concrete	ASTM C 478
Epoxy-resin System Used with Concrete	Bond Strength	ASTM C 882
Manhole Patching Material		
Cement mortar	Compressive Strength	ASTM C 109
Cement mortar	Tensile Strength	ASTM C 190
Cement mortar	Time of Setting	ASTM C 191
Mortar and Concrete	Packaged, Dry, Combined Materials	ASTM C 387
Paints	Standard test method for evaluating degree of blistering	ASTM D 714
Epoxy-resin System Used with Concrete	Bond strength	ASTM C 882
Joints	Butyl rubber gasket	
Size/Item	*Material*	*Description*
Paint, Varnish, Lacquer, and Related Products	Standard terminology	ASTM D 16
Tape Test	Method for measuring adhesion	ASTM D 3359
Coating	Surface cleaning concrete for coating	ASTM D 4258
Building Laterals		
Shallow pipe	PVC	
Deep pipe	DIP	

Additionally, approved materials shall conform to the following standards:

- The same pipe material shall continuously be used between access structures
- Elastomer bell and spigot joints will be used for new pipe installations
- Asbestos cement pipe (ACP) is not allowed under any circumstance

2.1 APPROVAL OF ALTERNATE MATERIALS

Alternate materials must be submitted to the responsible District for approval prior to issuance of a project's Notice to Proceed. The request for use of alternate materials must include any modifications to the Special Provisions and must be stamped and signed by a Professional Engineer registered in the State of California or Nevada, as appropriate. Approval for use of proposed alternative materials shall be granted in writing.

2.2 EASEMENTS & RIGHTS OF WAY (ROW)

Coordinate new easement over any public sanitary sewer when installed outside of street ROW with responsible District:

- Minimum 15-foot-wide easement for single utility easement
- Minimum 20-foot-wide easement for more than one utility in easement
- Easement to be dedicated as "public sewer easement" if only sewer is located within easement
- Easement to be dedicated as "public utility easement" if more than sewer is located within easement
- Easement to be centered over the buried sewer or sewer/utility
- Easement configuration to encompass all publicly-maintained appurtenances
- Separate maintenance easement may be required for difficult-to-access areas
- When sewer is installed along property line, the easement to be wholly contained on one parcel
- All property restrictions placed on easement to be noted on the supplemental sheet of the Subdivision Map or Easement Deed if easement is not dedicated as part of the subdivision
- Include typical notes:
  - "No structures may encroach on, above, or below the surface of the ground in any public sewer easement. This includes footings or foundations, eaves from the roof or any adjacent structure, pools, ponds, or outbuildings or structures on slabs or foundations. Decks, sheds, or other structures that are easily moved should not hinder access for maintenance to the sewer system."
  - "No trees may be planted in a public sewer easement without first obtaining approval from the agency with jurisdiction. Trees must not cause damage to the sewer system from root intrusion or hinder access for maintenance of the sewer system."

- "Agency maintenance staff will take due caution when performing maintenance or repair work in easements, but will not be responsible for repair or replacement of trees, landscaping, or structures located within easements without prior approval from the agency with jurisdiction."

- Prepare legal descriptions for temporary and permanent easements and include in design submittal
- Provide legal description in strip form or in directional form – irregular forms require metes and bounds description

2.3 ACCESS

- Right of entry from ROW to easements if an easement is not located adjacent to an access road
- Clear access must be provided to all sewer system structures for maintenance and repair work.
- All-weather vehicle access roads are required to every structure on the sewer system.
- Access roads must be a minimum of 12 feet in width and must contain turnarounds when the back-up distance is greater than 100 feet.
- Design plans for access roads must be submitted with the new or replacement sewer plan set.
- Adequate drainage measures that prevent damage to the access roads during rain events must be included in the design.
- Gates must be provided through any fence that crosses a public sewer easement that is equal to or greater than 14 feet in width to allow for vehicular access.
- Where only pedestrian traffic is required, gates must be 4 feet wide.
- Maximum grade on access road: 15%
- Maximum cross-slope on access road: 5%

2.4 ELECTRONIC STANDARDS

- CAD: AutoCAD 2007, or as required by responsible District
- Word Processing: Microsoft Word 2003, or as required by responsible District

2.5 DESIGN PLANS AND DETAILS

All design drawings submitted to the Districts shall incorporate the following:

- Design activities need to consider environmental, geotechnical, functional, traffic, construction, and economic impacts of the proposed design
- Project-specific survey and mapping to be provided for design
- Provide detailed plan showing:
  - ROW and property lines
  - Temporary and permanent easement limits
  - Onsite and offsite sewers and connections to existing sewers
  - Other utilities in the area
  - Septic systems existing or abandoned
  - Pumping/lift stations
  - Parcel numbers on property
- Plan and profile drawings for new and replacement pipes at horizontal scale of 1” = 20’ or 1” = 30’ and a corresponding vertical scale of 1” = 4’ or 1” = 6’
- Double panel plan drawings for repair or rehabilitation work at a horizontal scale of 1” = 40’
- Point repairs over 10 feet in length – provide plan and profile
- Sewer main improvements:
  - Include all sewers affected by project, including all sewers connecting to and/or immediately upstream and downstream of the project
  - Include flow data, geotechnical boring, lateral and cleanout locations
  - Upgrades to existing mains must be clearly defined
  - Use scale that defines at least one-half of property frontage
  - Show plan to most upstream connection
  - New street improvements over sewer alignment serving upstream properties must meet these requirements or to limit of street improvements, whichever is greater
- Improvement Plans
  - Site Plan
    - Locations of power pole
    - Transfer switch

    - Emergency fuel supply
    - Control panel
    - Wet well
    - Dry well
    - Ground slab
    - Driveway
    - Fencing
    - Water service
    - Emergency suction/discharge boxes
    - Site grading: drainage details
  - Wet Well
    - Influent piping (standard inside drop manhole)
    - Suction piping minimum (min.) 6 inches off bottom of manhole)
    - Emergency suction line
    - Bubbler line including connection hardware
    - Water/alarm levels (pump on, pump off, low level, high level)
    - Redundant high water float switch
  - Dry Well
    - Pumps
    - Piping
    - Safety ladder
    - Ladder light
  - Emergency Power
    - Electrical details specified to include size and material of conduit
    - Switch gear
    - Telemetry compatibility
    - Electrical details – power source, meter location, cabinetry

    - Wiring diagrams – connection to and between local utility system, transfer switch, emergency generator and dry well
    - Single-line diagram
  - Force main discharge details
- Design Details
  - Provide details when amending or adding to standard details
  - Provide details for all trench, connection, structures, bypass setups, traffic control, constructing sequencing when necessary to clearly define new, replacement, or repair/rehabilitation construction

3.0 Design Specifications

Include the following in addition to the "Orange Book" Standard Specifications for Public Works Construction, latest edition. Add technical specifications as needed for each project if not already covered in the Standard Specification.

3.1 DESIGN COST OPINION

For projects designed by consultants for local Districts, a cost opinion of probable construction costs through the projected mid-point of construction should be submitted at key points in the design process.

3.2 RECORD DRAWINGS

Record drawings are subjected to the jurisdiction of responsible Districts. If a record drawing guideline is not available, include at a minimum:

- Three (3) full-sized hard copies of record drawings
- Electronic version of AutoCAD drawing files
- Three (3) bound, hard copies of Operations and Maintenance (O&M) Manuals
- Electronic version of O&M Manuals, if available
- Drawings shall be stamped and signed by a registered engineer as required by State law

3.3 CONSTRUCTION PERMITS

- Local environmental agency or utility company encroachment permitting process must be identified before start of design

- Schedule impacts from permitting process to be included in project schedule

3.4 GEOTECHNICAL REPORT

- It may not be necessary to provide a Geotechnical Report on all projects. The need could be limited to those where such a report is required by the responsible District or for environmental compliance.
- A project-specific geotechnical report is required for any work that requires excavation, directional drilling, microtunnelling, or pipe bursting construction.
- Report should contain
  - A review and evaluation existing geotechnical data
  - A summary of field reconnaissance and test boring layout
  - A summary of field work performed – borings locations and depths (5 feet below invert elevation for pipes and 10 feet below invert for structures), and in-situ tests
  - Completed logs by registered Geotechnical Engineer or qualified geologist
  - Results of exploratory work and lab testing – type of soil (based on Uniform Soil Classification System), field density, cohesion, angle of internal friction, soil interfaces, stiffness/blow count, groundwater level at each boring, moisture content, liquid limit, plasticity index, expansion index, optimum moisture content, sniffer tests for Volatile Organic Compounds (VOCs)
- Report should include recommendations for:
  - Foundation design
  - Drainage requirements
  - Buoyancy avoidance
  - Bedding and backfill recommendations and unit weight
  - Compaction requirements
  - Cohesiveness
  - Frictional resistance allowed for anchor and thrust blocks and buried pipe
  - Trench width recommendations for rigid and flexible pipe
  - Bearing pressure allowed for net passive pressure for thrust blocks
  - Dewatering requirements and methods

- Groundwater contamination mitigation
- Modulus of soil reaction (E') soil modulus for deflection evaluation
- Constrained soil modulus for native and backfill material ($M_{s)}$
- Stable trench slope for excavation
- Effects of surcharged loads located at or near top of slope
- Limitations on surcharged loads
- Lateral earth pressure for sheeting and shoring design for trenches and jacking pits – lateral pressure not less than minimum lateral pressures permitted by local and state safety orders
- Suitable shoring methods
- Tunneling considerations, if applicable
- Special requirements – pile support, concrete cradles, etc.
- Suitability of onsite material for bedding and backfill
- Seismic requirements
- Corrosion soil protection

- Report shall contain an evaluation of known factors that will occur after the date of the report and how they impact the results of the report

3.5 APPROVAL PROCESS

- Design of pipelines, pumping/lift stations, and associated facilities should be coordinated with the responsible District throughout all phases of the project
- Responsible Districts staff will review design documents at critical points in the development of the project, including:
  - Design criteria
  - Materials
  - Hydraulic and structural calculations
  - Preliminary design
  - Geotechnical report
  - 60 and 95% complete

- Responsible District designated signatory on the final plans
- Responsible District approval does not relieve designer from responsibility of performing internal quality control prior to submittal to responsible District
- Records of surveys and monument maps to be filed with County Surveyor or as directed by responsible District:
  - Monument description (type, size, and identification), coordinate values, and source of record if recorded value
  - Note of recorded monuments not found
  - Discrepancies between record data and new survey data from field measurements
  - Reference monuments set to perpetuate existing monuments – descriptions, coordinate values, bearings or azimuths, and distances to found monuments
  - Project control survey – project control monuments set, coordinates, if disturbed or destroyed, or not
  - Reference monuments – descriptions, coordinates, and distances to original project monuments
  - Project control survey lines – bearings or azimuths, and distances
  - Stations on which survey is based – name, year, description, and coordinate values
  - Basis of bearings and azimuths (check with responsible District for standard basis to use)
  - Basis of the lengths of lines and any conversion factors used
  - Scale of map
  - Names and legal designations of tracts or grants for survey location
  - North arrow
  - Legend – definition of abbreviations, explanation of symbols, symbols for monuments
  - Title block
  - Key or vicinity map if applicable
  - Record of survey

3.6 ENVIRONMENTAL COMPLIANCE

- Permitting Reference

- California Environmental Quality Act (CEQA)
- Tahoe Regional Planning Agency (TRPA): Initial Environmental Checklist

3.7 EXISTING SURVEY MONUMENTS

- Existing survey monuments in project area must be located and coordinate values accurately documented
- Monuments to be disturbed by construction activities must be referenced prior to construction to reestablish accurately
- Reset monuments after construction in original location

4.0 Main Sewers

4.1 GENERAL – NEW AND REPLACEMENT

Minimum cover is 3 feet. If minimum cover cannot be met, fill pipe zone with controlled low-strength material (CLSM) backfill.

4.2 LOCATION

- Locate within public street ROW whenever possible
- When not in public street ROW:
  - Easement acquisition and limits must be defined on plans
  - Only approved materials shall be used
  - No lateral connections to easement line whenever possible
  - If lateral connection is necessary, use 2-way cleanout at property line
  - Locking or bolt lids where determined by District

4.3 SIZING

- Provide calculations or model showing basis for pipe sizing
- Size sewer mains for peak flows to serve entire tributary area at build-out densities conforming to the General Plan using appropriate peaking factors
- Minimum pipe diameter for sewer mains is 8 inches for new construction
- If not shown in applicable General Plan, use the following criteria to size sewer mains:

- Manning's "n" factor – 0.013
- average domestic flow – 125 gallons per person per day
- Peak Load Factor:
  Peaking Factor (PF) = 3.3 – (1.8 x $Q^{0.04}$), where,
  PF = dry weather peaking factor (min. 1.2)
  Flow (Q) = average base wastewater flow
- add 20% allowance for undefined infiltration/inflow.

- Design for minimum self-cleaning velocity of 2 feet per second (fps) under average flow condition
- Maximum depth divided by diameter (d/D) ratio of 0.7 for pipes 12 inches in diameter and smaller.
- Maximum d/D ratio of 0.97 for pipes greater than 12 inches in diameter
- No surcharging is permitted

4.4 SLOPE

Minimum Slope

- Preferred minimum slope no less than 0.01foot (ft)/ft for gravity sewers
- Achieve minimum self-cleaning velocity
- When preferred minimum slope cannot be achieved, use the following minimum slopes:
  8-inch-diameter: 0.01 ft/ft
  10-inch-diameter: 0.01 ft/ft
  12-inch-diameter: 0.007 ft/ft
  15-inch-diameter and greater: 0.007 ft/ft

Maximum Slope

- Preferred maximum slope no more than 0.15 ft/ft for gravity
- Steeper slopes may be considered under the following circumstances:
  - Restrained joints are used
  - Trench dams and drainage measures are used to prevent a buildup of hydrostatic pressure in the trench
  - Special hydraulic design of manhole channel for steep slopes and change in direction of flow in excess of 30 degrees that prevents overflows and allows for maintenance access.

4.5 ALIGNMENT

Horizontal

- Conform to State Standards and local health departments "Criteria for the Separation of Water and Sanitary Sewer"
- Minimum 5-ft clear separation from storm drains or other sewer mains except at crossings
- Minimum 4-ft clear separation from other utilities (gas, underground electric, underground television cable, etc.) except at crossings
- Parallel to street centerline where possible
- Minimum 5-ft clearance from all structures, building overhangs, gutters, property line, or edge of easement ROW
- Minimum 3-ft clearance from all monuments or lips of gutters
- Curved streets: align on one side of centerline to allow installation of other utilities without using transverse crossings and so that no part of the sewer main is less than one foot from the lip of the gutter
- Horizontal curves in the sewer main are not allowed between access structures
- For gravity sewer mains, horizontal deflections and fittings are not allowed between access structures

Vertical

- Conform to State Standards and NDR "Criteria for the Separation of Water and Sanitary Sewer"
- Minimum 1-ft clearance from storm drains, other sewer mains, and other utilities
- Provide approval from pertinent agency and details for protection of other facilities if minimum clearance cannot be maintained
- Provide calculations and methods to minimize deflection of pipe for pressure pipe applications
- Vertical curves in the sewer main are not allowed between access structures
- For gravity sewers, vertical deflections and fittings are not allowed between access structures

4.6 CONSTRUCTION TRENCH

- Sewer main trench shall be parallel to and deeper than adjacent structure footings: at least 45 degrees from the footing as required by the Uniform Plumbing Code (UPC)
- Minimum cover over pipe: 36 inches
- Main sewer cover less than 36 inches: use approved concrete encasement, casing pipe, pipe material with higher strength, concrete cap over trench, or CLSM for backfill

5.0 Connections to Sewer Mains

5.1 GENERAL

- Elevation of New Side Sewer Mains
  - Side sewer mains connecting to an existing main at an angle greater than 30 degrees – at least 0.1 foot higher than the existing main
  - Spring line (average flow) of smaller diameter pipe shall match spring line (average flow) of the larger diameter pipe
  - Invert of new main shall not be lower than invert of existing main
  - Connect at manhole
- Building Laterals
  - Separate lateral to be provided to each lot, unless otherwise approved
  - If same size as the existing main, must connect at manhole
  - If new lateral is smaller than new sewer main: use manufactured wye connection with base of wye pointed in the downstream direction
  - If new lateral is smaller than existing sewer main (15-inch-diameter or smaller): use approved saddles or taps
  - No lateral connections permitted on pipes larger than 15 inches in diameter
  - Provide private property cleanout on building lateral within one foot of building connecting to the building lateral and end one foot above ground level
  - Provide two-way cleanout at the property line
  - Provide proper cap to seal private property cleanout on building lateral
  - For connection of building laterals to service multiple lots off private driveways:

    - Private 6-inch-diameter building lateral may connect to public main only at a manhole
    - Joint Maintenance Agreement must be in place with Homeowner's Association
    - No more than four connections at one manhole location
- No connections allowed on stub-outs from manholes
- Provide backflow overflow device on laterals serving lots or buildings with plumbing fixtures lower than the nearest upstream manhole rim elevation
- Streets that have been repaved within last five (5) years may require the use of trenchless technologies as determined by Engineer of entity with jurisdiction

5.2 BUILDING LATERAL LOCATION

- Locate on property frontage: front or side boundary line parcel abutting the street
- Do not locate in easements when gravity service can be provided to the property frontage
- Align perpendicular to the curb alignment or easement from connection at building to connection on sewer main
- Provide angle of intersection with downstream sewer main of no less than 90 degrees
- Locate outside of driveways in the center third of the lot if possible
- Locate a minimum of 10 feet from trunk of trees
- In hillside locations, place on the low side of property frontage

5.3 BUILDING LATERAL SIZE

- Minimum building lateral size is 4-inch-diameter
- Maximum building lateral size is 6-inch-diameter
- Size according to the requirements of UPC, unless otherwise directed by District Engineer

5.4 BUILDING LATERAL DEPTH

- Depth should be sufficient to achieve design slope and serve entire building on each parcel

5.5 BUILDING LATERAL SLOPE

- Minimum slope, unless other approved by District:
  - 4-inch-diameter lateral: 2% slope or 1/4-inch drop per foot of pipe

- 6-inch-diameter lateral: 1% slope or 1/8-inch drop per foot of pipe

6.0 Inverted Siphons

- Avoid inverted siphons, D-shaped boxes, box sections, and other restrictive structures unless crossing under major utilities, rivers or creeks, and cannot be avoided. All siphons require approval of Districts representative.
- Provide double barrels in siphons, with one pipe smaller than the other (one dry weather flow and the other for excess wet weather flow)
- Include air jumper pipe to convey air from upstream to downstream
- Stop logs or gates to isolate each barrel for maintenance and inspection
- PVC lining required in all siphon structures
- Minimum 3 fps velocity at dry weather daily flows

7.0 Access Structures

7.1 GENERAL – NEW AND REPLACEMENT

- Manholes Required
  - At every horizontal or vertical change in alignment
  - Where sewer mains connect
  - Where building laterals of the same size connect to sewer main
  - Where 6-inch-diameter private building lateral serving multiple lots connects to sewer main
- Maximum distance between manholes is 500 feet
- Include 3-foot stub out at manholes at the end of a pipe where pipe may be extended in the future
- Cleanout may be used at end of sewers that will not be extended in the future and sewer main is 10 inches in diameter or less
- 90 degree minimum angle in the horizontal plane between the downstream outlet in the manhole and any incoming sewer
- Locking lids required for the following conditions:

  - Easement locations
  - School grounds
  - Parks and public access areas
  - Pipes larger than 12 inches in diameter
  - Utilize the following standard locking cover mechanism
- Unless other approved by the agency with jurisdiction, standard outside drop manhole is only required when the difference between the incoming and outgoing sewer is greater than 2 feet
- Change upstream slope if possible to avoid the need for drop manholes
- No more than four connections allowed per manhole
- Use 30-inch-diameter opening frame and cover

7.2 LOCATION

- 48-inch-diameter manhole: 3 ft clearance between center of manhole from any monument or lip of gutter
- 60-inch-diameter manhole: 4 ft clearance between center of manhole from any monument or lip of gutter
- Do not locate in front of:
  - Fire stations
  - Police stations
  - Emergency facilities
  - Freeway ramps
  - Driveways in commercial, industrial, or public facilities
  - Sidewalks
  - Pedestrian crosswalks
  - Street intersections
  - Gutters or other low points
  - Inaccessible areas
  - Locations that will affect public safety

7.3 SIZING

- Use 48-inch-diameter manhole for pipes 24 inches in diameter or smaller
- Use 60-inch-diameter manhole for pipes greater then 24 inches and less than or equal to 36 inches in diameter
- Use 72-inch-diameter manhole for pipes greater than 36 inches in diameter
- Use 60-inch-diameter outside drop manhole if only one drop connection is required
- Use 72-inch-diameter outside drop manhole if two to four drop connections are required

7.4 SLOPE THROUGH MANHOLE

- Maintain same slope through manhole when upstream and downstream slopes are the same
- Provide invert elevation at center of manhole channel
- Provide up and down invert elevations of manhole channel if slope is different on the upstream and downstream pipes
- Minimum of 0.1 ft drop across the manhole if change of alignment is greater than 30 degrees
- Sufficient drop across manhole to compensate for energy loss caused by change of alignment
- If pipe size changes from upstream to downstream in manhole, match spring line of pipes to minimize turbulent flow

7.5 STRUCTURAL REQUIREMENTS

- Include structural calculations with design submittal
- Reaches of pipe with the same diameter, slope, material, and trench condition may be submitted as one calculation.
- Rigid pipe loading
  - Marston's formula for load placed on pipe by backfill
  - Minimum values for preliminary design only:
    Soil weight – 120 pounds per cubic foot (pcf)
    k**μ**' factor – 0.110
  - Safety factor: 1.25 for rigid pipe
  - Three-edge bearing strength of the pipe

- Flexible pipe loading
  - Spangler's formula for load placed on pipe by backfill
  - Maximum deflection allowed determined by pipe deflections computed by the Iowa Deflection Formula in American Society of Civil Engineers (ASCE)/Water Environment Federation (WEF) design manual
  - E' modulus of soil reaction – use E' for each material (from geotechnical report) and combine using ability to verify (ATV) method
  - E' for Type II Alternate bedding and imported fill material – 1,000 psi (unless noted otherwise in geotechnical report) up to 12 inches above top of pipe
  - Deflection lag factor: 1.5
  - Withstand local buckling
- References
  - ASCE Manual and Report of Engineering Practice 60
  - Clay Pipe Engineering Manual
  - Handbook of PVC Pipe
  - ASCE/WEF Gravity Sanitary Sewer Design Manual
  - Other similar handbooks.
- Allowable deflection
  - Maximum allowable deflection:
    - 3% of the base inside diameter at 30 days after installation
    - 5% of the base inside diameter at 11 months after installation

8.0 Abandonment

Abandon Pipe

- Do not abandon pipes with building connections unless provisions are made to reroute flow from buildings
- If building connections are rerouted, disconnect at main and seal both main and lateral, abandon lateral in same manner as main pipe
- Provide concrete plug at downstream connection at manhole

- Compression plug to seal then fill with concrete
- Fill with sand slurry or CLSM
- Provide concrete plug at upstream connection at manhole
- Provide update on sewer map indicating that line is abandoned

Abandon Manhole Structure

- Abandon manhole structure:
  - When structures are located less than the standard distance from each other and are located along a straight-line reach of pipe
  - If the remaining distance does not exceed the design standard for the maximum distance between structures (varies according to pipe diameter) by more than 25%
  - If there are no lateral connections at the structure
- Procedures for abandonment during rehabilitation include:
  - Line through the existing manhole
  - Excavate and remove frame, cover, and cone
  - Cover the liner pipe with an inverted half pipe and grout in place
  - Fill the manhole to the top of the barrel with sand
  - Place a flat steel cover over the barrel
  - Backfill above the cover
  - Match existing surface improvements

9.0 Repair and Rehabilitation

9.1 GENERAL

- Rehabilitation recommendations for the pipes and manholes – based on condition assessment data
- Condition assessment data to consist of closed-circuit television (CCTV) and manhole inspections according to the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) system

- If CCTV is not possible, other methods may be approved by the responsible District – submit for approval by responsible District
- Condition assessment reports to include at a minimum:
  - Photographs of the typical conditions and major defects
  - NASSCO standard defect report
  - Microsoft Office version of software to view data
  - Hard copy in Adobe pdf format
  - Electronic copy suitable for viewing on office version of software

9.2 POINT REPAIR AND JOINT REPAIR REQUIREMENTS

- Repair localized defects using internal techniques or external excavation replacement as applicable:
  - less than 10 feet in length
  - Protruding laterals: trim internally
  - Moderate to severe offset joints: excavate pipe around offset, realign and support during lining operation, reinstall bedding and backfilling
  - Root masses: trim internally prior to lining
  - Localized circumferential cracks and leaking or cracked joints: install circular seals
  - Localized multiple or spiral cracking: excavate and replace pipe, use rubber couplings or lining
  - Soil grouting to fill voids around the pipe or to stabilize soils
  - Removal of major debris or encrustations prior to lining
  - Soil grouting: soil grouting with CLSM provides side support to the pipe in areas where voids have been created around the pipe and the area to be grouted is minor
- Open-cut excavation on a short segment of pipe for collapsed or crushed pipe or severely offset joints:
  - In areas where significant voids may have developed, the pipe will likely have to be replaced using open-cut replacement.

- Open-cut excavation point repairs by digging along the length of the pipeline to be replaced, unearthing and replacing the pipe for 10 feet or less conforming to new main sewer pipe requirements.

- Required on pipes prior to using the rehabilitation methods

9.3 OPEN-CUT REPLACEMENT

- Requires consideration of bypass pumping, traffic control, bedding and backfilling, public safety and access, and surface restoration requirements
- Remove existing pipe and dispose at approved facility.
- New pipe shall meet the requirements of Section 2.0.

9.4 PIPELINE REHABILITATION

- Recommendations for rehabilitation, repair, or replacement based on field inspection data
- Determine if a pipeline point repair is needed prior to lining. In some instances, a combination of point repair and rehabilitation methods can be used on a segment and still be more cost-effective than full pipe replacement.
- CIPP
  - Pipeline CIPP rehabilitation includes proper end sealing and connection liners or sealing
  - CIPP installation requires inserting a flexible fabric liner saturated with a thermosetting resin into the existing pipeline through a manhole
  - Fabric tube holds the thermostatic resin in place during installation until curing and hardening are completed
  - Unsaturated polyester, epoxy, and vinyl ester are commonly-available resins – each resin has different chemical resistance to domestic wastewater and shrinkage potential
  - Polyester provides corrosion resistance to acidic solutions, so it is suitable for most domestic gray water applications and for all gravity-flow stormwater applications
  - Vinylester offers better corrosion resistance but less strength and stiffness than polyester - some are suitable for pressure pipe applications because of their elongation properties
  - Epoxy resin is considerably more expensive than the other resins but offers the best resistance to corrosion – not often used for sewer applications
  - Shrinkage potential of polyester resin requires proper end sealing and connection liner at any lateral connection to ensure a watertight seal

- Primary methods for installing CIPP: winching the tube into the sewer or using an inversion method
- Full bypass or diversion of the flow is required for installation
- Some defects cannot be corrected by CIPP and must be corrected prior to installation (e.g., severe offset joints, collapsed or severely deformed pipe, heavy deposits, severe root intrusions, protruding laterals)
- CIPP liner can be installed from existing manhole structures – larger diameter installations may require removal of manhole frame/cover/cone
- Service laterals are reinstated using remote internal cutting machines prior to installing connection liners
- CIPP design criteria and minimum standards for the pipe CIPP liner are included in Table 2 below.

Table 2. CIPP Design Criteria and Minimum Standards for Pipe CIPP Liner

Item	Criteria/Standard
Minimum Standards	Flexural Strength, ASTM D790, 4,500 psi Flexural Modulus (short term), ASTM D790, 300,000 psi Flexural Modulus (long term), 150,000 psi
Soil Density	Minimum 120 lbs/ft 3, depth of cover over pipe (varies) and water table above top of pipe (varies) – use minimum 5 feet above top of pipe
E'	1,000 psi with live load and partially deteriorated pipe 700 psi without live load and fully deteriorated pipe
Fabric	Felt or equal
Resin type	Polyester (assumes use of connection liner)
Deterioration	Fully deteriorated or partially deteriorated
Ovality factor	To be determined by field inspection
Factor of Safety	2 if corroding conditions in pipe 1 if using liner as I/I barrier

- Liner thickness depends on a number of factors such as pipe diameter, pipe length, depth of cover, soil density, ovality factor, and factor of safety
- Design parameters may be better defined after thorough field investigation

- Current standards that are used for CIPP design and installation are included in Table 3 below.

Table 3. Current Standards Used for CIPP Design and Installation

Reference	
ASTM D543	Standard practices for evaluating the resistance of plastics to chemical reagents
ASTM D570	Standard test method for water absorption of plastics
ASTM D624	Standard test method for tear strength of conventional vulcanized rubber and thermoplastic elastomers
ASTM D638	Standard test method for tensile properties of plastics
ASTM D695	Standard test method for compressive properties of rigid plastics
ASTM D790	Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials
ASTM D1042	Standard test method for linear dimensional changes of plastics under accelerated service conditions
ASTM D2240	Standard test method for rubber property - durometer hardness
ASTM F1216	Rehabilitation of existing pipelines and conduits by inversion and curing of a resin impregnated tube
ASTM F2304	Standard practices for rehabilitation of sewers using chemical grouting
ASTM D2990	Test method for tensile, compressive and flexural creep and creep-rupture of plastics
ASTM D3574	Standard test methods for flexible cellular materials - slab, bonded, and molded urethane foams
ASSHTO	H20 vehicle loading standard

- Although the existing pipe will withstand some loads, the new liner should be designed generally to new pipe standards.
- For small diameters, there is less sensitivity to the various parameters such as partially or fully deteriorated condition, as the resulting design thickness of the liner will not change.
- In the large-diameter pipes, changing parameters will have a significant effect on the design thickness of the liner and, subsequently, the construction cost.
- Perform analysis to determine the most cost-effective liner thickness design
- Design wall thickness rounded out to next standard 1.5 millimeter (mm) incremental thickness above the minimum calculated, cost-effective thickness
- CIPP terminal connection and end seal: provide a watertight seal at the terminal ends of the liner – cut pipe flush with the inlet and outlet pipe and ends permanently sealed

between the liner and the existing pipe with an epoxy resin compound compatible with the liner/resin system

  - Service connection: seal using a connection liner compatible with the liner system by top hat® system or equal for pipes less than 18 inches in diameter and use epoxy sealant materials on pipes larger than 18 inches in diameter

9.5 MANHOLE REHABILITATION

Manhole Rehabilitation designs shall conform to the following guidelines.

- Rehabilitation options for structures include:
  - Replace frame and cover
  - Step removal
  - Raise to grade
  - Structural liner
  - Manhole coatings
  - Install new structure
  - Abandon structure
  - Remove and replace structure
- Recommendations for rehabilitation, repair, or replacement based on field inspection data
- Consider defects inside or outside of the structure before recommending renewal method
- Products applied inside the structure avoid or minimize excavation
- Perform cost-effective evaluation of combining structure repair methods (if more than one is required) with replacement of the entire structure
- Replace frame/cover and riser: replaced if misaligned or damaged – requirements for new frame/cover and riser construction
- Step removal: remove deteriorated steps and refinish wall – do not replace steps
- Raise to grade: required excavation to remove the existing frame and cover, inserting grade rings, sealing the joints between the grade rings, reseating the frame and cover (or replacing them if they are damaged), and backfilling around the structure to make it level with the surrounding grade

- Manhole coatings: manholes not exhibiting signs of corrosion or with light corrosion and other defects that require manhole coating may be protected by chemical sealing, patching, and spray-on coatings. Coating system is typically comprised of a cement-based substrate for repairing, resurfacing, and waterproofing the walls of the manhole with an epoxy coating placed over the substrate that is resistant to micro-biologically induced corrosion and will cure in a moist environment
- Grout behind the manhole walls to fill voids outside the structure or to seal visible leaks before the coating installation
- Minimum design criteria for the manhole coating system are included in Table 4 below.

Table 4. Minimum Design Criteria for Manhole Coating Systems

Item	Criteria/Standard
Substrate Repair – Trowel Application	Application time Working time @ 70°F – 30 minutes Initial set @ 70°F – 3 hours Compressive strength: @ 24 hours – 3,500 psi, At 5 hours – 2,500 psi Density – 137 pcf Mix ratio (power to water, by weight) – 9:1
Lining – Epoxy System	Application time: Working time @ 70°F – 45 minutes, ASTM C308 Initial set @ 70°F – 17 hours, ASTM C308 Bond strength (dry or damp MH) – concrete failure Compressive strength – 4,000 psi, ASTM C109 Density – 121 (pcf), ASTM C905 Length change – 0% Mixing ratio (powder to water, by volume) – 3:1

- Structural/non-structural liner:
  - The economics of structural rehabilitation of manholes depend on such factors as severity of chemical attack or damage, location, depth of the manhole, and the depth to water table
  - Cured-in-place manhole (CIPM) lining products, similar to those used for pipe rehabilitation, are available to line manhole walls
  - CIPM liners can be structural or non-structural (thin), depending on the need
  - Other structural liners are available that allow a new manhole to be constructed inside the existing one
  - CIPM liners are fabricated from reinforced fiberglass and PVC layers

- Insert manhole liners are fabricated from HDPE or fiberglass
- Other structural liners are fabricated in-situ from cement mortar with corrosion-resistant surfaces
- Manhole liners result in varying reductions of the barrel diameter of the structure depending on the method selected
- Installation may or may not require the removal and reconstruction of the bench and channel
- Minimum design criteria for the CIPM and prefabricated manhole liners are included in Table 5 below.

Table 5. Minimum Design Criteria for CIPM and Prefabricated Manhole Liners

CIPM Liner	Criteria/Standard
Minimum Composite Physical Properties	≤ 12 feet in depth:
	Flexural Strength, ASTM D790, 15,000 psi Flexural Modulus, ASTM D790, 800,000 psi Compressive Strength, ASTM D695, 8,500 psi Compressive Modulus, ASTM D695, 800,000 psi
	> 10, ≤ 16 feet in depth
	Flexural Strength, ASTM D790, 20,000 psi Flexural Modulus, ASTM D790, 900,000 psi Compressive Strength, ASTM D695, 9,400 psi Compressive Modulus, ASTM D695, 900,000 psi Compressive Modulus, ASTM D695, 1,000,000 psi
	> 16 feet in depth:
	Flexural Strength, ASTM D790, 25,000 psi Flexural Modulus, ASTM D790, 1,000,000 psi Compressive Strength, ASTM D695, 10,000 psi
Fabric	12-oz structural fiberglass
Resin type	Thermosetting epoxy due for structural solution, less shrinkage
Preformed Manhole Insert	**Criteria/Standard**
Load Rating	H20
Standard	ASTM D3753

- Install New Structure
  - When it is cost-effect to do so due to the number or severity of manhole defects, install a new manhole.
  - Install a new structure on a service lateral to facilitate bypass pumping when necessary.
  - Sewer manholes or cleanouts will be designed according to the design details.

- Remove and Replace Structure
  - If replacement of the structure is required because structural rehabilitation is not practical or because it is less expensive to replace than to repair the structure
  - If the structure experiences subsidence because of the surrounding soil or compaction failure, replacement is recommended to correct external environmental problems and defects in the structure
  - Replacement of the manhole involves
    - Bypass pumping
    - Excavation, removal and disposal of the existing structure
    - Construction of a new structure
    - Bedding and backfilling
    - Surface restoration

10.0 Pumping/Lift Stations

10.1 GENERAL

- Pumping/lift stations are not permitted where an acceptable gravity system alternative is available.
- Not allowed within street ROW
- Design pumping/lift station for entire upstream tributary flow at build-out densities, PF, and I/I allowances.
- Provide 100% backup pumping capacity for all pumping/lift stations.
- Provide calculations for wet well sizing and pump specifications with design submittal
- Tandem pumping allowed when:
  - Low flow
  - High Total Dynamic Head (TDH) conditions
  - Express written permission of the responsible District is required
- Provide 12 ft paved access road with 14-ft-wide rolling gate
- Provide turnarounds at stations constructed along heavily traveled streets

- Provide service vehicle access to wet well
- Provide reinforced concrete base slab sized adequately to counteract buoyancy forces and include supporting design calculations in design submittal
- Provide single surface pad over site incorporating station access, wet well/dry well access, supporting generator and fuel supply tanks, as necessary
- Provide restrained flexible couplings on all outlet piping within two feet of station walls
- Provide reinforced concrete supports for pipes between wet well and dry well where appropriate
- Wet well size:
  - Submersible station - minimum 72-inch-diameter wet well with 4-hour capacity or as necessary to accommodate pumping equipment
  - All other stations – size based on good sanitary engineering practices
- Provide eccentric plug valve on-line into wet well
- Provide emergency bypass system:
  - 6-inch PVC suction line, discharge line, and standpipe
  - Standpipe with cap and cam-lock connector
  - Bypass located in a vault
  - Standpipe connected to force main with American Water Works Association (AWWA) resilient seat gate valve with stainless steel trim and check valve
  - Gate valves for isolation on suction and discharge lines
  - 1-inch minimum water service with reduced pressure backflow preventor and piping insulation
- Simplex keyless push button access control systems for all buildings rekeyable, Almont locks for all padlock applications, fall protection device for ladders that include winch and center post:
  - Center post: with top and back rollers or approved equal
  - Ladder: non-skid surface
- Spare pump and air release valve prior to acceptance hydrogen sulfide and foul odor suppression recommendations and calculations with design submittal

- Equipment access: hatch must be provided above pumps and motors that allow removal of pumps and motors with a crane, winch or hoist without the need for special rigging equipment
- Allowed pumping station types depend on size, head, and motor horsepower and are included in Table 6 below.

Table 6. Pumping Station Types and Details

Packaged wet well/ dry well	Up to 300 gpm	Up to 45 feet	100 HP @ 1450 rpm
Vertical centrifugal, dry pit, non-clogging	No restrictions	No restrictions	No restrictions
Submersible	Up to 2000 gpm	Up to 160 feet	100 HP @ 1800 rpm

10.2 PACKAGED WET/DRY WELL STATIONS

- An above-ground station is preferred whenever possible
- Standard lift station:
  - 7-foot, 6-inch (7'6") standard diameter
  - Fiberglass reinforced plastic underground lift station
  - Above-ground controls
  - Below-ground pump shut-offs
- Manufactured and assembled as a package including pumps, motors, internal valves and piping, level indicators, control switches, ladder, alarms, blower and dehumidifier
- Supply and warranty through one company
- Self-priming, horizontal, centrifugal, sewage pumps
- Motors to be totally enclosed, fan cooled, and premium efficiency
- 3-way valves if space does not permit isolation valves for each pump

10.3 VERTICAL CENTRIFUGAL STATION

- Vertical, dry pit, single stage non-clogging centrifugal sewage pumps
- Grease seal reservoir for pumps with mechanical grease seals
- Motors to be totally enclosed, fan cooled, and premium efficiency
- Individual air bleed system from each pump to the wet well

- Seal water piping system: Schedule 80 PVC or Type “K” copper and to include drains
- Lift station enclosure design coordinated with Building and Fire Departments with respect to occupancy class and electrical and Heating Ventilating and Air Conditioning (HVAC) system design

10.4 SUBMERSIBLE PUMPING STATION

- Minimum of two submersible centrifugal sewage pumps, guide rails, wet well access, discharge seal and elbow, motor control center, starters, liquid level control system and all hardware necessary for a complete working system
- Supply and warranty through one company
- Electric, submersible, centrifugal, non-clogging pumps
- Pump and motor suitable for continuous operation at full name plate load while motor is completely submerged, partially submerged, or totally non-submerged
- Electrical equipment/panels above-ground
- Each pump furnished with a discharge connection system for removal and installation of pump without entry into the wet well
- Hardware in wet well, chains, cable, and slide rails: 316 stainless steel

10.5 PUMPS

- Provide pumps, regardless of station type that are:
  - Non-clogging
  - Capable of passing a minimum 3-inch-diameter solid
  - Single-speed
- Provide the following equipment:
  - Minimum of two pumps and controls to alternate lead and lag pumping
  - One spare rotating mechanism to replace each pump type
  - One set of routine service replacement parts, such as wear rings, bearings, and seals, for each pump type
  - Hour meters for each pump that records pump run time when the motor is operating
  - Magnetic flow meter on the discharge of the station, located in approved vault, and with display installed in the station

10.6 PAINTING

Painting of station, equipment, and appurtenances using the pumping/lift station paint standards listed below in Table 7 below.

Table 7. Pumping/List Station Paint Standards

Type	Color
Pump suction isolation valve	Blue
Pump discharge isolation valve	Red
Pump discharge check valve	Orange
Force main isolation valve	White
Emergency pump isolation valve	Yellow
Emergency pump check valve	Brown
Sump pump isolation valve	Black
Sump pump check valve	Orange
Mechanical seal pressure valve	Pink
Chemical isolation valve/piping	Purple
Electric motors	Blue
Sewer pumps and pipes	Green
Compressed air system	Per responsible District
Standby generator	Per responsible District

10.7 PIPING AND VALVING

- When not included in package stations, all internal main lift station piping to be flanged, unless a main pumping/lift station
- Flexible connections to allow for disassembly at main pumping/lift station piping: Victaulic, Dresser, or equal
- Manual vents and drains on all main piping to allow draining of sewage prior to piping disassembly
- Resilient seat gate valves in manholes for station wet-well isolation
- Pump isolation valves
  - Ductile iron, non-lubricated eccentric plug valves with worm gear operators
  - Stainless steel bearing
  - Nickel seats
  - Neoprene faced plugs

  - Nitrile-butadiene packing
- Main pump check valves
  - Cast iron swing checks with external lever return
  - Do not install in the vertical
  - Disc, pivot arm and bearing: 316 stainless steel or cast iron with bronze trim disc
  - Seat: field replaceable with neoprene facing

10.8 FORCE MAINS

- Locator boxes to be placed at every horizontal change in alignment or a maximum of every 500 feet
- No. 12 insulated copper wire to be placed on top of and along the entire length of all non-metallic pipe to extend to the surface of all box locations and structure along the force main
- Wire to be fastened to top of pipe to avoid displacement or damage during backfilling operations
- Locator boxes to conform to valve box requirements with lids clearly marked "sewer"
- Private and public force mains may not connect directly to manholes, but rather to a gravity pipe prior to connection to existing sewer system pipe or manhole.
- Gravity pipe at the end of a force main must be of a suitable material to resist corrosion.
- Private and public force mains must be detailed on the sewer plans.
- Private force mains must connect to responsible District sewer system.
- Private and public force mains may not discharge to manholes.
- Provide a swab launching station for force main preventative maintenance and detail on pump station plans, including necessary valving, unless other means of force main cleaning are provided
- Pumping station pumps are to be used to propel swab through the pipe, unless other means of force main cleaning are provided.

10.9 ELECTRICAL

- Free standing electrical service and transfer switch: heavy duty electrical weatherproof enclosure securely mounted, minimum 24 inches above the ground
- Concrete pad around steel supports

- 110-volt duplex, ground fault interrupter (GFI), receptacle in weatherproof box
- Weatherproof box: 316 stainless steel hinges and hardware, factory primed, and field painted per painting requirements
- Enclosures to be epoxy-coated
- Mobile generator
  - Manual transfer switch
  - Generator plug: minimum 36 inches above ground (provide single-line diagram for wiring manual transfer switch)
- Station dry well is confined space: provide explosion proof dry well lighting to illuminate the ladder and floor
- Exterior light: 12-inch-diameter pole-mounted luminaries at 120 volts (V), 70 watts (W) high pressure sodium (HPS)
- Occupational Safety and Health Administration (OSHA)-approved rubber mat in front of all indoor control panels
- Ability to operate station with one pump removed for maintenance – local-remote switch and no parallel switching to provide proper lockout procedures
- Local disconnect at motor per National Electrical Code (NEC)
- Twenty-five percent additional spare wire and 2-inch conduits or oversize conduits to meet ultimate station capacity
- Drives (Variable Frequency Drive (VFD) or not)
- Solid state smart-type motor starters
- Pump control option to provide ramp start modes:
  - Soft start with selectable kickstarts
  - Current limit
  - Full voltage

10.10 TELEMETRY

Control Panels Features

- Panels and enclosures with National Electrical Manufacturers Association (NEMA) ratings
  - NEMA 3 316 SS for outside installations, including sun shield

  - NEMA 12 for protected installations inside buildings
- Panel design
  - Lamp with switch
  - 120 variable frequency drive VAC duplex convenience outlet
  - Heating and cooling to maintain internal components within operating tolerances and to avoid condensation
  - 120 VAC uninterruptible power supply (UPS) or an equivalent direct current (DC) voltage subsystem sized for 150% of peak load for all internal panel components for a minimum of 30 minutes run time
  - Radio communications system compatible with Supervisory Control and Data Acquisition (SCADA) system
  - High temperature switch (alarm) for the control panel
  - Automatic alarm dialer to annunciate critical alarms.

Programmable Logic Controller (PLC)

- PLC to perform monitoring and control of the facility
- Large or small PLC as specified
- PLCs to include:
  - Analog inputs and outputs isolated with 4-20 milli-Ampere (mA) current signal isolators
  - Two serial communication interfaces running MODBUS remote terminal unit (RTU) mode
  - Operator interface panel
  - Input and output points per specifications
  - 20% spare analog and digital I/Os

Panel-mounted Devices

- 24 VDC power supplies – linear, open frame, minimum capacity of 3.0 Ampere (Amp)
- Relays – single pull double throw (SPDT), minimum 10 Amp rating
- Signal isolators – current isolators and converters
- Terminal block system – terminal blocks, fuse blocks, and disconnect blocks

- Temperature switch – temperature switch used to monitor internal panel high temperature conditions
- Internal lighting – fluorescent interior light at same approx. Width of control panel located along top of panel and with separate light switch
- UPS sized for 150% of calculated load with sufficient battery backup time for 30 minutes of operation
- Wet well level measurements
  - Continuous (analog) wet well level measurement using reactive air cell bubbler system
  - Bubbler system components (compressors, pressure transmitter, valves, etc.) Mounted in control panel
  - Air cell mounted 6 inches above wet well floor
  - 304 or 316 stainless steel (SS) tubing for all piping
  - differential pressure transmitter for pressure (level) measurement on bubbler system;
  - 0.5-inch National Pipe Thread (NPT) block and shutoff valves
  - 0.5-inch NPT three-valve manifold for calibration
  - Duplex air compressor with manual alternation
  - Compressor or equal capable of supplying 5 psi air at 100 cubic feet per minute (cfm)
  - Normally open solenoid valve on the air supply line to allow build up of pressure and supply burst of air to clear the air cell periodically
  - Protection for controller
  - Float for high-high level contact

Record Drawings and O&M Documentation

- Three (3) copies of as-built drawings and Operations and Maintenance (O&M) manuals (hardware and software)
- Electronic Compact Disc – Read Only Memory (CD-ROM) as-built drawings and hardware manuals where available

- As-built drawings:
  - Show physical location of components; loop drawings (end-to-end wiring diagrams) meeting Instrument Society of America (ISA) S5.4 standards with minimum required items plus optional items
  - Electronic version in latest edition of AutoCAD
- O&M manuals for hardware
  - Equipment comprising system in the hardware instruction manuals for all equipment including third-party equipment provided as part of the SCADA system
  - Instructions for O&M of the installed system
  - O&M instructions for individual equipment units comprising the system
- Standard hardware manuals acceptable with errata sheets to reflect specific equipment provided
- O&M manuals for software
  - Complete, thorough, organized, and standardized documentation for operations centers, RTUs, PLCs, and other software provided as part of SCADA system
  - Documentation providing different degree of detail at each level
  - System manual to provide broad approach
  - Subsystem documentations to focus on smaller pieces of the overall system
  - Program documentation to pinpoint finest detail
  - PLC program fully annotated and documented

Testing Requirements

- Factory Acceptance Test (FAT):
  - Fully test all SCADA components at Contractor's facility prior to shipping, installing, reprogramming, or reconfiguring the SCADA equipment
  - Verify compliance with specifications and correct deficiencies at Contractor's facility and not in the field
  - Test functional, performance, and interface requirements to extent possible
  - Test each control loop from terminal strips to the PLC

- Site Acceptance Test (SAT):
  - After installation, fully test all SCADA components to verify compliance with specifications
  - Test functional, performance, and interface requirements to extent possible
  - Test each control loop from the instrument or terminal strip, through PLC, to central SCADA system
  - Tune all control loops
  - Test all control strategies
- Operational Availability Demonstrations (OAD):
  - During 90-day period during which SCADA system is used for day-to-day operations, test system stability and completeness
  - Start OAD after successful completion of field testing and when notified to start by responsible District
  - Successful testing is achieved at system availability of 99.8% or better
  - If unsuccessful test, restart and repeat testing
  - Final acceptance only after 99.8% or better is achieved

Programming and Configuration Services:

- PLCs configured based on configuration drawings, Piping and Instrumentation Diagram (P&ID), Process Control Narratives, and functionality as specified
- Include necessary constant and variables required to meet specifications whether shown on drawings or not
- Provide fully functioning control system
- Conduct coordination meetings at responsible District's designated location during configuration and programming at least twice
- Solicit input at meetings from and coordinate with responsible Districts staff
- Samples to be provided by contractor of PLC programs
- Diagrams in ladder rung format to be used for the PLC program documentation system
- All inputs to be shown near the left "power rail"
- All outputs to be shown near the right "power rail"

- Show on drawings:
  - Diagrams for all device codes and functional descriptions
  - PLC reference codes and input/output (I/O) assembly codes
  - Module and terminal numbers
- Source code for all operator interface programming well annotated to explain operation
- I/O tag numbers in rung or device annotations
- Control strategy numbers to identify PLC program sections
- Alternative programming techniques may be used if approved in writing by responsible District
- Organize and structure all PLC programs to aid in software maintenance and modification
- PLC program organization into three-level "outline" structure for strategies, equipment items (or subcategories), and functions
- PLC strategy to consist of the logic required by one strategy in the Process Control Narratives
- PLC equipment item (or substrategy) to consist of the logic associated with one piece of mechanical equipment
- Functions to be the smallest subdivision of programs to consist of functions, subroutines, or short algorithms requiring five to ten rungs of ladder logic
- Ladder logic for PLC programming unless otherwise approved by responsible District
- PLC programming to be well documented for each contact, coil, timer, function block, or other rung item annotated in program listing with:
  - Internal item number (i.e., coil number contact number, etc.)
  - External tags (where applicable)
  - Brief description of item's function
- External tags – input or output tag number from the PLC I/O schedule
- Points created in a PLC and transmitted to or from the central computer system – tag number used in the central computer

Alarm Signals

The following alarm signals (at a minimum) shall be provided for transmission by a dial-up telephone alarm system:

- Pump fail
- Pump high temperature
- Pump vibration
- Dry well flooding (critical alarm)
- High wet well level (critical alarm)
- Low oxygen, lower explosive limit (LEL) and hydrogen sulfide
- Commercial power failure
- Standby power failure.

Dial-up Telephone for Use by Automatic Alarm Dialer

- Wall mounted telephone
- Same dial-up line for operator convenience

10.11 MONITORING SYSTEMS

Gas Monitoring System

- Permanent gas monitoring system in dry wells
- Monitor
  - Lack of oxygen
  - LEL
  - Hydrogen sulfide concentration (liquid and air)
- Monitoring system tied to telemetry system alarms

10.12 STANDBY POWER

- Permanently installed generator
- Natural gas fueled
- Automatic transfer switch, manual transfer switch and load bank connections
- Load bank receptacles to test generator for output and generator break-in

- Verify gas pressure with local utility company
- Verify fuel demand with generator manufacturer prior to design submittal
- Engine manufacturer certification that engine is designed to operate on natural gas and propane
- Generator in approved color prior to shipping
- Single line diagram for wiring
- Generator sizing calculations to be submitted and use:
  - Loading based on lead pump running, lag pump starting, and full operation of all electrical equipment at the site
  - Generator running 100% of name plate current for 4 hours on primary fuel supply using local utility load bank
- Automatic back-up propane fuel capability and 24-hour supply of fuel
- Propane tank to be factory-pained with approved color
- Local fire department approval for site of back-up fuel tank
- Instrumentation
  - Generator voltage, frequency, and amp meters
  - Oil pressure gage
  - Battery volt meter
  - Temperature gage
  - Hour meter
  - External battery with trickle charge
  - Dry contacts for telemetry – showing generator running
- Automatic shut-off and alarms
  - Low engine oil pressure
  - High engine temperature
  - Over speed
  - Over crank
- Locate exhaust away from dry well ventilation

- Stainless steel rain cap
- Insulate exhaust stack from generator enclosure or roofing material
- Provide sound attenuation as necessary to meet or exceed responsible District's noise standards
- Attenuation may include silencers, insulation and/or enclosure
- Submit ambient noise measurements and calculations demonstrating compliance with local standards

11.0 Internal Inspection of Existing Sewer

11.1 GENERAL

- Use approved field data entry software system
- Defect coding and reporting according to NASSCO PACP and MACP
- In accordance with Standard Scope of Services

12.0 Bypass Pumping and Flow Diversion

12.1 GENERAL

- Requirements listed are for temporary bypass pumping and flow control of peak sewage flows during construction when needed.
- Contractor is responsible for labor, materials, and supervision to temporarily provide bypass pumping and flow control to meet the specific needs of inspection, cleaning, or rehabilitation/replacement work.
- Requirements for temporary bypass pumping or flow diversion must meet local and state transportation agency requirements with respect to bypass piping location in streets and ROW.
- Encroachment Permit requirements apply when necessary.
- For purposes of bypass pumping lateral flows, right of entry onto private property is not permitted without ROW/right-of-access ROA agreement.
- If laterals are shown on sewer maps, they are from best-available records or not shown.

- Internal inspection may identify additional laterals not shown that may require bypass pumping.
- No interruption of sewage flow shall be permitted throughout the duration of any construction project.
- Bypass Operation: 24 hours per day during the period of work.
- Bypassed flow to be continuously monitored and metered.

Submittals

- Project-specific bypass plans:
  - Are prepared by the contractor and submitted for review
  - Are a means and methods of accomplishing and maintaining the bypassing
  - Are to be accepted by the responsible District
  - Provide for accessibility to pedestrians and vehicular traffic
  - Are to include, but not be limited to, the following:
    - Clearly-defined drawings (one drawing per bypass) indicating the scheme and location of temporary sewer plugs and bypass discharge lines for each of the project sites, and showing the method and location for discharging the bypass lines
    - Staging areas for pumps, if bypass pumping is being used
    - Sewer plugging method and type of plug
    - Number, size, material, location and method of installation of suction piping
    - Bypass pump sizes, capacity, number of each size to be onsite, and power requirements
    - Calculations of static lift, friction losses and flow velocity (pump curves showing pump-operating range for selection of bypass pumping pipe size)
    - Standby power generator size and location for electrically driven bypass pumps
    - Downstream discharge plan
    - Thrust and restraint block sizes and locations
    - Sections showing suction and discharge pipe depth, embedment, select fill and special backfill
    - Method of noise control for each pump and generator
    - Temporary pipe supports and anchoring required

    - Plans for access to bypass pumping locations required
    - Schedule for installation of and maintenance of bypass pumping lines
    - Plan indicating selection location of bypass pumping line locations
    - Detailed plans of a redundant backup system
    - Emergency response plan
    - Description of compliance permit conditions
    - Staffing plan for monitoring and maintaining pumps
    - Spillage notification and cleanup plan
    - Connection detail if bypass line connects to existing structure
- Project-specific flow diversion plan are:
  - To be prepared by the contractor and submitted for review
  - A means and methods of accomplishing flow diversion
  - To be accepted by the responsible District
  - To include, but not be limited to, the following:
    - Detailed procedures for handling existing wastewater flow
    - Schedule
    - Location
    - Listing of equipment and capacities

13.0 Odor Control

13.1 GENERAL

- Provided by contractor during entire construction period when rehabilitating or replacing sewer pipes or manholes
- Accepted by the responsible District
- Prevalent odorant in municipal sewer systems is generally hydrogen sulfide
- Other non-hydrogen sulfide odors could be present
- All gases monitored and controlled
- Odor control plan must be submitted to include, but not be limited to:

- Means and methods of accomplishing and maintaining the odor control
- Odor concentration measurement
- Chemical feed site requirements
- Odor control system requirements
- Monitoring

13.2 CHEMICAL FEED SITE REQUIREMENTS

- Include temporary chemical feed locations where chemicals are added directly to the sanitary sewer flows.
- Chemicals to be suited specifically for suppression of odorants in municipal sewer systems
- All Chemical(s) shall be approved by responsible District. Chemicals may consist of, but not limited to the following: (calcium nitrate), Thiogaurd® (magnesium hydroxide), sodium hypochlorite (bleach) ferrous/ferric chloride (iron salts) or hydrogen peroxide
- Include multiple chemical addition locations as needed.
- Include more than one chemical, depending on the odor concentrations identified
- Meet all safety requirements for equipment and potential chemical hazards to protect contracting and responsible District personnel and the local community
- Chemical feed sites shall include adequate storage tanks for the chemical chosen to provide a minimum of seven (7) days of uninterrupted operation.
- Chemical feed locations may or may not be trailer portable systems depending on the location of the work.
- Each location shall be powered with a generator, have fresh water and adequate chemical containment in the event of leaks or spills.
- Adherence to all of the chemical manufacturers' recommendations
- Maintain MSDS certifications on-site for each chemical at each chemical addition location
- Each location will have the capacity of being serviced by a standard chemical delivery truck.
- Each chemical feed site will have a minimum of two (2) chemical feed pumps, each capable of delivering adequate amounts of chemical to maintain headspace odor concentrations at the bypass location to an average of not more than 20 parts per million (ppm).
- One pump shall be used as a primary pump, with the second as backup in the event of failure of the first pump.

- All piping, valves and safety equipment are part of the odor control requirements.

13.3 ODOR CONTROL SYSTEM REQUIREMENTS

- At chemical feed locations, air extraction/odor control systems provided
- Air extraction systems to be portable trailer mounted and have the capacity to create minimum negative pressures of -(0.02) inch water column (in/wc) a minimum 500 feet upstream of the bypass
- Locations of the air extraction units will vary during the sewer work.
- Temporary power provided that is adequate to operate the entire system
- Size of the sewer line to be considered – multiple trailer units may be required for the large diameter sewer lines
- Include a three-stage packed tower odor scrubber in conjunction with a carbon polisher:
  - Capable of 99% removal efficiency with a recirculation rate of 25 gpm per 1,000 cfm of airflow
  - With the ability to be configured to remove hydrogen sulfide, ammonia, mecaptans and other odorous organic compounds and acid gases
  - Minimum six (6) feet of 3.5-inches of packing and the carbon absorber shall have a bed depth of a minimum of three (3) feet
  - Capable of providing an average inlet loading of 20 ppm, with peaks up to 50 ppm of incoming odorant concentrations
  - Each portable system must reduce the incoming odorant levels in the headspace of the sewer line from 20 ppm average to no greater than 0.010 ppm.

13.4 MONITORING

- Continuous odorant monitoring at the inlet and the outlet of the air extraction system
- Monitoring equipment must be capable of sampling every 10 minutes
- Capacity to accurately determine odorant concentrations from 0.005 ppm to 200 ppm

14.0 Reporting Requirements for Spills

14.1 GENERAL

- SSOs are a serious public health and environmental health issue and must be prevented.
- Sewer work in the vicinity of streams, rivers, storm drains, or other bodies of water requires notification to the agency with jurisdiction over the waterways where work is done within 20 feet of their facilities.
- All pre-design work must include mitigation efforts required to prevent SSOs.
- Agency approved language to be included in design specifications to protect waterways from SSOs.
- Contractors required to contact responsible District within 24 hours upon exposing a sewer line regardless if a planned event or an accidental event.
- Contractors are required to prepare a Spill Prevention Plan (SPP) and an Emergency Response Plan (ERP), and provide training program before Notice to Proceed.
- Contractors are responsible for assuring that the procedures described for reporting spills are known and followed by their on-site employees and sub-contractors. ROW Inspectors/ Construction Management Inspectors will check to verify that all employees are aware of this information during site visits.
- Contractors are financially responsible for the repair of any damaged sewer lines, and all costs incurred as the result of a SSO to include, but not limited to:
  - Emergency response personnel
  - Equipment
  - Materials
  - Cleanup and restoration
  - Inspections
  - Litigation of damage
- Failure to prevent SSOs will result in possible fines to be determined by the regulatory agencies. The responsible District may also be liable for the costs from the results of the spill.

14.2 PURPOSE OF THE SPILL PREVENTION AND ERP

- The purpose of the SPP is to anticipate the activities and materials that could result in a spill of hazardous material during the course of the project.
- Hazardous materials are defined as chemicals and sewage.
- Responsible District to provide sufficient information to:
  - Analyze the processes, chemicals and procedures present during the life of the project that could result in a spill of hazardous material
  - Identify the materials or procedures needed to respond to a spill of hazardous material used during the project
  - Define SPP provisions required for contractor to submit project-specific SPP.
- The purpose of the ERP is to identify critical areas surrounding the project work site(s) that could be affected by a spill of hazardous materials and to define the actions to be taken in response to a spill.
- ERP shall be submitted by the contractor prior to being issued the Notice to Proceed.

14.3 CONTENTS OF THE SPILL PREVENTION PLAN

The SPP narrative will at a minimum:

- Identify operations during the project that could be a source of or lead to an overflow or spill
- List all hazardous chemicals present at the work site and copies of the material safety data sheets (MSDS) for these chemicals (projects that do not have a requirement to comply with the Federal Worker Right to Know statute are exempt from this requirement)
- Define the materials and/or equipment needed to respond to spills of hazardous materials or sewage overflows. Examples include:
  - Spill containment booms
  - Adsorbent pads
  - Placement of overflow containment where large volumes of hazardous chemicals are stored at the worksite
  - Materials needed to make emergency repairs to leaking pipes:
    - Includes MSDS for each chemical for spill response procedures to determine the materials and equipment needed to respond to chemical spills

- Describes the notification steps to take immediately once a sewer line is exposed or relocated during project work
- Documents that the design of the project has been reviewed and accepted by responsible District
- Acknowledges understanding of the SSO notification requirements before project work starts
- Acknowledges contract specifications requirements to address notifications and the SSO response obligations placed upon the contractor.

14.4 CONTENTS OF THE EMERGENCY RESPONSE PLAN

- The ERP narrative will include at a minimum:
  - Separate sections for Sewage Spills, Chemical Spills, Power Failure, and Pump Failure
  - defined emergency response roles and employees' resources designated to fulfill these roles, for example:
    - Site supervisor could be responsible for making the map(s)
    - How employees working at the site must be informed of the actions they are expected to take if the ERP is activated
    - Procedures and checklists for employees so that they know what is expected to be done before a spill occurs. Procedure and checklists should include:
      - notification of agencies/public
      - containment
      - repair and cleanup
      - restoration
    - Identification of employees and training to use specialized equipment needed to respond to spills
- Map (may be hand-drawn) that describes:
  - Likely flow path a spill would take at each work location
  - Critical areas along the flow path and in the vicinity of the work
  - Location of storm drains, streams, washes, rivers, lakes or water bodies at or near the job site that could receive sewage overflow
  - Descriptions of the actions to take to prevent overflow or spill from entering critical areas

- Names and phone numbers of the responsible District staff to notify in the event of an overflow or exposure of a sewer line to be provided at the pre-bid meeting by local agencies
- Form to complete whenever a hazardous material escapes from the collection system, bypass systems, or jobsite
- Training and preparedness- staging equipment, notification of staff, contractors, and emergency agencies
- Immediate response to be initiated in the event of a spill
- Disposal locations and permits required.

14.5 CHEMICAL SPILLS

MSDS provided by the chemical manufacturer containing information on the potential hazards of the chemical (health, fire, reactivity and environmental), information on how to work safely with the specific chemical(s), what to expect if exposure occurs, and what to do if a spill happens. If a spill occurs, the contractor activates the plan and follows responsible District ERP. If a local ERP is not available, the steps to follow are:

1. **Initiate response activities** - If there is a medical emergency, fire, explosion, or release of a hazardous chemical or imminent threat to public safety, call 911 immediately.
2. **Notify responsible District emergency contact** immediately of sewage spills – Do NOT call 911 for a wastewater spill.
3. Make an initial assessment of the situation *without endangering* personnel or public:
   a. Determine if additional assistance or equipment is necessary
   b. Instruct employees to perform their assigned response tasks
   c. These tasks and roles are:
      - Spill Response Coordinator – is responsible for performing the following tasks:
        - Making an immediate survey of the spill
        - Initiating the primary response by directing staff as needed
        - Consulting the maps of the critical areas surrounding the spill and using this material to make decisions to direct response activities
        - Coordinating response activities
        - Notifying responsible District emergency contact and keeping track of who was contacted and the time they were contacted

- filling out the Confidential Spill Report Form (Appendix A).

– Supervisor/Owner – is responsible for performing the following tasks:

  - obtaining support for the spill response activities if needed
  - performing an internal investigation into the causes of spill
  - preparing a formal report to responsible District management explaining the circumstances that led to the spill
  - writing and implementing new procedures to remedy the failures that led to the spill
  - Assuring that notification of the emergency contact person at the responsible District has been done
  - Collecting information
  - Responding to the questions in the Spill Reporting Form
  - Taking photographs of all stages of the incident if possible and include them in the report
  - After the incident is under control, interviewing personnel who were present during the incident
  - Compare all reports and eyewitness accounts and try to reconcile discrepancies before writing the report
  - Writing a report describing the cause of the incident and actions taken in response
  - Submit a copy of the Spill Reporting Form within 24 hours
  - Submit one set of reports to responsible District within one week of spill

15.0 Standard Details

Table 8 provides a list of standard details included in Appendix B.

Table 8. Standard Details Included in Appendix B.

Standard	No.
Sewer Manhole	SS-01
Manhole Base Configurations	SS-02
Sewer Manhole Channelization	SS-03
24” Manhole Frame and Cover	SS-04
Typical Manhole Lid Configurations	SS-05

Standard	No.
Pressure Manhole – Bolt-Down Cover	SS-06
Shallow Manholes	SS-07
Junction Structures for Multiple Connections	SS-08
Terminal Manhole	SS-09
Interior Drop Manhole	SS-10
Sewer Pipe Bedding & Backfill	SS-11
Surface Restoration	SS-12
Concrete Encasement	SS-13
Vertical Pipeline Separation	SS-14
Horizontal Pipeline Separation	SS-15
Residential Sewer Service	SS-16
Sewer Main Tap (Residential)	SS-17
Cut-in Connection	SS-18
Cleanout Assembly	SS-19
Special Cleanout Assembly – 90° (Residential)	SS-20
Manhole Frame Grade Adjustment	SS-21
Abandoned Manhole	SS-22
Abandoned Pipe Plug	SS-23
Backwater Device	SS-24
Residential Pressure Sewer Service Connection	SS-25
Single Residential Outdoor Pump Housing	SS-26
Pumping/Lift Station Site Layout	SS-27A
Sleeve Installation Through Walls and Floor Slabs	SS-27B
Concrete Pipe Support	SS-27C
Rectifier Installation Details	SS-27D

Appendix A: Confidential Spill Reporting Form

Standard Design Guidelines

Wastewater Infrastructure Partnership

LAKE TAHOE BASIN, CALIFORNIA & NEVADA

Instructions: The supervisor or spill coordinator shall ensure that appropriate on-site personnel re included or consulted for information or data required by this form. Information required by this form shall be compiled as soon as possible, ideally upon discovery of a spill or release of hazardous material. This form shall be reviewed for completeness and accuracy and any discrepancies reconciled before submitting it to responsible District. This form must be submitted within 24-hours of the commencement of the spill or release.

1. Facility name and address, location, intersection or major cross street where spill occurred.

2. Is or was there a fire, explosion, or hazardous chemical release that left the jobsite?

3. Describe any personal injuries and the extent of injuries if any. Include the name (s) of individual(s) injured.

4. Identify the hazardous chemical(s) released. If none released please state “none” below.

5. How much was spilled? Use units such as gallons or pounds.

6. Was waste water released? Please state “yes” or “no”.

7. How much was spilled? Explain how you estimated the amount.

8. Date and time of initial call or complaint. If none please state “none” below:

9. Date and time the problem was identified, and the name(s) of person(s) who made the discovery.

10. Date and time spill occurred or started.

11. Where and how did the spill occur? Include a description of the source of the spill. Attach a diagram or map if the spill was from a sewer main. Describe all events that led up to the spill. Use an extra sheet of paper as needed. List the number of additional pages below.

12. Where did the spilled material go? Check all that apply. (List on following page)

Private property ( )
Public property ( )
City Street ( )
Sanitary Sewer ( )
Storm Drain or channel ( ) identify by name or on map

Dry wash ( ) identify by name or on map
Flowing water body ( ) identify by name or on map
River or pond ( ) identify by name or on map
Secondary Containment ( ) identify on map
Other ( ) Please describe

13. How far did the spill travel? Describe the path the spill took to its final destination. Include a drawing or map.

14. Describe how, when and by whom the spill was stopped or contained.

15. How much time elapsed between the beginning of the spill and containment?

16. List the names, titles, and phone numbers of all persons who participated in the spill response. Use the back of this form if necessary.

Name	Title	Agency/Company/etc	Phone number

17. Printed name and signature of person completing this form:

_____

_____ Phone Number_____

Signature_____ Date Signed_____

Appendix B: Design Standards

Standard Design Guidelines

Wastewater Infrastructure Partnership

LAKE TAHOE BASIN, CALIFORNIA & NEVADA