SOUTH DAVIS SEWER DISTRICT

WEST BOUNTIFUL, UTAH

RESOLUTION NO. 114-2

SEWER DESIGN AND CONSTRUCTION STANDARDS

Adopted 6/15/2023

Revision Date	Revision Pages	Signature: Chair, Board of Trustees

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This Resolution identifies the detailed Standards that are to be used by Developers, Engineers, Construction Contractors and others in designing, bidding and constructing Sewer Collection Systems that are to be owned and maintained by the South Davis Sewer District.

It is deemed advisable to establish these Standards so that design and construction of sewer collection systems to be owned by the District will be of good, consistent, quality and workmanship and materials. This will help provide for maximum life of all Collection System facilities as well as ease of maintenance for such sewer systems.

This Resolution cancels Resolution No.'s 114 and 114-1 as well as any former Board Minutes or District Resolutions which are different from or contrary to the intent of this Resolution.

The invalidity of any section, clause, sentence or provision of this Resolution shall not affect the validity of any other part of this Resolution that can be given effect without such invalid part or parts.

This Resolution shall take effect upon its passage, approval and recording of the District as provided by law for all developments and/or line extensions filed with the District subsequent to the date of passage of the Resolution.

PASSED AND ADOPTED by the Board of Trustees of the South Davis Sewer District, State of Utah, on the 15th day of June, 2023.

Chair, Board of Trustees

Clerk

SOUTH DAVIS SEWER DISTRICT CORPORATE Seal UTAH

SECTION 1 - DESIGN AND STAKING STANDARDS

A. REVIEW DOCUMENTS

Resolution No. 109 outlines the documents to be submitted by the Applicant for sewer service.

B. CODES AND STANDARDS

The design of sewer collection systems shall be based upon the following codes and standards:

1. Utah Division Of Water Quality Administrative Rules For Design Requirements For Wastewater Collection, Treatment And Disposal Systems (Rule R317-3), As Amended
2. South Davis Sewer District Industrial Pretreatment Program - Effluent Requirements: Rules and Regulations (District Resolution No. 123), As Amended
3. Other Applicable Regulatory Agency Regulations, As Amended

C. DESIGN PERIOD

The sewer system should be designed for the estimated ultimate tributary population except for those parts that can be readily increased in capacity when required. The maximum anticipated capacity required by institutions, industrial parks, etc. must be considered in the design.

D. DESIGN CAPACITY

Sewer capacity shall be determined based on:

1. Maximum hourly domestic sewage flow;
2. Additional maximum flow from industrial plants;
3. Inflow;
4. Ground water infiltration;
5. Potential for sulfide generation;
6. Topography of area;
7. Location of the sewage treatment plant;
8. Depth of excavation; and
9. Pumping requirements.

Design Average Flow: Design average flow should be based on one hundred (100) gallons per capita per day unless site-specific data indicates otherwise. Commercial contributions shall be determined based upon actual and projected contributions from existing developed, comparable data.

Design Peak Flow:

1. Gravity lines fifteen (15) inches or less in diameter shall be designed to carry not less than four (4) times the design average flow.
2. Gravity lines larger than fifteen (15) inches in diameter shall be designed to carry not less than two and one-half (2.5) times the design average flow.

E. GRAVITY SEWER

Except as provided in Section 10 (Lift Stations) and Section 11 (Force Mains), all standards and specifications referenced herein are for gravity sewer systems.

F. SEWER SIZE

No public sewer shall be less than eight (8) inches in diameter as per Utah Administrative Code R317-3.

G. SEWER DEPTH

The top of the sewer pipe shall be placed no less than three (3) feet deep and no more than fifteen (15) feet deep.

H. SEWER SLOPES

All sewers shall be designed and constructed for mean flow velocities, when flowing full, of not less than two (2) feet per second and not more than fifteen (15) feet per second based on Manning's formula using an "n" value of 0.013. Use of other practical "n" values may be justifiable on the basis of research or field data and as approved by the District.

Sewer main pipe sections with a slope of six (6) to ten (10) percent cannot exceed three hundred (300) feet in length. Sewer main pipe sections with a slope greater than ten (10) percent cannot exceed two hundred (200) feet in length.

The following are the minimum slopes permitted (Table 1); however, slopes greater than these are desirable, especially in the upper reaches of sewer systems. If any section of sewer main is constructed less than the District minimum requirement, an O&M fee will be assessed for each sub-standard pipe section. In all cases where minimum slope is difficult to attain, design and construction shall be closely coordinated with the District.

Table 1. Minimum slopes permitted.

Sewer Size (in)	Min. Slope (ft/100 ft)	Sewer Size (in)	Min. Slope (ft/100 ft)
4	2.00	15	0.144
6	1.00	18	0.113
8	0.40	21	0.092
10	0.285	24	0.077
12	0.248		

I. SEWER ALIGNMENT AND PLACEMENT

Sewers should be laid with straight alignment and uniform slope between manholes. The lid and hardware of all manholes shall be kept out of the curb and gutter.

J. SEWER SIZE INCREASE

Flow energy gradient should be continuous at manholes where there is a change in sewer diameter. To accomplish this with sufficient accuracy and prevent surcharges, the eight-tenths (8/10) depth point of the two sewers shall be placed at the same elevation. Proper allowance shall be made for any manhole head loss.

K. INVERTED SIPHONS

Care should be taken during sewer design to avoid inverted siphons unless there is no other alternative. When an inverted siphon is necessary, design shall be closely coordinated with the District.

Inverted siphon design should include the following features:

1. A minimum of two (2) barrels.
2. Minimum pipe diameter of six (6) inches with an arrangement to exclude debris and solids.
3. Velocities of at least three (3) feet per second at average flow.
4. Appurtenances and clearances to permit convenient rodding, flushing and other maintenance.
5. Inlet and outlet arrangement that allows normal flow to be diverted to one (1) barrel and permits cleaning of any barrel while others are in service.
6. Vertical alignment should permit cleaning and maintenance.

L. PROTECTION OF OTHER UTILITIES

It is generally recognized that sewers and appurtenances must be kept remote from public water supply wells and other water supply sources as well as other utilities. The following specific requirements shall be observed at all times:

1. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenances thereto, which could permit the passage of any wastewater or polluted water into the potable supply.

2. There shall be no physical connection between a public or private subsurface drain used to convey groundwater or surface water and a sewer.

3. Sewers shall be laid at least ten (10) feet horizontally from any existing or proposed water main and at least five (5) feet horizontally from any existing or proposed subsurface drain. To the extent possible, the horizontal separation between sewers and all other utilities shall be at least five (5) feet. The distances identified herein shall be measured from edge of pipe to edge of pipe.

4. In cases where it is not practical to maintain a ten (10) foot horizontal separation between the sewer and water main, a deviation may be allowed based on supportive data from the design engineer. Such deviation may allow installation of the sewer closer to a water main, provided that the top of the sewer pipe is at least eighteen (18) inches below the bottom of the water main and the sewer is laid:

    a. in a separate trench, or
    b. on an undisturbed earth shelf located on one side of the sewer trench.

5. Sewers crossing above water mains or proposed water mains shall be laid to provide a minimum vertical distance of eighteen (18) inches between the outside of the water main and the outside of the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. In such cases, adequate structural support shall be provided for the sewer to prevent damage to the water main.

6. Where sewer and water mains must cross and proper vertical separation is not possible, the sewer shall be constructed of mechanical-joint cast iron, ductile iron, galvanized steel or protected steel pipe for a distance of at least ten (10) feet on either side of the point of crossing. The design engineer may use other types of joints if equivalent joint integrity is demonstrated. The lines shall be pressure tested to assure water tightness before backfilling.

M. STAKING FOR SEWERS

Grade stakes shall be set for all sewer lines at each manhole location and at a maximum spacing of fifty (50) feet. A ten (10) foot offset will be typical, but greater offsets that are a reasonable distance from the trench can be used as required by the project. The Applicant shall exercise extreme care so as not to disturb the stake during the excavation, pipe laying and backfill operations.

A steel fence post is to be placed on each lot corner at least 4 feet above grade level.

N. DRAWING REQUIREMENTS

Construction Drawing submitted to the District for approval shall be clear, neat and shall include the information and conform to the format outlined below. Applicant must have District approved/stamped/signed construction drawings and cut sheets on-site before work can be started.

Any necessary deviation from the District-approved final Construction Drawing must be approved by the District prior to making the change.

The Applicant's engineer is responsible for on-site inspections and all As-Built information including building sewer/lateral lengths and final manhole locations including rim, inlet and outlet elevations.

Construction Drawing

General Requirements:

Project Name
Owner's Name
Date
Professional Engineer or Surveyors Stamp (Signed and Dated)
Drawing Size: 24" x 36"
Scale of Drawing
Four Prints Submitted to District (First Submittal = 1 print; Final = 4 prints)
Revised Drawings Must Show Revision Number, Date, and Description of Change
Name of City
Sections, Township, and Range
North Arrow (On Top of Plan) and Scale of Drawing (Every Page)
Survey Benchmark
Utility/Site Plan (24" x 36") - Single sheet showing all sewer lines, manholes and laterals to be constructed (lengths and distance not required).

Construction Drawing

Plan View:

Streets and Parcels:
- Street Name
- Street Right-Of-Way Width
- Pavement Widths
- Lot Lines
- Lot Numbers
- Easement Width and Locations

Utilities:
- Location of all Existing and Proposed Utilities
- No utility conflicts

General:
- Distance from Project to Nearest Existing Manhole
- Number of Nearest Existing Manhole

Manholes:
- Size and Location (Meets Minimum Size Requirements)
- Stationing
- All Sections End in a Manhole

Lines:
- Size and Material of Sewer Line
- Location of Sewer Lines with Respect to Street Centerlines, Lot Corners and Other Appropriate Tie Points

Building Sewers (Sewer Lateral Services):
- Number of Building Sewers Equals the Number of Dwellings
- Opposing Building Sewers require a Series of Two (2) Gasket Bell and Spigot "Wye" Fittings

Easement (if applicable):
- Show Sewer Easement if Not in Dedicated Street

Construction Drawing

Profile View:

Grades:
- Existing Grades Over Sewer
- Proposed Finish Grades Over Sewer

Manholes:
- Manhole Size (Meets Minimum Size Requirements)
- Concentric Cones (No Flat Top Lids Permitted)
- Stationing
- Rim and Invert (Inlet and Outlet) Elevations
- Drop Manholes, if any, Identified

General:
- Location of Nearest Existing Manhole
- Rim and Invert Elevations of Existing Manhole
- New Sewer and Existing Sewer Match and 8/10 of Pipe Diameter

Lines:
- Size and Material of Sewer Line
- Length (Outside of Manhole to Outside of Manhole)
- Slope (Meets Minimum Slope Requirements, Calculated from Pipe Opening to Pipe Opening)

As-Built Drawing

As-Built Drawing shall be submitted and approved by the District before final acceptance of any sewer line and shall include the information and conform to the format outlined below:

Same Information As Required on "Construction Drawing"
Manhole Numbers, Provided by the District, Identified in Plan and Profile Views
Building Sewer Locations Must Match District TV Records Within Five (5) Feet
Marked "As-Built"
Drawing Size: 24" x 36"
One Print Copy with Professional Engineer Stamp (Signed and Dated)
One Digital Submission in Accordance with the Following:

Electronic Files. The Applicant's engineer shall deliver one scanned or exported set of approved as-built drawings in PDF file format. The drawing set shall be complete with professional engineer's stamp and signature on each page and shall include the title sheet, plan/profile sheets, cross-sections and details. The plan sheets shall be scanned or exported at a minimum of 400 dpi resolution for black-and-white or 200 dpi for color to maintain legibility of each drawing.

Transfer Media. The District will accept as-built drawings via email or on a USB flash drive. Physical media shall be labeled with the subdivision name and date of submittal and will not be returned.

SECTION 2 - TRENCH EXCAVATION FOR SEWERS

A. GENERAL

This Section covers the requirements for trench excavation for sewers.

B. CONTROL OF GROUNDWATER

All trenches shall be kept reasonably free from excess water during excavation, fine grading, pipe laying, jointing and bedding operations. Where the trench bottom is unstable because of the presence of water, and in cases where the static ground water elevation is above the bottom of any trench or bell hole excavation, such ground water shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. Surface water shall be prevented from entering trenches. Pumping and any other necessary measures to control ground and surface water are the responsibility of the contractor.

C. EXCAVATION FOR PIPELINES

Trench excavation will be done as per applicable APWA standards. Excavation protection shall be provided in accordance with OSHA and UOSH safety standards and with applicable APWA standards.

Excavation for pipelines shall follow lines parallel to and equidistant from the location of the pipe centerline. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

1. Excavation for trenches shall extend to a depth of at least twelve (12) inches below the bottom of the pipe (See approved District detail, Sheet 114-1). Unstable earth at the grade of the pipe or the presence of water that must be drained to maintain a dry trench bottom may require a greater depth of excavation. The trench shall be bedded with graded gravel bedding in accordance with Section 3 of these Specifications.

2. The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible, but not wider than eighteen (18) inches on each side of the sewer pipe.

D. SHEETING, BRACING AND SHORING OF EXCAVATIONS

Excavation shall be sheeted, braced and shored as required to support the walls of the excavations to eliminate sliding and settling and as necessary to protect the workmen, the work in progress and existing utilities and improvements. All such sheeting, bracing and shoring shall comply with the requirements of the State of Utah and Federal OSHA Requirements.

All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Applicant and the Applicant shall affect all necessary repairs or reconstruction resulting from such damage.

The Applicant shall take all necessary precautions to protect the workmen. Any injury to a workman shall be the sole responsibility of the Applicant.

E. PROTECTION OF EXISTING UTILITIES AND PROPERTY

Excavation shall be performed in a manner that protects all pipes, conduits, culverts, bridges and all other public and private property that may be endangered by the work.

SECTION 3 - PIPE BEDDING

A. GENERAL

This Section covers the requirements for preparing a suitable foundation and bearing surface on which the pipe is to be installed. It also covers backfilling around and over top of the pipe. This work is known as pipe bedding and includes blinding and haunching of the pipe.

Applicant is advised to ensure proper bedding, trench backfill and compaction requirements are adhered to. Road base and asphalt must comply with the requirements of the jurisdiction responsible for the roadway.

B. PIPE BEDDING

All sewer pipe shall be protected from lateral and vertical displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded. All sewer mains and laterals shall be bedded with a minimum of twelve (12) inches of imported one (1) inch graded gravel under the pipe and twelve (12) inches over the pipe (See approved District detail, Sheet 114-1). Fabric wrap shall be placed on top of the pipe zone per Part D ("Trench Filter Fabric") of this section. Unstable clays, organic soils or other unstable base material may require a greater depth of bedding or alternate materials. These situations shall be approved by the District on a case-by-case basis. The use of the onsite native materials may be approved on a case-by-case basis.

The trench bottom shall be excavated, filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the spring line of the pipe shall be deposited and compacted in layers not to exceed six (6) inches in un-compacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Care must be taken to ensure no voids are left below the spring line of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved methods in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses.

C. GRADED GRAVEL BEDDING

Graded gravel shall be used as bedding under sewer lines, laterals and manholes as shown on the District's standard drawings. Graded gravel bedding for flexible sewer pipe shall be clean crushed rock or gravel conforming to the following gradation:

Screen (in)	% Passing
1	100
3/4	50-75
1/2	10-25
1/4	0-3

The gravel material shall be deposited over the entire trench width in six (6) inch maximum layers and each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding or by a combination of one or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the installed pipe.

D. TRENCH FILTER FABRIC

Trench Filter Fabric shall be furnished and installed in all trench conditions between the bedding and backfill material whenever crushed rock is used as bedding.

1. Material: Trench Filter Fabric shall be a nonwoven material type and meet or exceed the specifications presented in Table 2 below:

Table 2. Trench Filter Fabric Specifications.

Property	ASTM Test Method	Nonwoven Minimum[1] Average Roll value
Grab Tensile Strength	D 4632	112 lbs
Trapezoidal Tear Strength	D 4533	40 lbs
CBR Puncture Strength	D 6241	300 lbs
Permittivity	D 4491	1.5 sec^{-1}
Apparent Opening Size (AOS)	D 4751	Maximum #70 Sieve
UV after 500 hours	D 4355	70%

[1]All values in this table are the minimum values allowed in each direction except as noted, and are based on Minimum Average Roll Value (MARV).

2. Installation:
   a. Trench Filter Fabric shall be installed in such a manner to prevent migration of fines.
   b. Adjacent rolls shall be overlapping a minimum of twenty-four (24) inches in the longitudinal and transverse directions.

SECTION 4 - TRENCH BACKFILLING

A. GENERAL

This section covers backfilling of sewer trenches above the level of the pipe bedding.

The backfill and compaction of all utility trenches above the sewer line bedding material shall comply with requirements of the jurisdiction responsible for the roadway.

B. BACKFILLING

Backfill above an elevation of one (1) foot above the top of the pipe shall be accomplished with imported material free from rocks larger than four (4) inches in diameter. It shall be either compacted or consolidated according to the requirements of the materials being placed and as required by the appropriate Jurisdiction responsible for the roadway. Materials shall not be permitted to fall directly into the trench from such a height or in such a manner as to cause damage to the structure, alignment or grade of the pipe. It shall be thoroughly compacted using hand or mechanical tampers. In addition, the subgrade should be protected from desiccation, flooding and/or freezing.

C. DISPOSAL OF EXCESS MATERIALS

All excess materials shall be hauled away and disposed of by the Applicant.

D. SOIL TESTING

All in-place density testing of backfill shall be performed to the satisfaction of the governing jurisdiction. Any testing required by the governing jurisdiction shall be provided at the expense of the applicant.

SECTION 5 - SEWER PIPE

A. GENERAL

This section covers the pipe materials and installation requirements for gravity sanitary sewer collection systems. Pipe for gravity sewer systems shall be PVC plastic or centrifugally cast, glass-fiber-reinforced, polymer mortar (CCFRPM) pipe. Vitrified clay sewer pipes, non-reinforced concrete pipe or ABS composite and solid wall pipes will not be allowed. No other material will be allowed without prior written approval of the District.

B. CCFRPM PIPE

For sewer mains larger than twenty-four (24) inches in diameter, CCFRPM pipe shall be used. CCFRPM pipe shall conform to ASTM D3262 and be installed according to manufacturer's requirements.

C. PVC PLASTIC PIPE

PVC plastic sewer pipe shall conform in all aspects to ASTM D1784. PVC sewer pipe must meet all the dimensional, chemical and physical requirements outlined in ASTM D3034, shall have a SDR of 35.0 for diameters four (4) inch to fifteen (15) inch and ASTM F679 for eighteen (18) inch, twenty-one (21) inch and twenty-four (24) inch. Pipe shall be installed according to the requirements of ASTM D2321 and the manufacturer's requirements. Pipe joints shall be of the bell and spigot type with the bell an integral part of the pipe wall section. The rubber gasket shall be solid cross-section, factory assembled and securely locked in place to prevent displacement. The rubber gaskets shall conform to ASTM F477. Fittings shall be made of PVC plastic conforming to ASTM D1784, have a cell classification as outlined in ASTM D3034 and shall have gasket joints.

SECTION 6 - PIPE INSTALLATION

A. GENERAL

No groundwater/wastewater will be allowed in sewer main lines ($1000/day fine) until the project has been accepted by the District for ownership and maintenance. An inflatable plug will be installed by District personnel during construction and shall not be removed until the project is completed, including all construction and final paperwork items and then only by District personnel.

B. PIPE LAYING

All sewer pipe installation shall proceed up grade on a stable foundation with joints closely and accurately fitted. Gaskets shall be fitted properly in place and care shall be taken in joining the pipe units to avoid twisting of gaskets. Joints shall be clean and dry and a joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure. Petroleum products such as oil or grease will not be permitted as these products can damage some elastomeric gaskets.

If the position of the length of the pipe needs to be adjusted after being laid, the pipe shall be removed and re-jointed as if for a new pipe. When pipe laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above general requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

C. INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All sewer pipes shall be installed accurately to the defined line and grade within the following limits:

Variance from established line and grade shall not be greater than one-thirty second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-forth (1/64) inch per inch of pipe diameter or one-half (1/2) inch maximum.

D. BUILDING SEWER/SEWER LATERAL SERVICE CONNECTIONS

Building sewer (sewer lateral service) connections will not be made to District facilities until such time as the project has been accepted by the District for ownership and maintenance, and the Applicant has been notified in writing. In addition, the following requirements shall be met along with those outlined in Resolution No. 104, as amended:

1. Gravity building sewers must be four (4) inch or larger pipe diameter. PVC plastic sewer pipe per ASTM D1784 that meets the dimensional, chemical and physical requirements outlined in ASTM D3034 and has an SDR of 35.0 (SDR-35) shall be used and shall be green in color. Pipe joints shall be of the bell and spigot type with the bell an integral part of the pipe wall section. The rubber gasket shall be of solid cross-section, factory assembled, and securely locked in place to prevent displacement. The rubber gasket shall conform to ASTM F477.

2. Building sewers in new construction shall connect to the main using a factory "wye" connection. A series of two (2) gasket bell and spigot "wye" fittings is required where two opposing building sewer connections are within four (4) feet of each other (See approved District detail, Sheet 114-2).

3. The method for connecting building sewers to existing sewer mains shall be based on the sewer main material and size as shown in Table 3 below (See approved District detail, Sheet 114-3).

Table 3. Building Sewer Connections to Existing Sewer Mains.

SEWER MAIN	*MATERIAL*	*CLAY*				*CONCRETE*				*PVC*			
	DIAMETER (IN)	6	8	10	>=12	6	8	10	>=12	6	8	10	>=12
METHOD													
Splice a factory "wye" into the main using two (2) slip/repair or stainless steel shielded sewer repair (shear band) couplings (no more than a one-half (1/2) inch gap between joints). Flexible-type couplings are not permitted. The couplings shall be shaded in salt from the springline up to the top of the coupling.		X				X				X	X	X	
Core the mainline and install an Inserta-Tee fitting to make the connection. Inverts of new building sewers must clear the high water line of the existing sewer main at the connection.			X	X	X		X	X	X				X

Building sewer connections to any other type of pipe shall be approved by the District on a case-by-case basis.

4. Building sewers are to be extended twenty (20) feet beyond back of curb. A green two-by-four (2x4) inch wood stake shall be placed at the end of the building sewer, extending from the flow line of the building sewer to a height of one (1) foot above grade level (See approved District details, Sheets 114-2 and 114-3).

5. A glue cap or PVC push cap is required at the end of each building sewer. No "Brandt" plugs will be allowed.

6. It is encouraged to install building sewers in manholes whenever possible. Flow channels shall be required for all building sewers that enter the manhole and shall be smooth and semi-circular in cross section and shall match the pipe diameter. Flow channels must clear the highwater line of the existing main. In addition, resilient pipe-to-manhole connectors (boots) shall be used and the connection shall be grouted.

7. When connection is made to an existing stub line, the Applicant shall work with the District to verify that the stub is connected to the sewer main line and ensure the stub line is open and free of obstructions. The District does not guarantee slope on existing stub lines.

8. A manhole will be required when connecting a building sewer serving four (4) or more units in an apartment, condominium complex, etc. to the District's main line.

9. The building sewer shall run in a practical alignment and at a uniform slope of not less than one-quarter (1/4) inch per foot or two (2) percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer or to the structural features or the arrangement of any building or structure to obtain a slope of one-quarter (1/4) inch per foot or two (2) percent, any such pipe or piping four (4) inches or larger in diameter may have a slope of not less than one-eighth (1/8) inch per foot or one (1) percent, when approved by the District.

10. The minimum cover over the top of the pipe shall be three (3) feet.

11. Refer to Resolution No. 104, as amended, for cleanout materials and design.

E. INSTALLATION OF CASINGS AND PIPE IN CASING

When sewer pipe is installed under highways or railways, casings may be required for the following reasons:

- To prevent damage to structures caused by soil erosion or settlement or the pipe installation caused by line failure or leakage.
- To permit pipe removal and replacement in the future.
- To accommodate highway or railway requirements.
- To permit boring rather than excavation where open excavation is not feasible.

Installation and requirements for casings and carrier pipe shall be approved by the District on a case-by-case basis.

F. PIPE REPAIRS

Before performing any main line or building sewer pipe repairs, the District shall be notified of the damage. The repair method shall be reviewed and approved by the District.

For PVC mainline repairs, PVC repair sections shall be spliced into the mainline using slip/repair couplings. Flexible (elastomeric)-type (Fernco) couplings will not be allowed on sewer main line repairs.

For CCFRPM mainline repairs the manufacturer's stainless steel closure coupling shall be used to splice a section of CCFRPM into the damaged main line.

For clay and concrete mainline repairs, use stainless steel shielded adjustable sewer repair couplings (shear band coupler) with PVC replacement pipe.

Physical replacement of the building sewer by normal "cut and fill" methods is acceptable. Trenchless pipe replacement methods will be allowed on a case-by-case basis.

SECTION 7 - MANHOLES

A. GENERAL

Manholes shall be installed at the end of each line, at all changes in grade, size or alignment, at all intersections and at all intervals not to exceed four hundred (400) feet for sewers fifteen (15) inches or less in diameter and five hundred (500) feet for sewers over eighteen (18) inches in diameter unless otherwise approved in writing by the District. All manholes shall be constructed in accordance with the District's approved detail (Sheet 114-4) and meet the following requirements:

1. For slopes greater than ten (10) percent, the distance between manholes cannot exceed two hundred (200) feet for any pipe size. For slopes between six (6) and ten (10) percent, the distance between manholes cannot exceed three hundred (300) feet for any pipe size.

2. The minimum diameter of any manhole that has a total of three (3) or more, eight (8) inch or larger pipes entering and/or leaving it, or any pipe greater than fifteen (15) inches in diameter entering or leaving it, shall be sixty (60) inches unless otherwise approved in writing by the District.

3. The minimum diameter shall be forty-eight (48) inches for all other manholes.

4. All manholes must have a concentric cone unless otherwise approved. **Flat top lids are not permitted.**

5. The minimum depth shall be five and one-half (5.5) feet from bottom of flow line to finished grade.

6. Flow channels through manholes shall have two-tenths (2/10) foot slope or match the engineered slope of pipe. Flow channels shall be required for all sewer lines, including building sewers, that pass through or enter a manhole. Said flow channels shall be smooth and semi-circular in cross section and shall match the pipe diameter.

7. All inlets and outlets where PVC pipe has been used must be grouted (See approved District detail, Sheet 114-5). Any hole that goes completely through the wall of the manhole must be grouted with non-shrink grout to make it watertight.

8. Sewer lines entering manholes should be compatible with existing flow lines. Sewer lines that are twenty-four (24) or more inches above the invert must be approved by the District in writing. These sewer lines should be constructed with an inside drop pipe that utilizes a tee, with no Brandt plug, to provide access to the line for cleaning (See approved District detail, Sheet 114-6). Piping must be brought down the side of the manhole to drop the flow into the

trough of the manhole. The piping must be bracketed to the wall of the manhole using a minimum of two (2) stainless steel brackets. All joints must be glued. No slip joints shall be permitted. The minimum diameter for a manhole with an inside drop is five (5) feet.

9. Manholes shall be furnished complete with cast iron rings and covers. Low-profile hardware on manholes is prohibited. Manhole lids must be South Davis Sewer District approved (See approved District detail, Sheet 114-7).

10. Manhole steps/ladders are not permitted.

11. If an existing manhole needs to be core-drilled to add an additional sewer main or building sewer, the core must be sized to fit the new pipe and then re-cored to fit a boot. Flow channels must also be cut in for any new sewer main or building sewer. Said flow channels shall be smooth and semi-circular in cross section and shall match the pipe diameter.

12. Concrete collars are required on all manholes (See approved District detail, Sheet 114-8) in streets, roadways and other paved areas. The use of Whirl*y*GIG® thermoplastic concrete forms is mandatory. The top of the cone (which may be adjusted as necessary with one (1), six (6)-inch concrete grade ring) should be no less than twelve (12) inches below the finished grade and no more than sixteen (16) inches below the finished grade. Six (6) to ten (10) inches of steel risers may be used to adjust manholes to grade in non-pavement easements only. Rip rap (native rock or imported) retention shall be required on the uphill sides of all manholes in non-pavement easements with steep side-slopes.

B. FOUNDATION PREPARATION

Dewatering of the site shall conform to the requirements for pipe trench dewatering in Section 2 Paragraph B. Adequate foundation for all manhole structures shall be obtained by removal and replacement of native material with a minimum of two (2) feet of imported two (2) inch gravel defined in this section. Gravel bedding shall extend a minimum of twelve (12) inches outside the outside limits of the base section (See approved District detail, Sheet 114-4). The bedding shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast elements.

Extra care must be taken to properly bed and haunch pipe connections to manholes to avoid settlement and/or shifting of pipes.

Graded gravel bedding for manholes shall be clean crushed rock or gravel conforming to the following gradation:

Screen (in)	% Passing
2	100
1	10
3/4	3

C. CONCRETE BASES

Manhole bases shall be precast. Cast-in-place may be approved on a case-by-case basis when necessary. Concrete manholes shall have a minimum 28-day compressive strength of 4,000 psi and conform to ASTM C478 specifications. Where sewer lines, including building sewers, pass through or enter manholes the flow channels shall be smooth and semi-circular in cross section and they shall match the pipe diameter.

Changes of direction of flow within the manhole shall be made with a smooth curve with as long a radius as possible. The shelf of the manhole outside the flow channels shall be smooth and slope toward the channel at not less than one-half (1/2) inch per foot.

The connecting boots shall conform to ASTM C923 specifications. The boot shall either be "cast-in-place" in the precast base or attached to the precast base by means of an internal expanding band. When the boot is attached to the precast base, a watertight seal between the boot and the precast base must be accomplished. An external band shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of stainless steel.

If approval for a cast-in-place manhole is given, a donut must be cast into place around any PVC or CCFRPM pipe penetrations.

D. PRECAST WALL AND CONE SECTIONS

All precast concrete manhole riser and cone sections shall conform to ASTM C478 specifications. In addition:

1. The top of the manhole cone section shall be no less than twelve (12) inches below finished grade and no more than sixteen (16) inches. If the cone will sit more than sixteen (16) inches below finished grade, use of one (1), six (6) inch concrete grade ring will be allowed. If more than one (1), six (6) inch concrete grade ring would be needed to achieve a maximum depth of sixteen (16) inches below finished grade, the addition of another precast concrete manhole riser section will be required.

2. The taper section shall be of concentric conical design and shall taper uniformly from forty-eight (48) or sixty (60) inches, as required, to a thirty (30) inch inside diameter.

3. The precast concrete manhole riser sections used in the manhole below the cone section shall be furnished in section lengths of one (1), two (2), three (3), and four (4) feet as required.

4. Flexible butyl mastic conforming to the requirements of ASTM C990 shall be used between manhole sections.

5. No flat tops will be allowed unless specifically approved by the District in writing.

E. MANHOLE RINGS AND COVERS

All iron castings shall conform to the requirements of ASTM A48 (Class 35B). Rings and covers shall have machined bearing surfaces. The minimum cover weight shall be one hundred thirty-five (135) pounds and the minimum ring weight shall be one hundred seventy-five (175) pounds. In addition to the manufacturer name, heat/cast date and country of origin, the cover shall be marked "SOUTH DAVIS SEWER DISTRICT" (See approved District detail, Sheet 114-7). The cover shall have one (1) pry hole.

All manhole rings shall be carefully set to the grade shown on the approved drawings or as directed by the District.

Use of low-profile hardware is prohibited.

F. MANHOLE STUBS FOR FUTURE CONNECTIONS

All sewer lines must end in a manhole. Manholes can be stubbed for future connections by setting a precast manhole base with a rubber boot connection for the sewer pipe. A push-in plug shall be clamped into the boot.

SECTION 8 - INSPECTION AND TESTING

A. GENERAL

This section covers inspection and testing that must be completed prior to the District's acceptance of the sanitary sewer collection system.

B. PRELIMINARY INSPECTION

A preliminary inspection shall be completed prior to air test and closed circuit television (CCTV) inspection. When the sewer construction has been completed, the Applicant is responsible to contact District personnel for a preliminary inspection. Prior to this preliminary inspection, the following items shall be completed:

1. All manholes shall be uncovered and accessible.
2. Any and all steps/ladders shall be removed from manholes.
3. All manholes shall be grouted, including inlets and outlets (See approved District detail, Sheet 114-5).
4. All manholes shall be cleaned and vacuumed.
5. Sufficient water shall be introduced to the system from the dead-end manholes to reach the plug in order to identify bellies (low areas) during the TV inspection.

C. AIR TEST

After the preliminary inspection has been completed and approved by District personnel, an air test shall be performed on all installed sewer lines by a third party tester at the expense of the Applicant. District personnel must be present during the air test. Written test results shall be submitted to the District. The air test shall follow the procedures outlined in ASTM F1417.

Once the project has passed the required air test, District personnel shall perform a CCTV inspection.

NOTE: CCTV inspection will not be completed until the preliminary inspection has been completed and approved and the project has passed the air test. Applicant will be charged fifty dollars ($50) plus ten dollars ($10) per manhole for each additional site visit necessary to complete CCTV or preliminary inspections.

D. DEFLECTION TEST

The Applicant will conduct a deflection test on installed flexible sewer pipe, including CCFRPM, as directed by the District. The deflection test shall be conducted by pulling a cylindrical mandrel of suitable material through the sewer. The cylinder shall have a diameter not less than five (5) percent smaller than the internal diameter of the sewer to be tested.

The Applicant shall remedy any pipe that has deflected such as to prevent free passage of the cylinder through it.

The long-term deflection limits of PVC are set at seven and one-half (7.5) percent and the initial deflection limit is five (5) percent as per ASTM D3034. These same limits shall be assumed when testing CCFRPM pipe for installation acceptance.

E. FINAL INSPECTION

The final inspection is to be completed after the final road surfacing. When the final road surfacing has been completed, the Applicant is responsible to contact District personnel for a final inspection. Prior to this final inspection, the following items shall be completed:

1. All manholes shall be uncovered and raised to grade. Concrete collars shall be installed in accordance with Section 7, Part A, Paragraph 11 (Also see approved District detail, Sheet 114-8).
2. District-approved covers shall be installed on all manholes in accordance with Section 7, Part A, Paragraph 8 (See approved District detail, Sheet 114-7).
3. All manholes shall be clean and free of debris.

NOTE: If the above work has not been completed when an inspection is request and additional final inspections are required, the Applicant will be charged fifty dollars ($50) plus ten dollars ($10) per manhole for each additional site visit necessary to complete the final inspection.

After the final inspection has been completed and approved by District personnel, District personnel shall clean/jet wash new sewer main lines and remove the inflatable plug.

SECTION 9 - RESTORATION OF SURFACE IMPROVEMENTS

The Applicant shall be responsible for the protection and restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work and not specified or shown on the Drawings to be either temporarily or permanently removed.

Existing improvements shall include, but are not limited to, permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences and walls. All improvements shall be reconstructed to equal or better, in all respects, than the existing improvements removed.

Applicant shall ensure proper bedding and compaction requirements are adhered to. The roadbase and asphalt must comply with the requirements of the jurisdiction responsible for the roadway.

All restoration of surface improvements shall be approved by the District or the governing jurisdiction.

SECTION 10 - LIFT STATIONS

Wastewater lift stations (pumping stations) shall be allowed only when use of gravity sewer is not feasible. In such cases, lift stations shall be constructed in accordance with the requirements of this section.

A. GENERAL

At a minimum, all lift stations shall be submersible duplex stations that have a wet well with Flygt FRP TOP Sump Basin Insert, valve vault for pump bypass and control panel as described in subsequent sections and in accordance with approved District details (Sheets 114-9 through 114-12). All facilities shall be below ground with the exception of the control panel. Access cover size and design shall be approved by the District. Additional requirements shall be approved by the District on a case-by-case basis.

1. Layout. The layout of all lift station facilities (including, but not limited to, the wet well, valve vault, discharge piping, power transformer, control panel, bollards, etc.) shall be approved by the District. The direction of opening of the wet well and valve vault access covers shall be approved by the District.

2. Accessibility.

    a. The lift station facility shall be readily accessible by maintenance vehicles during all weather conditions. The facility shall be located off the traffic way of streets and alleys. A minimum of eighteen (18) inches of compacted road base with three (3) to four (4) inches of one (1) inch-minus gravel will be required in the lift station compound.
    b. Provision shall be made to facilitate maintenance and removal of pumps, motors and other mechanical and electrical equipment. Safe means of access and proper ventilation shall be provided to wet wells and valve vaults containing equipment, valves or piping that require inspection or maintenance.
    c. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

3. Protection. Lift station structures and electrical and mechanical equipment shall be protected from physical damage that would be caused by a one hundred (100) year flood. Lift stations must remain fully operational and accessible during a twenty-five (25) year flood. Bollards shall be provided for protection of lift station facilities and shall be installed in sleeves so they can be removed as necessary. Fencing and alarm system requirements shall be evaluated by the District on a case-by-case basis. The District may require a yard light.

4. Power Supply. Applicant shall be responsible to work with the local power company to supply three (3) phase power to the lift station. Applicant agrees to pay all of the costs to construct the improvements, to provide legal rights-of-way and to comply with all requirements outlined by the power company.

5. Odor and Corrosion Control. The lift station design should incorporate measures for:

   a. mitigating the effects of sulfide corrosion to structure and equipment; and
   b. effective odor control when a populated area is within close proximity.

   Notwithstanding the foregoing, in no case shall exhaust vents be permitted on lift station facilities.

B. WET WELL

1. Materials. The materials selected in construction and installation must be safe and able to withstand adverse operating environmental conditions caused by presence of hydrogen sulfide and other corrosive gases, greases, oils and other constituents frequently present in sewage.

2. Size. The minimum diameter of any wet well shall be seventy-two (72) inches. The wet well size and level control settings shall be appropriate to avoid heat buildup in the pump motor due to frequent starting (short cycling) and septic conditions due to excessive detention time.

3. Base. The lift station base shall be precast concrete with a minimum twenty-eight (28) day compressive strength of 4,000 psi and shall conform to ASTM C478 specifications. A Flygt FRP TOP Sump Basin Insert for self-cleaning of the lift station shall be cast into the base of the lift station (See approved District detail, Sheet 114-10).

4. Sections. All precast concrete riser sections shall conform to ASTM C478 specifications. The wet well shall be constructed using as few riser sections as possible to limit the number of joints. Rubber gaskets conforming to the requirements of ASTM C443 for flexible watertight joints shall be used for sealing the joints to prevent exfiltration or infiltration.

5. Electrical Equipment. Electrical systems and components (e.g., motors, lights, cables, conduits, switchboxes, and control circuits) in wet wells shall comply with the National Electrical Code requirements for Class 1 Group D, Division 1 locations. In addition, equipment located in the wet well shall be suitable for use under corrosive conditions. Each flexible cable shall be provided with watertight seal and separate strain relief.

6. Check Valves. A Flygt HDL Ball Check Valve shall be placed in the vertical run of discharge piping for each pump within the wet well (See approved District detail, Sheet 114-9B). Based on the specific lift station and wastewater application, an appropriate check valve shall be selected by the manufacturer and approved by the District.

7. Access Frame and Cover. Unless otherwise specified, the wet well shall be furnished with a frame and hatch, rated three hundred (300) pounds per square foot (lb/sq ft), complete with hinged and flush locking mechanism, upper guide holder and level sensors cable holder. The frame shall be securely placed and mounted above the pumps (See approved District details, Sheets 114-9A and 114-9B) and shall be equipped with a safety grating for fall prevention. The access hatch and frame shall be traffic rated if the lift station must be located in a traffic way.

C. PUMPS

1. Overview. The lift station shall be furnished with two (2) Flygt submersible non-clog wastewater pumps (See approved District details, Sheets 114-9A and 114-9B). Each pump shall be equipped with an appropriately sized submersible electric motor that shall be no less than five (5) horsepower (HP). Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

2. Pumping Rates. The pumps and controls of lift stations, and especially lift stations pumping to the treatment works or operated as part of the treatment works, should be selected to operate at varying delivery rates to permit discharging sewage at approximately its rate of delivery to the lift station.

3. Sizing. Pumps and motors shall be sized for the ten (10) year peak flows; preferably the twenty (20) year sewage flow requirements. These operating points shall be shown on the system-head curves. Pumps and motors shall be capable of handling flows in excess of the expected maximum flow.

4. System - Head Calculation

    a. The design engineer shall submit system-head calculations and curves. System-head curves for C values of 100, 120 and 140 in the Hazen William's equation for calculating head loss corresponding to minimum, median and maximum water levels shall be developed.
    b. A system-head curve for C value of 120 corresponding to median (normal operating) water level shall be used to make preliminary selection of motor and pump. The pump and motor must operate satisfactorily over the entire range of system-head curves for C values of 100 and 140 corresponding to minimum and maximum water levels intersected by the head-discharge relationship of a given pump.

5. Pump Design. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two (2) stainless steel guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet well. No portion of the pump shall bear directly on the sump floor.

6. Pump Warranty. The pump manufacturer shall warrant the units being supplied against defects in workmanship and material for a period of five (5) years or ten thousand (10,000) hours under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

7. Spare Pump Assembly. The Applicant shall provide a spare pump assembly, which must include stainless steel guide rail brackets.

D. VALVE VAULT

A valve vault shall be installed adjacent to the lift station to allow for pump isolation and bypass. The vault shall be appropriately protected from physical, weather or freezing damage, with proper access for operation and maintenance.

1. Materials. The valve vault shall be precast concrete conforming to ASTM C857 and ASTM C858 specifications. The concrete shall have a minimum 28-day compressive strength of 4,000 psi. Mechanical seals and grout shall be used for all valve vault perforations. Interior valve vault components shall be properly painted.

2. Size. The minimum size of any valve vault shall be four (4) feet by six (6) feet. The minimum height of the valve vault shall be five (5) feet. The vault shall be sized to accommodate all valves and fittings shown in approved District detail, Sheet 114-11. Discharge piping and valves shall be placed eighteen (18) inches to twenty-four (24) inches above the floor of the valve vault.

3. Valves.

    a. Isolation Valves. An eccentric plug valve for pump isolation shall be placed on the discharge pipe of each pump. These valves shall be part of a fabricated fitting made of AISI Type 304 stainless steel or Schedule 80 PVC conforming to ASTM D1785. A third pipe for pump bypass shall connect at the juncture of the discharge pipes (See approved District detail, Sheet 114-11). An eccentric plug valve shall be placed on the bypass pipe to prevent backflow during normal lift station operation. A minimum of six (6) inches of clearance shall be maintained between fitting flanges and vault walls.

b. Pump Bypass. The bypass pipe shall be equipped with a six (6) inch AISI Type 304 stainless steel concentric reducer. The top of the spool shall have male pipe thread and shall be fitted with a six (6) inch female stainless steel camlock cap. In the event of pump failure, the plug valves on the discharge pipes shall be closed to prevent flow back into the wet well during bypass pumping operations. The bypass pipe and camlock cap shall be aligned with the vault frame and cover to allow a rigid discharge connection (See approved District detail, Sheet 114-11).

4. Access. The frame and cover shall be sized and located to allow access to the plug valves and camlock cap without entering the vault and shall be equipped with a safety grating for fall prevention.

5. Dewatering. Accumulated water shall be drained to the wet well through a four (4) inch drain line. A four (4) inch eccentric plug valve shall be located in the drain line between the valve vault and wet well to prevent sewage gases and liquid from entering the vault during surcharged wet well conditions. Said valve shall be placed within an appropriately sized irrigation valve box for ease of access. The vault floor should have an adequate slope to the point of drainage.

E. CONTROLS

All wiring and electrical work shall be performed by a certified licensed electrician.

1. Level Control System.

   a. Type. The level control system shall be an APG PT500 submersible liquid level transmitter with one hundred (100) feet of cable unless otherwise specified with a SOLO SL4896-CRE controller. Also required is a Roto Float direct acting float switch with a normally open contact and one hundred (100) feet of cable for High Level Alarm redundancy..
   b. Location. The level control system shall be located away from the turbulence of incoming flow and pump suction.
   c. Maintenance. In accordance with the manufacturer's recommendations, the transmitter should occasionally be cleaned. At the same time, the transmitter should be visually inspected to make sure neither cable or casing show any signs of damage.

2. Conduits. Four (4), three (3) inch Schedule 40 PVC electrical conduits meeting specifications UL 651 and NEMA TC 2 shall be installed from the wet well to the control panel sub-section for all cables and wiring (See approved District detail, Sheet 114-12). Use of a ninety (90) degree sweep elbow with a thirty-six (36) inch radius will be required. The horizontal runs shall be buried a minimum of eighteen (18) inches deep, embedded in sand and marked with Underground Electrical caution tape.

3. Control Panel. The lift station shall be equipped with a Flygt automatic pump control center in NEMA 4X Stainless Steel gasketed enclosure for four hundred sixty (460) volts, three (3) phase, sixty (60) hertz, three (3) wire power supply. For each pump motor, there shall be a combination circuit breaker/overload with manual reset for protection against current overloads, short-circuit protection, and disconnect for all phases; across-the-line magnetic contactor; hand/off/automatic pump operations selector switch; pump alternator for the two (2) pumps (providing alternating operation of pumps under normal conditions, or in case of high level, allowing both pumps to operate simultaneously) with L1/AUTO/L2 lead pump selector switch and high level alarm function.

   The following shall also be included in the panel:

   a. SOLO SL4896-CRE Controller
   b. High Level Alarm Indicator Light
   c. Anti-Condensation Heater and Thermostat
   d. Running Time Meters
   e. Pump Run Lights
   f. Secondary Lightening Arrestor
   g. Three (3) Phase Power Monitor Phase Protection
   h. Aluminum Inner Dead Front Door
   i. Incoming Power Terminals with Neutral and Ground Terminations
   j. Heavy Duty Square D FAL Frame Circuit Breakers
   k. NEMA Rated Square D Motor Starter with Overloads for Each Pump
   l. Control Circuit Breaker
   m. Control Voltage Transformer
   n. 24VDC Power Supply

   The control panel, transfer switch, and utility company meter shall be mounted using three (3) inch diameter galvanized pipe buried at least thirty-six (36) inches deep in a concrete base at least twelve (12) inches in diameter. A stainless steel enclosure shall be installed against the bottom of the control panel as a sub-section for the four (4), three (3) inch PVC conduits to terminate in and allow separation of conduits to control panel. The enclosure will be a minimum of twelve (12) inches tall and the same width and depth of the control cabinet. It must have a removeable cover on the face of the enclosure and vents with bug screening on both side ends. All cabling for pumps and level control must have CG type cord fittings into control enclosure from sub-section.

   A manual three (3) pole, Double throw transfer switch with lock On and Off capabilities and Appleton Powertite Inlet (or equal) shall be mounted on rack to supply power to control cabinet from Utility or Generator power.

F. TESTING

Equipment shall be shop tested and field tested as specified hereinafter. All costs for the tests shall be borne by the Applicant. In the event any equipment fails to meet the performance values set forth in this specification, the equipment shall be modified and re-tested or replaced with equipment that performs in accordance with this specification.

1. Standards. The test code of the American Hydraulic Institute for testing pumps and sound engineering practice shall be used. All pump performance documentation, including flow/head curves, shall adhere to the Hydraulic Institute Standards and shall allow no negative tolerance on flow, head, hydraulic efficiency or any other criteria deemed by the District to be necessary to evaluate pumping system performance.

2. Pump Test. The pump manufacturer shall perform the following inspections and tests on each pump, using the motor cable to be supplied with the pump, before shipment from the factory:

    1. Impeller, motor rating and electrical connections shall be checked for compliance with the purchase order.
    2. A motor and cable insulation test for moisture content or insulation defects shall be made.
    3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
    4. The pump shall be run submerged a minimum of six (6) feet under water and tested to determine the head versus capacity, motor total electrical power draw (KVA) and motor active electrical power draw (KW) for the full speed at which the pumps are specified and shown on a performance test curve.
    5. After operational test No. 4, the insulation test (No. 2) is to be performed again.

    After the test, the pump cable end shall be fitted with a shrink-fit rubber boot to protect it from moisture or water. A written report stating the foregoing steps have been completed shall be supplied with each pump at the time of shipment.

3. Site Test. The pump shall be tested at start-up. Voltage, current and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and forms for recording data.

4. Acceptance Test. An acceptance test shall be run to demonstrate that the pumping units, motors and control system meet the following requirements:

    a. The pumping units operate as specified without excessive noise, cavitation, vibration and without overheating of the bearings.
    b. All automatic and manual controls function in accordance with the specified requirements.
    c. All drive equipment operates without being overloaded.

G. AUXILIARY AND EMERGENCY EQUIPMENT AND OPERATION

Lift stations shall be designed to prevent bypassing of raw sewage and backup into the sewer system. For use during possible periods of extensive power outages, mandatory power reductions or uncontrolled storm events, an emergency power generator or portable pump shall be provided by the Applicant at the District's discretion. Said equipment shall meet the requirements outlined below.

1. Internal Combustion Engines. The following general requirements shall apply to all internal combustion engines used to drive auxiliary pumps, service pumps through special drives or electrical generating equipment.

    a. Engine Protection. The engine must be protected from damaging operating conditions. Protective equipment shall shut down the engine and activating an alarm on site unless continuous manual supervision is planned. Protective equipment shall monitor for conditions of low oil pressure and overheating. Oil pressure monitoring is not required for engines with splash lubrication.
    b. Size. The engine shall have adequate rated power to start and continuously operate all connected loads.
    c. Fuel Type. The type of fuel must be carefully selected for maintaining reliability and ease of starting, especially during cold weather conditions. Unused fuel from the fuel storage tank should be removed annually, and the tank refilled with fresh fuel.
    d. Engine Ventilation. The engine shall be located above grade with adequate ventilation of fuel vapors and exhaust gases.
    e. Routine Start-up. All emergency equipment shall be provided with instructions indicating the need for regular starting and running of such units at full loads.
    f. Protection of Equipment. Emergency equipment shall be protected from damage at the restoration of regular electrical power.

2. Engine-Driven Pumping Equipment. Where permanently installed or portable engine-driven pumps are used, the following requirements in addition to the above requirements apply:

    a. Pumping Capacity. Engine-driven pump(s) shall be capable of pumping at the design pumping rates unless storage capacity is available for flows in excess of pump capacity. Pumps shall be designed for anticipated operating conditions, including suction lift if applicable.
    b. Operation. Provisions shall be made for automatic and manual start-up and load transfer. The pump must be protected against damage from adverse operating conditions. Provisions should be considered to allow the engine to start and stabilize at operating speed before assuming the load. Where manual start-up and transfer is justified, storage capacity and alarm system must meet the requirements stated hereinabove.
    c. Portable Generating Equipment. Where portable generating equipment or manual transfer of power to the pumping equipment is provided, sufficient storage capacity shall be provided in the design of pumping station, to allow time for detection of pump station failure and transportation and connection of generating equipment. The use of special electrical connections and double throw switches are recommended for connecting portable generating equipment.

H. INSTRUCTIONS AND EQUIPMENT

The District shall be provided with and maintain a complete set of operational instructions, including emergency procedures, maintenance schedules, special tools and necessary spare parts.

Local, state and federal safety requirements, including those in applicable fire code, the Uniform Building Code etc., must be reviewed and complied with. Those requirements take precedence over the foregoing requirements, if more stringent, and should be incorporated in the design.

SECTION 11 - FORCE MAINS

A. PIPE MATERIAL

Pipe for sanitary sewer force mains shall be polyvinyl chloride (PVC) pressure pipe or high-density polyethylene (HDPE) pipe as described below.

1. Polyvinyl Chloride (PVC) Pressure Pipe. PVC pressure pipe shall meet the requirements of AWWA C900 or AWWA C905. The material shall conform to ASTM D1784 for cell class 12454 and have a hydrostatic design basis of 4,000 psi. For AWWA C900, the minimum pressure class/DR rating shall be Class 200/DR 14. For AWWA C905, the minimum pressure class/DR rating shall be Class 200/DR 21.

    a. Joints. Joints shall be a bell end coupling push-on type with joint restraints as needed. Joint restraints shall be Megalug® style mechanical joints for PVC pipe as manufactured by EBAA IRON or approved equal. The push-on joint and gaskets shall meet the requirements for ASTM D3139 and F477.
    b. Fittings. Fittings shall be restrained joint ductile iron fittings conforming to ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111. Restrained joints shall be Megalug® style for PVC as manufactured by EBAA Iron, or approved equal.

2. High-Density Polyethylene (HDPE) Pipe. Materials used for the manufacture of HDPE pipe shall be extra high molecular weight, high density ethylene/hexane copolymer PE3408 polyethylene resin meeting the requirements of ASTM D3350 with a minimum cell classification of PE345464C for materials in accordance with AWWA C906, DR14. Pipe shall be sized in accordance with ductile iron pipe sizes (DIPS). All material shall have a hydrostatic design basis of 1,600 psi.

    The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions or other defects that may affect the wall integrity. All material shall be listed by the Plastic Pipe Industry in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-4 testing and validation for samples of the pipe manufacturer's production pipe.

    Permanent identification of sewer piping shall be provided by co-extruding longitudinal green stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.

a. Joints. HDPE pipe shall be joined into continuous lengths on the job-site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The District may approve electrofusion on a case-by-case basis. Mechanical joint adapters shall be used only when joining polyethylene materials to different piping materials. Joint restraint to prevent axial separation shall be incorporated into the design of the sleeve or coupling used to connect HDPE pipe plain ends. Internal pipe wall stiffeners must be used when restraining HDPE. The restrained coupling system shall be Series 4800 manufactured by EBAA Iron, Inc. or an approved equal.
b. Fittings. Fittings shall be either HDPE or ductile iron. HDPE fittings shall be manufactured in accordance with ASTM D3261 by injection molding, a combination of extrusion and machining or fabricated from HPDE pipe conforming to this Standard. Fittings shall be fully pressure rated and provide a working pressure equal to the adjacent pipe with an included two (2) to one (1) safety factor. Ductile iron fittings shall be restrained joint ductile iron fittings conforming to ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111 with MJ Adapters.

B. TESTING

All sanitary sewer force mains shall be hydrostatic tested for leaks in accordance with the requirements and procedures contained in Appendix B.

C. DEPTH OF COVER

Sanitary sewer force mains shall have a minimum of four (4) feet of cover unless otherwise approved by the District.

D. VELOCITY

A velocity of not less than two (2) feet per second shall be maintained at the average design flow, to avoid septic sewage and resulting odors.

E. AIR RELIEF VALVE

An automatic air relief valve shall be placed at any high point in the force main to prevent air locking. The air relief valve shall be placed inside of a District-approved manhole (See Section 7) with a flat floor base for access purposes.

F. TERMINATION

All force mains shall terminate in a manhole at a point not more than two (2) feet above the flow line of said manhole.

G. DESIGN PRESSURE

The force main and fittings, including thrust restraint, shall be designed to withstand normal pressure and pressure surges (water hammer).

H. THRUST RESTRAINT

Unless otherwise specified by the District, concrete thrust blocking shall be provided at all horizontal or vertical bends between ten (10) and ninety (90) degrees as well as at fittings, valves, etc., that may be subject to movement or separation resulting from normal pressure and pressure surges.

Concrete for thrust blocking shall have a minimum twenty-eight (28) day compressive strength of 3,000 psi. Thrust blocking shall be formed and placed in such a manner that the pressure to be exerted at the point of blocking shall be transferred to firm, undisturbed earth at a maximum load of two thousand (2,000) pounds per square foot. Thrust blocking shall be constructed so that the pipe and fittings are accessible for repair and joint flexibility is not impaired.

I. DESIGN FRICTION LOSSES

Friction losses through force mains shall be based on the Hazen and Williams formula or other hydraulic analysis to determine friction losses. When the Hazen and Williams formula is used, the design shall be based on the value of C equal to 120.

When initially installed, force mains will have a significantly higher C factor. The higher C factor should be considered only in calculating maximum power requirements.

J. SEPARATION FROM WATER MAIN

In accordance with Utah Administrative Code R309-550-7,

1. Sewer force mains shall not be installed within ten (10) feet (horizontally) of a water main.

2. When a sewer force main must cross a water line, the crossing shall be as close as practical to the perpendicular. The sewer force main shall be at least eighteen (18) inches below the water line.

3. When a new sewer force main crosses under an existing water main, all portions of the sewer force main within ten (10) feet (horizontally) of the water main shall be enclosed in a continuous sleeve.

K. SPECIAL CONSTRUCTION

Force main construction near streams or used for aerial crossings shall meet the requirements stated in Utah Administrative Code R317-3-2.8 (Sewer In Relation To Streams).

L. WARNING TAPE

A clearly labelled non-detectable warning tape shall be placed two (2) feet above the top of a force main and a minimum of six (6) inches below grade along its entire length. Warning tape shall meet OSHA Regulation 1926-956(c)(1). The tape shall be six (6) inches wide with black lettering imprinted on a green background conforming to APWA color code specifications.

M. TRACER WIRE

All force mains shall have a tracer wire installed along the length of the pipe. The requirements in this section apply specifically to open trench projects. Tracer wire requirements for directional drilling or pipe bursting projects will be at the District's discretion. The tracer wire shall be installed so that electrical continuity is maintained throughout the pipe system. As few connections as possible shall be made in the tracer wire.

1. Placement. The tracer wire shall be taped to the top of the pipe every eight (8) to ten (10) feet using non-adhesive, waterproof silicone tape or approved equivalent and not allowed to "float freely" within the backfill.

2. Material. At a minimum, the tracer wire shall be #12 AWG high-strength copper clad steel (HS-CCS), insulated with a thirty (30) mil, high-density polyethylene (HDPE) or high molecular weight polyethylene (HMWPE) insulation, and rated for direct burial use at 30 volts. The HS-CCS conductor must be twenty-one (21) percent conductivity for locating purposes. The minimum break load shall be three hundred eighty (380) pounds. Insulation color shall be green per APWA color code specifications.

3. Wire Connectors. Wire connectors shall be direct-bury three (3) way lockable connectors specifically manufactured for use in underground tracer wire installation to provide electrical continuity. Connectors shall contain a dielectric waterproof and corrosion-proof sealant and shall be installed in a manner so as to prevent any uninsulated wire exposure. Non-locking friction fit, twist on or taped connectors are prohibited.

4. Termination/Access. At a minimum, the tracer wire shall have an access point at the beginning and ending points of the pipe run with no distance between access points to exceed four hundred (400) feet unless otherwise approved by the District. Tracer wire access points shall be within public rights-of-way or public utility easements. Wire terminations must be located outside of roadways. All tracer wire termination points shall utilize an approved grade level/in-ground access box specifically manufactured for this purpose. Said box shall be identified with "sewer" cast into the cap and be colored green per APWA color code specifications.

   A minimum of two (2) feet of excess/slack wire is required in all tracer wire access boxes after meeting final elevation. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminals for the tracer wire connection and the terminal for the grounding anode wire connection. The grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

5. Grounding. Tracer wire shall be properly grounded at all end points. Grounding of tracer wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of twenty (20) feet of #14 AWG red HDPE insulated copper clad steel wire connected to the anode (minimum one-half (0.5) pound) specifically manufactured for this purpose, and buried at the same elevation as the utility. The grounding anode at tracer wire end points shall be installed in a direction one hundred eighty (180) degrees opposite of the tracer wire, at the maximum possible distance. A minimum of two (2) feet of excess/slack wire is required in all tracer wire access boxes after meeting final elevation.

6. Repairs. Any damage that occurs during installation of the tracer wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

7. Testing. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by District personnel prior to acceptance of ownership. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

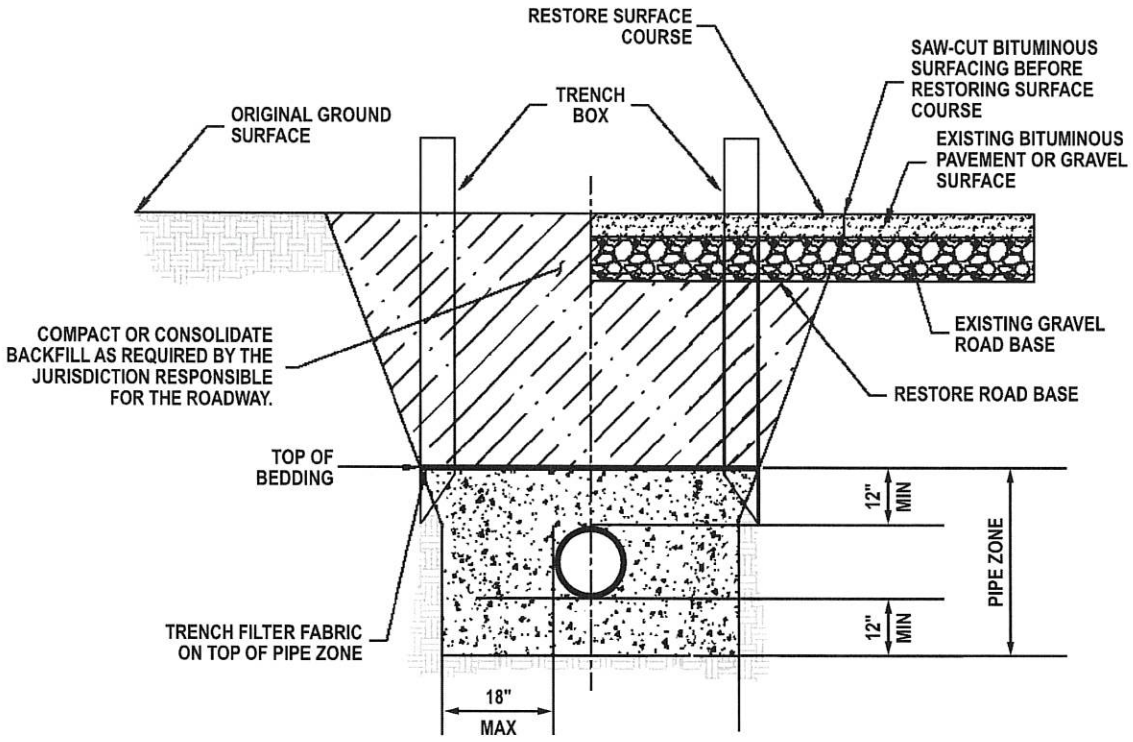
N. MARKER SIGNS

The District shall evaluate the need for aboveground marker signs on a case-by-case basis. If, in the District's opinion, marker signs would significantly improve protection, the District will identify requirements for marker signs including, but not limited to, design and material requirements and the interval at which they should be located.

APPENDIX A - STANDARD DETAIL DRAWINGS

The following standard detail drawings have been approved by the District and are shown on the following pages:

SHEET	*TITLE*
114-1	Standard Sewer Main Trench Detail
114-2	Building Sewer Connection to Sewer Main (New Construction)
114-3	Building Sewer Connection to Sewer Main (Existing Sewer)
114-4	Precast Manhole Detail
114-5	Grout Detail
114-6	Inside Drop Detail
114-7	Ring & Cover Detail
114-8	Concrete Collar Detail
114-9A	Lift Station Wetwell Detail
114-9B	Lift Station Wetwell Detail
114-10	Lift Station TOP 150 Basin Detail
114-11	Lift Station Pump Bypass Detail
114-12	Lift Station Control Panel Detail



SECTION

NOTES:

1 - THE DISTRICT RECOMMENDS CONTRACTOR MEET ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING (SEE OSHA AND UOSH REQUIREMENTS, LATEST EDITIONS).

2 - CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE LAYING PIPE WITHIN 50 FEET OF SAID UTILITIES, WHICH MAY BE EXPOSED, DAMAGED, OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE DISTRICT ENGINEER TO MODIFY GRADE OF PIPELINE IN ORDER TO GO AROUND UTILITIES.

3 - ALL SEWER MAINS SHALL BE BEDDED WITH A MINIMUM OF 12 INCHES OF IMPORTED 1-INCH GRADED GRAVEL UNDER THE PIPE AND 12 INCHES OVER THE PIPE. UNSTABLE CLAYS, ORGANIC SOILS, OR OTHER UNSTABLE BASE MATERIAL MAY REQUIRE A GREATER DEPTH OF BEDDING OR ALTERNATE MATERIALS.

4 - TRENCH FILTER FABRIC SHALL BE FURNISHED AND INSTALLED BETWEEN THE BEDDING AND BACKFILL MATERIAL FOR ALL SEWER MAINS.

SCALE: NONE

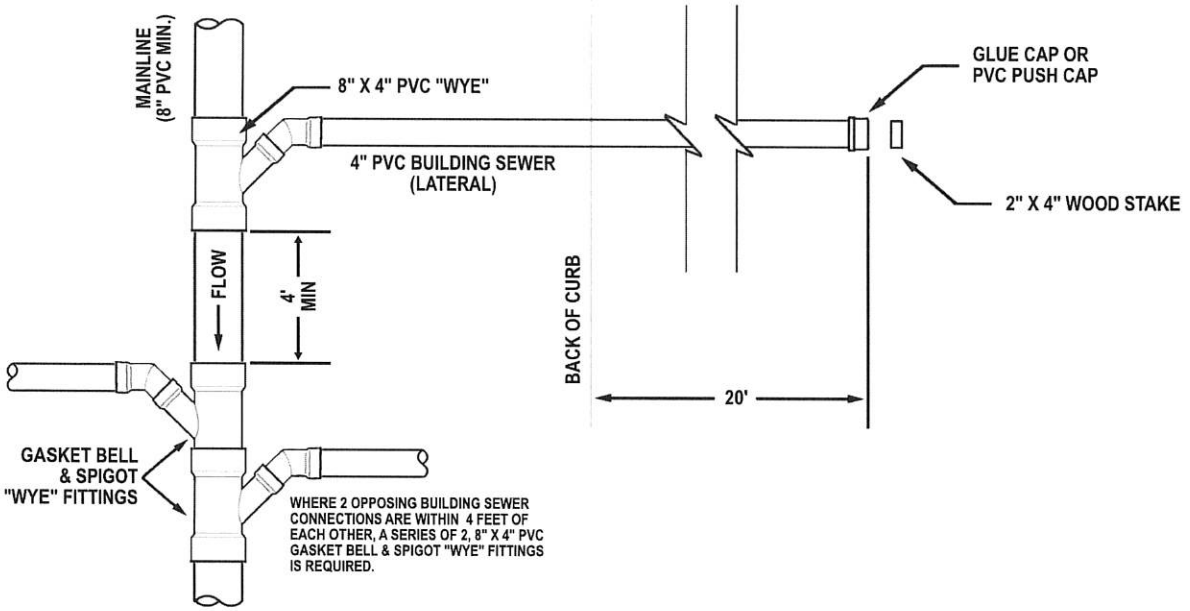
ORIGINAL		
04/17/2019	LBH	
REVISIONS		
07/14/2020	LBH	

SOUTH DAVIS SEWER DISTRICT

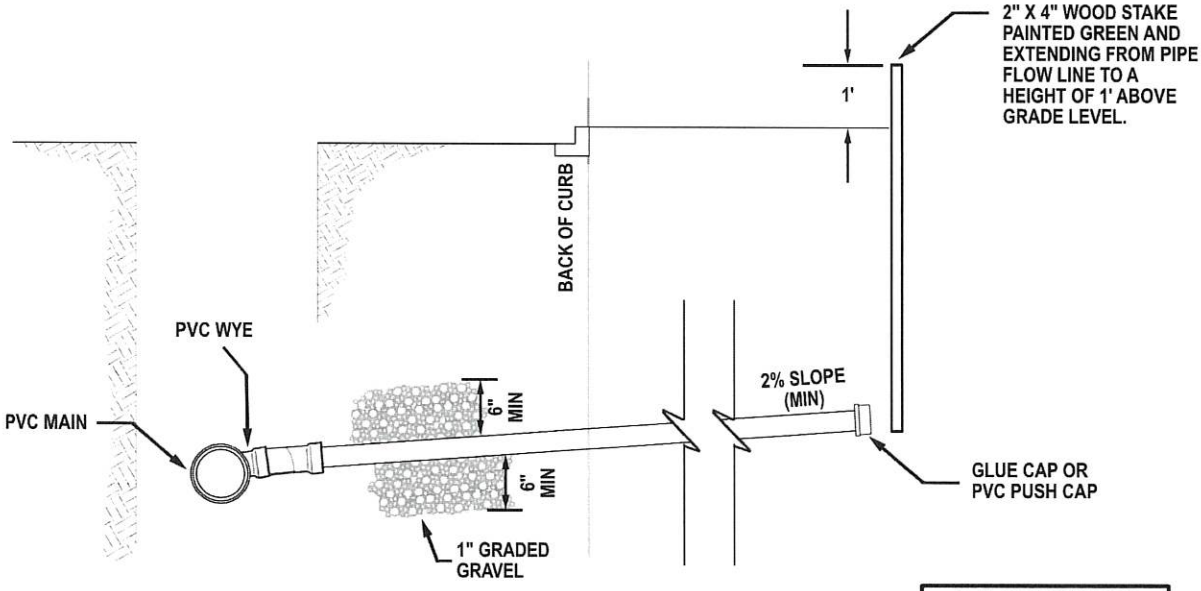
STANDARD SEWER MAIN TRENCH DETAIL

SHEET:

114-1



PLAN VIEW



PROFILE VIEW

SEE RESOLUTION NO. 104 FOR CLEANOUT INFORMATION.

NOTES:

1 - GRAVITY BUILDING SEWERS MUST BE 4 INCH OR LARGER PIPE DIAMETER. PVC PIPE SHALL BE SDR-35 AND SHALL BE GREEN IN COLOR.

2 - BUILDING SEWERS SHALL CONNECT TO THE MAIN USING A "WYE" CONNECTION. WHERE 2 OPPOSING BUILDING SEWER CONNECTIONS ARE WITHIN 4 FEET OF EACH OTHER, A SERIES OF 2, 8" X 4" PVC GASKET BELL & SPIGOT "WYE" FITTINGS IS REQUIRED.

3 - A GLUE CAP OR PVC PUSH CAP IS REQUIRED AT THE END OF EACH BUILDING SEWER. "BRANDT" PLUGS ARE NOT ALLOWED.

4 - THE BEDDING MATERIAL SHALL BE 1-INCH GRADED GRAVEL, WELL HAUNCHED. IF THE NATIVE MATERIAL IS SAND, IT MAY BE USED, WELL HAUNCHED.

5 - THE MINIMUM COVER OVER THE TOP OF THE PIPE SHALL BE 3 FEET.

SCALE: NONE

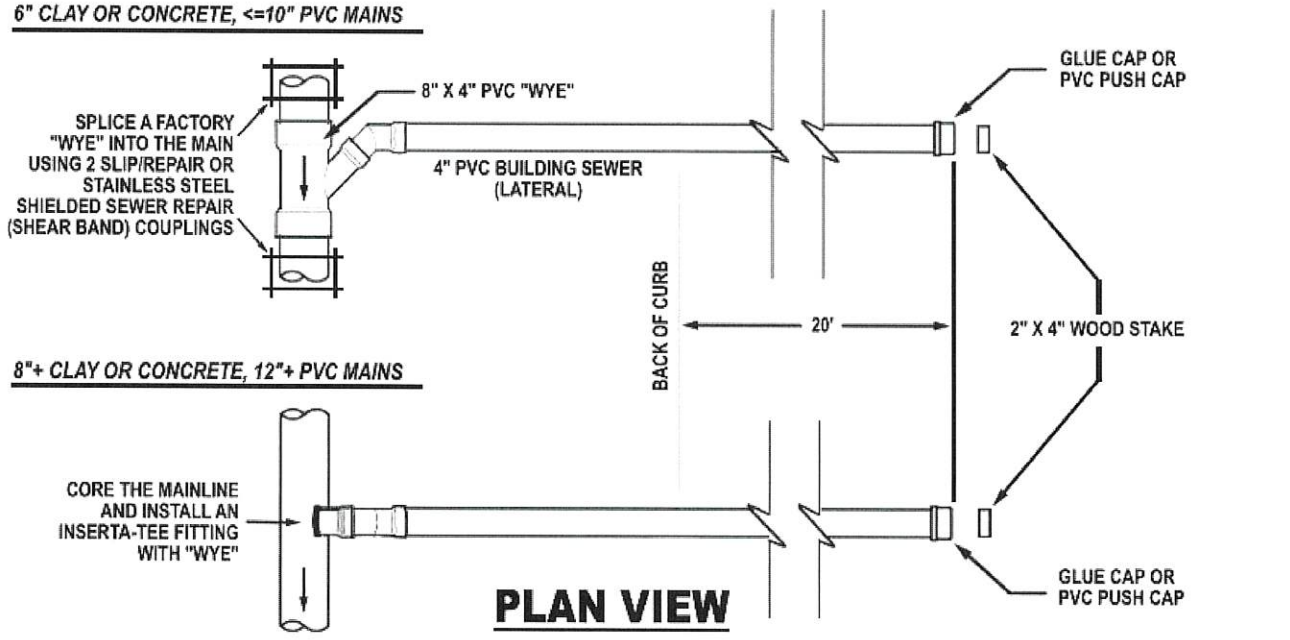
ORIGINAL		
04/11/2019	LBH	
REVISIONS		
07/02/2020	LBH	
07/14/2020	LBH	
10/06/2021	LBH	
06/13/2023	LBH	

SOUTH DAVIS SEWER DISTRICT

BUILDING SEWER CONNECTION TO SEWER MAIN (NEW CONSTRUCTION)

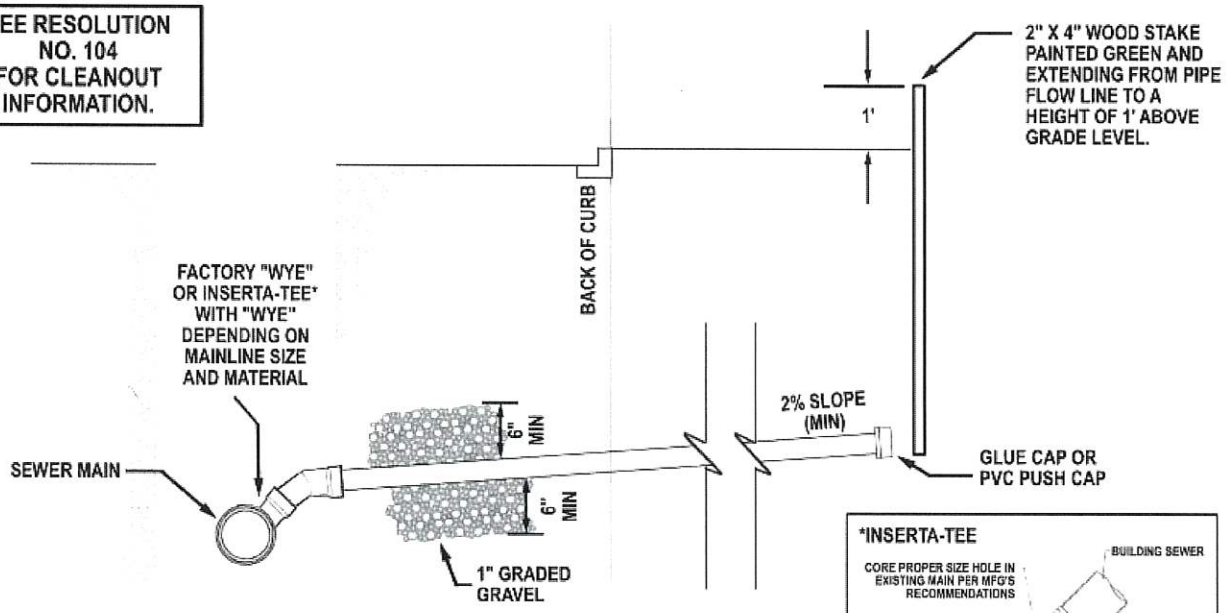
SHEET:

114-2

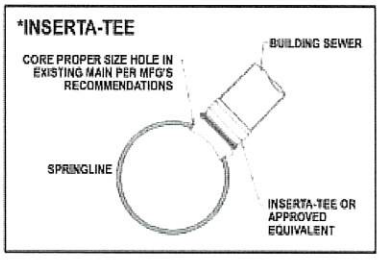


PLAN VIEW

SEE RESOLUTION NO. 104 FOR CLEANOUT INFORMATION.



PROFILE VIEW



NOTES:

1 - GRAVITY BUILDING SEWERS MUST BE 4 INCH OR LARGER PIPE DIAMETER. PVC PIPE SHALL BE SDR-35 AND SHALL BE GREEN IN COLOR.

2 - FOR 6-INCH CLAY OR CONCRETE OR 10-INCH AND SMALLER PVC MAINLINES, SPLICE A FACTORY "WYE" INTO THE MAIN USING 2 SLIP/REPAIR OR STAINLESS STEEL SHIELDED SEWER REPAIR (SHEAR BAND) COUPLINGS (NO MORE THAN A 1/2-INCH GAP BETWEEN JOINTS). FLEXIBLE-TYPE COUPLINGS ARE NOT PERMITTED. THE COUPLINGS SHALL BE SHADED IN SALT FROM THE SPRINGLINE UP TO THE TOP OF THE COUPLING. FOR 8-INCH AND GREATER CLAY OR CONCRETE OR 12-INCH AND GREATER PVC MAINLINES, CORE THE MAINLINE AND INSTALL AN INSERTA-TEE FITTING WITH "WYE".

3 - A GLUE CAP OR PVC PUSH CAP IS REQUIRED AT THE END OF EACH BUILDING SEWER. "BRANDT" PLUGS ARE NOT ALLOWED.

4 - THE BEDDING MATERIAL SHALL BE 1-INCH GRADED GRAVEL, WELL HAUNCHED. IF THE NATIVE MATERIAL IS SAND, IT MAY BE USED, WELL HAUNCHED.

5 - THE MINIMUM COVER OVER THE TOP OF THE PIPE SHALL BE 3 FEET.

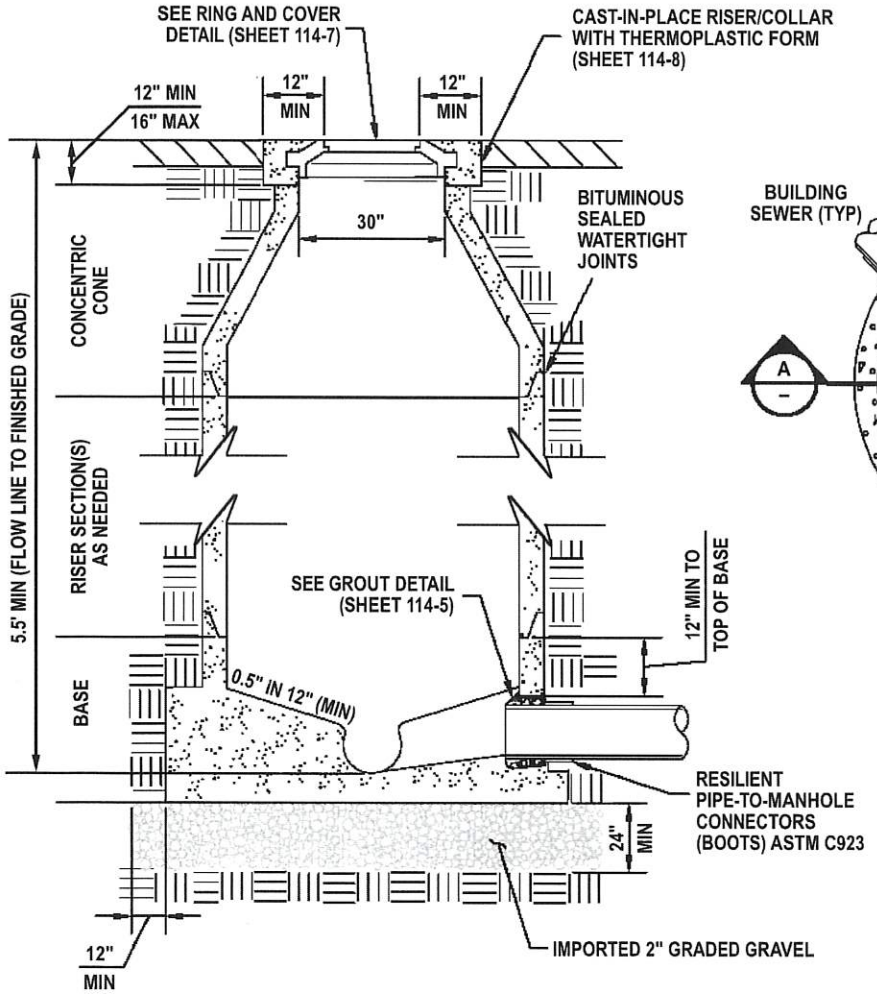
SCALE: NONE

ORIGINAL		
04/17/2019	LBH	
REVISIONS		
07/02/2020	LBH	
07/14/2020	LBH	
06/13/2023	LBH	

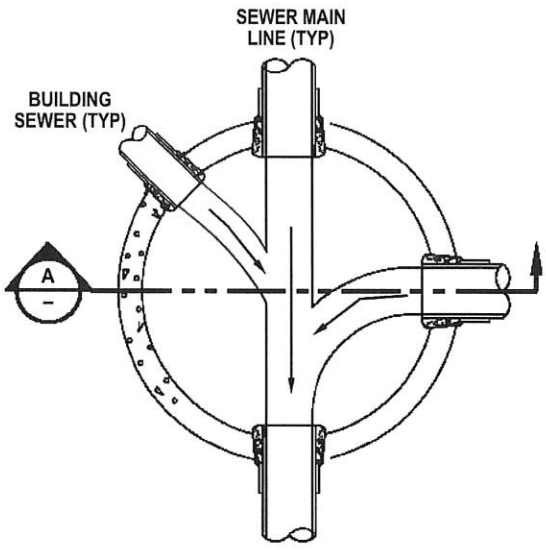
SOUTH DAVIS SEWER DISTRICT

BUILDING SEWER CONNECTION TO SEWER MAIN (EXISTING SEWER)

SHEET: 114-3



SECTION A



PLAN

NOTES:

1 - THE MINIMUM DIAMETER OF ANY MANHOLE THAT HAS A TOTAL OF 3 OR MORE, 8-INCH OR LARGER PIPES ENTERING AND/OR LEAVING IT, OR ANY PIPE GREATER THAN 15 INCHES IN DIAMETER ENTERING OR LEAVING IT, SHALL BE 60 INCHES UNLESS OTHERWISE APPROVED IN WRITING BY THE DISTRICT. THE MINIMUM DIAMETER FOR ALL OTHER MANHOLES SHALL BE 48 INCHES.

2 - CONCRETE MANHOLES SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4000 PSI AND CONFORM TO ASTM C478 SPECIFICATIONS.

3 - MANHOLE BASES SHALL BE PRECAST.

4 - ALL MANHOLES MUST HAVE A CONCENTRIC CONE UNLESS OTHERWISE APPROVED. FLAT TOP LIDS ARE NOT PERMITTED.

5 - THE MINIMUM DEPTH SHALL BE 5.5 FEET FROM BOTTOM OF FLOW LINE TO FINISHED GRADE. THE TOP OF THE CONE (WHICH MAY BE ADJUSTED AS NECESSARY WITH 1, 6-INCH CONCRETE GRADE RING) SHOULD BE NO LESS THAN 12 INCHES BELOW THE FINISHED GRADE AND NO MORE THAN 16 INCHES BELOW THE FINISHED GRADE. A CAST-IN-PLACE RISER/COLLAR WITH THERMOPLASTIC FORM IS REQUIRED.

6 - THE LID AND HARDWARE OF ALL MANHOLES SHALL BE KEPT OUT OF THE CURB AND GUTTER.

7 - FLOW CHANNELS THROUGH MANHOLES SHALL HAVE 0.2 FOOT SLOPE OR MATCH THE ENGINEERED SLOPE OF PIPE. FLOW CHANNELS SHALL BE REQUIRED FOR ALL SEWER LINES, INCLUDING BUILDING SEWERS, THAT PASS THROUGH OR ENTER A MANHOLE. FLOW CHANNELS SHALL BE SMOOTH AND SEMI-CIRCULAR IN CROSS SECTION AND SHALL MATCH THE PIPE DIAMETER.

8 - MANHOLE STEPS ARE NOT PERMITTED.

9 - MANHOLES SHALL BE BEDDED WITH A MINIMUM OF 24 INCHES OF IMPORTED 2-INCH GRADED GRAVEL. GRAVEL BEDDING SHALL EXTEND A MINIMUM OF 12 INCHES OUTSIDE THE OUTSIDE LIMITS OF THE BASE SECTION.

10 - EXTRA CARE MUST BE TAKEN TO PROPERLY BED AND HAUNCH PIPE CONNECTIONS TO MANHOLES TO AVOID SETTLEMENT AND/OR SHIFTING OF PIPES.

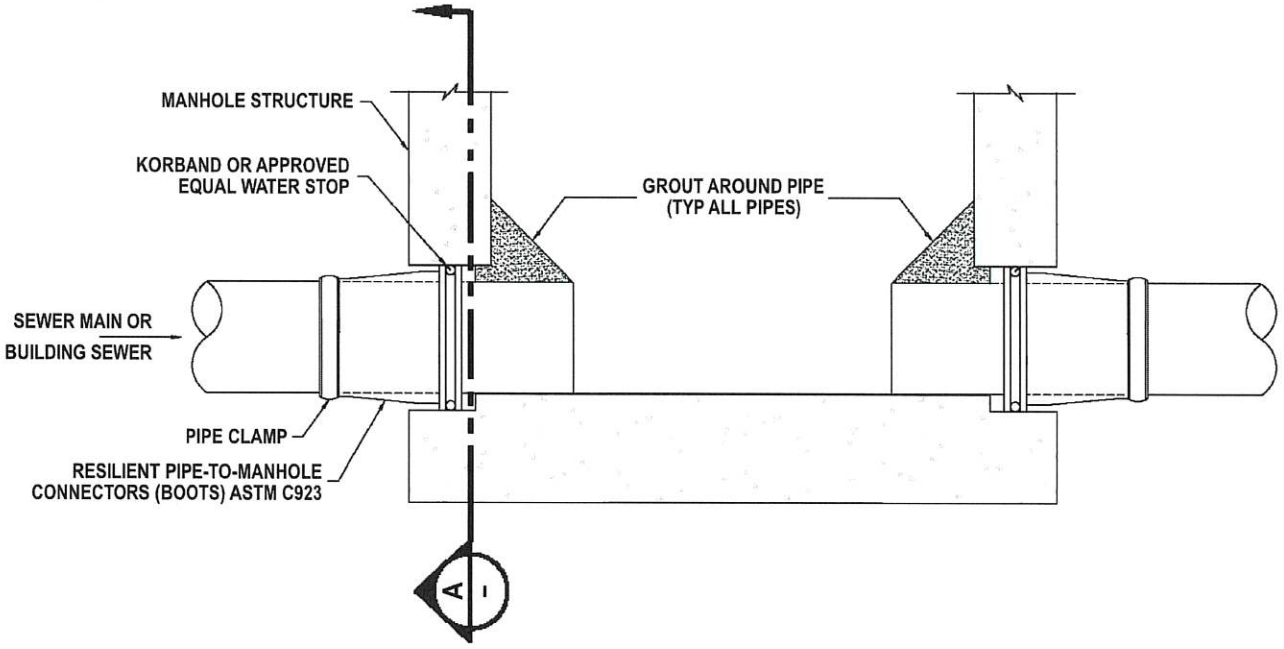
SCALE: NONE

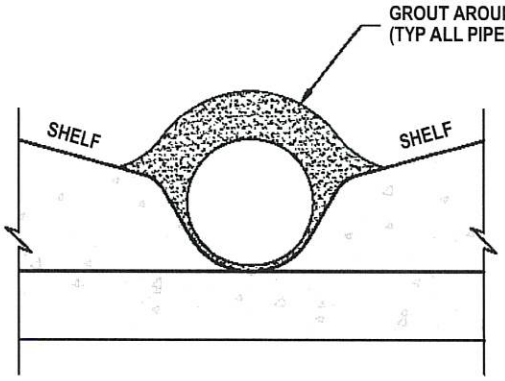
ORIGINAL		
11/01/2021	LBH	
REVISIONS		
09/15/2022	LBH	

SOUTH DAVIS SEWER DISTRICT

PRECAST MANHOLE DETAIL

SHEET: 114-4





SECTION A -

NOTE:

GROUT ONLY THE INLETS AND OUTLETS OF MANHOLE, AS SHOWN. GROUT WORK MUST BE DONE COMPLETELY FROM SHELF TO SHELF TO RECEIVE DISTRICT APPROVAL.

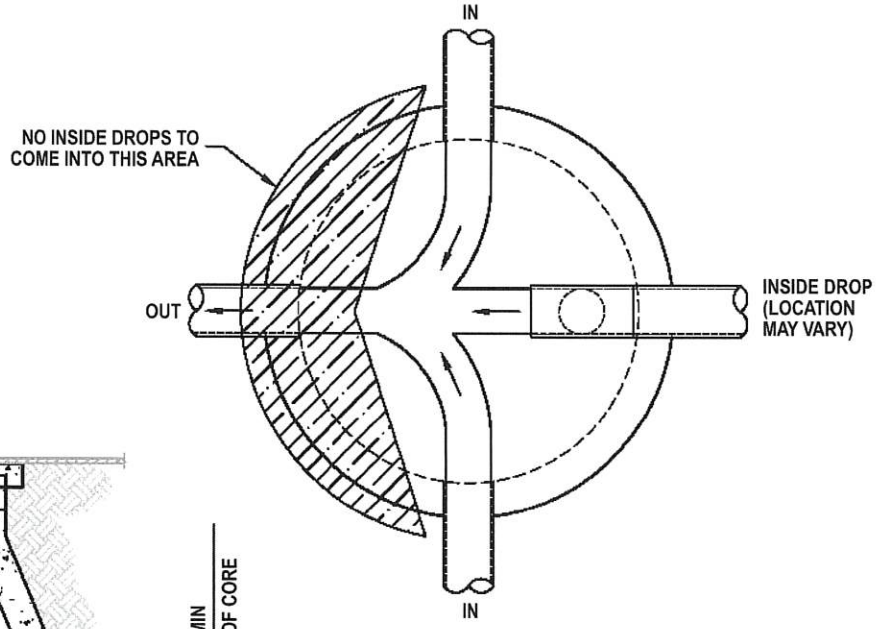
SCALE: NONE

ORIGINAL		
07/02/2020	LBH	
REVISIONS		
07/14/2020	LBH	

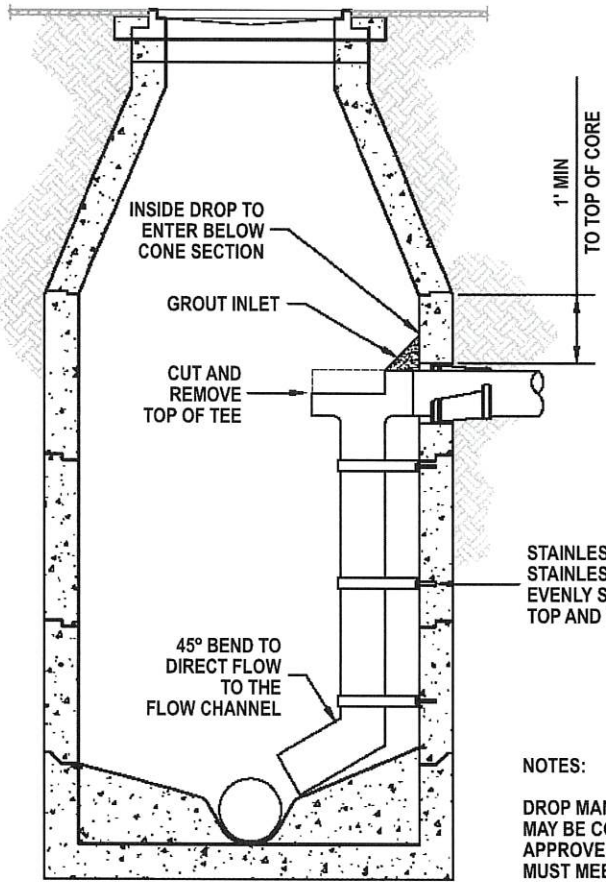
SOUTH DAVIS SEWER DISTRICT

GROUT DETAIL

SHEET: 114-5



PLAN



SECTION

NOTES:

DROP MANHOLES ARE GENERALLY NOT ALLOWED. THE USE OF DROP MANHOLES MAY BE CONSIDERED IN EXTREME CIRCUMSTANCES. DROP MANHOLES MUST BE APPROVED BY THE DISTRICT IN WRITING. WHERE APPROVED, DROP MANHOLES MUST MEET THE REQUIREMENTS PROVIDED IN RESOLUTION 114 AND THIS DETAIL.

1 - MANHOLE DIAMETER SHALL BE A MINIMUM OF 5 FEET.

2 - ONLY INTERNAL DROP CONNECTIONS ARE ALLOWED.

3 - DROP CONNECTION PIPE DIAMETER AND FITTINGS SHALL BE EQUAL TO OR GREATER THAN THE DIAMETER OF THE SEWER SERVICE.

4 - USE OF GLUED FITTINGS IS REQUIRED ON THE DROP CONNECTION.

5 - MANHOLE SHALL BE CORE-DRILLED TO ACCOMMODATE THE DROP. THE CORE MUST BE SIZED TO FIT THE PIPE AND THEN RE-CORED TO FIT A BOOT. PIPE SHALL BE GROUTED AT MANHOLE PENETRATION.

6 - SPECIAL PERMISSION MUST BE OBTAINED FROM THE DISTRICT FOR INSTALLATIONS RESULTING IN LESS THAN 36" OF CLEARANCE.

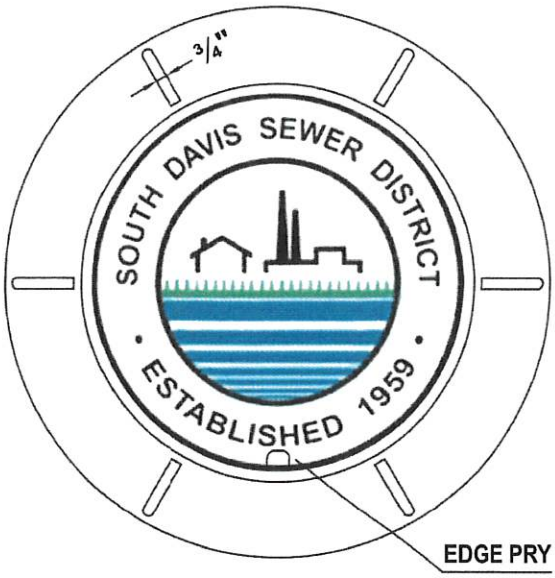
SCALE: NONE

ORIGINAL		
04/18/2019	LBH	
REVISIONS		

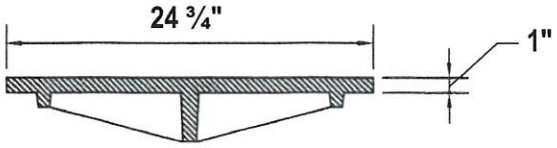
SOUTH DAVIS SEWER DISTRICT

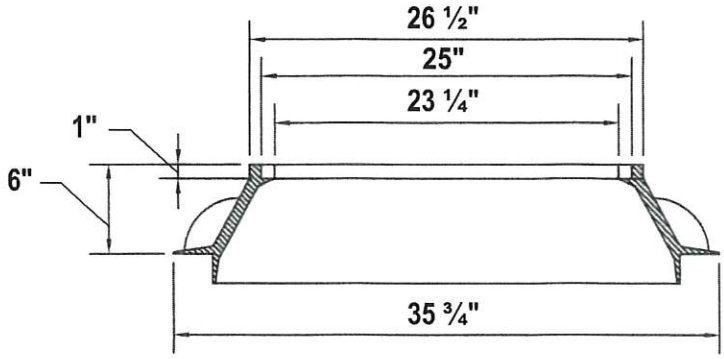
INSIDE DROP DETAIL

SHEET: **114-6**



PLAN





SECTION

NOTES:

1 - CASTING TO MEET REQUIREMENTS OF ASTM A48 CLASS 35B.

2 - CASTING TO BE PAINTED BLACK WITH ASPHALT BASED PAINT.

3 - CASTING TO BE FURNISHED WITH MACHINED SEATING SURFACES.

4 - MFR NAME AND HEAT/CAST DATE TO BE CAST ON RING & COVER.

5 - COUNTRY OF ORIGIN TO BE MARKED PER USCS REGULATIONS.

6 - USE OF LOW-PROFILE HARDWARE IS PROHIBITED.

SCALE: NONE

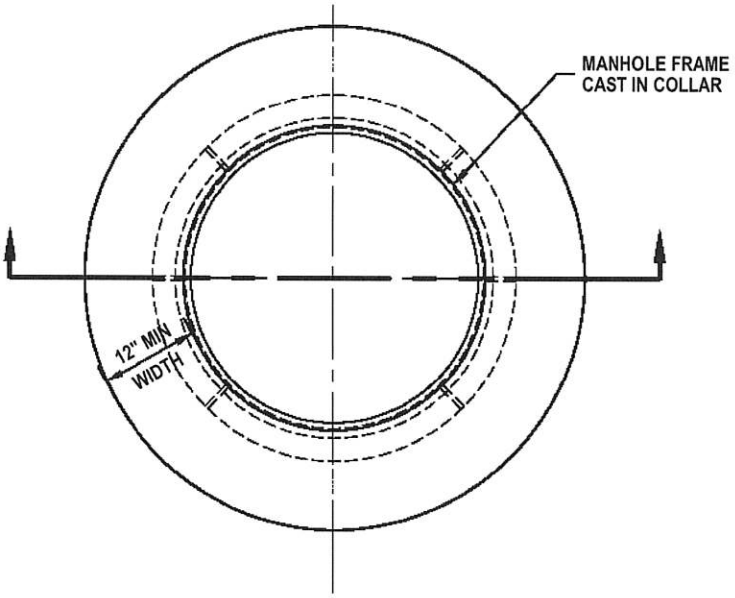
ORIGINAL		
04/18/2019	LBH	
REVISIONS		

SOUTH DAVIS SEWER DISTRICT

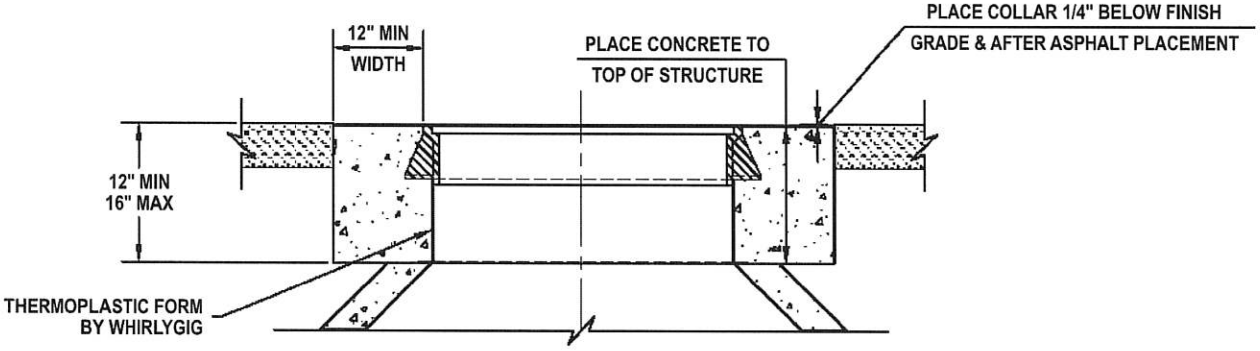
RING & COVER DETAIL

SHEET:

114-7



PLAN



(SEE NOTE)

SECTION

NOTE:

CONCRETE COLLARS ARE REQUIRED ON ALL MANHOLES IN STREETS, ROADWAYS & OTHER PAVED AREAS. CONSTRUCT CAST-IN-PLACE RISER/COLLAR WITH THERMOPLASTIC FORM BY WHIRLYGIG. THE TOP OF THE CONE (WHICH MAY BE ADJUSTED AS NECESSARY WITH 1, 6-INCH CONCRETE GRADE RING) SHOULD BE NO LESS THAN 12 INCHES BELOW FINISHED GRADE AND NO MORE THAN 16 INCHES BELOW FINISHED GRADE. IN NON-PAVEMENT EASEMENTS ONLY, 6 TO 10 INCHES OF STEEL RISERS MAY BE USED TO ADJUST MANHOLES TO GRADE.

SCALE: NONE

ORIGINAL		
04/19/2019	LBH	
REVISIONS		
07/15/2020	LBH	

SOUTH DAVIS SEWER DISTRICT

CONCRETE COLLAR DETAIL

SHEET:

114-8

NOTES:

1 - DRAWING COURTESY OF FLYGT. MODIFICATIONS REQUIRED BY SOUTH DAVIS SEWER DISTRICT (THE DISTRICT) ARE ALSO INCLUDED.

2 - FOR OUTLINE DIMENSIONS OF PUMP, SEE FLYGT DRAWING 14-68 00 15.

3 - CONFIGURATION AND DIMENSIONS SHOWN ARE MINIMUM REQUIREMENTS ONLY. ALL DETAILS, INCLUDING SIZING OF PIT, TYPE, LOCATIONS AND ARRANGEMENT OF VALVES AND PIPING, ETC. SHALL BE APPROVED BY THE DISTRICT.

4 - ACCESS FRAME AND COVER SHALL BE APPROVED BY THE DISTRICT AND SHALL BE EQUIPPED WITH A SAFETY GRATING FOR FALL PREVENTION.

5 - THE DIRECTION OF OPENING OF THE WETWELL AND VALVE VAULT ACCESS COVERS SHALL BE APPROVED BY THE DISTRICT.

6 - THE LAYOUT OF ALL LIFT STATION FACILITIES (WETWELL, VALVE VAULT, POWER TRANSFORMER, CONTROL PANEL, BOLLARDS, ETC.) SHALL BE APPROVED BY THE DISTRICT. BOLLARDS SHALL BE INSTALLED IN SLEEVES SO THEY CAN BE REMOVED AS NECESSARY.

7 - EXHAUST VENTS SHALL NOT BE PERMITTED ON LIFT STATION FACILITIES.

8 - FENCING AND ALARM SYSTEM REQUIREMENTS SHALL BE EVALUATED ON A CASE-BY-CASE BASIS. THE DISTRICT MAY REQUIRE A YARD LIGHT.

9 - THE LIFT STATION SHALL BE EQUIPPED WITH AT LEAST 5 HP, 3-PHASE FLYGT N-SERIES SUBMERSIBLE PUMPS (WITH HARD-IRON CHOPPER IMPELLER AND INSERT RING), A FLYGT 150 TOP BASIN AND A FLUSH VALVE.

10 - A MINIMUM OF 18" OF COMPACTED ROAD BASE WITH 3"-4" OF 1"-MINUS GRAVEL WILL BE REQUIRED IN THE LIFT STATION COMPOUND.

11 - MINIMUM LIQUID LEVEL IN WETWELL MAY NOT FALL BELOW TOP OF VOLUTE.

(A) INDICATES INFORMATION TO BE DETERMINED BY OTHERS.

(B) LOCATE ANCHOR BOLTS USING CLEAR INSIDE EDGE OF ACCESS FRAME AND CENTER LINE OF PUMP AS REFERENCE POINT. BOLT LOCATIONS MUST BE HELD TO MAINTAIN EXACT POSITION OF PUMP RELATIVE TO ACCESS FRAME.

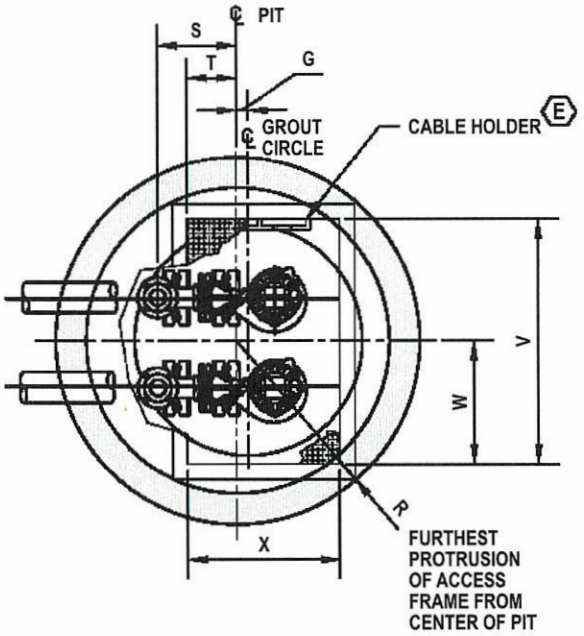
(C) CAST ACCESS FRAME AND COVER IN THE LID.

(D) CHECK VALVES SHALL FACE AWAY FROM EACH OTHER AND SHALL NOT BE DIRECTED TOWARD THE DISCHARGE SIDE OF THE WETWELL OR TOWARD THE GUIDE BARS.

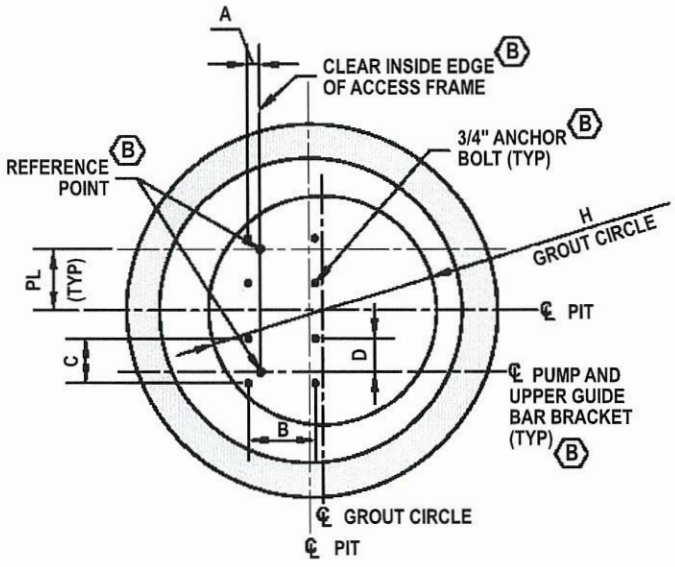
(E) CABLE HOLDER SHALL BE A STAINLESS STEEL UNISTRUT ANCHORED TO THE BOTTOM SIDE OF THE ACCESS COVER.

(F) STAINLESS STEEL CHAIN WITH SLING AND GRIP EYE SUFFICIENT TO RETRIEVE PUMPS SHALL BE CONNECTED TO THE PUMPS.

(G) MECHANICAL SEALS AND GROUT SHALL BE USED FOR ALL WETWELL AND VALVE VAULT PERFORATIONS.



TOP VIEW PLAN



BASE SECTION PLAN

DIMENSIONAL CHART

NOM. SIZE	VERSION	STATION															COVER			
		A	B	C	D	F	G	H	R	S	T	U	CV	MW	PL		SIZE	V	W	X
3"	STD	2 5/16	9 7/8	7 3/4	3 7/8	15 3/4	1	45	36	15 1/2	9 1/2	84	9 1/2	12	9		C	48	24	30
4"	STD	2 3/4	9 7/8	7 3/4	3 7/8	15 3/4	1	45	36	16 1/2	10	84	11 1/2	12	9		C	48	24	30

ALL DIMENSIONS IN INCHES (VERIFY WITH FLYGT)

SCALE: NONE

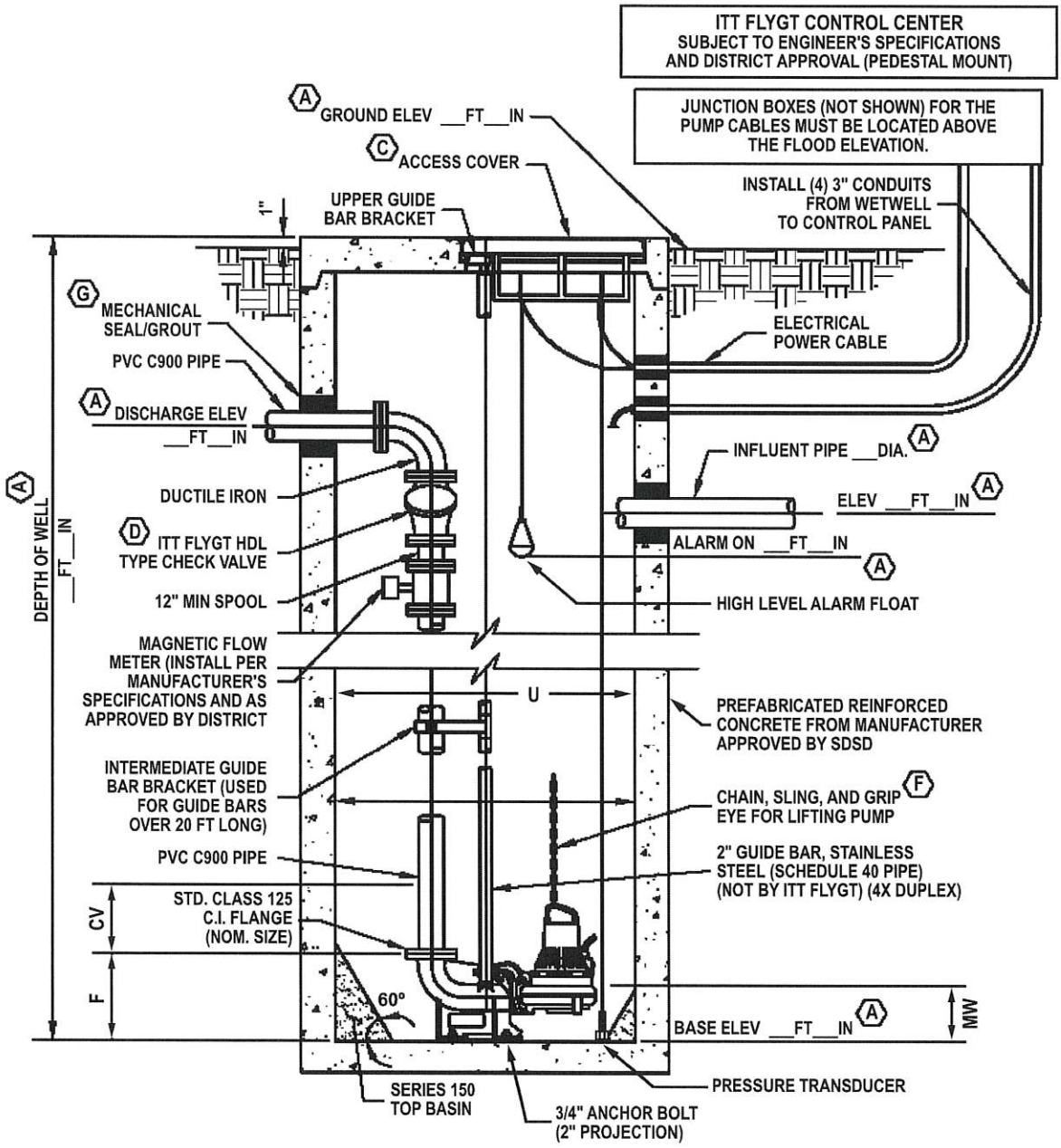
ORIGINAL		
04/19/2019	LBH	
REVISIONS		
07/07/2020	LBH	

SOUTH DAVIS SEWER DISTRICT

LIFT STATION WETWELL DETAIL

SHEET:

114-9A



SECTION

DIMENSIONAL CHART																			
NOM. SIZE	VERSION	STATION														COVER			
		A	B	C	D	F	G	H	R	S	T	U	CV	MW	PL	SIZE	V	W	X
3"	STD	$2\frac{5}{16}$	$9\frac{7}{8}$	$7\frac{3}{4}$	$3\frac{7}{8}$	$15\frac{3}{4}$	1	45	36	$15\frac{1}{2}$	$9\frac{1}{2}$	84	$9\frac{1}{2}$	12	9	C	48	24	30
4"	STD	$2\frac{3}{4}$	$9\frac{7}{8}$	$7\frac{3}{4}$	$3\frac{7}{8}$	$15\frac{3}{4}$	1	45	36	$16\frac{1}{2}$	10	84	$11\frac{1}{2}$	12	9	C	48	24	30

ALL DIMENSIONS IN INCHES (VERIFY WITH FLYGT)

SCALE: NONE

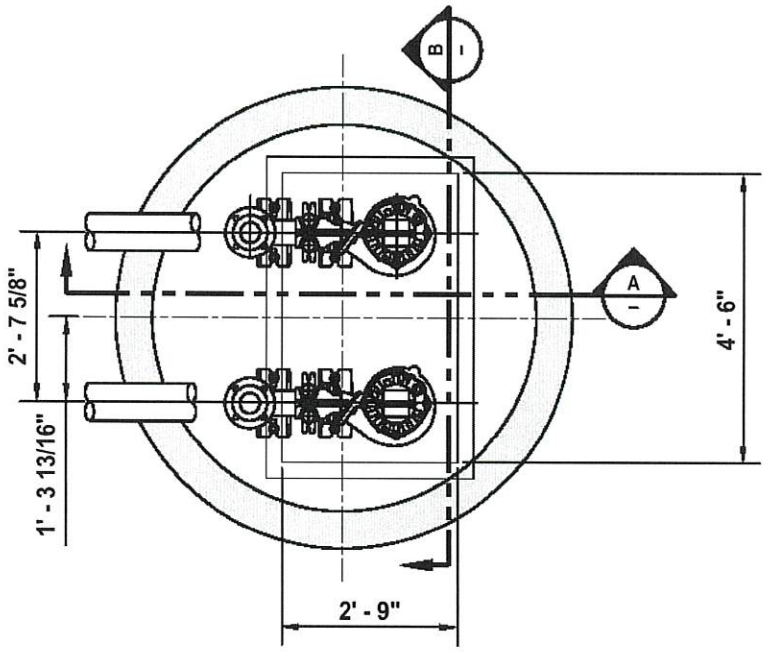
ORIGINAL		
04/19/2019	LBH	
REVISIONS		

SOUTH DAVIS SEWER DISTRICT

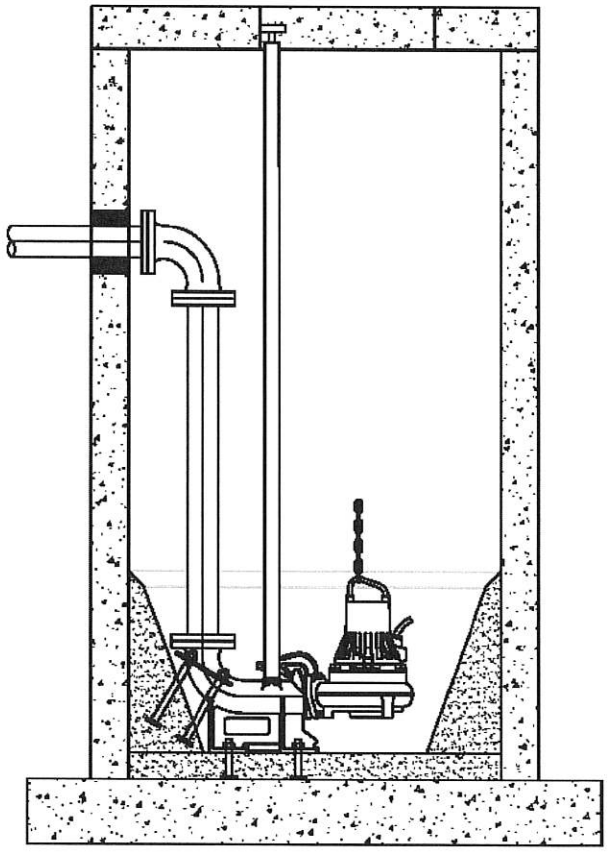
LIFT STATION WETWELL DETAIL

SHEET:

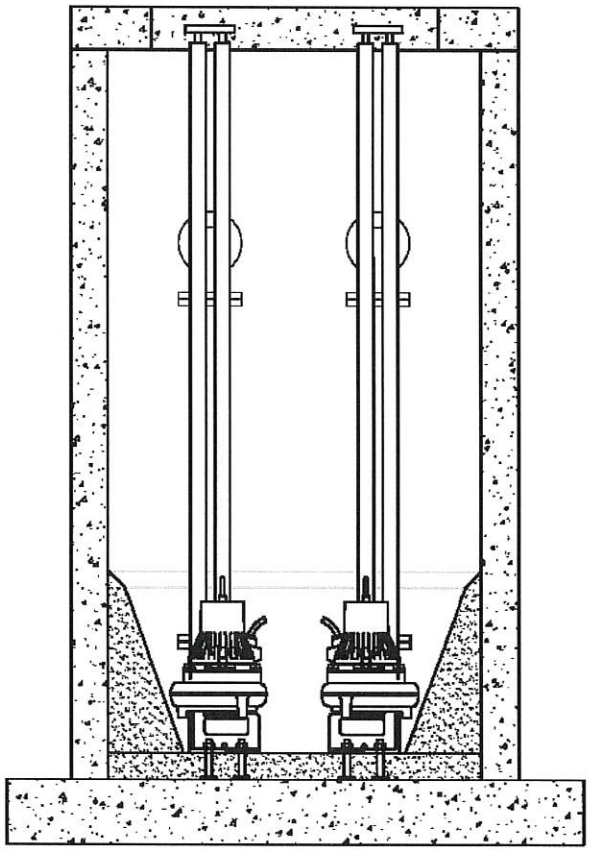
114-9B



CP3127HT TOP 150 BASIN PLAN



SECTION A



SECTION B

SCALE: NONE

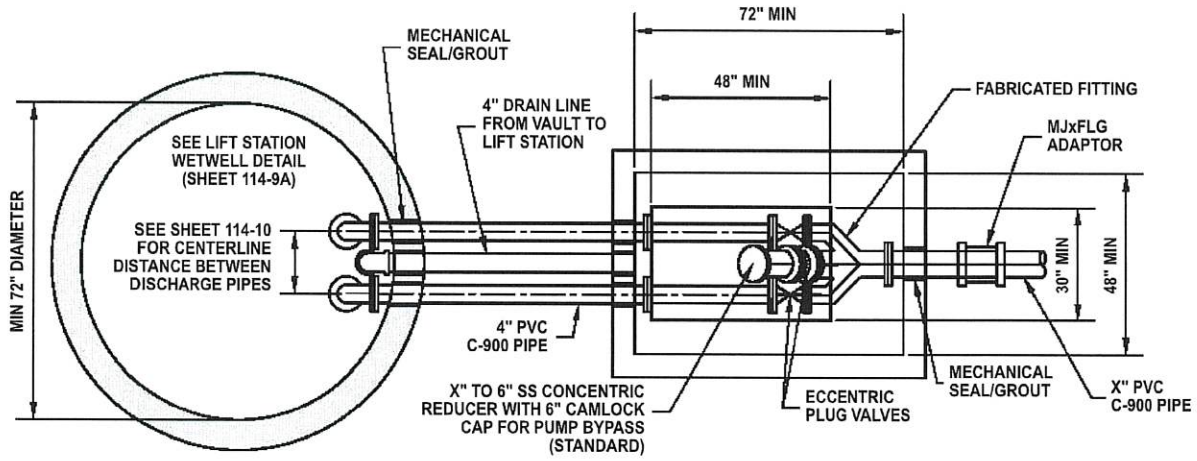
ORIGINAL		
04/19/2019	LBH	
REVISIONS		

SOUTH DAVIS SEWER DISTRICT

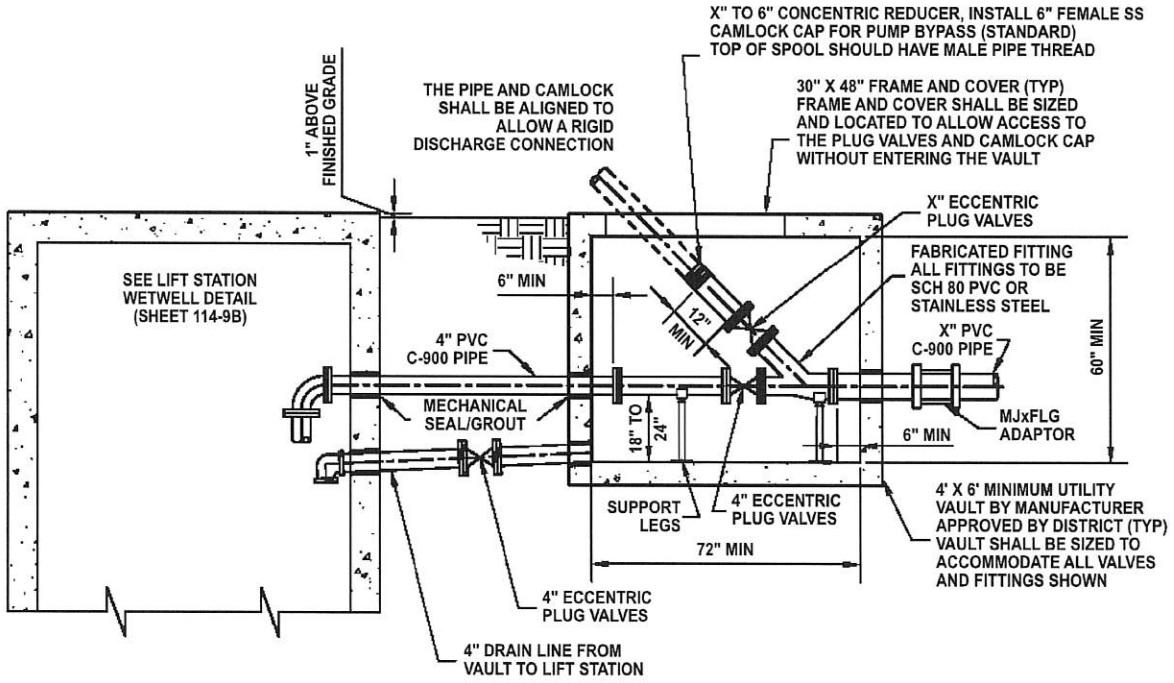
LIFT STATION
TOP 150 BASIN DETAIL

SHEET:

114-10



PLAN



SECTION

NOTES:

1 - MECHANICAL SEALS AND GROUT SHALL BE USED FOR ALL VALVE VAULT PERFORATIONS.

2 - EXHAUST VENTS SHALL NOT BE PERMITTED ON LIFT STATION FACILITIES.

3 - INTERIOR VALVE VAULT COMPONENTS SHALL BE PROPERLY PAINTED.

4 - ACCESS FRAME AND COVER SHALL BE APPROVED BY THE DISTRICT AND SHALL BE EQUIPPED WITH A SAFETY GRATING FOR FALL PREVENTION.

5 - THE DIRECTION OF OPENING OF THE WETWELL AND VALVE VAULT ACCESS COVERS SHALL BE APPROVED BY THE DISTRICT.

6 - THE LAYOUT OF ALL LIFT STATION FACILITIES (WETWELL, VALVE VAULT, POWER TRANSFORMER, CONTROL PANEL, BOLLARDS, ETC.) SHALL BE APPROVED BY THE DISTRICT. BOLLARDS SHALL BE INSTALLED IN SLEEVES SO THEY CAN BE REMOVED AS NECESSARY.

7 - VICTAULIC FITTINGS MAY BE USED IN PLACE OF THE FABRICATED FITTING. GLUED FITTINGS SHALL NOT BE PERMITTED.

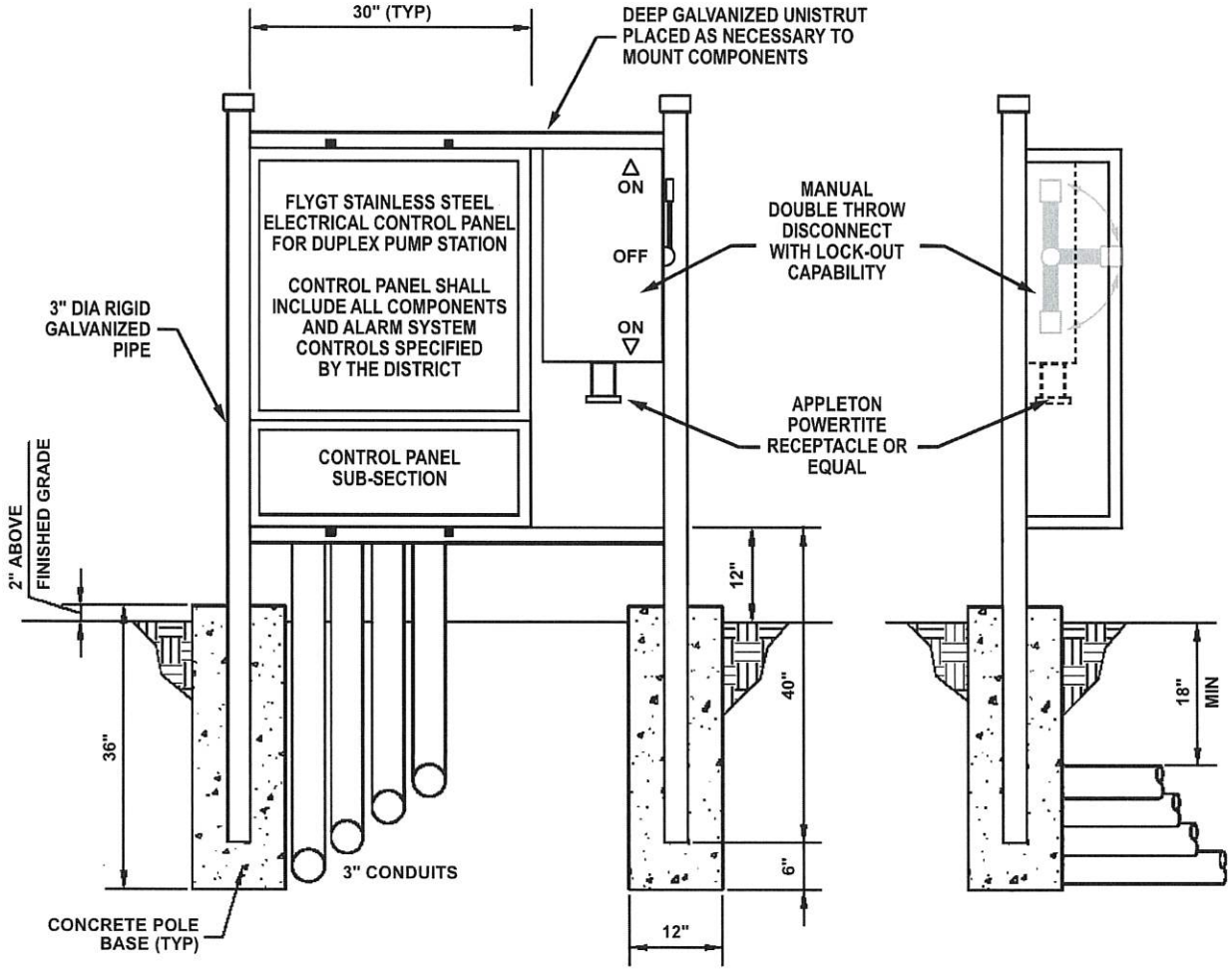
SCALE: NONE

ORIGINAL		
04/29/2019	LBH	
REVISIONS		
07/07/2020	LBH	

SOUTH DAVIS SEWER DISTRICT

LIFT STATION PUMP BYPASS DETAIL

SHEET: **114-11**



SECTION - FRONT VIEW

SECTION SIDE VIEW

NOTES:

1 - THE AVAILABLE POWER SUPPLY AT THE LIFT STATION SHALL BE 480 VOLT 3-PHASE.

2 - ALL WIRING AND ELECTRICAL WORK SHALL BE PERFORMED BY A CERTIFIED, LICENSED ELECTRICIAN.

3 - THE MANUAL DOUBLE THROW DISCONNECT SHALL HAVE A LOCK-OUT FEATURE.

4 - INSTALLATION OF 4, 3-INCH SCHEDULE 40 PVC ELECTRICAL CONDUITS IS REQUIRED FROM THE WET WELL TO THE CONTROL PANEL SUB-SECTION FOR ALL CABLES AND WIRING. USE OF A 90-DEGREE SWEEP ELBOW WITH A 36-INCH RADIUS WILL BE REQUIRED. THE HORIZONTAL RUNS SHALL BE BURIED A MINIMUM OF 18 INCHES DEEP, EMBEDDED IN SAND AND MARKED WITH UNDERGROUND ELECTRICAL CAUTION TAPE.

5- NOT SHOWN ARE THE POWER UTILITY AUTHORIZED METER BASE, MAIN DISCONNECT AND ALARM SYSTEM. PLACEMENT OF THESE COMPONENTS ON THE ELECTRICAL RACK SHALL BE APPROVED BY THE DISTRICT.

6 - THE LAYOUT OF THE LIFT STATION FACILITIES (WETWELL, VALVE VAULT, POWER TRANSFORMER, CONTROL PANEL, BOLLARDS, ETC.) SHALL BE APPROVED BY THE DISTRICT. BOLLARDS SHALL BE INSTALLED IN SLEEVES SO THEY CAN BE REMOVED AS NECESSARY.

7 - ALARM SYSTEM REQUIREMENTS SHALL BE EVALUATED ON A CASE-BY-CASE BASIS.

SCALE: NONE

ORIGINAL		
04/19/2019	LBH	
REVISIONS		
07/07/2020	LBH	

SOUTH DAVIS SEWER DISTRICT

LIFT STATION CONTROL PANEL DETAIL

SHEET:

114-12

APPENDIX B - FORCE MAIN HYDROSTATIC TEST

A. SCOPE

This specification governs the testing of sanitary sewer force mains by the hydrostatic test method. All sanitary sewer force mains shall be hydrostatic tested for leaks.

B. GENERAL REQUIREMENTS

1. The hydrostatic test method shall be in accordance with ANSI/AWWA C605-94 for PVC mains and ASTM F2164 for HDPE mains.

2. The Contractor shall remove all debris, soil and rocks from the sanitary sewer force main(s) prior to the hydrostatic test.

3. The Contractor shall provide the water for the hydrostatic test and shall be responsible for hauling water. If water is to be used from a fire hydrant, the Contractor shall familiarize himself with the City's fire hydrant meter rental rules and regulations.

4. The Contractor shall furnish all equipment and labor required, including necessary piping/hoses, injection booster pump, test pressure gauge, water source for testing the sanitary sewer force main(s) with a measuring meter and stopwatch. The measuring meter dial shall be in one-tenth (0.10) gallon increments. The test pressure gauge shall have a minimum range of zero (0) to three hundred (300) psi and the pressure gauge figure intervals shall be a maximum of five (5) psi increments.

5. The Contractor shall take safety precautions when conducting pressurized fluid leak tests. Such precautions should include restraining pipe, components and test equipment against movement in the event of failure.

6. The hydrostatic test shall be performed by the Contractor and witnessed by District personnel. The Contractor shall furnish hydrostatic test reports of sanitary sewer force main(s) to the District.

7. The cost of the hydrostatic test including test corporation, filling water and the hydrostatic test is incidental to the cost of the project.

C. POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

1. Overview

   a. PVC sanitary sewer force main(s) shall be hydrostatic tested for leaks upon the completion of the backfill and compaction operation.

   b. All PVC sanitary sewer force main(s) shall be given a hydrostatic test of at least one and one-half (1.5) times the shutoff head of the connected pump(s) or one hundred fifty (150) pounds per square inch (psi), whichever is greater. The pressure measurement shall be made from the lowest elevation of the sanitary sewer force main section being tested. The test pressure shall not exceed the pipe or valve rated pressures.

   c. The hydrostatic test duration of each PVC sanitary sewer force main test section is two (2) hours (uninterrupted).

   d. The maximum allowable leakage of PVC sanitary sewer force main(s) shall be based upon the following formula:

$$L = \frac{SDP^{1/2}}{148{,}000}$$

   where
   - L = Allowable leakage (makeup water) in gallons per hour (GPH)
   - S = Length of pipe tested in feet
   - D = Nominal diameter of pipe in inches
   - P = Average test pressure maintained during leakage test in psi

2. Test Procedures

   a. After the sanitary sewer force main(s) have been laid and backfilled as specified, the Contractor shall slowly fill the sanitary sewer force main with water and remove/expel all air from the section of force main being tested.

   b. After the section of force main being tested has been filled with water, the test section shall be allowed to stand under static pressure for twenty-four (24) hours prior to the hydrostatic test.

c. The Contractor shall hydrostatic test (pre-test) the test section at the specified test pressure. The pre-test shall continue until the Contractor has satisfied himself that the test section will pass the hydrostatic test.

d. Once the test section has been pre-tested, the specified test pressure shall be supplied by means of the injection booster pump and the Contractor must record the initial pressure reading. After the two (2) hour test period, the Contractor must record the ending pressure reading. District personnel must witness the pressure readings.

e. After the two (2) hour test period, the computed allowable leakage volume (measured by the test water meter) must be injected into the force main test section by means of the injection booster pump. After the allowable leakage volume is added into the force main test section, the Engineer must record the final pressure reading. If the final pressure reading is less than the initial pressure reading, the force main test section has *failed the hydrostatic test*. If the final pressure reading is equal to or greater than the initial pressure reading, the force main test section has *passed the hydrostatic test*. District personnel must witness the pressure readings and leakage volume added.

f. After *passing the hydrostatic test*, remove the pneumatic plugs (test bulkheads) and/or open the line valves of the force main test section.

3. Failure of Hydrostatic Test

Any sanitary sewer force main that has visible leaks or fails the hydrostatic test must be repaired. Upon completion of the repairs and the backfill/compaction operation, the sanitary sewer force main shall be retested as described in the above test procedures. District personnel must witness the sanitary sewer force main repair and backfill operation. The cost of the repair and backfill is incidental to the cost of the project.

4. Acceptance

The sanitary sewer force main shall have passed the hydrostatic test if the force main test section does not exceed the allowable leakage after the two (2) hour test period. If the force main test section contains pipe of various diameters, the allowable leakage will be the sum of the computed leakage for each pipe size.

ALLOWABLE LEAKAGE OF PVC FORCE MAINS IN GALLONS PER HOUR (GPH) AT 150 PSI

PIPE DIA (IN)	100 FT	200 FT	300 FT	400 FT	500 FT	600 FT	700 FT	800 FT	900 FT	1000 FT
4	0.03	0.07	0.10	0.13	0.17	0.20	0.23	0.26	0.30	0.33
6	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
8	0.07	0.13	0.20	0.26	0.33	0.40	0.46	0.53	0.60	0.66
10	0.08	0.16	0.25	0.33	0.41	0.50	0.58	0.66	0.74	0.83
12	0.10	0.20	0.30	0.40	0.50	0.60	0.69	0.79	0.89	0.99

D. HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

1. Overview

   a. Leak Test Temperature. Where possible, test fluid and test section temperatures should be less than eighty (80) degrees Fahrenheit (ºF). At temperatures above eight (80) degrees Fahrenheit (ºF), reduced test pressure is required. Contact the pipe manufacturer for technical assistance with elevated temperature pressure reduction. Since sunlight heating of exposed polyethylene (PE) pipe can result in high pipe temperature, allow time for the test fluid and the test section temperature to equalize before applying test pressure. Bursting can result if test pressure is not reduced for elevated test section temperature.

   b. Leak Test Pressure and Duration. The maximum allowable leak test pressure and leak test time including initial expansion, and time at leak test pressure should be in accordance with the following equation and table:

$$P_{(T)} = \frac{2 \times HDS \times F_t \times H_T}{(DR - 1)}$$

where

$P_{(T)}$ = Leak Test Pressure, psi (MPa), for Leak Test Time, T
T = Leak Test Time, hours
HDS = PE material hydrostatic design stress for water at 73ºF, psi (MPa)
F_t = PE material temperature reduction factor
H_T = Leak test duration factor for leak test time, T
DR = Pipe dimension ratio

The hydrostatic design stress (HDS) for PE3408 is eight hundred (800) psi (5.5 MPa).

LEAK TEST DURATION FACTOR, "H_T"

Leak Test Pressure, $P_{(T)}$, psi (MPa)	Leak Test Time, T, hours	Leak Test Duration Factor, H_T
$P_{(8)}$	≤ 8	1.50
$P_{(48)}$	≤ 48	1.25
$P_{(120)}$	≤ 120	1.00

Various PE materials can have different elevated temperature performance. Consult the PE pipe manufacturer for the applicable temperature reduction factor, F_t.

c. Restraint. The pipeline test section must be restrained against movement in the event of catastrophic failure. Joints may be exposed for leakage examination provided that restraint is maintained.

d. Testing Equipment Capacity. The testing equipment capacity and the pipeline test section should be such that the test section can be pressurized and examined for leaks within test duration time limits. Lower capacity testing and pressurizing equipment may require a shorter test section.

2. Test Procedures

a. After the sanitary sewer force main(s) have been laid and backfilled or properly restrained as specified, the Contractor shall examine the test equipment and pipe test section to ensure that connections are tight, necessary restraints are in place and secure, and components that should be isolated or disconnected are isolated or disconnected. All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.

b. For pressure piping systems where test pressure limiting components or devices have been isolated, or removed, or are not present in the test section, the maximum allowable test pressure for a leak test duration of eight (8) hours or less is one and one-half (1.5) times the system design pressure at the lowest elevation in the section under test. If lower pressure rated components cannot be removed or isolated from the test section, the maximum test pressure is the pressure rating of the lowest pressure rated component that cannot be isolated from the test section. Test pressure is temperature dependent and must be reduced at elevated temperatures.

c. The test section should be completely filled with water, taking care to bleed off any trapped air. Venting at high points may be required to purge air pockets while the test section is filling. Venting may be provided by bleed valves or equipment vents.

d. The test procedure consists of initial expansion and test phases.

   1. For the initial expansion phase, the test section is pressurized to test pressure and make-up water is added as required to maintain maximum test pressure for four (4) hours.

   2. For the test phase, the test pressure is reduced by ten (10) psi. This is the target test pressure. If the pressure remains steady (within five (5) percent of the target test pressure) for an hour, leakage is not indicated.

3. Failure of Hydrostatic Test

   Any sanitary sewer force main that has visible leaks or fails the hydrostatic test must be repaired. If leaks are discovered, depressurize the test section before repairing leaks.

   According to the Plastics Pipe Institute, correctly made fusion joints do not leak. *Leakage at a butt fusion joint may indicate imminent catastrophic rupture. Depressurize the test section immediately if butt fusion leakage is discovered.* Leaks at fusion joints require the fusion joint to be cut out and redone.

   If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.

   Upon completion of the repairs, backfill/compaction operations and application of proper restraints, the sanitary sewer force main shall be retested as described in the above test procedures. District personnel must witness the sanitary sewer force main repair and all other operations. The cost of the repair and all other operations is incidental to the cost of the project.

4. Acceptance

   The sanitary sewer force main shall have passed the hydrostatic test if the pressure of the force main test section remains within five (5) percent of the target test pressure for one (1) hour.

APPENDIX C - REFERENCES

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Utah Administrative Code, *R309-550-7. Separation of Water Mains and Transmission Lines from Sewers and Other Pollution Sources*, State of Utah, accessed 06 July 2020, https://rules.utah.gov/publicat/code/r309/r309-550.htm#T7.

Utah Administrative Code, *Rule R317-3. Design Requirements for Wastewater Collection, Treatment and Disposal Systems*, State of Utah, accessed 06 July 2020, https://rules.utah.gov/publicat/code/r317/r317-003.htm#T2.

ASTM Standards

A48 Standard Specification for Gray Iron Castings

C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C478 Standard Specification for Precast Reinforced Concrete Manhole Sections

C857 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C858 Standard Specification for Underground Precast Concrete Utility Structures

C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

D1784 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3139 Standard Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

D3262 Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe

D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity

D4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile

D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles

D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

D4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679 Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

F2164 Standard Practice of Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure