



DESIGN STANDARDS AND SPECIFICATIONS GUIDE

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February 2006

Updated June 2019

Update by FOUR CORNERS Water & Sewer District

- Added plan requirements.
- Updated specifications with additional details and references to parts that are not obsolete.

FOUR CORNERS Water & Sewer District
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Water

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FOREWORD

Our central water and sewer systems are located in the Four Corners area of Gallatin County, which is eight miles west of Bozeman, Montana and eight miles south of Belgrade, Montana. FOUR CORNERS Water & Sewer District has been formed to operate and maintain these central water and sewer systems in the Four Corners area. By providing these systems with responsible administration, residents will be safer based on the use of modern technology and constant monitoring.

This document has been prepared to assist design engineers, architects, developers, contractors, or other interested individuals with the preparation of plans and specifications for water and sewer infrastructure improvements and extensions so that they will be compatible with the characteristics of the existing system. This is not an all-inclusive policy. All work shall comply with applicable current editions of Montana Public Works Standard Specifications (MPWSS), Montana Department of Environmental Quality (MDEQ) standards, Gallatin County regulations, and local fire district rules & regulations. All connections to the FOUR CORNERS Water & Sewer District will be subject to review and approval by the appropriate agencies and the utility prior to any construction of infrastructure.

I. CONSTRUCTION PLANS REQUIREMENTS

A. GENERAL REQUIREMENTS

1. All required design reports must be submitted and approved by FCWSD. Design reports may be submitted prior to or along with submittal of the plans and specifications.
2. Full-sized plans shall be on 11-inch by 17-inch plan sheets, 22-inch by 34-inch plan sheets, or 24-inch by 36-inch plan sheets. All plans submitted for review and approval will be stamped, signed, and dated by a professional engineer licensed in the State of Montana.
3. All project infrastructure plans must be submitted at the same time. Separate approval of infrastructure elements may be provided if necessary.
4. Plans for water facilities shall be separate from plans for sanitary sewer facilities.
5. Where existing infrastructure is being extended, existing material, size, elevation, horizontal alignment, and grade shall be field-verified, and all critical utility crossings shall be field-verified, prior to plan and specification submittal.
6. Water and sewer plans shall have both plan and profile views of the proposed improvements. Plan and profiles should have the same horizontal scale and be positioned on the plan sheet in a manner that aligns horizontal stations when possible.
7. Project datum and benchmarks shall be clearly identified on the plans.
8. A general location map shall be submitted that shows the project extents and the relationship of each page to the overall project.
9. Plan drawings shall be submitted in English units.

10. Plans should be submitted to FCWSD for review when design has reached the 80% stage. Comments will be returned to the Engineer for inclusion in the 100% plans submitted for approval.

B. DRAWING SCALES

Drawing scales shall be as follows. Other scales will be considered on a case-by-case basis.

1. Plan View: 1" = 50' or 1" = 30'
2. Profile View, Horizontal: 1" = 50' or 1" = 30'
(match plan view scale)
3. Profile View, Vertical: 1" = 5' OR 1" = 3'
(10X Exaggeration from Horizontal)
4. Stationing Interval: 50 feet or 100 feet

C. PLAN VIEW REQUIRMENTS

The following items must be included with all plans. Existing features should be shown using a lighter line weight, shading, or dashed linetype compared to proposed features.

1. Plan Views shall include:
 - a. North Arrow.
 - b. Symbol Legend.
 - c. Property lines and ownership Information.
 - d. Street names and easements with dimensions.
 - e. Alignment stationing.
 - f. Edge of existing paved or gravel surfaced roads.
 - g. Culverts.
 - h. Monument boxes.
 - i. Existing and proposed utilities and structures shall include line size and material where appropriate for the following items:
 - i. Water lines (main lines and service lines),

- valves, and hydrants.
- ii. Sanitary sewer lines (main lines and service lines) and manholes.
- iii. Storm sewer lines, manholes, and inlets.
- iv. Gas lines.
- v. Electric lines, poles, transformers.
- vi. Telephone lines, manholes, junction boxes.
- vii. Cable TV lines and junction boxes.
- viii. Irrigation systems, ditches, and structures.
- ix. Fiber optic lines and structures.
- x. Street lights.
- xi. A proposed method of restoration of all areas disturbed during construction shall be specified.

2. Profile Views shall include:

- a. Vertical and horizontal grids of scales.
- b. Final grade designated using solid linetype.
- c. Existing grade designated using dashed linetype.
- d. Existing utilities where crossed.
- e. Alignment stationing.

D. UTILITY PLAN REQUIREMENTS

1. The following general notes must appear on all plan sets:

- a. All construction will conform to FCWSD standards and detail drawings (latest edition), MPWSS (latest edition) and other applicable MDEQ standards.
- b. Any existing or new valves which control the FCWSD water supply shall be operated by FCWSD personnel only.
- c. Four Corners Water and Sewer District shall be notified at least 24 hours prior to beginning any work.
- d. The contractor shall field-verify line and grade of existing connections.
- e. Contractor shall have an approved SWPPP issued by the agency having jurisdiction.

2. Plans for water facilities shall show, at minimum, the following:
 - a. Size, type, and structural class of proposed new water line(s), including AWWA specifications.
 - b. Bedding class.
 - c. Type of excavation and backfill.
 - d. Existing water lines, including size and material.
 - e. Proposed valves, fittings, fire hydrants, and service lines, with stationing
 - f. Depth of cover from finish grade to the top of proposed water line(s).
 - g. Requirements for pipe deflection, if necessary.
 - h. Type of joint restraint, if required.
 - i. Size of gravity thrust blocks based on calculated design
 - j. Existing or proposed pressure reducing valves, if required.

3. Plans for sanitary sewer facilities shall show, at minimum, the following:
 - a. Size, type, and structural class of proposed new sewer line(s), including American Society for Testing and Materials (ASTM) specifications.
 - b. Slope of each proposed pipeline segment.
 - c. Bedding class.
 - d. Type of excavation and backfill
 - e. Existing sewer lines and manholes including size, material, field-verified invert elevations, and field-verified slopes.
 - f. Proposed manholes with stationing and rim and invert elevations.
 - g. Existing and proposed sewer service lines with size and stationing.
 - h. Existing and proposed cleanouts.

II. UTILITY DESIGN CRITERIA

A. WATER DISTRIBUTION LINES AND DESIGN CRITERIA

1. All additions or modifications to the FCWSD water system will be designed in accordance with the criteria set forth in this and other sections of this Guide as approved by FCWSD. Polyvinyl Chloride (PVC) Pressure Pipe (Northern Pipe Products PVC AWWA C-900, or equivalent) shall be used exclusively unless special approval, in writing, of alternate materials is given by FCWSD. Ductile iron pipe (ASTM A536) with a minimum pressure rating of 250 psi shall be installed in buildings, beneath structures, and in vaults. The ductile iron pipe shall extend a minimum of 2 feet from buried vaults and 5 feet from building foundations. Bends and fittings shall also be ductile iron pipe with mechanical joints compatible with PVC pipe materials. Mechanical joints shall be restraint type glands. All additions to the water system will also be designed and installed in accordance with MPWSS, MDEQ, and applicable Fire District Standards.
2. Master Water Plan: A master water plan may be required at the discretion of FCWSD for each subdivision or other major development prior to approval of any portion of the water system. An overall plan of the development, including all areas outside of the study area which would naturally be served through the study area shall be submitted to ensure that main location and sizes will allow for future connections. No irrigation water will be provided by FCWSD unless specifically agreed to as part of a master water plan process.
3. Design Report: A design report prepared by a professional engineer licensed in the State of Montana demonstrating compliance with these requirements shall be submitted to and approved by FCWSD concurrently with MDEQ review. Design parameters and the critical conditions shall be shown on an overall plan of the new service area. An overall plan of development, including all areas outside of the study area which would naturally be served through the study area may be required by FCWSD.
4. Main Size: The water distribution system shall be designed to meet the maximum day demand plus fire flow and the peak hour demand. The design shall be based on a maximum day to average day ratio of 3:1 (for an average daily usage of 100-gallons per day per person and 2.5 persons per household), plus fire flow demand as determined by ISO (Insurance

Services Office) criteria. A “C” Factor of 130 shall be used in modeling system designs. The working residual water pressure shall not be less than 20-psi at any point in the water distribution under maximum day plus fire flow or peak hour demands. The velocity of the water in the system shall not exceed 15-feet per second through a main line. The minimum diameter for any new main is 6-inch. Water and sewer mains that cross perpendicularly shall have a minimum of 18-inches of vertical separation and be separated by a minimum of 11 feet horizontally. Water mains shall be installed with sufficient cover to prevent freezing. Water mains installed with less than 6.5 feet of cover require justification by the design engineer.

5. Main Extensions: All main extensions shall be looped, where possible at the discretion of FCWSD. All dead end mains shall end with a fire hydrant or blow-off hydrant, preferable above grade. Permanent dead-end mains shall not exceed 500-feet long. Temporary dead-end mains scheduled for future extension may end with a temporary at-grade blow-off in lieu of a fire hydrant or blow-off hydrant at the discretion of FCWSD. A mainline valve will be installed at the dead end prior to the cap to prevent interruption of service when line is extended. See Figure Numbers 02660-5 and 02660-6 for depictions of blow-off hydrants. All water mains shall be installed with tracer wire and detectable tape marked “water” for future locating. Tracer wire on mains is to be brought to surface alongside hydrants only, not in valve boxes.
6. Services: Water services shall be installed in accordance with the following unless otherwise approved or required by FCWSD.
 - a. A water line is designated as either a service line or water main based on its use, not its size. Generally, a line serving a single building or facility is considered a service line. A line that either serves or intends to serve more than one building is generally designated as a water main. The standard sizes of service lines are 3/4-, 1-, 1½-, 2-, 4-, 6-, or 8- inch. Fire service lines shall be a separate service and shall be sized by licensed fire suppression professional.
 - b. Residential water service stubs shall be installed in accordance with Figure Number 02660-1. Residential water service pipe shall be IPS polyethylene pressure pipe and shall conform to AWWA C901 (Polyethylene

(PE) Pressure Pipe, Tubing and Fittings 3/4-inch through 3-inch for Water) and ASTM PE 3406-3408. Plans and specifications prepared by a Professional Engineer licensed in the State of Montana shall be submitted to FCWSD for service lines larger than 4-inch.

- c. Commercial water service stubs shall be installed in accordance with Figure Number 02660-1. Commercial water service pipe shall be 4-inch or larger PVC (Northern Pipe Products PVC AWWA C-900, or approved equal). The services shall have a gate valve located at the main line and have a tapped end-cap with an IPS polyethylene pressure pipe blow off extending to the ground surface.
- d. The service line stubs shall generally be installed at the center of each lot, to 8-10 feet inside the lot line. Water services shall be located in accordance with Figure Number 02660-2. Water services and sewer services are required to have a minimum of 8-feet of horizontal separation. All water services will be installed with tracer wire from the main to its termination at the curb stop. Tracer wire for services to be brought to the surface alongside curb valve box. An easement shall be provided to allow access to the curb stops located inside the lot line.
- e. Corporation Stops shall be brass corporation stops with inlet end to suit tapping requirements and compression outlet for IPS polyethylene pipe. Corporation stops shall be Mueller H-15005N compression fittings, or an Engineer- approved equal.
- f. Service saddles, where required, shall be flat, double strap saddles, stainless steel with NPR gaskets and corporation stop threads. Service clamps shall be Romac Style 306 Service Saddle, or approved equal. Service clamps for PVC shall provide full support around the circumference of the pipe with a bearing area of sufficient width along the axis of the pipe so that the pipe will not be distorted when the clamp is tightened.
- g. Curb stops shall be a ball type valve with Minneapolis pattern screw mount. Curb stops shall be Mueller Model H-15156N, or Engineer-approved equal.

- h. Curb boxes shall be extension type and shall have an extended length of 7.0 feet. Curb boxes furnished shall be Mueller model H-10300, or Engineer-approved equal. Curb boxes shall include a stationary rod.
- i. No service line shall be extended into a building until an "Application for Service Permit" has been completed and approved by FCWSD.
- j. Backflow prevention devices shall be installed on each fire and domestic service line. Meters will be supplied by FCWSD and installed on all service lines, including fire service lines, by the contractor and inspected by FCWSD. Meter pits shall not be used unless specifically approved by FCWSD. Each unit within a multi-unit building must have its own separate meter for domestic use.
- k. All service connections shall be uniform in size from the service tap to the building structure or structures unless otherwise approved or required by FCWSD. FCWSD shall reserve the right to require a larger service connection to any building, structure, or development if the water requirements, when calculated by the fixture unit method, as specified in the Uniform Plumbing Code, cause the service line to exceed ten (10) feet per second.
- l. Each service line and meter shall supply a specific building or unit within a multi-unit building. For multi-unit buildings with single service:
 - i. Each unit shall have a separate meter and shut-off valve that is clearly and permanently labeled based on the unit it serves. Meters installed in crawl spaces shall be installed in the crawl space of the unit it serves. Grouping of meters in one crawl space is not allowed.
 - ii. Shut-off valves and water meters must be accessible by FCWSD at all times. Access may be provided by the following means:
 - A. Access easement may be provided to FCWSD for valves and meters located outside of buildings on

private property.

- B. If manifolding a service within a heated room in a building, a physical key or access code must be provided to FCWSD. A plumbing plan must be submitted to FCWSD for review and approval prior to construction.
 - m. All service line stubs shall be sized to adequately serve the maximum anticipated demand for the property being served.
 - n. Separate irrigation water supply service design, if proposed, will be reviewed by FCWSD to ensure separation from the potable water system. Irrigation water services shall be located a minimum of 8' from potable water services and will not be allowed to terminate within any structure. Measures shall be taken in the design to prevent cross-connection of the potable and irrigation water system components.
7. Valves: Valves shall be installed in accordance with the following unless otherwise approved or required by FCWSD.
- a. Gate valves shall be iron body, resilient seat gate valves with non-rising stems with design, construction and potable rating conforming to AWWA C509 and ANSI/NSF 61. Main line gate valves for underground installation shall be mechanical joint by mechanical joint with thrust restraint and shall have a 2-inch square operating nut for key operation. All valves shall open counter clockwise. Valves shall be Mueller A-2360 series resilient gate valves, AVK Series 65 ductile iron gate valves, or Engineer-approved equal.
 - b. Every leg of a main intersection shall have a valve. Water main valves shall be located in accordance with Figure Number 02660-2.
 - c. All connections to an existing water main will begin with a new valve and have a detailed plan for disinfection and testing.
 - d. Valves shall be located at not more than 500-foot intervals in commercial districts and at not more than

one block or 800-foot intervals in other areas.

- e. Valves shall be placed so that the main shut-downs can be accomplished with only one fire hydrant being out of service at a time.
 - f. Valve boxes shall be cast iron, 5 ¼-inch diameter, adjustable valve boxes with base as required for the valve size used. Valve boxes shall be of the screw type and of sufficient length for the pipe bury as specified. The cast iron cover of the valve box shall have the word "Water" stamped thereon. Valve boxes shall be SIGMA VB630DD, or an Engineer-approved equal.
 - g. Valve boxes where the valve nut is greater than 8 feet below ground surface shall have an extension rod attached to the valve nut. The top of the extension rod nut should be between 6' and 7' below lid.
 - h. All valve boxes shall be located in finished asphalt unless specifically approved by FCWSD
8. Hydrants: Hydrants shall be installed in accordance with the following unless otherwise approved or required by FCWSD.
- a. Hydrants shall be Mueller Super Centurion, AVK Series 2780, or an Engineer-approved equal. Hydrants shall be connected to the flange side of a 6-inch (flange by mechanical joint) gate valve and connected to the hydrant lead. Hydrants shall be a minimum of 7.0' tall from bury line to water main invert and be designed taller for larger sized mains. Hydrant assemblies shall be installed in accordance with Figure Number 02660-3.
 - b. Hydrants shall be provided at each street intersection and at intermediate points so that hydrants are spaced from 350- to 600-feet depending on the area being served and according to the requirements of the applicable fire authority. Mid-block hydrants shall be installed in line with lot lines. See Figure Numbers 02660- 2, and 02660-4.
9. Air Relief: Air relief shall be provided at all high points in the line where air can accumulate by means of hydrants, services, or other air relief valves.

10. Pressure Reducing Valves: Pressure reducing valves shall be installed when the anticipated average-day line pressure exceeds 120 psi.

11. Thrust Restraint: All thrust restraint shall be designed to withstand the test pressure or the working pressure plus the surge allowance, whichever is larger. Adequate factors of safety shall be employed in the design. Mechanical joint restraints shall be EBAA Iron Series 2000PV, Romac ALPHA Series, or Engineer-approved equal. Bell restraints for PVC pipe shall be EBAA Series 1600, or Engineer-approved equal. All water system piping will be pressure tested in accordance with the current edition of MPWSS at a test pressure no less than 150 psi.

B. SANITARY SEWER SYSTEM DESIGN CRITERIA

1. All additions or modifications to the FCWSD sanitary sewer system will be designed in accordance with the criteria set forth in this and other sections of this Guide as approved by FCWSD. All additions to the sewer system will also be designed and installed in accordance with MPWSS, MDEQ, and applicable local standards.
2. Master Sewer Plan: A master sewer plan may be required by FCWSD for each subdivision or other major development prior to approval of any portion of the sewer system. An overall plan of the development, including all areas outside of the study area which would naturally be served through the study area shall be submitted to ensure that main location and sizes will allow for future connections.
3. Design Report: A design report prepared by a professional engineer licensed in the State of Montana demonstrating compliance with these requirements shall be submitted to and approved by FCWSD concurrently with MDEQ review. Design parameters and the critical conditions shall be shown on an overall plan of the new service area. An overall plan of development, including all areas outside of the study area which would naturally be served through the study area may be required by FCWSD.
4. New sewer lines shall be sized to flow at no more than 75-percent of full capacity at peak hour conditions upon the full build-out of the development. The effects of the proposed development's sewer loading on existing downstream sewer lines shall be analyzed.
5. New sanitary sewer lines to serve residential areas shall be designed to accommodate an average daily flow rate of 100-gallons per person per day with 2.5 persons per household per Circular DEQ-2 and the Gallatin County Census Data. Residential densities for new developments shall be calculated based on anticipated property usage.
6. New sanitary sewer lines to serve non-residential areas shall be designed to accommodate the average daily flows based on Circular DEQ-4, Tables 5.1 & 5.2 or as approved by FCWSD. All non-residential services shall contain applicable pre- treatment devices to ensure that wastewater entering the sewer system is residential-type wastewater. Pre-treatment shall be reviewed and approved by FCWSD on a case by case

basis.

7. A Manning's friction factor of 0.013 shall be used in designing new sewers. A peaking factor shall be calculated for each pipe segment based on the following formula;

$$\frac{Q_{max}}{Q_{ave}} = \frac{18+P^{1/2}}{4+P^{1/2}} \quad (P = \text{Population in thousands})$$

8. **Manholes:** Manholes shall be installed in accordance with the following unless otherwise approved or required by FCWSD.

- a. Construct manholes from precast concrete sections having frames, covers, and steps in accordance with Figure Numbers 02730-1 and 02730-2. Manholes shall meet ASTM C478; "Precast Reinforced Concrete Manhole Sections", specifically including mandatory rejection requirements. Steps shall be manufactured by M.A. Industries Inc., or Engineer-approved equal. Frames and covers shall be D&L A-1172 frame with "SANITARY SEWER", or Engineer-approved equal. Manhole lids shall include a gasketed infiltration control pan and internal chimney seal. A watertight bolt-down lid may be required at FCWSD's discretion in areas where water infiltration is likely.

- b. **Manhole Spacing and Location:** The maximum distance between manholes shall be as follows:

<u>SEWER PIPE SIZE</u>	<u>MAXIMUM DISTANCE</u>
8" to 15"	400'
18" to 30"	500'
Larger than 30"	600'

All Manhole lids shall be located in finished asphalt or concrete surfaces unless specifically approved by FCWSD. Any manholes approved for installation outside of asphalt shall have access, reinforced concrete collars, and carsonite markers provided.

- c. All manholes installed shall have watertight exterior joint wrap installed at all joints to prevent infiltration into the structure. Additionally, all manholes shall have a waterproof coating

installed.

- d. **Barrel Size:** The alignment and number of pipes into the manhole will determine the barrel size of pipe used. All 48-inch manholes will have eccentric cone top sections if the total manhole height is greater than six feet. All other manholes will be straight with flat tops. All drop manholes shall be “inside drop” with a minimum barrel diameter of 60-inch. The internal diameter of the manhole barrel shall be typically as follows:

<u>SEWER PIPE SIZE</u>	<u>BARREL SIZE</u>
12” or less	48”
15” to 27”	60”
30” to 48”	72”

- e. **Manhole Channels:** All manholes shall have full depth channels. When a smaller main is being connected to a larger main at a manhole, the manhole inverts shall be set so that the 8/10 depth of flow of each main is equal in elevation. The minimum drop across a manhole (invert in to invert out) is 0.1’ (cut-in manholes excepted). A drop across the manhole of 0.2’ is recommended where grade permits.
9. **Sanitary Sewer Mains:** The minimum diameter of a sewer main is 8-inches. Main size lines shall be sized for flow, not available slope. PVC pipe shall be used for all gravity flow mains unless other materials are specifically approved. PVC sewer pipe shall meet ASTM D1784, “Rigid Polyvinyl Chloride Compounds” requirements and ASTM D3034, “Standard Specifications for Polyvinyl Chloride Sewer pipe and Fittings”, with an SDR of 35 4”-15”. Sewers shall be installed at a sufficient depth to receive water from basements and to prevent freezing. Sewers must not be installed with less than 4 feet of cover over the pipe without justification by the design engineer. Sewer and water mains that cross perpendicularly shall have a minimum of 18-inches of vertical separation. All sewer mains shall be installed with detectable tape marked “sewer”.
10. **Sanitary Sewer Services:** The minimum diameter of a service is 4-inch. Service pipe shall be SDR 35, PVC, pipe conforming to ASTM D3034. Services shall connect to the main with in-line gasketed wyes for new services. Addition of services to existing sewer mains shall connect using GPK 101-Series solvent weld saddle wye and stainless steel clamps or Inserta Tee ® with stainless steel band. The service line stub, from the

main to 8- 10 feet inside the property line or easement line, shall be installed with a maximum slope of ½-inch per foot. The minimum slope of a 4-inch service stub is ¼ -inch per foot. The minimum slope of a 6-inch service line stub is 1/8-inch per foot. Sewer service line stubs will typically be installed 15-feet from the downstream lot line, to 8-10 feet inside the property line. Services are to be installed perpendicular to the main except at end of main locations such as cul-de-sacs. Sanitary sewer services shall be installed in accordance with Figure Numbers 02660-2 and 02730-4. Sewer services and water services are required to have a minimum of 8-feet of horizontal separation. Sewer services that cross water mains shall be installed below water mains with a minimum of 6-inches of vertical separation.

11. A sewer cleanout must be placed within 3 feet of any building, at any 45-degree or greater bend, at pipe size transition points, and placed at a maximum 100-foot interval for long straight runs in compliance with the Uniform Plumbing Code. See Figure Number 02730-4.
12. Access Roads: A 12'-wide all-weather gravel access road shall be constructed to provide access to all sanitary sewer manholes and lift stations not located within a paved public or private street or parking lot.
13. Sanitary Sewer Lift Stations:
 - a. Lift Station wet wells shall be watertight pre-cast concrete or fiberglass structures with a minimum inside diameter of 72" or minimum inside dimensions of 10'x10'. Wet wells installed in high groundwater areas will be watertight. Concrete wet wells shall be installed with a watertight exterior joint wrap at all joints and a waterproof exterior coating. The interior of concrete wet wells shall be epoxy-coated to ensure resistance to fumes created from domestic wastewater. Concrete structures should be fully-cured prior to application of epoxy, with surface preparation and installation performed per manufacturer specifications. Epoxy coating shall be spray-applied Tnemec Perma-shield FR Series 436 with a minimum dry film thickness of 50 mils, or approved equal. Buoyancy calculation will be required as part of the Engineer's design report. Penetrations into the wet well shall be watertight (cast-in Z-Lock gaskets for concrete structures or fabricated pipe flanges for fiberglass structures). Each wet well will have a lockable

hatch. Hatches for concrete structures shall be aluminum and cast into the concrete lid, providing for access to and removal of the submersible pumps. Hatches shall include safety grate when hatch is open. All wet wells shall contain a hopper bottom sloped toward the pumps. Each wet well will contain a carbon filter with a standpipe to 18" above the ground surface with a protective shield. Other structure sizes or basic design characteristics may be reviewed by FCWSD on a case by case basis.

- b. Lift Station valve vaults shall be watertight pre-cast concrete structures with an inside diameter of 72" (minimum) or inside dimensions of 6'x10' (minimum). Valve vaults shall be installed with watertight exterior joint wrap at all joints and a waterproof exterior coating for concrete structures. Buoyancy calculation will be required as part of the Engineer's design report. Penetrations into the valve vault shall be Z-Lock gaskets cast into the concrete. Each valve vault will have a traffic-rated D&L A-1173 with insulated dust pan and cover along with access steps cast into the wall. All valve vaults shall contain a check valve, manually operated valves for each pump, a Badger magmeter flow meter, a sump pump and check valve, and 120V power along with a timer-operated light fixture. Valve vaults shall have bypass piping to allow servicing. Bypass piping shall be installed upstream of the flow meter and downstream of any wyes or manifolds and check valves. Bypass piping shall penetrate the top of the valve vault and have a weather-resistant female camlock coupler. Bypass piping penetrations shall be sealed using cast-in seals or approved equal. Refer to Figures 02730-5 and 02730-6.
- c. Lift Station pumps shall be manufactured by HOMA Pump Technology or approved equal explosion-proof, non-clog submersible pumps with rail system and lifting chain. Each lift station will have a minimum duplex pump configuration and be variable frequency drive (VFD). An Engineer's design report containing pumping conditions shall be submitted to FCWSD for review and approval.
- d. Piping inside the lift station and valve vault to 5 feet outside the concrete structures shall be Class 51 ductile iron pipe. Piping shall have ANSI 150 flanged ends or flange adapters for plain ends with thrust

restraint provided.

- e. Backup power shall be provided for each lift station site based on the power needs of the pumps and electrical panel/telemetry installation. Power generation shall be accomplished by a Cat/Olympian or approved equal natural gas fired engine in a weather-proof enclosure designed for sound dampening. The backup power package shall be connected to an ASCO transfer switch or approved equal.
- f. An electrical panel installation shall be adjacent to all lift station vaults containing a transformer pad according to NW Energy specifications, a service meter, main shut-off breaker, variable frequency drive control, a backup power transfer switch, a 120-volt transformer, a 120-volt breaker box, and a telemetry enclosure provided by M.E.T Automation and Controls or approved equal. Electrical and telemetry components will be located in a small building enclosure. An option for housing the electrical components using NEMA weather approved boxes mounted to rails anchored in concrete may be discussed with FCWSD where a building enclosure is not feasible. All electrical and telemetry components shall be reviewed and approved by FCWSD.
- g. Typical lift station installations are shown in Figures 02730-6 and 02730-7. A tour of existing FCWSD lift station infrastructure is encouraged prior to initiating new designs.
- h. Pressure testing of lift station and valve vaults will be required to determine water-tightness of the sewer components. Testing shall conform to the current edition of MPWSS.
- i. Security fencing of sewer components such as the lift stations, electrical enclosures, and backup power generators may be required at the discretion of FCWSD.