

# **CHAPTER 5**

## **SANITARY SEWER DESIGN STANDARDS**

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## CHAPTER 5

### SANITARY SEWER

#### 5-000 General Considerations

5-010 General Sanitary sewerage refers to wastewater derived from domestic, commercial, and industrial pretreated waste to which storm, surface, and ground water are not intentionally admitted.

Any extension of or connection to Marysville's sanitary sewer system must be approved by the Engineering Department and must conform to the City of Marysville's Comprehensive Sanitary Sewer Plan.

Within the corporate City limits where a public sewer is available it must be used (M.M.C. 14.01.050).

The standards established by this chapter are intended to represent the **minimum** standards for the design and construction of sanitary sewer facilities. Greater or lesser requirements may be mandated by the City due to localized conditions. Washington State Department of Ecology's Criteria for Sewage Works Designs shall also be utilized by the city in its review and approval of system connections, extensions, and/or modifications as well as the most recent addition of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

Anyone who wishes to extend or connect to the City's sewer system should contact the Engineering Department for a sewer extension/connection fee estimate of the costs due the City for a sewer extension or connection, per M.M.C. 14.01.030 Application for Utility Service.

Prior to the release of any water meters, connection to the public sewer system must be completed and all connection/capital fees, recovery fees, main fees, inspection fees, and other applicable fees must be paid prior to any commercial or subdivision final approval.

Maintenance of the building or side sewer shall be the responsibility of the property owner to the main line. At the City's discretion maintenance and/or repair to side sewers within City right of way will be required to be completed by the city and billed to the property owner.

5-100 Design Standards The design of sanitary sewer systems shall be dependent on local site conditions. The design elements of sanitary sewer systems shall conform to minimum City Standards set forth herein and follow current design practice and in compliance with M.M.C. 14.03. All sewers shall be designed as a gravity sewer whenever physically and/or economically feasible or as outlined in the Comprehensive Sanitary Sewer Plan.

A. Detailed engineering plans shall be submitted for the City's review. The plans shall indicate the location, size, and the type of pipe material for the proposed sewers and the connection with existing sewers. These plans shall be separate from water plans.

B. Plans and profiles shall show:

- Location of streets, right-of-ways, easements, existing utilities, and sewers.
- Ground surface, pipe type, class and size, manhole stationing, invert and surface elevation at each manhole, and grade of sewer between adjacent manholes. All manholes shall be numbered on the plans and correspondingly numbered on the profile. Where there is any question of the sewer being sufficiently deep to serve any residence, the elevation and location of the basement floor, if basements are served, shall be plotted on the profile of the sewer which is to serve the house in question. The Developer shall state that all sewers are sufficiently deep to serve adjacent basements, except where otherwise noted on the plans.
- All known existing structures, both above and below ground.
- All utility easements, including County recording numbers.

- Details in scale drawings which clearly show special sewer joints and cross-sections, and sewer appurtenances such as manholes and related items and all other items as required by the City to clearly identify construction items, materials, and/or methods.
- C. Construction of new sewer systems or extensions of existing systems will be allowed only if the existing receiving system is capable of supporting the added hydraulic load. Sewers shall be extended to the far property line(s) to facilitate future extensions of same.
- D. Collection and interceptor sewers shall be designed and constructed for the ultimate development of the tributary areas.
- E. Sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of infiltration and inflow.
- F. Computations and other data used for design of the sewer system shall be submitted to the City for approval.
- G. The sewage facilities shall be constructed in conformance with the most recent edition of the Standard Specifications for Road, Bridge, and Municipal Construction, and current amendments thereto, State of Washington, revised as to form to make reference to Local Governments, and as modified by any special City requirements and standards contained herein.
- H. Material and installation specifications shall contain appropriate requirements that have been established by the industry in its technical publications, such as ASTM, AWWA, WPCF, and APWA standards. Requirements shall be set forth in the specifications for the pipe and methods of bedding and backfilling so as not to damage the pipe or its joints, impede cleaning operations and future tapping, nor create excessive side fill pressure or ovalation of the pipe, nor impair flow capacity.
- I. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer because of the width and depth of trench should be

made. When standard-strength sewer pipe is not sufficient, extra-strength pipe shall be used.

J. The Developer shall be required, upon completion of the work and prior to acceptance by the City, to furnish the City with a written guarantee covering all materials and workmanship for a period of two years after the date of final acceptance and the Developer shall make all necessary repairs during that period at his own expense, if such repairs are necessitated as the result of furnishing poor materials and/or workmanship. The Developer shall obtain warranties from the contractors, subcontractors and suppliers of material or equipment where such warranties are required, and shall deliver copies to the City upon completion of the work.

K. Sewer mains to be installed shall be of material noted below:

Gravity sewer:

Less than 5' cover over top of pipe: D.I.P. Class 52, or C-900: City engineer approval required.

5' – 18' cover over top of pipe: PVC, ASTM D 3034, SDR 35 or ASTM F 789.

Greater than 18' cover over top of pipe: D.I.P. Class 52, or C-900.

Use D.I.P. with anchors and hill holders on slopes of 15% percent or greater.

Forcemain:

Use D.I.P. Class 52 for all depths.

5-105 Gravity Sewer Design Standards The design of any sewer extension/connection shall conform to City Standards, Department of Ecology's 2008 "Criteria for Sewage Works Design" or current addition, and any applicable standards as set forth herein.

The layout of extensions shall provide for the future continuation of the existing system as determined by the City.

New gravity sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. See the following DOE table on Design Basis for Sewage. This figure is assumed to cover normal infiltration, but an additional allowance shall be made where conditions are unfavorable. Generally, laterals and submain sewers should be designed with a peaking factor of 4 to be applied to the average daily per capita flow rate.

Therefore, laterals and submain sewers should be designed to carry, when running full, not less than 400 gallons daily per capita contributions of sewage. When deviations from the foregoing per capita rates are used, a description of the procedure used for sewer design shall be submitted to the Department of Public Works for review and approval.

**TABLE 2. DESIGN BASIS FOR NEW SEWAGE WORKS**

Taken from: "Criteria for Sewage Work Design"

By: State of Washington Department of Ecology, ~~October 1998~~ August 2008

Discharge Facility	Design Units	Flow* (gpd)	BOD (lb./day)	SS (lb./day)	Flow Duration (hr)
Dwellings	per person	100	0.2	0.2	24
Schools with showers and cafeteria	per person	16	.04	.04	8
Schools without showers and with cafeteria	per person	10	.025	.025	8
Boarding schools	per person	75	0.2	0.2	16
Motels with 65 gal/person (rooms only)	per room	130	0.26	0.26	24
Trailer courts at 3 persons/trailer	per trailer	300	0.6	0.6	24
Restaurants	per seat	50	0.2	0.2	16
Interstate or through highway restaurants	per seat	180	0.7	0.7	16
Interstate rest areas	per person	5	0.01	0.01	24
Service stations	per vehicle services	10	0.01	0.01	16
Factories	per person per 8-hr shift	15-35	0.03-0.07	0.03-0.07	Operating Period
Shopping Centers	per 1,000 sq. ft. of ultimate floor space	200-300	0.01	0.01	12
Hospitals	per bed	300	0.6	0.6	24
Nursing homes	per bed	200	0.3	0.3	24
Homes for the aged	per bed	100	0.2	0.2	24
Doctor's office in medical center	per 1,000 sq. ft.	500	0.1	0.1	12
Laundromats, 9 to 12 machines	per machine	500	0.3	0.3	16
Community colleges	per student and facility	15	0.03	0.03	12
Swimming pools	per swimmer	10	0.001	0.001	12
Theaters, drive-in type	per car	5	0.01	0.01	4
Theaters, auditorium type	per seat	5	0.01	0.01	12
Picnic areas	per person	5	0.01	0.01	12
Resort camps, day & night, with limited plumbing	per campsite	50	0.05	0.05	24
Luxury camps with flush toilets	per campsite	100	0.1	0.1	24

\*Includes normal infiltration

5-110 Main Line - Gravity

- A. Size. Sewer mains shall be sized for the ultimate development of the tributary area. Nothing shall preclude the City from requiring the installation of a larger sized main if the City determines a larger size is needed to meet the requirements for future service.  
\*See code on over\_sizing.

The minimum size for sub\_mains and mains shall be 8 inch inside diameter. The minimum size for a side service shall be 6 inches. See definitions in Chapter 1-025.

A 6-inch diameter main may be approved if it meets all of the following criteria as outlined in Section C1-4 of the Department of Ecology's "Criteria for Sewage Works Design" 1998 version, and with the Public Works Director's approval.

The design is subject to all other design requirements as noted in this Chapter.

- B. Material. Sewer main shall be PVC, ASTM D 3034, SDR 35 or ASTM F 789 with joints and rubber gaskets conforming to ASTM D 3212 and ASTM F 477.

If ductile iron pipe is shown on the plans, it shall conform to ANSI A21.51 or AWWA C151 and shall be cement mortar-lined, push-on joint, minimum thickness Class 52.

- C. Depth. Gravity sewer shall have a minimum depth of 5 feet to provide gravity service to adjoining parcels, adequate head room within manholes for maintenance personnel and vertical clearance between water and sewer lines. Actual depth will be determined by slope, flow, velocity, and elevation of existing system.

- D. All building sewer connections to the main shall be made with a tee connection. All new mains connecting to existing mains shall require the installation of a new manhole if the connection is not made at an existing manhole.

5-115 Connection to Existing System

- A. At connection to existing system, all new sewer connections shall be physically plugged until all tests have been completed and the City approves the removal of the plug.

- B. Connection of new pipe lines to existing manholes shall be accomplished by using provided knock-outs. Where knock-outs are not available, the manhole shall be core drilled for connection. The transition of connecting channels shall be constructed so as not to interrupt existing flow patterns.
- C. Connection of a pipe line to a system where a manhole is not available shall be accomplished by setting a new manhole, unless otherwise approved by the City Engineer. The existing pipe shall not be cut into until approval is received from the City.
- D. Connections to manholes requiring a drop shall follow the criteria as outlined in Section 5-140.
- E. Connections where an existing stub out is not available or where a new building sewer is the same size as the existing main shall be accomplished by the installation of a new manhole, unless otherwise approved by the City Engineer.
- F. Taps shall not be allowed to protrude more than 1 inch into the existing main. A City inspector shall be notified 48 hours prior to any tap of a City sewer. A City Inspector shall be present to witness the tap.
- G. Couplings and O-ring adapters utilized for joining pipes of dissimilar materials such as cast iron soil pipe to ductile iron pipe or cast iron to vitrified clay, and/or for making secure watertight connections between pipes of different nominal sizes such as a 4 inch building sewer to a 6 inch lateral, shall be flexible elastomeric polyvinyl chloride (PVC) as manufactured by Fernco, Inc. or Engineer approved equal. Couplings shall be supplied with 316 stainless steel band clamps, fasteners and shear rings as applicable to the sizes and types of pipes to be connected together. Couplings and adapters shall conform to applicable parts.

5-120 Manholes Precast manholes shall meet the requirements of ASTM C 478 with either a precast base or a cast-in-place base made from 3000 psi structural concrete. Manholes shall be Type 1, 48-inch diameter minimum for depths 8 feet and over and type 3, 48-inch diameter for depths under 8 feet. See Standard Plans 5-120-001 through 5-120-004. The minimum clear opening in the manhole frame shall be 24 inches. Joints shall be rubber gasketed conforming to ASTM C 443 and shall be grouted from the inside and outside. Lift holes shall be grouted

from the outside and inside of the manhole. All inside grouting shall be brushed finished. The manholes shall be manufactured with exterior water proofing to within 3-inches from all joints. Following manhole installation, all interior and exterior joints shall be grouted. The exterior joints shall also receive a water proof coating that overlaps the manufacturer's water proofing by a minimum of 1-inch. (See SP 5-120-005 for locations requiring manholes to be water-proofed.)

Eccentric manhole cone shall be offset so as not to be located in the tire track of a traveled lane.

Manhole frames and covers shall be cast iron casting marked "Sewer" conforming to the requirements of ASTM A-30, Class 25, and shall be free of porosity, shrink cavities, cold shuts or cracks, or any surface defects which would impair serviceability. Repairs of defects by welding or by the use of smooth-on or similar material will not be permitted. Manhole rings and covers shall be machine-finished or ground-on seating surfaces so as to assure non-rocking fit in any position and interchangeability. Manholes located in areas subject to inflow shall be equipped with a PRECO sewer guard watertight manhole insert or approved equal. Manhole frames and covers shall be installed on a minimum of eight inches (8") of standard radial manhole adjustment bricks.

Where lock-type castings are called for, the casting device shall be such that the cover may be readily released from the ring and all moveable parts shall be made of non-corrosive materials and otherwise arranged to avoid possible binding.

All manholes shall be waterproofed with MC-TAR waterproofing membrane or equal.

All castings shall be coated with bituminous coating prior to delivery to the job site.

Safety steps shall be fabricated of polypropylene conforming to an ASTM D-4101 specification, injection molded around a 1/2-inch ASTM A-615 grade 60 steel reinforcing bar with anti-slip tread. Steps shall project uniformly from the inside wall of the manhole. Steps shall be installed to form a continuous vertical ladder with rungs equally spaced on 12-inch centers.

Gravity sewers shall be designed with straight alignment between manholes.

Manholes shall be provided at a maximum of 400 foot intervals for 8 inch to 15 inch sewers, 500 foot intervals for 18 inch to 24 inch sewers, at intersections, and at changes in direction, grade, or pipe size. Greater spacing may be permitted in larger sewers.

Minimum slope through the manhole shall be 1/10th of one foot from invert in to invert out.

Manhole sizing shall be determined by the following criteria:

A. 48" Manhole

1. 2 connecting pipes, 8 inch to 12 inch diameter
2. 3 connecting pipes, 8 inch to 10 inch diameter, perpendicular
3. 4 connecting pipes, 8 inch diameter, perpendicular

B. 54" Manhole

1. 2 incoming pipes, 8 inch to 12 inch with less than 45° deflection
2. 3 connecting pipes, 10 inch to 12 inch diameter, perpendicular
3. 4 connecting pipes, 10 inch to 12 inch diameter, perpendicular

C. 72" Manhole

1. 2 incoming pipes, 15 inch to 18 inch diameter with less than 45° deflection
2. 3 connecting pipes, 15 inch diameter, perpendicular
3. 4 connecting pipes, 15 inch diameter, perpendicular

In the above criteria "deflection" refers to the angle between any 2 pipe channels in the manhole. Minimum deflection between incoming and outgoing pipes is 80 degrees.

For other pipe configurations, the size of the manhole shall be approved by the City.

The above configurations will provide adequate shelves and room for maintenance and performing T.V. inspections. Minimum shelf width shall be 15" from the edge of channel to the manhole wall at the widest point.

5-125 Slope All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second based on Mannings formula using an “n” value of 0.013. Use of other practical “n” values may be permitted by the City if deemed justifiable on the basis of research or field data submitted. The following minimum slopes should be provided; however, slopes greater than these are desirable.

Sewer Size (Inches)	Minimum % Slope % (Feet per 100')
6	1.00
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

Under special conditions, slopes slightly less than those required by the 2.0 feet per second velocity may be permitted by the City Engineer. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for the design average flow. Whenever such decreased slopes are proposed, the design engineer shall furnish with the plans his computations of the depths of flow in such pipes at minimum, average, and daily or hourly rates of flow. Larger pipe size shall not be allowed to achieve lesser slopes.

Sewers shall be laid with uniform (constant) slope between manholes.

5-130 Increasing Size Manholes shall be provided where pipe size changes occur.

Where a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

5-135 High Velocity Protection Where velocities greater than 15 feet per second are expected, special provisions such as thrust blocking and piping materials such as ductile iron shall be made to protect against displacement by erosion and shock.

5-140 Drops Straight grades between invert out of last manhole and connection to existing are preferred over drops whenever possible. Care must be taken when designing steep grades or sweeps so as not to create a situation of excessive velocity or excavation. Grade changes associated with "sweeps" shall not be allowed unless otherwise approved by the City Engineer.

A drop connection shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall have a fillet to prevent solids deposition.

An inside drop connection shall be constructed per Standard Plan 5-140-001.

Outside drop structures shall be constructed per Standard Plan 5-140-002.

5-145 Cleanouts Cleanouts are not an acceptable substitute for manholes, however, they may be used in lieu of manholes at the end of 6 or 8 inch diameter lines of not more than 150 feet in length. This does not include a 6-inch building sewer to serve one or two single family dwellings. Location of cleanout for building sewer is governed per Standard Plan 5-150-001.

All cleanouts in City right-of-way or easements shall be extended to grade and a 3-foot square by 4-inch concrete pad shall be installed around all cleanouts that are not in a pavement area. See Standard Plan 5-145-001.

5-150 Building Sewer A building or side sewer refers to the extension from a building sewer beginning two feet outside the outer foundation wall at the structure to the sanitary sewer main. Building sewers from the main to the right-of-way line shall be minimum 6-inch diameter. Maintenance of the sewer from the mainline to the building is the responsibility of the property owner. Prior to connection of a building sewer to the public sewer a connection permit must be obtained from the City. Materials and design criteria for a building sewer are covered by the EDDS and/or City of Marysville hand outs. Inspection of the building sewer is the responsibility of the Public Works/Building Department. At the City's discretion maintenance and/or repair to side

sewers within City right of way will be required to be completed by the city and billed to the property owner.

5-155 Marking Side Sewers The location of all side sewers shall be marked with a twelve gauge wire and 2" x 4" wood "marker" at the termination of the stub. The "marker" shall extend from the trench to above finished grade. Above the ground surface, it shall be painted "green" with "sewer" and the depth, in feet, stenciled in white letters 2" high. See Standard Plan 5-150-003. Offset markers may be used when the side sewer location is within an existing driveway or other obstacle.

5-160 Sanitary Sewer/Water Main Crossings

See Chapter 2, Section 2-170 for requirements regarding sewer and water separation.

5-165 Preconstruction

A preconstruction meeting shall be held with the City prior to commencing staking. All construction staking shall be inspected by the City prior to construction.

5-170 Staking All surveying and staking shall be performed by an engineering or surveying firm capable of performing such work. The engineer or surveyor directing such work shall be licensed as a Professional Engineer or Professional Land Surveyor by the State of Washington.

The minimum staking of sewer lines shall be as directed by the City Engineer or as follows:

- A. Stake location of mainline pipe and laterals every 50 feet with cut or fill to invert of pipe.
- B. Stake location of all manholes for alignment and grade with cut or fill to rim and invert of pipes.
- C. Front lot corners shall be staked prior to construction for side sewer tee location.

5-175 Trench Excavation See Chapter 2, Section 2-190 for requirements regarding trench excavation. See Standard Plans 5-175-001 through 5-175-003.

5-180 Backfilling See Chapter 2, Section 2-240 for requirements regarding backfilling. See Standard Plans 5-175-001 through 5-175-003 and 5-180-001.

5-185 Dewatering of Trench Where water is encountered in the trench, it shall be removed before pipe-laying operations and the trench so maintained until the ends of the pipe are sealed and provisions are made to prevent floating of the pipe. Trench water or other deleterious materials shall not be allowed to enter the pipe at any time. Dewatering is required to one(1) foot below the invert of the pipe.

The developer/contractor shall furnish, install, and operate all necessary dewatering wells and equipment to keep the trench free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property or nuisance to the public. Sufficient pumping equipment in good working condition shall be available at all times for all emergencies, including power outage, and shall have available at all times competent workers for the operation of the pumping equipment.

5-190 Street Patching and Restoration See Chapter 2, Sections 2-260 and 2-270 for requirements regarding street patching and trench restoration.

5-195 Testing Gravity Sewers Prior to acceptance and approval of construction, the following tests shall apply to each type of construction.

A. Gravity Sewer

1. Prior to acceptance of the project, the gravity sewer pipe shall be subject to a low pressure air test per WSDOT Standards. The Contractor shall furnish all equipment and personnel for conducting the test under the observation of the City inspector. The testing equipment shall be subject to the approval of the City.

The Contractor shall make an air test for his own purposes prior to notifying the City to witness the test. The acceptance air test shall be made after trench is backfilled and compacted and the roadway section is completed to subgrade.

All wyes, tees, and end of side sewer stubs shall be plugged with flexible joint caps, or acceptable alternates, securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable and their removal shall

provide a socket suitable for making a flexible jointed lateral connection or extension.

Immediately following the pipe cleaning, the pipe installation shall be tested with low-pressure air.

2. Testing of the sewer main shall include a television inspection by the Contractor. Television inspection shall be done after the air test has passed and before the roadway is paved. Immediately prior to a television inspection, enough water shall be run down the line so it comes out the lower manhole. A copy of the video tape and written report shall be submitted to the City. Acceptance of the line will be made after the tape has been reviewed and approved by the Inspector. Any tap to an existing system needs to be televised as well. No ponding within the sanitary sewer line!
3. A water test of all manholes may also be required. The water test shall be made by the Contractor first by filling the manhole up with water and letting it sit for 24 hours to allow the water to saturate the concrete. After 24 hours the manhole shall be filled to the top of the cone. The water cannot drop more than 0.05 gallons in 15 minutes per foot of head above invert to pass. Upon completion of the water test, the water shall be pumped out of the manhole and not allowed to be released to the system.
4. A mandrel test in accordance with Section 7-17.3(2)G of the Standard Specifications shall be required on all sewers except laterals (side sewers).

5-200 Sewage Lift Stations This chapter covers the general requirements for design and construction of sewage pump stations.

Plans, specifications, and peak sewage flow calculations shall be submitted to the City for approval. Pump station peak sewage design flow rates shall meet the standards in the latest edition of the "Recommended Standards for Sewage Works" Great Lakes - Upper Mississippi River Board of State Sanitary Engineers (10 state standards). Submitted drawings shall conform to the requirements of the City of Marysville and the State of Washington Department of

Ecology, Criteria for Sewage Works Design (CSWD). Lift station designs shall be prepared and sealed by a professional engineer.

All sewage pump station designs shall follow the minimum guidelines as specified in Chapter 3 of the CSWD. All sewage pump stations shall be the wet well-dry well type, with long shaft pumps or pedestal mounted pumps. Pedestal mounted pumps shall be vertically mounted with an elevated motor drive coupled directly to the pumps through a flexible coupling. Long shaft pumps shall have the pumps located at the bottom of the dry well and the motor drives housed in an above ground control building. Large pump stations are stations with over 1.0 MGD flow and as determined by the City. Suction lift, or pneumatic ejector are not allowed. Screw type and submersible lift stations will be considered.

5-205 Location and Flood Protection Sewage pump stations should be located as far as practical from present or proposed built-up residential areas. The site is to be accessible by an all-weather road. Noise control, odor control, and station architectural design should be taken into consideration. Sites for stations shall be of sufficient size for future expansion or addition, if applicable.

The station's operational components shall be located at an elevation that is not subject to the 100-year flood stage or shall otherwise be adequately protected against the 100-year flood stage damage. The stations shall be designed to remain fully operational during the 100-year flood event.

All lift stations will be designed to serve the appropriate tributary basin as identified in the Marysville "Comprehensive Sanitary Sewer Plan".

5-210 Design Standards The design of any lift station shall conform to City standards, Department of Ecology's "Criteria of Sewage Works Design" and applicable standards as set forth herein. In addition, the plans shall include the following:

1. An overall site drawing of the lift station showing the location of all components including elevations;
2. Electrical service size, voltage, and enclosure type and location in relation to the pump station;

3. A list of specific materials used including quantity description and manufacturer name;
4. A schematic and line diagram of the service and motor control center and lift station;
5. The electrical and controls systems shall be designed to meet state and local electrical code requirements;
6. The plans shall show all applicable telemetry installation with schematics;
7. An operation and maintenance manual from the lift station contractor shall be supplied.
8. A lift station emergency pumper connection/by-pass connection shall be installed per Standard Plan 5-210-001.
9. Pump operation, alarms, and electrical inspection of all lift stations is required.

#### 5-215 Pumping Rate and Number of Units

At least two pump units shall be provided, each capable of handling the expected maximum flow. (Peak design flow.)

Where three or more units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that with any one unit out of service, the remaining units will have the capacity to handle the maximum sewage flow.

When the station is expected to operate at a flow rate less than 0.5 times the average design flow for an extended period of time, the design shall address measures taken to prevent septicity due to long holding times in the wet well.

Consideration should be given to the use of variable-speed pumps, particularly when the pump station delivers flow directly to a treatment plant, so that sewage will be delivered at approximately the same rate as it is received at the pump station.

5-220 Grit and Clogging Protection Where it may be necessary to pump sewage prior to grit removal, the design of the wet well should receive special attention, and the discharge piping should be designed to prevent grit settling in pump discharge lines of pumps not operating.

For large pump stations handling raw sewage, consideration should be given to installation of readily accessible bar racks with clear openings not exceeding 2-1/2 inches, unless pneumatic ejectors are used or special devices are installed to protect the pumps from clogging or damage. Where the size of the installation warrants, a mechanically cleaned bar screen with grinder or comminution device is recommended. Where screens are located below ground, convenient facilities must be provided for handling screenings. For the larger or deeper stations, duplicate protection units, each sized at full capacity, are preferred.

5-225 Pumping Units

A. Type of Pumps

(See specific type of pump station.)

B. Pump Openings

Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

C. Priming

Pumps shall be so placed that under normal operating conditions they will operate under a positive suction head (except for suction lift pumps).

D. Intake

Each pump should have an individual intake. Wet well design should be such as to avoid turbulence/cavitation near the intake.

E. Operation Controls

Control float cages should be so located as not to be affected by the flows entering the wet well or by the suction of the pumps. Air-operated pneumatic controls are preferred for all sewage pump stations. Provisions should be made to automatically alternate the pumps in use. Pump stations with motors and/or controls below grade should be equipped with a secure external disconnect switch.

Backup control float cages or retention rings should be so located as not to be affected by the flows entering the wet well or by the suction of the pumps, and allow removal for inspection, testing or replacement without entering wet well.

Programmable Logic Controller (PLC) control via Ultrasonic level detection is preferred for all sewage pump stations. Ultrasonic sensor is to be mounted to allow easy adjustment of aim, without entering the wet well, and so that the sonic cone does not detect walls, pumps, cables etc. or a reasonable amount of grease ring growth.

Provisions should be made to automatically alternate the pumps in use. Pump stations with motors and/or controls below grade should be equipped with a secure external disconnect switch.

5-230 Flow Measurement Suitable devices for measuring sewage flow should be provided at pumping stations with flow capacity greater than 1.0 million gallons per day (mgd).

5-235 Bypasses/Storage Provision may be made for controlled bypasses and/or storage, if necessary to avoid excessive property or equipment damage. The controlled bypass shall be manually operated valve or plate covering the bypass discharge, and shall act as a pump connection port.

Where overflows affect public water supplies, shellfish production, or water used for culinary or food-processing purpose, a storage-detention basin, or tank, shall be provided that has a minimum 2 hours of detention capacity at the anticipated overflow rate. Storage-detention tanks, or basins, shall be designed to drain to the station wet well.

5-240 Alarm System An alarm system shall be provided for all pumping stations. Permanent lift stations shall have a telemetry alarm to 24-hour monitoring stations or telephone alarms to duty personnel. When telemetry is not used, an audio-visual device should be installed at the station for external observation.

Alarms for high wet well, low wet well, and power failure should be provided, as a minimum, for all pump stations. For larger stations, alarms signaling pumps and other component failures or malfunctions shall also be provided. See Sections 5-252 and 5-254.

A backup power supply, such as a battery pack with automatic switchover features, should be provided for the alarm system, such that a failure of the primary power source will not disable the alarm system. Test circuits should be provided to enable the alarm system to be tested and verified as in good working order.

Uninterruptable power supplies (UPS) (one for AC and a separate, independent one for DC power), with automatic switchover features incorporating power quality, TVSS and Surge Arrestor protections, should be provided for the alarm system, such that a failure of the primary power source will not disable the alarm system. Test circuits should be provided to enable the alarm system to be tested and verified as in good working order. Automatic self testing is to be performed and monitored by the alarm system. Diagnostic failure, Battery failure and Low Battery are to be provided as a minimum.

5-245 Materials Considerations

In the selection of materials, consideration should be given to the presence of hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present in sewage. With the exception of the pumps, pipe and wiring, metal materials located in areas subject to such conditions shall be stainless steel (guide rails, fasteners, cable, etc.)

5-250 Electrical Equipment

Electrical systems and components (e.g., motors, light, cables, conduits, switchboxes, control circuits) in enclosed or partially enclosed spaces where flammable mixtures occasionally may

be present (including raw sewage wet wells) shall comply with the National Electrical Code requirements for Class I Division 1 locations.

5-251 Electrical & Telemetry Controls

(This section not currently used)

5-252 Pump Control Panel. The electrical control panel shall be located in a control building, on a concrete housekeeping pad, or seven or more feet above the dry well floor

Controls are to be separated into a Pump Control Panel (PCP) and a Telemetry & Control Panel (RTU). Ideally, both shall be of the same manufacture, but the PCP can be manufactured by the pump supplier if required. Access shall be by quarter turn latches or by three-point latch with handle. Multiple, multi-turn latching devices along sides of door is not allowed at any time. Outdoor panels (with all other electrical equipment) shall be mounted inside a double door enclosure with padlock hasp, filtered vents, temperature controlled fan and heater. The electrical control panels shall be located in a control building, on a concrete housekeeping pad, or seven or more feet above the dry well floor.

The Pump Control Panel shall be provided with the minimum following items

- Backup Float control based on an adjustable pump run time after High Float (High-High Alarm) clears. Low Float to be provided for Low-Low Alarm.
- Magnetic motor starter, each pump
- Thermal-magnetic motor branch molded case circuit breaker, each pump
- Power Quality Relays, each pump on load side of motor branch breakers. Shall prevent pump from operating, until all conditions clear, automatically resetting. Last event shall be indicated. Required protections include
  - Over & Under voltage
  - Phase Reversal
  - Phase Loss & Imbalance
  - Over & Under Frequency
- Over-temperature, each pump.
- Seal leak detection, each pump

- Hand-off-automatic selector switch, each pump
- Elapse time indicator, each pump
- Ammeter, each pump
- Run indicator lights, each pump
- Pilot light indicator for each and every alarm, automatic shut-down and running condition
- Alarm reset and test buttons
- 110 volt convenience GFCI outlet
- Control power available indicator light
- One normally open and one normally closed auxiliary contacts for all devices for telemetry interface
- False alarms shall not be indicated to the Telemetry & Control Panel while Pump Control Panel is without power.

The Telemetry & Control Panel shall be provided with the minimum following items

- Wet well level sensor system
- Programmable Logic Controller (PLC) and Operator Interface Unit (OIU)
- Lag, lead and automatic pump selector switch (via Operator Interface Unit)
- AC & DC UPS systems
- Ethernet switch, patch cables, and other equipment as required for providing a connection to the City's Local Area Network (LAN) directly, via radio or other methods as required.
- 110 volt convenience GFCI outlet
- No alarm horn or beacon required for permanent sites that are monitored by the Telemetry system.

The City has a standardized program code for the PLC & OIU, and will provide upon request. Program code is based on standardized Input/Output (I/O) arrangement, based on standardized control panel design. Electronic drawings will be provided on request.

5-253 Service Wiring. Underground wiring shall be provided between the pump station and nearest power pole.

5-254 Telemetry & Annunciator Panel

A. There shall be no annunciator panels provided for any water or sewer sites. All alarms shall be provided via the Operator Interface Unit. Communication shall be over Ethernet. Alarms shall be:

- 1) Pump Overload for each
- 2) Pump Overtemp for each
- 3) Pump Seal leak for each
- 4) Pump Call-vs-Run disagree for each (Pump in Auto, and PLC called to run, but starter did not pull in) (latched in PLC to disable pump)
- 5) Pump Valve-vs-Run disagree for each (if Pump is running and check valve does not open) (latched in PLC to disable pump)
- 6) Pump Power Quality failure for each
- 7) Pump Hand-Off-Auto switch is In-Auto
- 8) Pump Hand-Off-Auto switch is in Hand
- 9) Utility/power to Telemetry Panel fail aka "UPS on Battery" [power to DC UPS to be disconnected in this condition]
- 10) UPS Battery Low/Failed
- 11) DC UPS Low Battery
- 12) DC UPS Battery Fail

- 13) Ethernet Communication failure with HQ
- 14) High Wet Well Float (shall trip higher than analog alarm)
- 15) High Wet Well Level via Ultrasonic Level sensor analog signal
- 16) Low Wet Well Level via Ultrasonic Level sensor analog signal
- 17) Low Wet Well Float (shall trip lower than analog alarm)
- 18) Level Transmitter Failure (signal less than 4ma)
- 19) Level Transmitter Power Loss or Echo Failure
- 20) Generator Running
- 21) Generator Trouble
- 22) Generator Fail
- 23) Generator Not-In-Automatic
- 24) Generator Low-Fuel (other Generator Alarms to be displayed on its local Annunciator per that section)
- 25) Automatic Transfer Switch in Normal Power Position
- 26) Automatic Transfer Switch in Emergency Power Position
- 27) Flow Meter Transmitter Failure (signal less than 4ma)
- 28) Flow Meter Transmitter Power Loss or Diagnostic Failure
- 29) Smoke Detected
- 30) Smoke Detector OK
- 31) Pump Flow-vs-Run disagree for each (if Pump is running and metered flow rate does meet an expected minimum) (warning only and does not disable pump)

Status and Data shall be:

- 1) Wet Well Level

- 2) Pump Running for each
- 3) Pump Starts for each (Today, Yesterday and Accumulated – adjustable via OIU to match those on Pump Control Panel)
- 4) Pump Runtime Hours for each (Today, Yesterday and Accumulated – adjustable via OIU to match those on Pump Control Panel)
- 5) Estimated Pumped Flow (Gallons/ft of Wet Well x (actual pump start – actual pump stop) or Actual Pumped Flow (based on pulse from flow meter each 1000 gallons) (Today, Yesterday and Accumulated)
- 6) Lead Pump (Automatic or Lead Selection via OIU)
- 7) OIU time and date shall be based on PLC time, adjustable via the OIU, and daily synchronized on a discreet signal from the HQ
- 8) Lead, Lag (et all) start and stop levels to be adjustable via the OIU for control by the PLC
- 9) High and Low Analog Wet Well levels to be adjustable via the OIU

Final Pump start and stop levels, wet well hatch level, high and low float trip levels, high and low analog alarm levels, transducer empty distance (face to bottom of the wet well), influent pipe level (and any other pipe, conduit or drain levels) are to be recorded on the final drawings. Both levels from the bottom of the wet well and elevations from sea level shall be provided.

#### 5-255 Telemetry & Control Panel and Equipment

- A. Enclosure - Enclosure shall be rated for the environment it is located in. Outdoor panels (with all other electrical equipment) shall be mounted inside a double door enclosure with padlock hasp, filtered vents, temperature controlled fan and heater. The electrical control panels located in a control building shall be wall mounted so their tops are no more than 6 feet above grade, or shall be floor mounted on a concrete housekeeping pad.

Access to the enclosure shall be by quarter turn latches or by three-point latch with handle. Multiple, multi-turn latching devices along sides of door is not allowed at any time.

The Telemetry & Control Panel shall be provided with the minimum following items:

- Programmable Logic Controller (PLC) and Operator Interface Unit (OIU)
- Door switch(es) for control of work light and for open/close status for intrusion alarm system.
- AC & DC UPS systems
- Ethernet switch, patch cables, and other equipment as required for providing a connection to the City's Local Area Network (LAN) directly, via radio or other methods as required.
- 110 volt convenience GFCI outlet (for Laptop use only)
- Fold-out laptop shelf (minimum 12" deep)
- The City has standardized program code subroutines for the PLC & OIU, and will provide upon request. Program code is based on standardized Input/Output (I/O) arrangement, based on standardized control panel design. Electronic drawings will be provided on request.

- B. Power Protection and Backup - Other than enclosure work light(s), heater, fan and convenience receptacle, all other power shall be protected by a standby Uninterruptable Power Supply (UPS), with dry contacts for monitoring by the PLC, equal to an APC Smart-UPS 1500 with Smart Card. Pigtails and receptacles shall be provided such that the UPS can be bypassed and removed. All DC power shall be protected by a "DC UPS" equal to a Puls UB10.245 with an UZK12.261. DC UPS shall draw power only from Utility Power and never when the AC UPS is on battery. Sites with an on-site standby generator require no more than a 15 minute power backup for the DC & AC UPS'. Six hours will be the minimum; with critical radio relay sites (such as above grade reservoirs) shall remain functional for 24 hours. This shall include any ancillary equipment required for operation (such as a booster pump for hydraulic valves actuated by solenoid valves, etc.). All instrumentation shall be protected and backed-up by the UPS system, including (but not limited to):

Flowmeters

Level transmitters

- C. Programmable Logic Controllers

PLC shall be an Allen-Bradley MicroLogix 1100 with up to four expansion modules per City standard I/O layout for Sewage Lift Station. Sites that require more Input/Output (I/O) may

utilize the MicroLogix 1400 or 1500, or may use a CompactLogix . All PLC's shall have a Memory Module (EEPROM) installed, with program configured to automatically re-load on program corruption.

D. Operator Interface Units

OIU shall be an Allen-Bradley PanelView Plus, 7"" color, touch, Ethernet, DC power. Sites requiring more than the minimum 10 screens to display all statuses, setpoints, and alarm screens, shall use a 10" or larger OIU.

Outdoor locations shall be provided with a sunscreen, such as a top hinged opaque cover to block direct sunlight.

Screens included shall be at minimum:

- 1) Welcome with site name, current PLC/OUI date and time (they shall be the same, and shall be synchronized with the SCADA PC daily at 4:00 am)
- 2) Screen List
- 3) Login Screen (login required for setpoint changes, or to shutdown or configure terminal), including Latched Alarm Reset (no login required) and SCADA PC's transmitted seconds (used for communications heartbeat)
- 4) Site Overview
- 5) Setpoints
- 6) Reports (flow totalization, pump run times & start counts) for today, yesterday and accumulated).
- 7) Door Events (Open/Close time & dates for doors, hatches, ladder guards, gates, etc.)
- 8) Pump Events (Booster pumps, dosing pumps, etc.) (Start/Stop dates & times, and triggering value: reservoir level, PSI, NTU, PPM, etc.)
- 9) Alarm History
- 10) Alarm Summary

Navigation buttons at the bottom shall allow navigation to the next and previous screen (for screens 4-8 above or within a sub-set of each screen type), Alarm History, Alarm Summary and to the Screen List

E. Alarm Beacons and Horns

No alarm horn or beacon is required for permanent sites that are monitored by the Telemetry system. They may be required as part of the intrusion system, if site maybe prone to vandalism

G. ULTRASONIC LEVEL TRANSMITTER AND TRANSDUCTOR

— Sites requiring level monitoring other than via pressure transmitter shall use a Milltronics LUT420 Ultrasonic Level Transmitter. This unit will provide a 4-20 ma signal to the PLC for monitoring the water level. It will also provide a dry-contact signal that closes on power loss, failure, or echo loss.

-Milltronics XPS-15 transducer: The unit shall be mounted so that the sonic cone (produced when the unit sends a sound pulse) does not come in contact with the walls, floats, vertical risers, etc. The footprint of the sonic cone increases at a 20:1 ratio: 20 feet down from the face of the transducer, the footprint is a circle with a 1-foot radius. This 1-foot radius contains 50% of the sound energy, so additional clearance should be allowed for. The XPS-15 has a 1" NPT for mounting, and factory cable. The unit shall be mounted in such a fashion (non-rigid) that it could be easily moved if the installed location creates false echoes.

A handheld programmer and/or programming software (with cable) shall be provided. A submergence shield shall be provided and installed on the XPS-Transducer. Siemens LUT420 shall be protected by the AC UPS. If the installation is "tight", and could generate false echoes and/or false levels are determined during startup or the warranty period, Brannom Instruments shall be hired to commission the LUT420. All parameter settings shall be provided to the City via an Excel file. The settings that were changed from the factory defaults shall be recorded on an as-built drawing set.

H. Analyzers, Meters and Transmitters

Shall provide a 4-20 ma output for process monitoring. PLC shall alarm on high and low values (as appropriate) as well as loop failure.

Relay contact shall be provided for alarm monitoring and power failure. Circuit shall open on power failure or alarm.

I. ASP's and VFD's shall accept a 4-20 ma signal for speed control, and a discrete signal for start/stop.

A 4-20 ma signal shall be provided for speed feedback to the PLC.

Relay contacts will be provided for Running, Leak Detection (for dosing pumps), Hand-Off-Auto Statuses, Ready/Power Status, and Failure.

J. Monitoring of Door, Gate, Hatch, Ladder Guard, etc.

Shall be proximity switches with lifetime warranty, armored cable, UL listed for both AC and DC voltages, equal to a George Risk Industries 4400 series. Circuit shall fail safe; energized while closed, de-energized input to the PLC when open.

, de-energized input to the PLC when disarmed). Key shall match City's current selection.

5-256 Lighting Adequate interior and exterior lighting for the entire pump station shall be provided. Explosion proof is generally required.

5-260 Water Supply There shall be no physical connection between any potable water supply and a sewage pumping station which under any conditions might cause contamination of the potable water supply. Potable water supply brought to the station should comply with conditions stipulated in the D.O.H. Criteria for Accepted Cross Connection Control Assemblies. A minimum ¾ inch water line with a reduced pressure backflow assembly with protection shall be installed near the pump station for station cleaning purposes.

5-265 Pump and Motor Removal Provisions shall be made to facilitate removing pumps, motors, and other equipment, without interruption of system service.

5-270 Access Suitable and safe means of access should be provided to equipment requiring inspection or maintenance. Stairways and ladders shall satisfy all OSHA and WISHA requirements. All permanent lift stations shall be fenced to discourage the entrance of unauthorized persons and animals.

Hatches shall be provided directly over each pump for ease of pump and motor removal. All hatches shall be ¼" aluminum diamond plate door leaf, spring operated with stainless steel hardware. Wet well and dry well access hatches shall be fitted with a stainless steel slam lock and a recessed hasp and padlock. All hatches shall have a locking support arm and a drain gutter.

5-275 Valves and Piping Shutoff valves shall be placed on suction and discharge lines of each pump (as applicable) for normal pump isolation. A check valve shall be placed on each discharge line, between the shutoff valve and the pump. Pump suction and discharge piping should not be less than 4 inches in diameter except where design of special equipment allows. The velocity in the suction line should not exceed 6 feet per second and, in the discharge piping, 8 feet per second.

- A. Valves 4 to 12 inches shall be Waterous Series 500 plug valves with an epoxy coating to resist corrosion. A valve shall be located at a maximum of every 500 feet along a force main. Valve may be installed in conjunction with required pigging ports.
- B. Check Valves. Check valves used on lift stations shall have adjustable tension levers and spring. It shall have a working pressure of 150 psi. Valves shall be designed for use with corrosive fluids. A check valve shall be installed in a valve vault located adjacent to the lift station. Check valves shall conform to AWWA standards, such as Prensalar List 340, or approved equal. Valves shall be mounted horizontally where space permits.
- C. Valve Box Lids. Valve box lids may be used for isolation valves on a force main. Valve box lids shall be specified to be marked with "SEWER" so they can quickly be distinguished from valves in the water system.
- D. All station piping larger than 2-inches shall be flanged ductile iron. Flexible coupling shall be used on all pump discharges. Other couplings shall be used to provide flexibility in re-assembling piping.

5-280 Pigging Ports A pipeline pig is a projectile that is forced through the inside of a pipe to clean pressure pipelines. A pigging port is used as a point to send or retrieve the pig.

Pigging ports may be required:

- A. At every change in pipeline size
- B. At bends in the line
- C. No farther than every 1000 feet

These locations are subject to review and approval by the City.

5-285 Ventilation Ventilation shall be provided for all pump stations during all periods when the station is manned. Where the pump is below ground, mechanical ventilation is required and should be arranged so as to independently ventilate the dry well. If screens or mechanical equipment, which might require periodic maintenance and inspection, are located in the wet well, then it should also be mechanically ventilated. There should be no interconnection between the wet well and the dry well ventilation systems. In pits over 15 feet deep, multiple inlets and outlets are desirable. Dampers should not be used on exhaust or fresh air ducts and should be avoided to prevent clogging. Switches for operation of ventilation equipment should be marked and conveniently located above grade and near pump station entrance. Consideration should be given also to automatic controls where intermittent operation is used. The fan wheel should be fabricated from nonsparking material. In climates where excessive moisture or low temperature is a problem, consideration should be given to installation of automatic heating and/or dehumidifying equipment. Where heat buildup from pump motors may be a problem, consideration should be given to automatic ventilation to dissipate motor heat. Corrosive resistant metal pipe is required for all vent piping.

5-300 Wet Well - Dry Well Stations

5-305 Type of Pumps

Sewage pumps shall be heavy duty vertical non-clog, centrifugal and designed specifically for municipal unscreened raw sewage application.

- Acceptable pump manufacturers are as follows: Flygt, Fairbanks Morse, Peabody Barns, Worthington, Aurora, Cornell, or Wemco.
- Long shaft pumps shall have the drive motor connected to the pump with vertical shafts, universal joints, and bearings.
- Each pump motor shall have both bearing and stator heat sensors with alarms.
- The maximum pump speed shall be 1,160 rpm. Pumps shall have stuffing box and packing type shaft seal.

- The pump motor shall be non-overloading from shut-off to pump runout.
- An easy method of backflushing each pump shall be provided.

5-310 Separation Wet and dry wells, including their superstructures, should be completely separated.

Where continuity of pump station operation is necessary, consideration should be given to dividing the wet well into two sections, properly interconnected, to facilitate repairs and cleaning.

5-315 Wet Well Size The effective capacity of the wet well should provide a holding period not to exceed 10 minutes for the design average flow. Diameter of wet well shall accommodate adequate room to ensure Ultrasonic level sensor's sonic cone will not detect pumps, wall, cables, ladder, floats, influent turbulence or any other object that could affect its ability to detect the liquid level accurately.

5-320 Floor Slope The wet well floor should have a minimum slope of 1-to-1 to the hopper bottom. The horizontal area of the hopper bottom should be no greater than necessary for proper installation and function of the inlet.

5-325 Ventilation Wet well ventilation may be either continuous or intermittent. Ventilation, if continuous, should provide at least 12 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. Such ventilation should be accomplished by introduction of fresh air into the wet well by mechanical means.

Dry well ventilation may be either continuous or intermittent. Ventilation, if continuous, should provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour.

5-330 Dry Well Dewatering A separate sump pump should be provided in the dry wells to remove leakage or drainage within the discharge above the overflow level of the wet well. Water ejectors connected to a potable water supply will not be approved. All floor and walkway surface should have an adequate slope to a point of drainage. Dry well sump pump shall be submersible, 2-inch discharge, minimum 1 hp and able to handle 3/4 solids at 100 gpm at a 30 foot head.

5-335 Dry Well Emergency Equipment. Emergency battery operated lights, space heater, fire extinguisher, sump pump, pump motor disconnect switch, and electrical controls shall be installed in the dry well. All electrical devices shall be located a minimum of 7 feet above the dry well floor for protection against flooding.

5-340 Miscellaneous.

- The entire dry well floor shall be covered with fiberglass grating installed 4 inches above the bottom of the dry well floor.
- All piping and fittings shall be painted with Tnemec gray epoxy.
- The minimum clear space around the pumps shall be 2 feet.
- All railings, hatches, stairs, cat walks, and ladders shall comply with OSHA requirements.
- A baffle shall be placed in front of the inlet pipe to eliminate air entering the pump intakes.
- The inlet pipe shall be fitted with a sluice gate.
- An explosion proof light and access ladder shall be installed in the wet well.
- All wet wells and valve vaults shall be painted- inside with Tnemec epoxy or designed for wet well applications.

5-400 Suction Lift Stations

5-405 Priming Suction-lift pumps should be of the self-priming type, as demonstrated by a reliable record of satisfactory operation. The maximum recommended lift for a suction lift pump station is 15 feet, using pumps of 200 gallons per minute (gpm) capacity or less.

5-410 Capacity The capacity of suction lift pump stations should be limited by the net positive suction head and specific speed requirements, as stated on the manufacturer's pump curve for the most severe operating conditions.

5-415 Air Relief

A. Air Relief Lines

All suction lift pumps should be provided with an air relief line on the pump discharge piping. This line should be located at the maximum elevation between the pump discharge flange and the discharge check valve to ensure the maximum bleed-off of entrapped air. Air relief piping should have a minimum diameter of 1-1/4 inches. A separate air relief line shall be provided for each pump discharge. The air relief line should terminate in the wet well or suitable sump and be open to the atmosphere.

B. Air Relief Valves

Air relief valves should be provided in air relief lines on pumps not discharging to gravity sewer collection systems. The air relief valve should be located as close as practical to the discharge side of the pump.

C. Unvalved Air Relief

Unvalved air relief piping should be provided on all pumps discharging to varying head force mains, except that an air relief valve may be used where actual operating test data can be submitted that indicate that a particular air relief valve will fail in the open position under varying head conditions. NOTE: Unvalved air relief piping will materially affect pump efficiency and capacity, and should be considered by the designing engineer.

5-420 Pump Location Suction lift pumps should not be located within the wet well.

5-425 Access to Wet Well Access to the wet well should not be through the dry well, and the dry well should have a gastight seal when mounted directly above the wet well.

5-500 Submersible Pump Stations. See Standard Plans 5-500-001 and 5-500-002.

Submersible sewage pump stations shall meet all of the requirements where applicable for wet well/dry well pump stations except as follows:

- The pump and motor shall be designed and built to operate continuously while the motor casing is fully exposed above the sewage level.
- Pumps shall be rail mounted with a quick connect discharge connection.
- The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fastening to be disconnected.
- Each pump shall have both thermal and moisture sensors with automatic alarms.
- A valve vault shall be provided outside of the wet well and shall house all check valves and shut-off valves.
- A continuous running fan shall be provided for the wet well and the fan and motor shall be located in the valve vault.
- Each pump shall be fitted with a galvanized pump lifting chain.
- An access hatch shall be placed directly over each pump for pump liftout.
- An access hatch shall be located directly over the wet well ladder.
- The pump power cables and control cables shall terminate in the control panel in the control building, if the control building is less than 20 feet from the wet well; otherwise the cables shall terminate in a NEMA 4 junction box located in a hand hole just outside of the wet well.
- A gantry crane or tripod with chain hoist shall be provided with each pump station.
- A control building shall be located near the wet well and constructed above ground or a housekeeping pad shall be provided for the electrical controls.

5-505 Type of Pumps

Pumps shall be heavy duty submersible non-clog centrifugal and designed specifically for municipal unscreened raw sewage application. Acceptable pump manufacturers are as follows: Hydro-matic, Worthington, Cornell, and Pacific Pump Company.

5-510 Pump Removal Submersible pumps shall be readily removable and replaceable without dewatering the wet well or requiring personnel to enter the wet well. Continuity of operation and other units should be maintained.

A hoist and accessories for removing the pumps from the wet well shall be provided.

- 5-515 Controls The control panel shall be located outside the wet well and suitably protected from weather, humidity, and vandalism.
- 5-520 Valves All control valves on the discharge line for each pump shall be placed in a convenient location outside the wet well in a separate vault and be suitably protected from weather and vandalism. Outside valve covers shall not be allowed.
- 5-525 Submergence Positive provision, such as backup controls, shall be made to assure submergence of the pumping units.
- 5-600 Reliability
- 5-605 Objective The objective of reliability is to prevent the discharge of raw or partially treated sewage to any waters and to protect public health by preventing backup of sewage and subsequent discharge to basements, streets, and other public and private property.
- 5-610 Backup Units A minimum of two pumps shall be provided in each station in accordance with Section 1-110.
- 5-615 Power Outages An emergency power source shall be provided to ensure continuous operability unless the experience has shown the frequency and duration of outage to lift station is temporary and to be low and the pump station and/or sewers provide storage sufficient for expected interruptions in power service. A temporary lift station is defined as a lift station which is anticipated to be in operation for less than five years.
- 5-620 Emergency Power Supply
- 5-621 General Provision of an emergency power supply for pumping stations shall be made, and may be accomplished by connection of the station to at least two independent public utility sources, or by provision of in-place internal combustion engine equipment that will generate electrical or mechanical energy.

Emergency power shall be provided that, alone or combined with storage, will prevent overflows from occurring during any power outage that is equal to the maximum outage in the immediate area during the last 10 years. If available data are less than 10 years, an evaluation of a similar area served by the power utility for 10 years would be appropriate.

5-622 In Place Equipment Where in-place or mobile internal combustion equipment is utilized, the following shall be applied:

- A. Placement. The unit shall be bolted in place. Facilities shall be provided for unit removal for purposes of major repair or routine maintenance.
- B. Controls. Provision shall be made for automatic and manual startup and cut-in. See standard 5-500-001.
- C. Size. Unit size shall be adequate to provide power for lighting and ventilating systems and such further systems that affect capability and safety as well as the pumps.
- D. Engine Location. The unit internal combustion engine should be located above grade, with suitable and adequate ventilation of exhaust gases.

5-700 Force Mains

5-705 Size Minimum size force mains should be not less than 4 inches in diameter.

5-710 Velocity At pumping capacity, a minimum self-scouring velocity of 2 feet per second (fps) should be maintained unless flushing facilities are provided. Velocity should not exceed 8 feet per second.

5-715 Termination The force main should enter the receiving manhole with its centerline horizontal and with an invert elevation that will ensure a smooth flow transition to the gravity flow section; but in no case shall the force main enter the gravity sewer system at a point more than 1 foot above the flow line of the receiving manhole. The design should minimize turbulence at the point of discharge. See Standard Plan 5-715-001 and 5-715-002.

Consideration should be given to the use of inert materials or protective coatings for the receiving manhole to prevent deterioration as a result of hydrogen sulfide or other chemicals where such chemicals are present or suspected to be present because of long force mains.

5-720 Force Main Materials/Construction

- A. General. The pipe should be adapted to local conditions, such as character of wastes, soil characteristics, exceptionally heavy external loadings, internal erosion, corrosion, and similar problems.

Installation specification shall contain appropriate requirements based on the criteria, standards, and requirements established by the industry in its technical publications. Requirements shall be set forth in the specifications for the pipe and methods of bedding and backfilling thereof so as not to damage the pipe or its joints, impede cleaning operations, not create excessive side fill pressures or ovalation of the pipe, nor seriously impair flow capacity.

All pipes shall be designed to prevent damage from super-imposed loads. Proper allowance for loads on the pipe shall be made because of the width and depth of trench.

- B. Material. Force mains for sizes up to 8 inches shall be ductile iron AWWA C151 Class 52 with ductile iron fittings and gasketed joints. For 12 to 24 inch mains, pipe shall be ductile iron AWWA C151 Class 50 with ductile iron fittings and gasketed joints. A more rigid pipe may be required where unlimited trench widths occur. All ductile iron pipe and fittings shall be epoxy coated and mortar lined and designed for use with corrosive materials.
- C. Depth. Force mains shall have a minimum 36 inches of cover to top of pipe. See Chapter 2, Section 2-170 for sanitary sewer/water main crossing requirements.
- D. Velocity. The minimum velocity allowed is 2 feet per second (fps) at average Dry Weather Flow. 2 fps is required to maintain solids in suspension although 3 fps is desired to scour settled solids. Maximum velocity allowed shall be 8 fps.

5-725 Surge Protection The pump station and force main shall be sized to minimize rapid changes in velocities along the flow path.

5-730 Air/Vacuum Valves Air release valves and air/vacuum valves shall be located at the high points on the force main within a standard 48-inch manhole or a comparable sized, approved vault. Air release valves shall be fitted with an activated carbon canister to absorb compounds with disagreeable odors prior to releasing the air to the surrounding area. Grades shall be designed to minimize the need for air/vacuum valves when practical. Vehicular access to valve is required for maintenance.

5-735 Anchorage Force mains shall be sufficiently anchored within the pump station and throughout the line length. The number of bends shall be as few as possible. Thrust blocks, restrained joints, and/or tie rods shall be provided where restraint is needed.

Location of thrust blocking shall be shown on plans. Thrust block concrete shall be HMA poured against undisturbed earth. A plastic barrier shall be placed between all thrust blocks and fittings.

See standard detail number 2-130-001, 2-130-002, and 2-130-003 in water section. Designed and approved restraining joint systems may be allowed in lieu of thrust blocking. Restraining joint brand, type, and size shall be specified on the plans.

Gravity mains with a slope 18% or greater shall be ductile iron and anchored per standard plan 5-735-001

5-740 Pressure Tests All force mains shall be tested at a minimum pressure of at least 50 percent above the design operating pressure or 200 psi, whichever is greater, for at least 30 minutes. Leakage shall not exceed the amount given by the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

Where L is allowable leakage in gallons per hour

N is the number of pipe joints

D is the pipe diameter in inches

P is the test pressure in psi

Any leaks or imperfections developing under said pressure shall be remedied by the Contractor. No air will be allowed in the line. The main shall be tested between valves. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. The pressure test shall be maintained while the entire installation is inspected.

The Contractor shall provide all necessary equipment and shall perform all work connected with the tests. Tests shall be made after all connections have been made. This is to include any and all connections as shown on the plan. The Contractor shall perform all tests to assure that the equipment to be used for the test is adequate and in good operating condition and the air in the line has been released before requesting the City to witness the test.

A water test for all wet wells in accordance with the manhole water test for gravity sewer shall be required.

A mandrel test in accordance with Section 7-17.3(2)G of the WSDOT Standard Specifications is required.

5-800 Control Building (Large Pump Stations Only)

- A control building shall be located directly over the dry well and shall house the pump motors and controls.
- The control building shall be above ground and made of concrete block, brick or other requirements of local design agencies or commissions.
- The exterior design shall be compatible with its surroundings and shall be designed by a licensed architect.
- The control building shall be surrounded with a six-foot high chain link fence with a three-foot wide personnel gate and double leaf 14-foot total width access gate.
- An asphalt parking area, driveway, and truck turnaround area shall be provided.

- Onsite landscaping shall be provided.
- The control building shall be equipped with the minimum following equipment:
  - Steel doors
  - Sky light, directly over each pump
  - Emergency battery operated lights
  - Space heater
  - Fire extinguisher
  - Intrusion alarm
  - Ventilation
  - Wall and roof insulation
- A monorail, bridge crane, or gantry crane with chain hoist shall be installed over each pump.

#### 5-850 Private Grinder Pumps

Private Grinder Pumps are only permitted under special circumstances when no other means of sewer service is available. In general, gravity sewer shall be deepened to eliminate the need for grinder pumps. Use of private grinder pumps requires approval by the City Engineer or designee and will be evaluated on a case-by-case basis. Applicant will need to demonstrate that there is no other feasible means of servicing lot/lots for acceptance.

Permits/application:

- A grinder pump application and plumbing permit is required within the city limits.
- Grinder pump system application is required to be submitted outside the city limits.

Application documents:

- Document providing type and number of fixtures to be serviced by pump (2 copies).
- Submit a grinder pump sizing and selection worksheet (2 copies).
- Type of Pump proposed.

Minimum requirements:

- UL listed pump. (UPC approved in structure)
- 2" minimum discharge from pump servicing water closet. (Per UPC 2003 710.3 WA. State Administration).
- Pump curve from manufacture.

Tank Type:

- 3" building sewer outfall requires 500 gallon minimum size concrete tank outside of structure. 4" building sewer out fall requires 1000 gallon minimum size concrete tank. All other systems require detailed engineering plans and shall be submitted for the City's review.
- Interior grinder pump system requires UPC approval. Exterior grinder pump system (see standard plan 5-850).
- Concrete: 28 day compressive strength  $F_c' = 4000$  psi. Rebar #4 ASTM A-815 grade 60. DL-18" earth cover. LL = 25 snow. Soils = 2000 psf, water pressure: 62.4 psf. Flexible pipe adapter: press seal 4" cast-a –seal. Joint material: meets federal specs. SS-S-00210, ASHTO M- 1988 and ASTM C990, and risers as required.

Site Plan:

- Required when installed outside of structure. (2 copies)

House Plan:

- Required when installed inside of structure. (2 copies)

General Notes:

- Electrical Permit approved prior to final inspection.
- Force main shall be 2" PVC schedule 80. The force main shall be tested @ 150% of its design curve pressure.
- All inspections must be completed prior to backfilling.

- When (2) two 45 degree angles are used to achieve 90 degree bend, no less than one foot of pipe between the two 45 degree bends. (No 90's)

5-900 Grease Interceptors

When pretreatment facilities are required for fats, oils, and greases, by the City Pretreatment Ordinance, the facilities shall conform to the following:

A. Design

Grease interceptors shall be multiple compartment flotation chambers where grease floats to the water surface and is retained while the clear water underneath is discharged.

The grease interceptor shall be followed by a sampling compartment to allow for monitoring of discharges from the pretreatment unit. The geometry of the sampling compartment shall be in accordance with City of Marysville Standard Plans 5-900-001 and 5-900-002 plan for grease interceptors. Interceptors shall have fittings designed for grease retention.

There shall be an adequate number of manholes to provide access for cleaning and maintenance of all areas of the interceptors; a minimum of one (1) manhole per ten (10) feet of interceptor length. Manhole covers shall be gas-tight in construction, and have a minimum opening dimension of twenty (20) inches.

B. Sizing Criteria

Sizing formula. The size of the grease interceptor shall be determined by using the following formula: seating capacity or the number of meals served per peak hour, whichever is greater x 6.0 gallons x 2.5 hours x storage factor = interceptor size in gallons.

Storage factor shall be as follows:

Facilities open less than 16 hours	=1
Facilities open for 16 hours or more	=2
Facilities open for 24 hours	=3

In cases of certain fast food restaurants or establishments with the potential to discharge large quantities of oils, grease, solids or wastewaters, larger capacities of grease interceptors may be required. Pre-packaged or manufactured grease interceptors may be approved by the Director with proper engineering and application review.

The following General Notes shall be included on any plans dealing with sanitary sewer design.

**GENERAL NOTES (SANITARY SEWER MAIN INSTALLATION)**

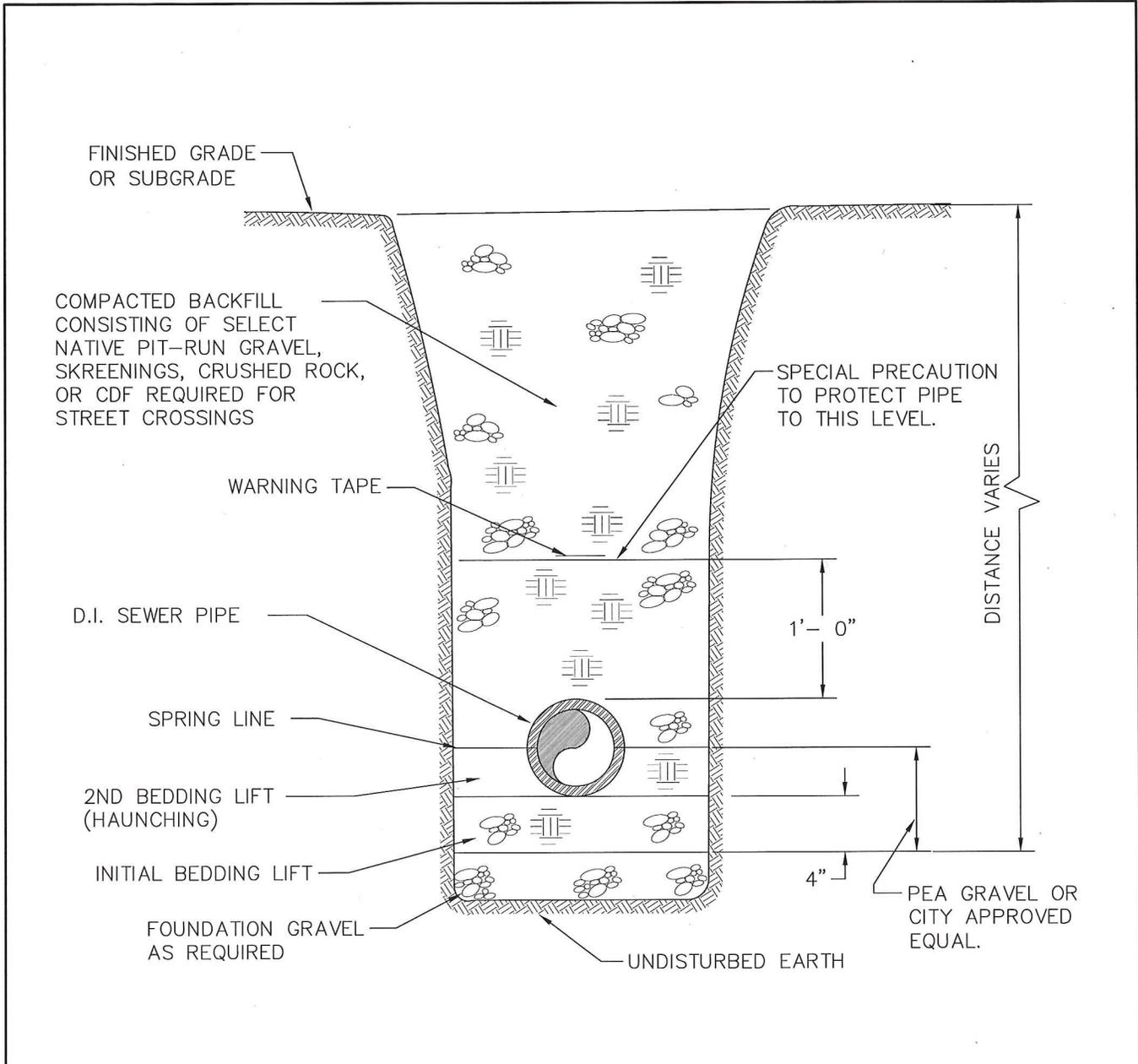
1. All workmanship and materials shall be in accordance with City of Marysville standards and the most recent copy of the State of Washington Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT).
2. City of Marysville horizontal datum shall be NAD 83, and the vertical datum shall be NAVD 88, in Washington State plane Coordinates (feet), Washington North Zone 4601. A list of benchmarks is available through the Public Works Department.
3. All approvals and permits required by the City of Marysville shall be obtained by the Contractor prior to the start of construction.
4. If construction is to take place in the County right-of-way, the Contractor shall contact the City Public Works Department to obtain all the required approvals and permits.
5. A preconstruction meeting shall be held with the City of Marysville Department of Public Works / Community Development Department prior to the start of construction.
6. The City of Marysville Community Development Department shall be notified a minimum of 48 hours in advance of a tap or connection to an existing sanitary sewer main. The inspector shall be present at the time of the tap or connection.
7. The Contractor shall be fully responsible for the location and protection of all existing utilities. The Contractor shall verify all utility locations prior to construction by calling the Underground Locate Line at 1-800-424-5555 a minimum of 48 hours prior to any excavation.
8. Gravity sewer main with  $\leq 5'$  of cover shall be D.I.P. Class 52; 5'-18' of cover shall be PVC, ASTM D 3034 SDR 35, or ASTM F 789 with joints and rubber gaskets conforming to ASTM D 3212 and ASTM F 477;  $>18'$  cover shall be D.I.P. Class 52, or C-900.

9. Precast manholes shall meet the requirements of ASTM C 478. Manholes shall be Type 1-48" manhole unless otherwise specified on the plans. Joints shall be rubber gasketed conforming to ASTM C 443 and shall be grouted from the inside. Lift holes shall be grouted from the outside and inside of the manhole.
10. Side sewer services shall be PVC, ASTM D 3034 SDR 35 with flexible gasketed joints. Side sewer connections shall be made by a tap to an existing main or a tee from a new main connected above the springline of the pipe.
11. All sewer mains shall be field staked for grades and alignment prior to construction by a licensed engineer or surveying firm qualified to perform such work. Prior to constructing any sewer, the lot corners shall be staked and sewer line location established by survey, cost of which shall be borne by the Developer.
12. All plastic pipe and services shall be installed with continuous tracer tape installed 12" to 18" under the proposed finished subgrade. The marker shall be plastic non-biodegradable, metal core or backing marked sewer which can be detected by a standard metal detector.
13. Each side sewer lateral shall have a 2" x 4" wood "marker" at the termination of the stub. The "marker" shall extend from the trench to above finished grade. Above the ground surface, it shall be painted "green" with SEWER and the depth, in feet, stenciled in white letters 2" high.
14. Side sewers shall be installed by the Developer and coordinated for clearance with power, telephone, and other utilities.

All side sewers to be installed 10 feet into lot served and staked and marked as shown on these plans.

15. Pipe bedding shall be in accordance with WSDOT Standard Plan B-18c Class F. Pea gravel is an acceptable bedding material. All pipe shall be laid on a properly prepared foundation according to Standard Specification 7-02.3(1). This shall include necessary leveling of the trench bottom or the top of the foundation materials as well as placement and compaction of required bedding material to uniform grade so that the entire length of the pipe will be supported on a uniformly dense unyielding base.

16. A 6 foot square X 4-inch thick concrete pad shall be installed around all SSMH'S and a 3 foot square X 4-inch thick concrete pad shall be installed around all cleanouts that are not in a pavement area.
17. Temporary street patching shall be allowed for as approved by the City Engineer. Temporary street patching shall be provided by placement and compaction of ATB or Class B asphalt concrete. Contractor shall be responsible for maintenance as required.
18. Erosion control measure shall be taken by the Contractor during construction to prevent infiltration and inflow into existing and proposed sanitary sewer facilities.
19. Provide traffic control plan(s) in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) as required.
20. It shall be the responsibility of the Contractor to have a copy of these approved plans on construction site at all times.
21. Any changes to the design shall first be reviewed and approved by the project engineer and the City of Marysville.
22. All lines shall be cleaned and pressure tested prior to paving in conformance with the above referenced specifications. (See note 1.) Testing of the sanitary sewer main shall include TV-ing of the main by the Contractor. Immediately prior to TV-ing, enough water shall be run down the line so it comes out the lower manhole. A copy of the video tape shall be submitted to the City of Marysville. Acceptance of the line will be made after the tape has been reviewed and approved by Public Works. A water test of all manholes in accordance with Marysville standard may also be required. Testing shall take place after all underground utilities are installed and compaction of the roadway subgrade is completed.
23. Prior to backfill all mains and appurtenances shall be inspected and approved by the City of Marysville Department of Public Works. Approval shall not relieve the Contractor for correction of any deficiencies and/or failures as determined by subsequent testing and inspections. It shall be the Contractor's responsibility to notify the City of Marysville for the required inspections.

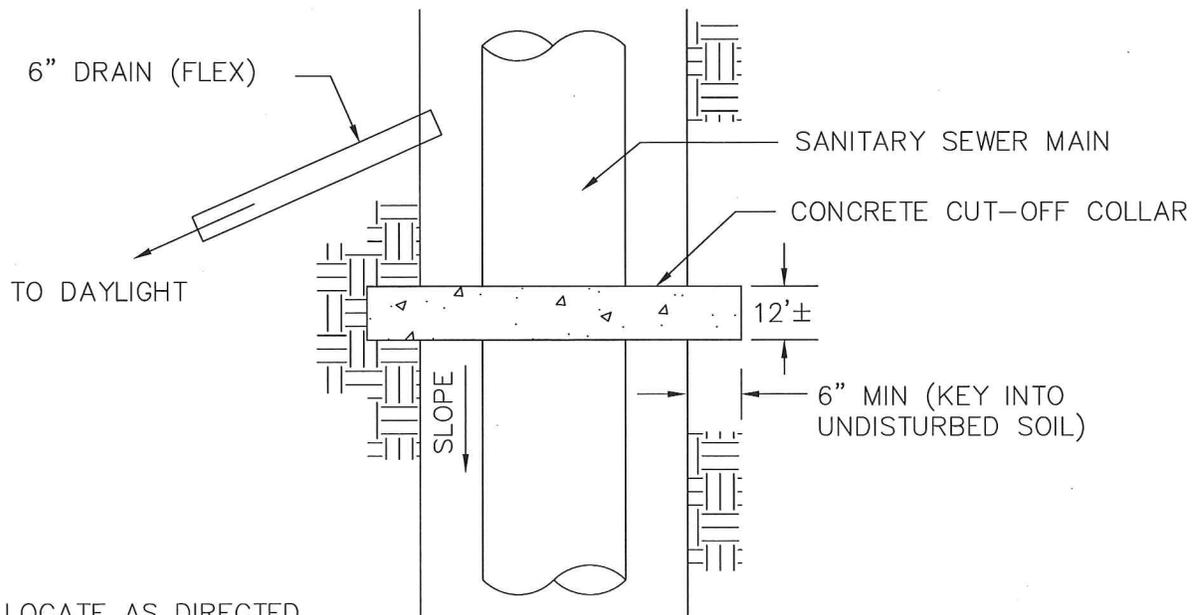


**NOTE:**  
 BACKFILL MATERIAL AND COMPACTION SHALL BE IN CONFORMANCE WITH CITY STANDARDS AND/OR THE STATE OR COUNTY PERMIT REQUIREMENTS (AS MAY BE APPLICABLE).

APPROVED BY  
*Kevin Nuteen* 5/9/07  
 MARYSVILLE CITY ENGINEER DATE

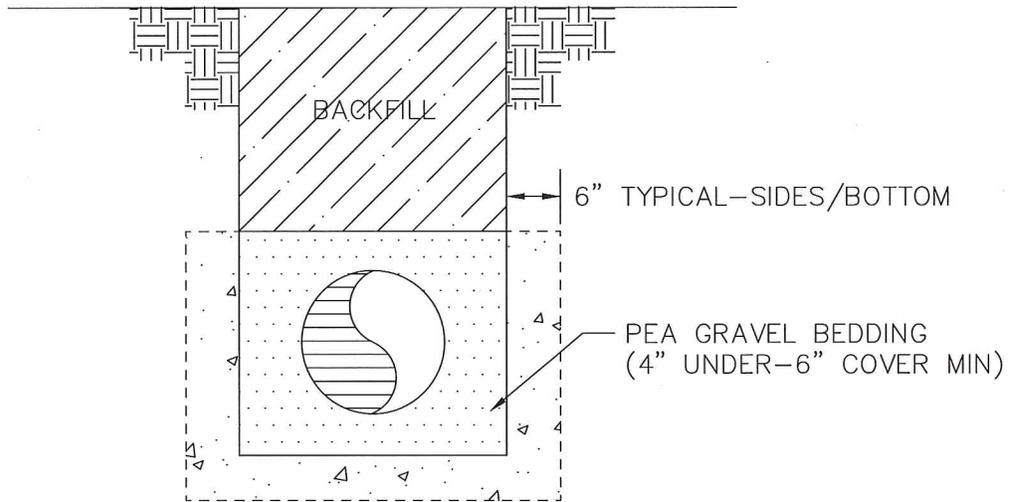


TRENCH  
 (RIGID PIPE)



LOCATE AS DIRECTED  
(BY CITY)

PLAN



SECTION

LAST REVISED 5/7/97

APPROVED BY

MARYSVILLE CITY ENGINEER

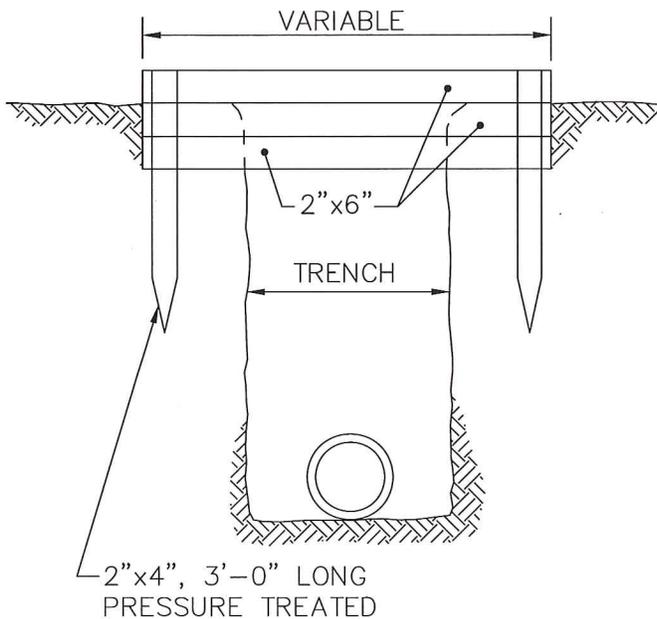
*Kew Nelson* 5/9/07

DATE

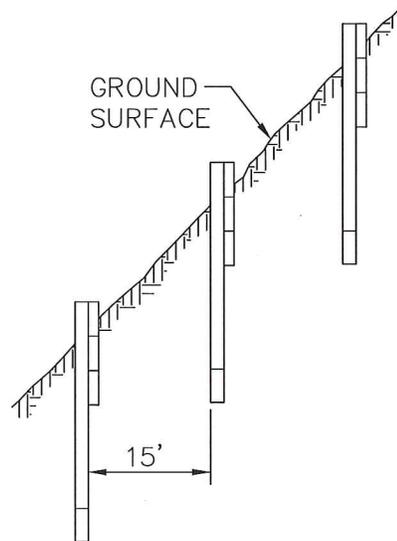


SANITARY SEWER  
DRAINAGE CUT-OFF  
COLLAR

STANDARD PLAN 5-175-003

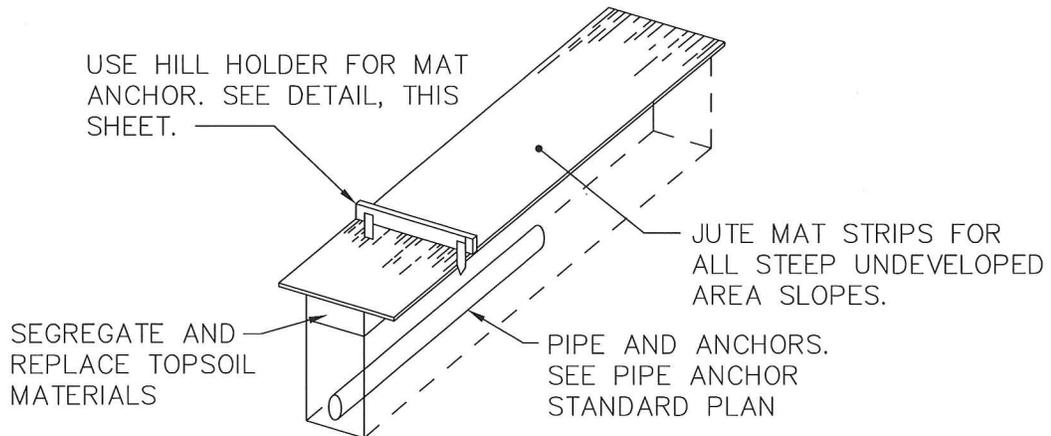


DETAIL OF HILL HOLDER



NOTE: HILL HOLDERS SHALL BE INSTALLED ON ALL STEEP SLOPES 20% OR GREATER AND AT SUCH OTHER LOCATIONS AS DIRECTED BY THE CITY ENGINEER.

TYPICAL HILL HOLDER INSTALLATION



JUTE MAT EROSION PROTECTION

LAST REVISED 8/14/01

APPROVED BY

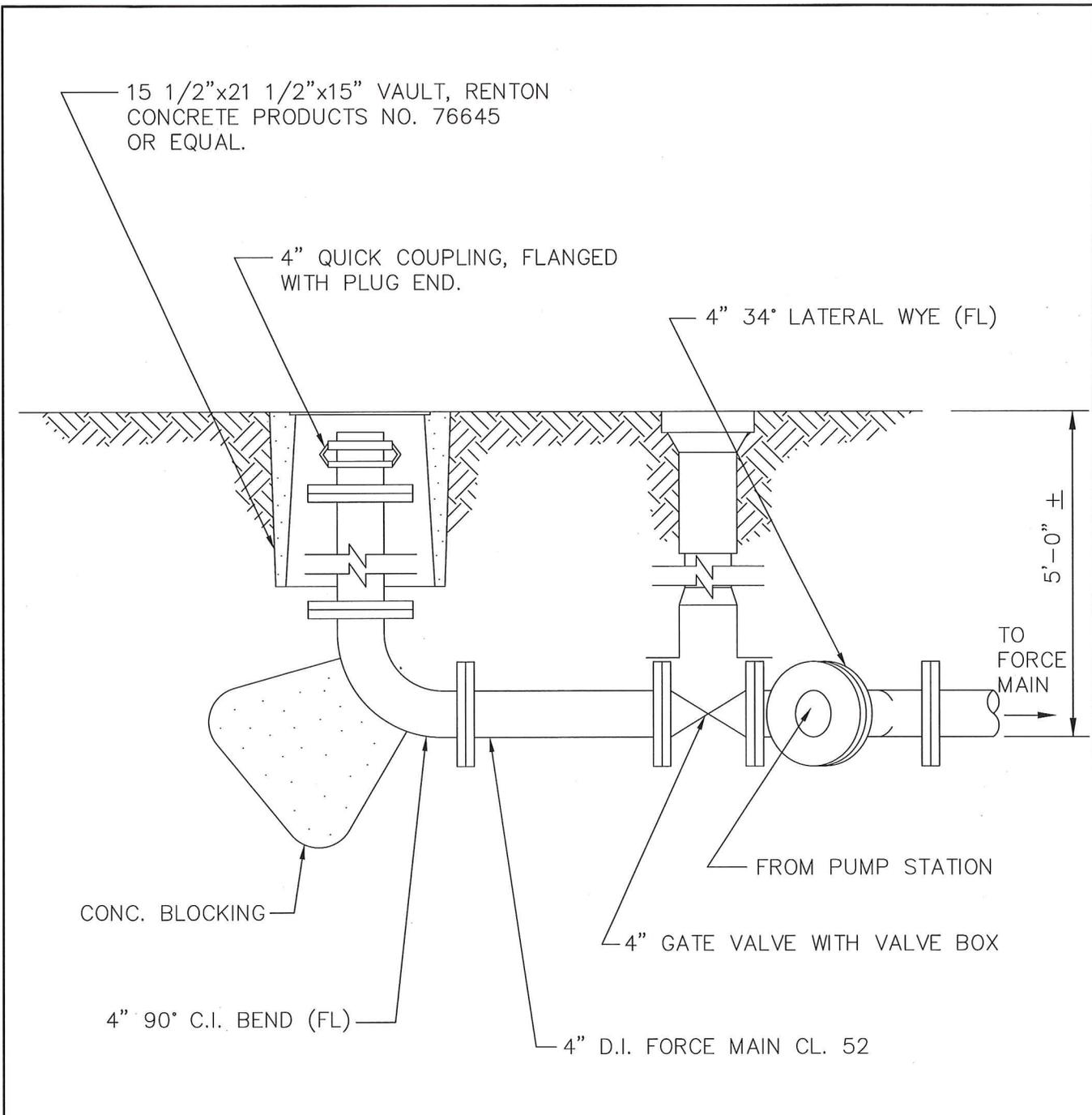
MARYSVILLE CITY ENGINEER

*Kevin Risher* 5/9/07  
DATE



HILL HOLDERS & JUTE MAT EROSION PROTECTION

STANDARD PLAN 5-180-001



EMERGENCY BYPASS CONNECTION

N.T.S.

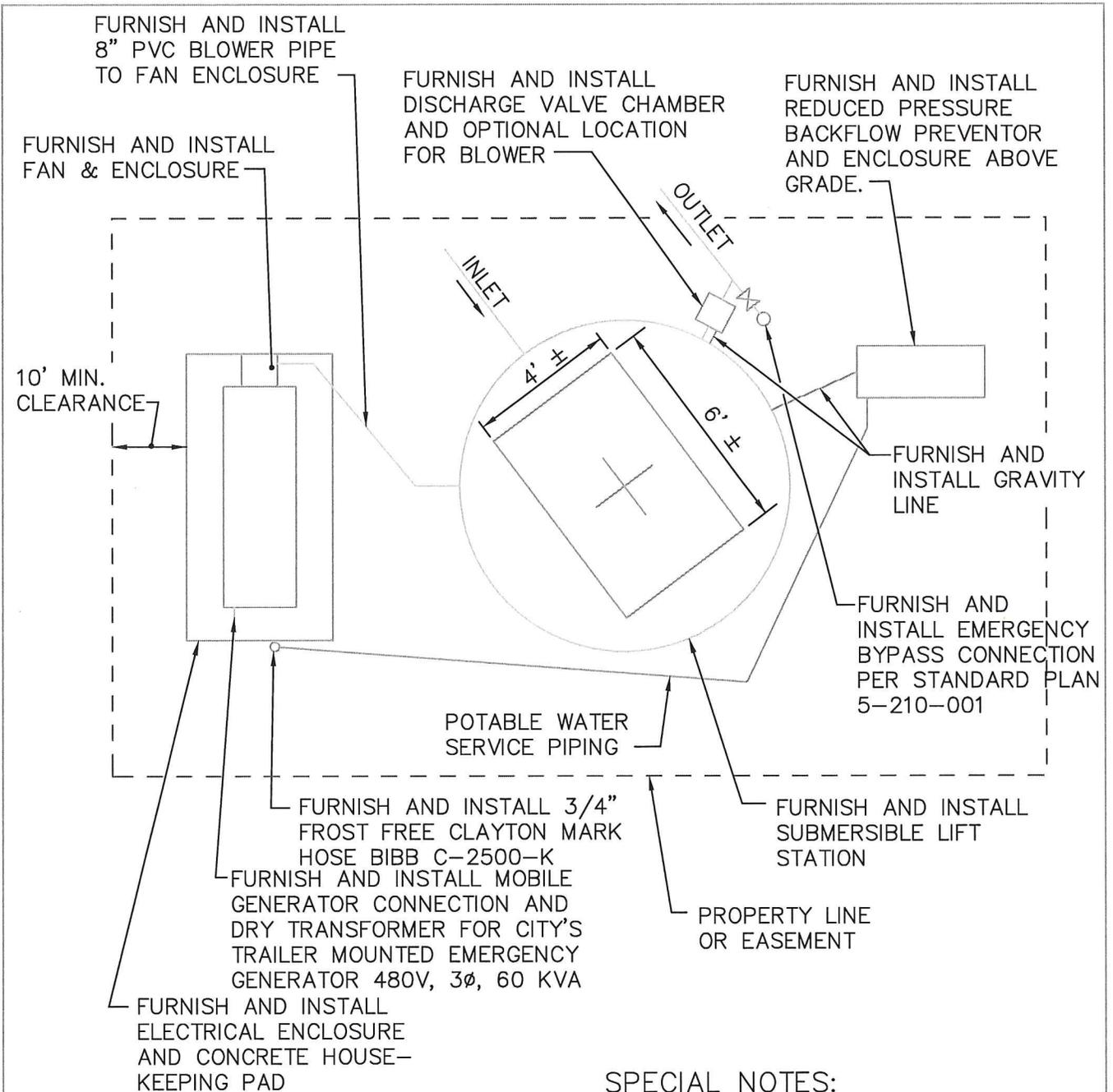
LAST REVISED 10/23/01

APPROVED BY  
*Kevin Nuber* 5/9/07  
MARYSVILLE CITY ENGINEER DATE

EMERGENCY BYPASS CONNECTION



STANDARD PLAN 5-210-001



EMERGENCY GENERATOR NOTES

1. SUPPLY CROUSE HINDS AR 2042 522 GENERATOR RECEPTACLE 480V, 3Ø, 4W
2. PROVIDE MANUAL TRANSFER SWITCH IN ELECTRICAL PANEL.
3. SIZE TRANSFORMER AND TRANSFORMER SWITCH TO RUN BOTH PUMPS.
4. CHECK TO SEE THAT PHASING MATCHES PORTABLE GENERATOR

SPECIAL NOTES:

1. IF GRADE IS 8% OR MORE, ASPHALT OR CONCRETE IS REQUIRED FOR DRIVEWAY ENTRANCE.
2. AREA WITHIN PROPERTY LINE OR EASEMENT SHALL BE PAVED WITH TYPICAL SECTION OF 3" ACP OVER 4" ATB.

LAST REVISED 03/24/15

APPROVED BY

MARYSVILLE CITY ENGINEER

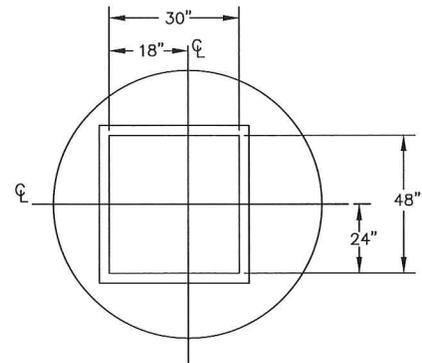
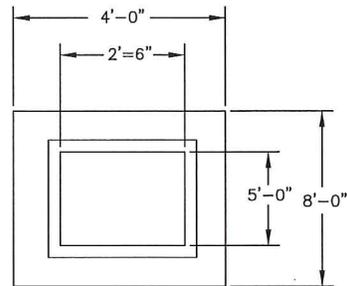
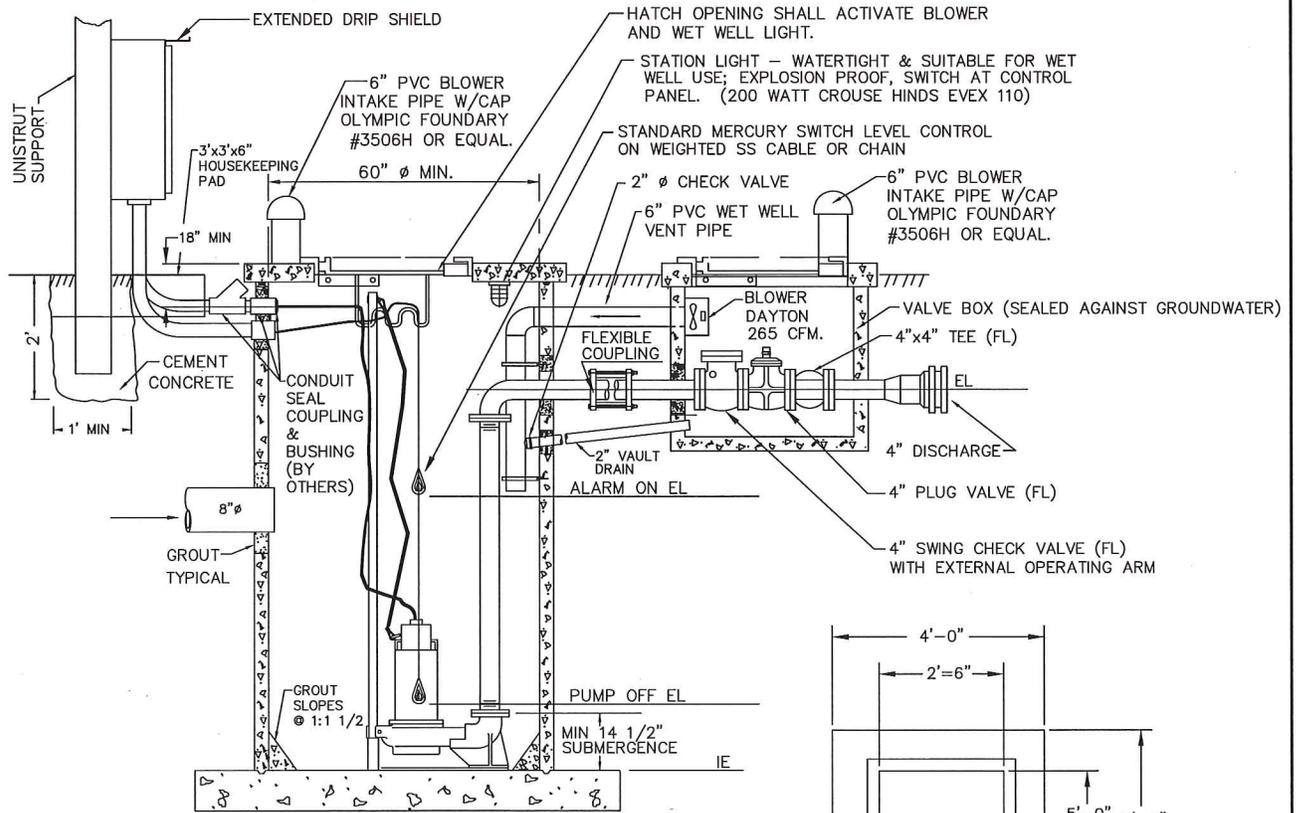
5/15/15

DATE

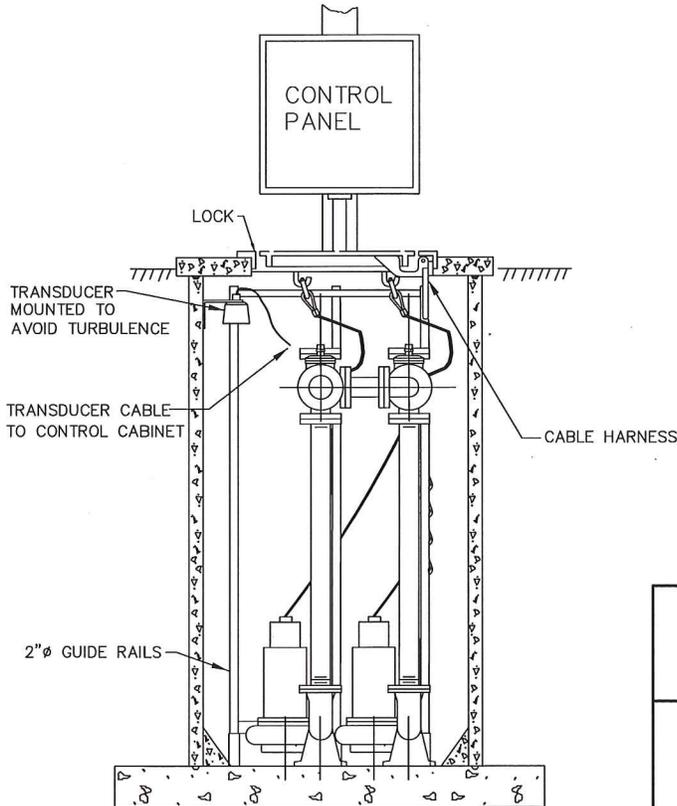


SEWAGE PUMP STATION  
TYPICAL SITE PLAN

STANDARD PLAN 5-500-001



TOP VIEW  
DOOR OPENING LOCATION



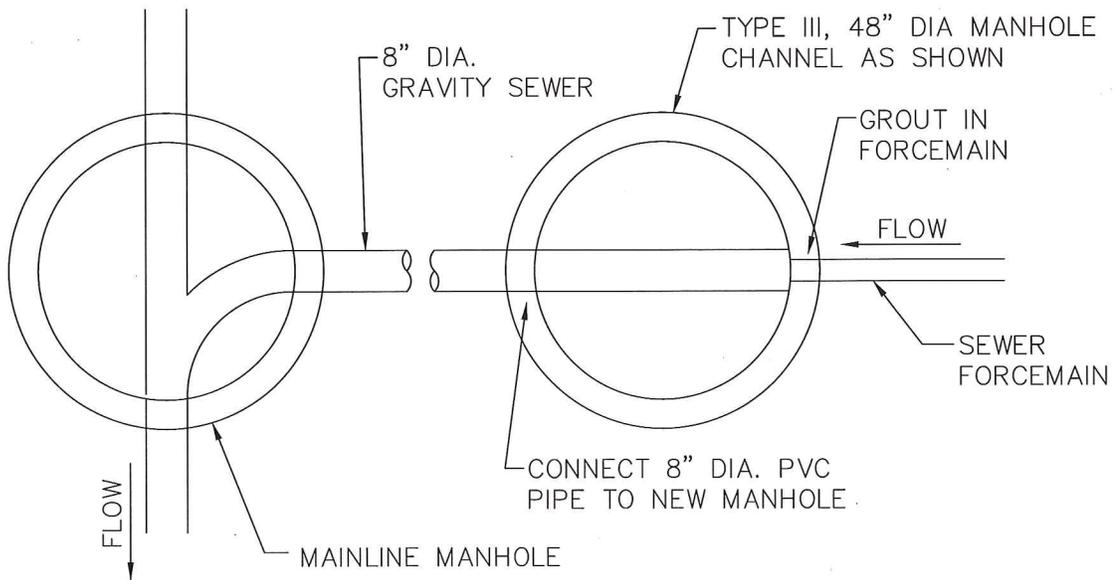
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MARYSVILLE CITY ENGINEER

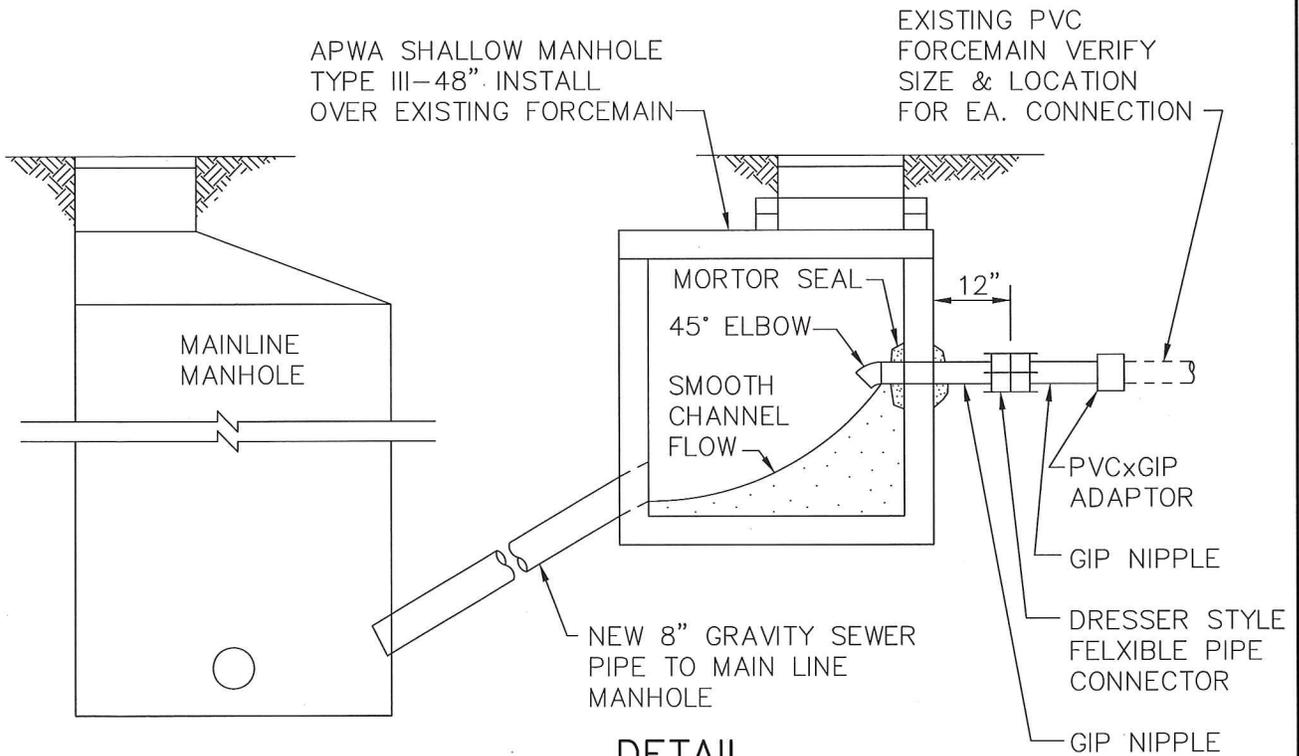
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SEWAGE PUMP STATION  
TYPICAL DETAILS





PLAN



DETAIL

LAST REVISED 10/23/01

APPROVED BY

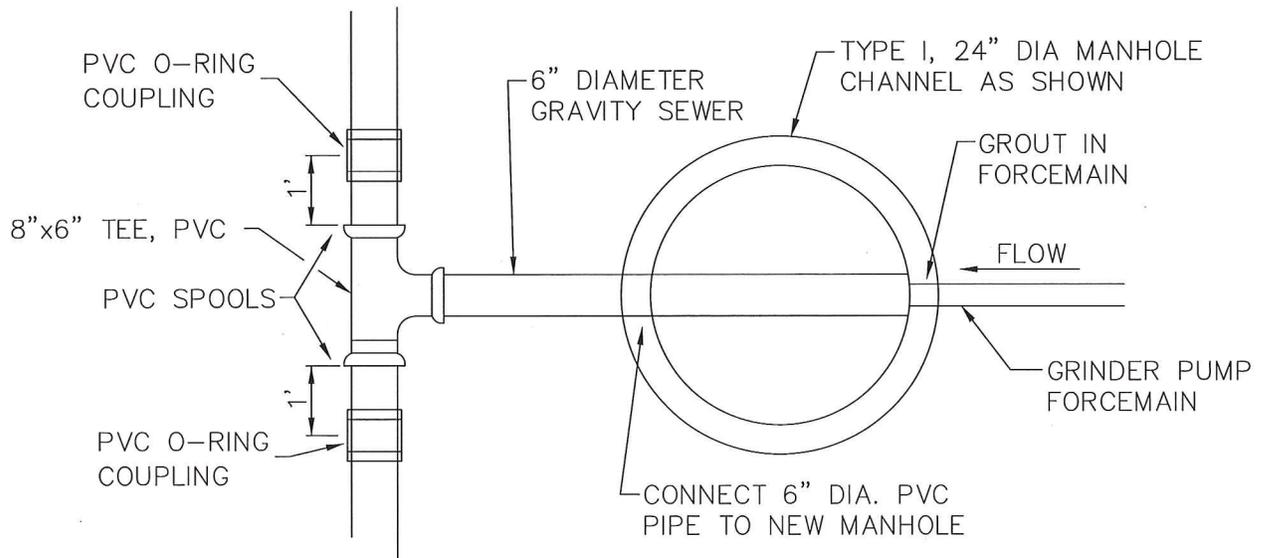
*Kenn Miller 5/9/07*

MARYSVILLE CITY ENGINEER

DATE

PUMP STATION FORCE-  
MAIN DISCHARGE  
MANHOLE

STANDARD PLAN 5-715-001



NOTE:

FERNCO COUPLINGS TO BE USED ONLY ON  
 6" PIPE DIA. OR LESS. 8' PIPE DIA. AND  
 LARGER MAIN LINES USE PVC O-RING COUPLINGS.

DUCTILE IRON CAN BE USED WITH APPROVED FITTINGS.

APPROVED BY

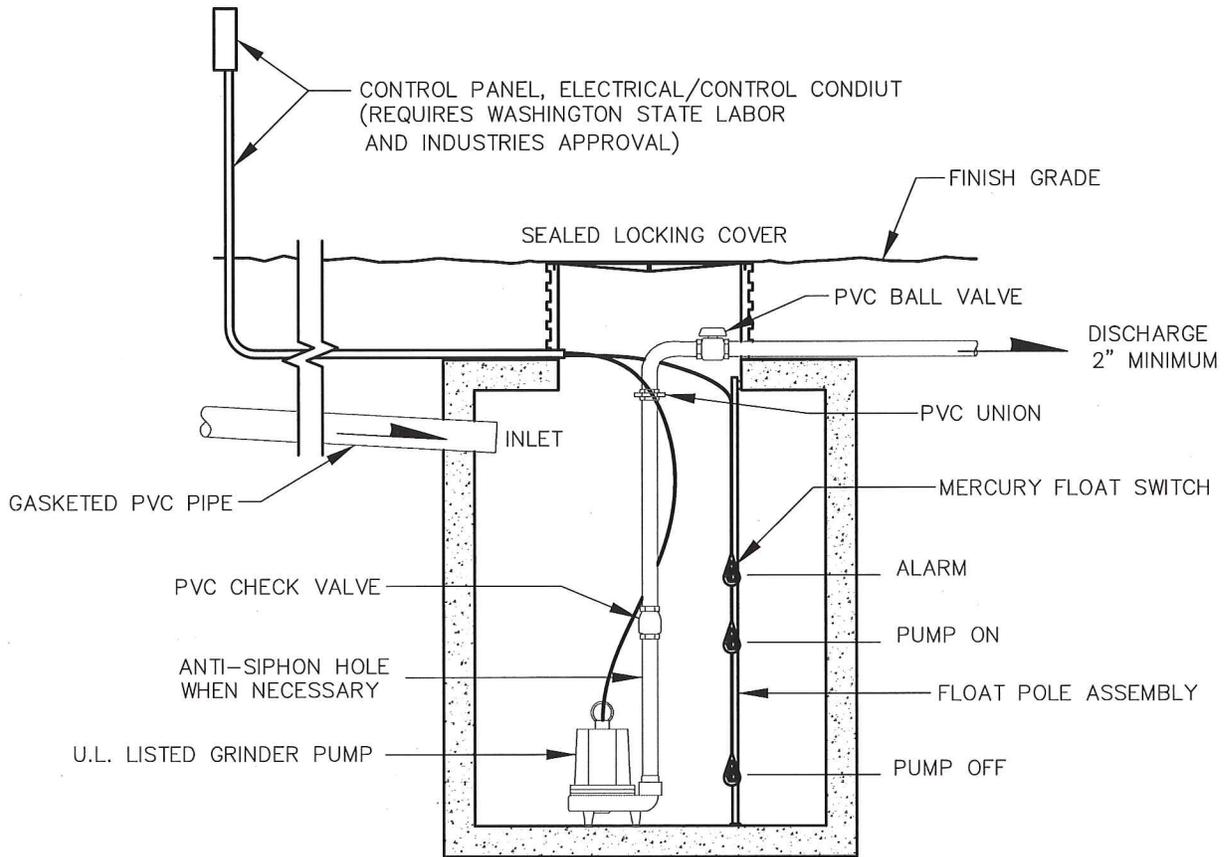
*Kevin Neuberger* 5/9/07

MARYSVILLE CITY ENGINEER

DATE

GRINDER PUMP DISCHARGE  
 MANHOLE FOR SINGLE  
 UNIT OR DUPLEX





**NOTES:**

1. MINIMUM TANK REQUIREMENT: 500 GAL., SINGLE CELL, REINFORCED CEMENT CONCRETE
2. PVC DISCHARGE PIPE AND FITTINGS TO BE SCHEDULE 80 OR GREATER
3. SIZING SHEET AND RECORD DRAWING MUST BE ONSITE PRIOR TO APPROVAL
4. WASHINGTON STATE LABOR AND INDUSTRIES ACCEPTANCE OF ELECTRICAL REQUIRED PRIOR TO FINAL APPROVAL
5. THE MINIMUM SIZE OF ANY PUMP OR ANY DISCHARGE PIPE FROM A SUMP HAVING A WATER CLOSET CONNECTED THERETO SHALL NOT BE LESS THAN TWO (2) INCHES. (UNIFORM PLUMBING CODE SECTION 710.3)
6. GROUT ALL PICK HOLES INSIDE AND OUT.

APPROVED BY

*Kevin Nielsen*

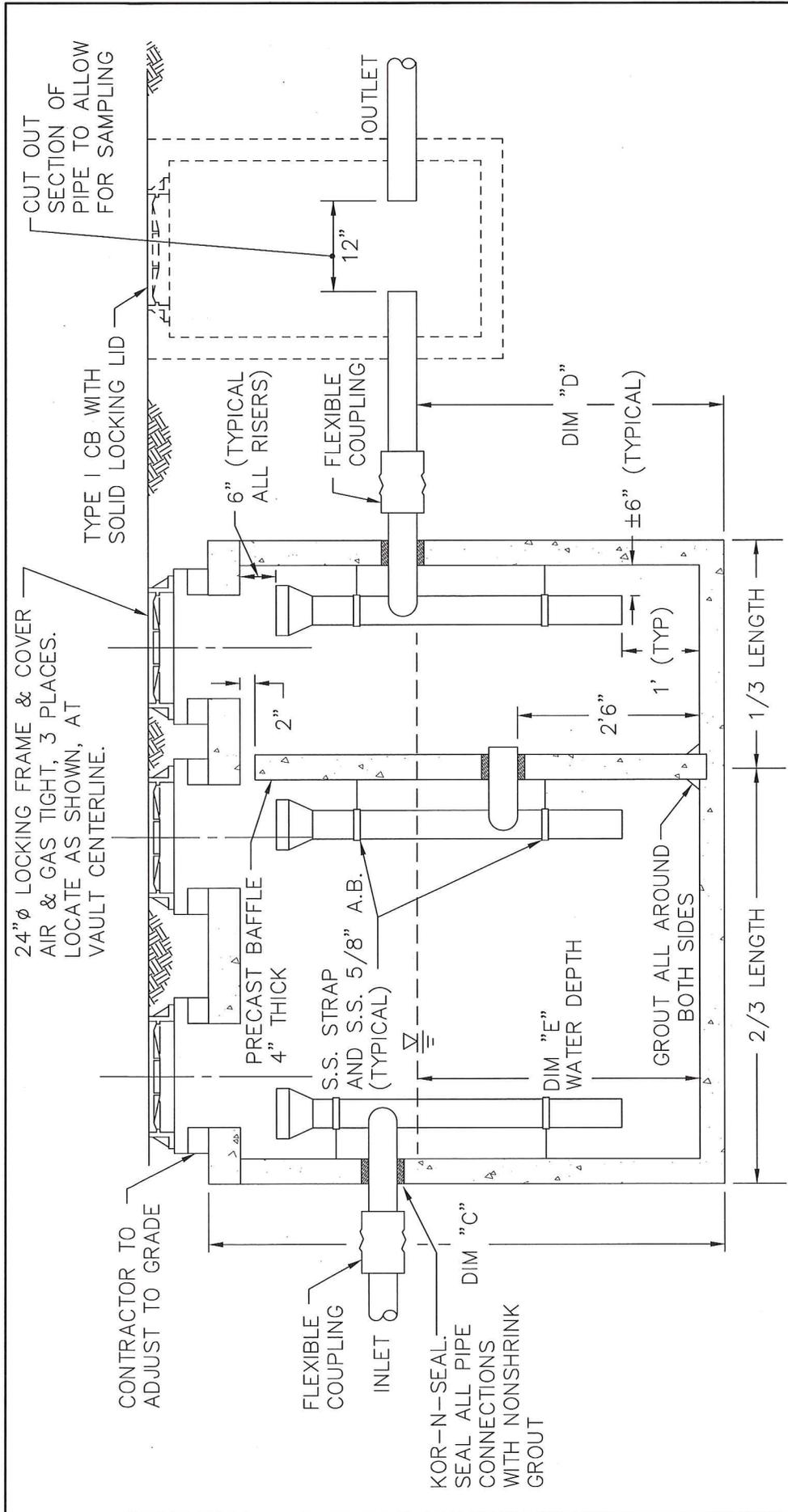
MARYSVILLE CITY ENGINEER

*5/9/07*

DATE

**PRIVATE GRINDER  
PUMP DETAIL**





APPROVED BY *Kevin Auten* 5/9/07  
 MARYSVILLE CITY ENGINEER DATE

**STANDARD GREASE INTERCEPTOR**  
 600 TO 7,000 GAL.



SHEET 1 OF 2  
 STANDARD PLAN 5-900-001

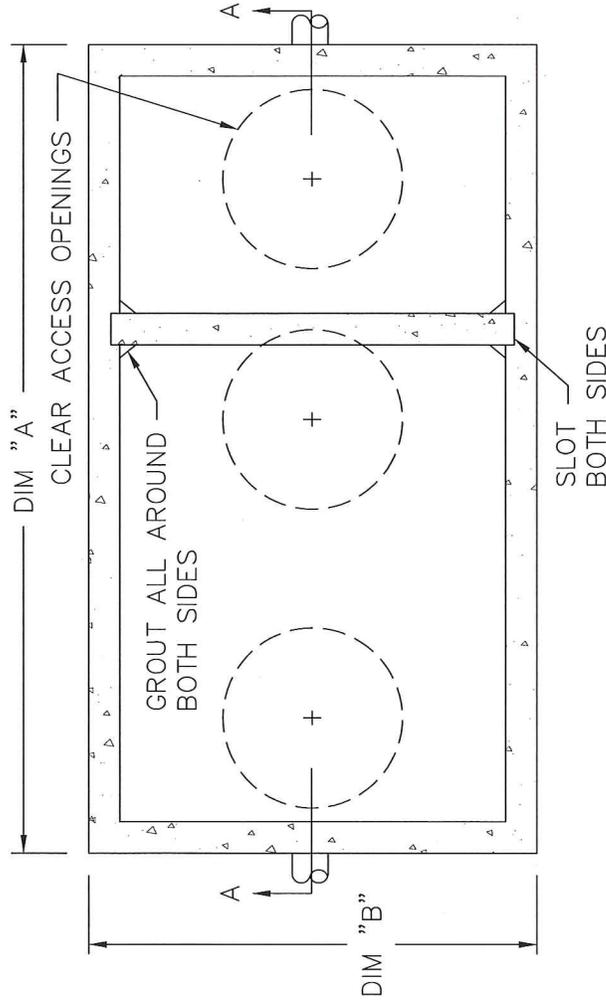
**SECTION A-A**

- NOTES:
- GREASE INTERCEPTORS LOCATED IN A PAVED AREA SHALL COMPLY WITH H-20 LOADING STANDARDS.
  - THE INTERCEPTOR SHALL BE INSTALLED ON LEVEL UNDISTURBED SOIL WITH A TOTAL BEARING CAPACITY OF A MIN OF 2000 LB/SQ FT. THE INTERCEPTOR SHALL BE SET ON A LAYER OF PEA GRAVEL, 12" MIN THICKNESS.
  - P.V.C. PIPE SHALL BE USED THROUGHOUT.
  - SAMPLING STATION WILL BE REQUIRED AT THE DISCRETION OF THE DIRECTOR OF PUBLIC WORKS.

NOTE:  
 GREASE TRAP NEEDS TO BE ACCESSABLE AT ALL TIMES

GALLON CAPACITY	600	750	950	1000	1250	1500	1750	2000	2500	3000	4000	5000	6000	7000
DIM "A"	7'-0"	7'-0"	7'-0"	9'-0"	9'-0"	11'-2"	11'-2"	12'-8"	12'-8"	13'-1"	13'-1"	15'-7"	15'-7"	19'-11"
DIM "B"	4'-8"	4'-8"	4'-8"	5'-0"	5'-0"	5'-8"	5'-8"	6'-8"	6'-8"	8'-0"	8'-0"	9'-7"	9'-7"	9'-11"
DIM "C"	7'-0"	7'-0"	7'-0"	7'-2"	7'-2"	7'-2"	7'-2"	8'-0"	8'-0"	8'-7"	8'-7"	10'-1/2"	10'-1/2"	10'-5"
DIM "D"	3'-6"	4'-3"	5'-3"	4'-2"	5'-2"	4'-4"	4'-11"	4'-7"	5'-6"	5'-1"	6'-8"	7'-4"	7'-1"	8'-0"
WATER DEPTH "E"	3'-2"	3'-11"	4'-11"	3'-10"	4'-10"	4'-0"	4'-7"	3'-10"	4'-9"	4'-8"	6'-3"	6'-1"	5'-8"	6'-7"

- GREASE INTERCEPTORS LOCATED IN A PAVED AREA SHALL COMPLY WITH H-20 LOADING STANDARDS.
- THE INTERCEPTOR SHALL BE INSTALLED ON LEVEL UNDISTURBED SOIL WITH A TOTAL BEARING CAPACITY OF A MINIMUM OF 2000 LB/SQ FT. THE INTERCEPTOR SHALL BE SET ON A LAYER OF PEA GRAVEL, 12" MINIMUM THICKNESS.
- P.V.C. PIPE SHALL BE USED THROUGHOUT.



APPROVED BY Karen Noben DATE 5/1/07  
 MARYSVILLE CITY ENGINEER

**STANDARD GREASE INTERCEPTOR**  
 600 TO 7,000 GAL.



PLAN VIEW

24" LOCKING FRAME & COVER  
AIR & GAS TIGHT. 4 PLCS.  
LOCATE AS SHOWN, AT  
VAULT CENTERLINE.

CONTRACTOR TO  
ADJUST TO GRADE

KOR-N-SEAL.  
SEAL ALL PIPE CONNECTIONS  
WITH NONSHRINK GROUT

DIM "D"  
WATER DEPTH

1' (TYP)

STAINLESS STEEL STRAP  
AND STAINLESS STEEL 5/8"  
ANCHOR BOLT (TYPICAL)

DIM "E"  
WATER DEPTH

2'6"

±6" (TYPICAL)

DIM "G"

TYPE I CB WITH  
SOLID LOCKING LID

6" (TYPICAL  
ALL RISERS)

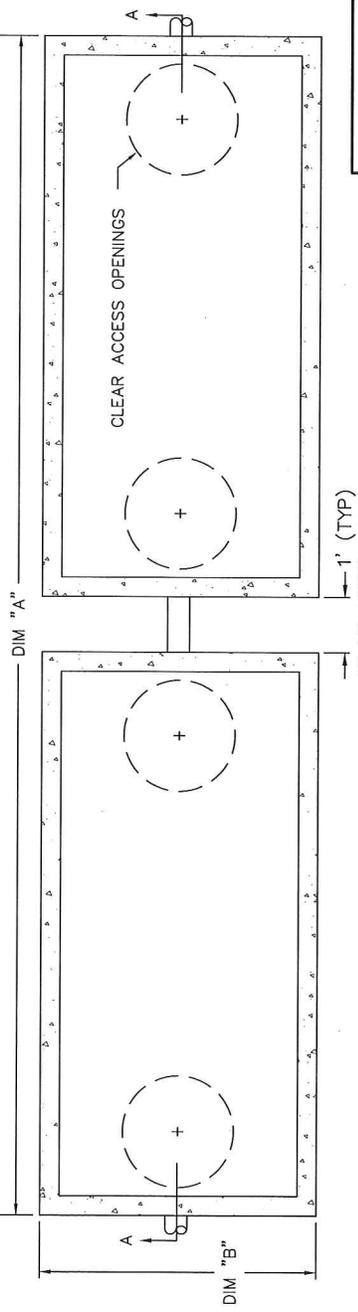
FLEXIBLE  
COUPLING  
(TYP)

CUT OUT  
SECTION OF  
PIPE TO ALLOW  
FOR SAMPLING

12"

OUTLET

**SECTION A-A**



SEE STANDARD PLAN  
5-900-001 (SHEET 2)  
FOR SIZING.

APPROVED BY *Kevin Nober* 5/9/07  
MARYSVILLE CITY ENGINEER DATE

**DOUBLE VAULT GREASE  
INTERCEPTOR**

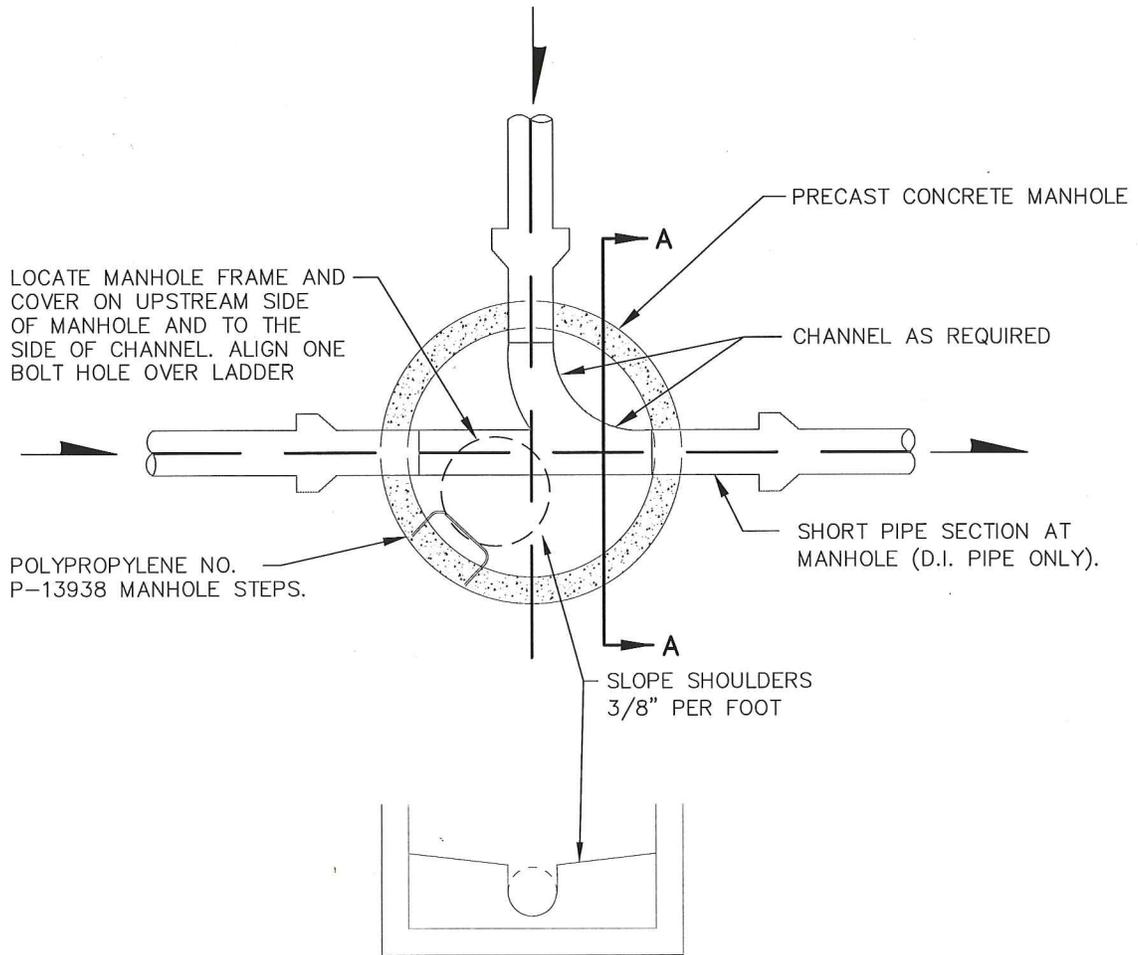


STANDARD PLAN 5-900-002

- NOTES:
- GREASE INTERCEPTORS LOCATED IN A PAVED AREA SHALL COMPLY WITH H-20 LOADING STANDARDS.
  - THE INTERCEPTOR SHALL BE INSTALLED ON LEVEL UNDISTURBED SOIL WITH A TOTAL BEARING CAPACITY OF A MIN OF 2000 LB/SQ FT. THE INTERCEPTOR SHALL BE SET ON A LAYER OF PEA GRAVEL, 12" MIN THICKNESS.
  - P.V.C. PIPE SHALL BE USED THROUGHOUT.
  - SAMPLING STATION WILL BE REQUIRED AT THE DISCRETION OF THE DIRECTOR OF PUBLIC WORKS.

NOTE:  
GREASE TRAP NEEDS TO BE  
ACCESSIBLE AT ALL TIMES

LAST REVISED 02/14/07



SECTION A-A

NOTES:

1. PIPE CONNECTIONS TO MANHOLES SHALL BE AS FOLLOWS:  
 PVC PIPE: CAST OR GROUT A MANHOLE COUPLING INTO WALL.  
 D.I. PIPE: BELL AND SPIGOT JOINT OR FLEXIBLE COUPLING  
 EITHER SHALL BE 12" MAXIMUM DISTANCE FROM MANHOLE  
 WALL. PVC AND D.I. PIPE, OPTIONAL: CORE THE MANHOLE  
 AND CONNECT SEWER PIPE WITH A WATER TIGHT FLEXIBLE  
 RUBBER BOOT IN MANHOLE WALL, KOR-N-SEAL BOOT  
 OR EQUAL.

APPROVED BY

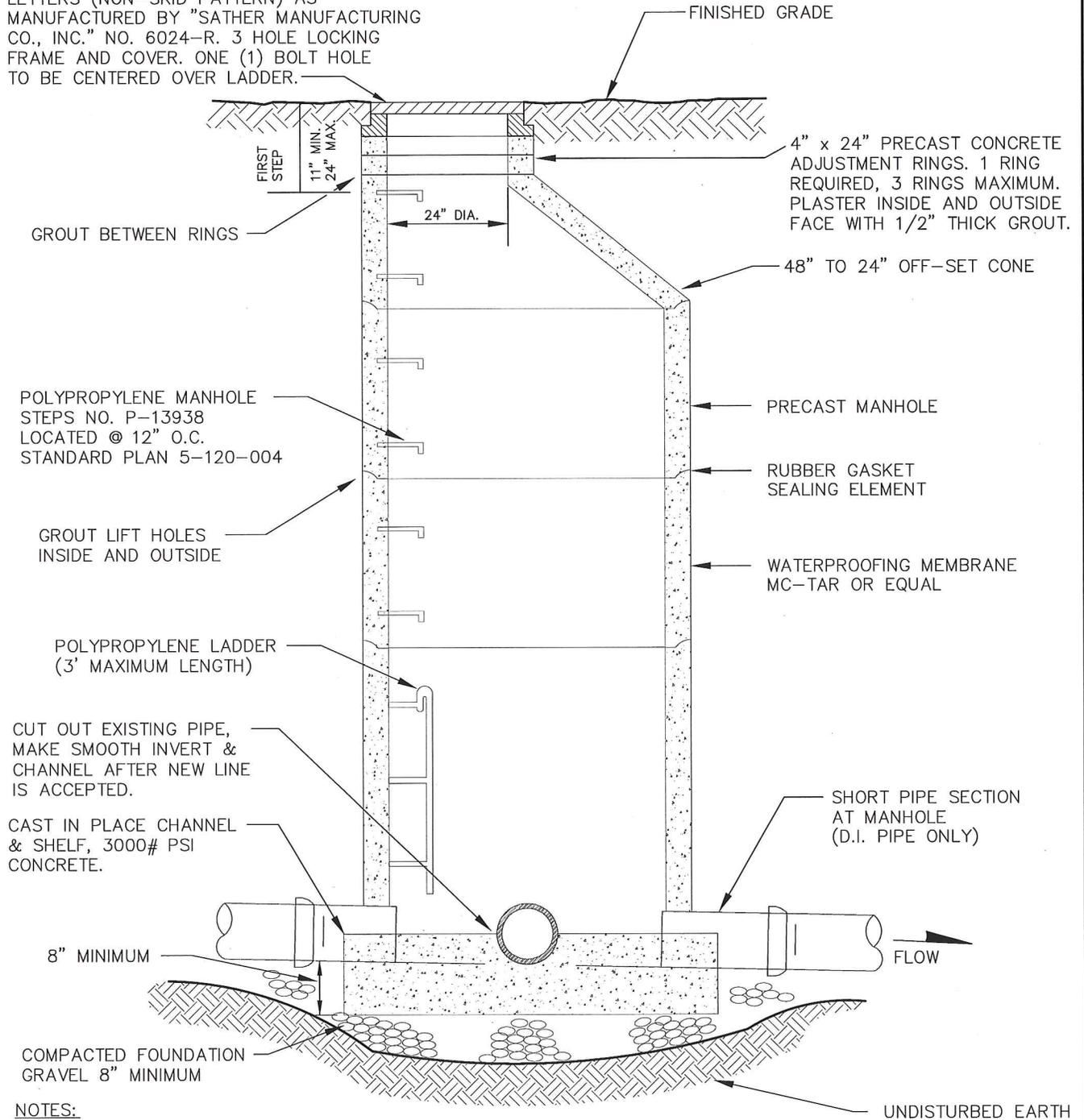
MARYSVILLE CITY ENGINEER

5/9/07  
DATE

MANHOLE PLAN



MANHOLE FRAME & COVER WITH "SEWERS"  
 CAST ON COVER WITH 3" HIGH RAISED  
 LETTERS (NON-SKID PATTERN) AS  
 MANUFACTURED BY "SATHER MANUFACTURING  
 CO., INC." NO. 6024-R. 3 HOLE LOCKING  
 FRAME AND COVER. ONE (1) BOLT HOLE  
 TO BE CENTERED OVER LADDER.



**NOTES:**

1. PIPE CONNECTIONS TO MANHOLES SHALL BE AS FOLLOWS: PVC PIPE" CAST OR GROUT A MANHOLE COUPLING INTO WALL. D.I. PIPE: BELL AND SPIGOT JOINT OR FLEXIBLE COUPLING EITHER SHALL BE 12" MAXIMUM DISTANCE FROM MANHOLE WALL. PVC AND D.I. PIPE, OPTIONAL: CORE THE MANHOLE AND CONNECT SEWER PIPE WITH A WATER TIGHT FLEXIBLE RUBBER BOOT IN MANHOLE WALL, KOR-N-SEAL BOOT OR EQUAL.
2. DROP OF GRADE THRU MANHOLE SHALL BE 0.10', UNLESS OTHERWISE APPLICABLE.

APPROVED BY

MARYSVILLE CITY ENGINEER

5/9/07  
 DATE

**TYPE 1  
 MANHOLE DETAIL**



MANHOLE FRAME AND COVER WITH 3 BOLT LOCK DOWN (SEE TYPICAL PRECAST MANHOLE DETAIL)

FINISHED GRADE

4" x 24" PRECAST CONC. ADJUSTMENT RINGS, 1 RING REQUIRED, 3 RINGS MAX. GROUT INSIDE AND OUTSIDE WITH 1/2" THICK GROUT. BRUSH FINISH INSIDE.

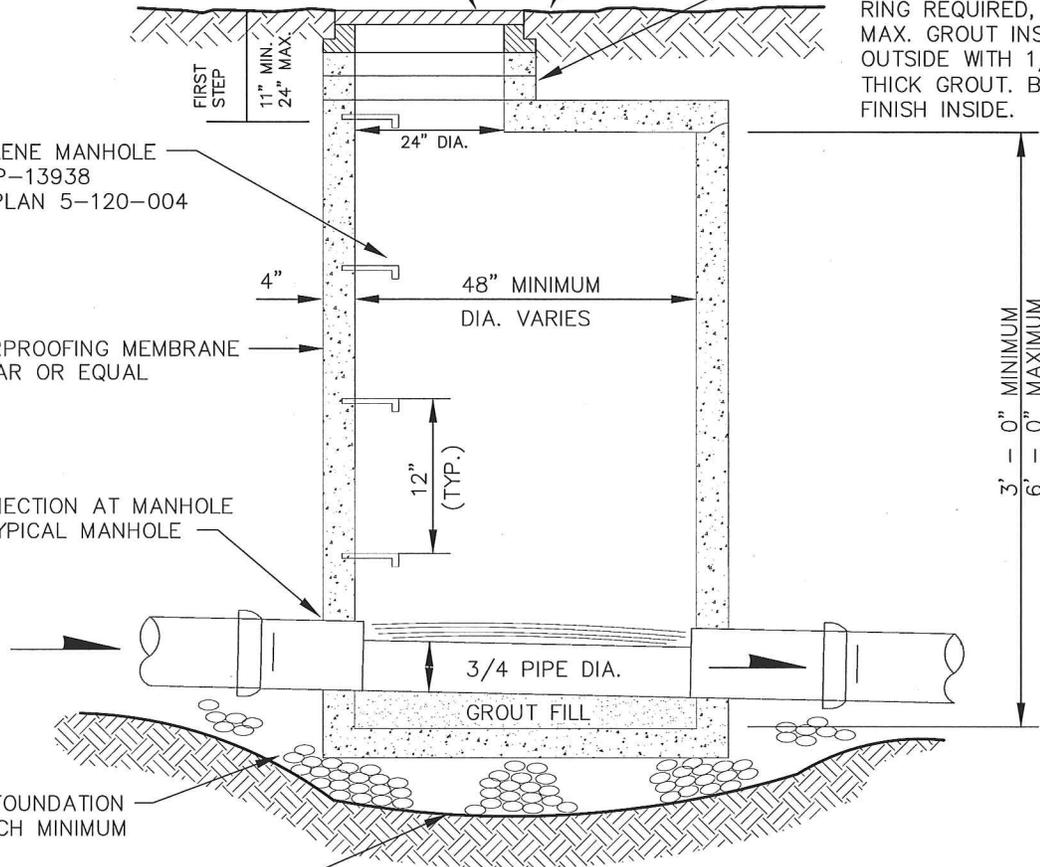
POLYPROPYLENE MANHOLE STEPS NO. P-13938 STANDARD PLAN 5-120-004

WATERPROOFING MEMBRANE MC-TAR OR EQUAL

PIPE CONNECTION AT MANHOLE AS PER TYPICAL MANHOLE

COMPACTED FOUNDATION GRAVEL 8-INCH MINIMUM

UNDISTURBED EARTH



**NOTES:**

1. PIPE CONNECTIONS TO MANHOLES SHALL BE AS FOLLOWS:  
 PVC PIPE: CAST OR GROUT A MANHOLE COUPLING INTO WALL.  
 D.I. PIPE: BELL AND SPIGOT JOINT OR FLEXIBLE COUPLING  
 EITHER SHALL BE 12" MAXIMUM DISTANCE FROM  
 MANHOLE WALL. PVC AND D.I. PIPE, OPTIONAL:  
 CORE THE MANHOLE AND CONNECT SEWER PIPE  
 WITH A WATER TIGHT FLEXIBLE RUBBER BOOT  
 IN MANHOLE WALL, KOR=N-SEAL BOOT OR EQUAL.
2. DROP OF GRADE THRU MANHOLE SHALL BE 0.10',  
 UNLESS OTHERWISE APPLICABLE.
3. GROUT ALL PICK HOLES INSIDE AND OUT.

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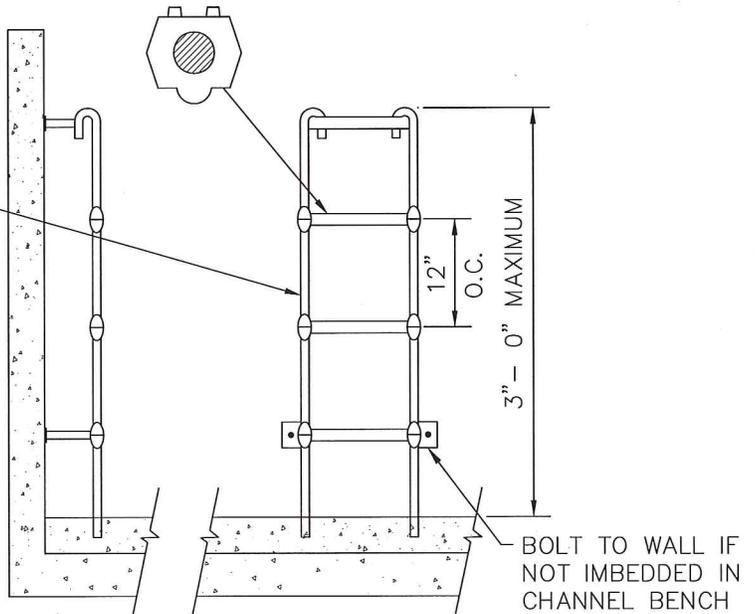
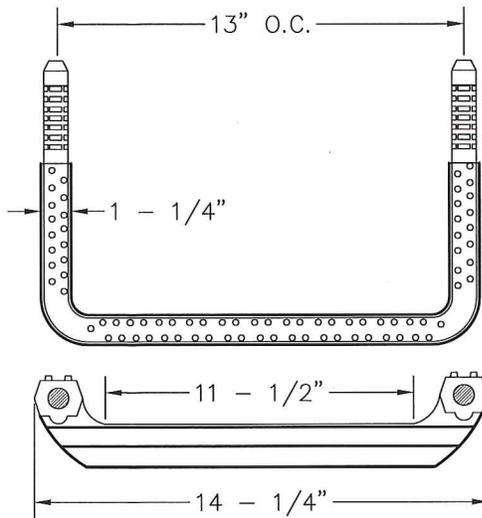
DATE

**TYPE 3  
 MANHOLE DETAIL**



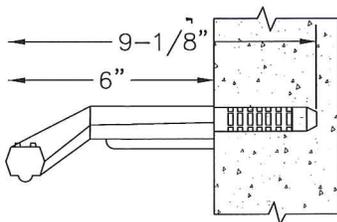
RUNG  
1/2" GRADE 60

RAIL  
9/16" ROUND  
BAR



LADDER SHALL CONFORM TO  
POLYPROPYLENE ASTM D-1401  
1/2" GRADE 60 REINFORCING  
BAR A-615 9/16" COLD DRAWN  
BAR C-1018.

POLYPROPYLENE LADDER



POLYPROPYLENE STEP, LANE  
NO. P-13938 OR EQUAL

POLYPROPYLENE  
MANHOLE STEPS

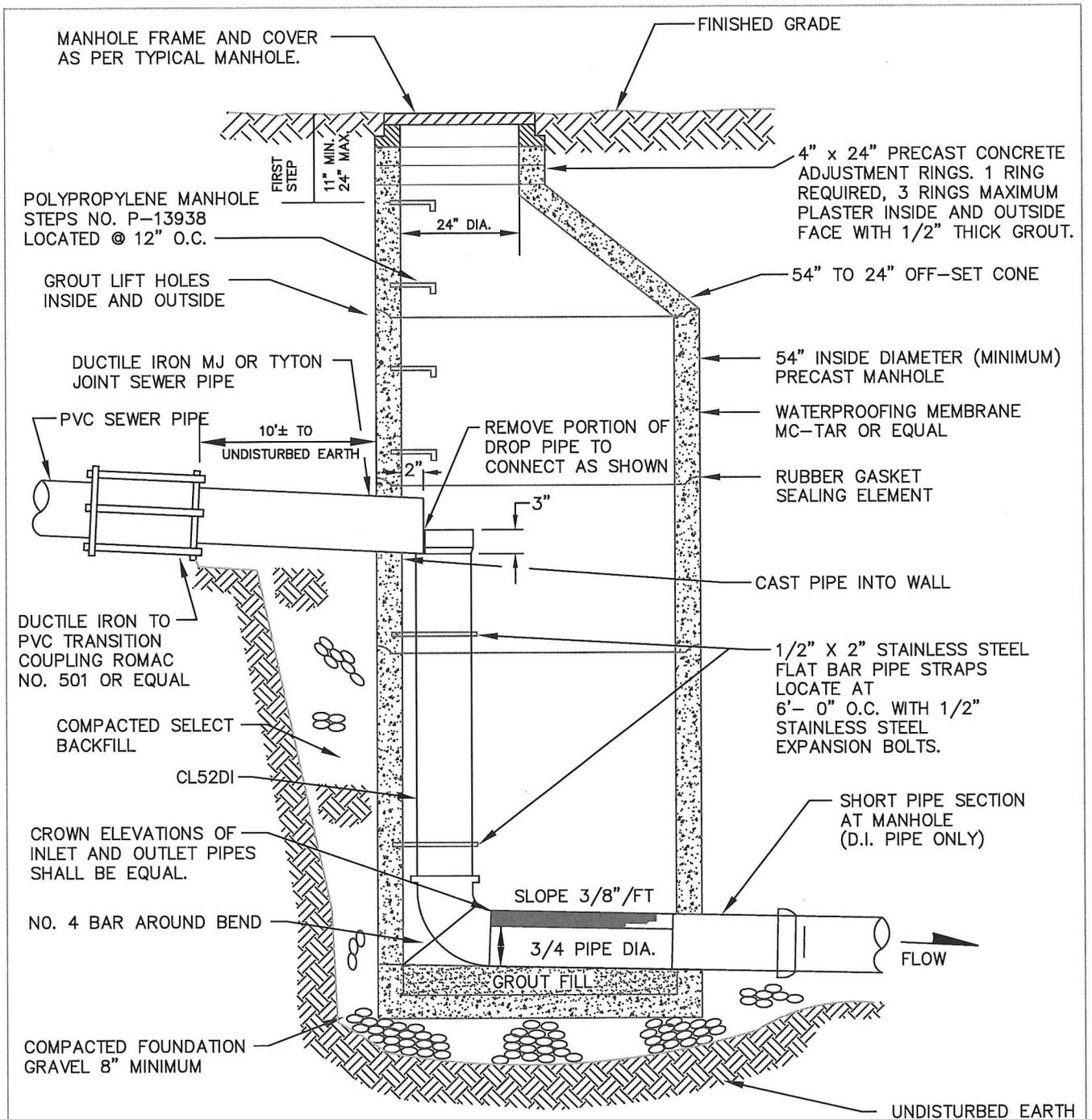
APPROVED BY

MARYSVILLE CITY ENGINEER

5/9/07  
DATE

LADDER DETAIL





**NOTES:**

1. PIPE CONNECTIONS TO MANHOLES SHALL BE AS FOLLOWS:  
 PVC PIPE: CAST OR GROUT A MANHOLE COUPLING INTO WALL  
 D.I. PIPE: BELL AND SPIGOT JOINT OR FLEXIBLE COUPLING EITHER SHALL BE 12" MAXIMUM DISTANCE FROM MANHOLE WALL. PVC AND D.I. PIPE, OPTIONAL: CORE THE MANHOLE AND CONNECT SEWER PIPE WITH A WATER TIGHT GLEXIBLE RUBBER BOOT IN MANHOLE WALL, KOR-N-SEAL BOOT OR EQUAL.
2. DROP OF GRADE THRU MANHOLE SHALL BE 0.10', UNLESS OTHERWISE APPLICABLE.

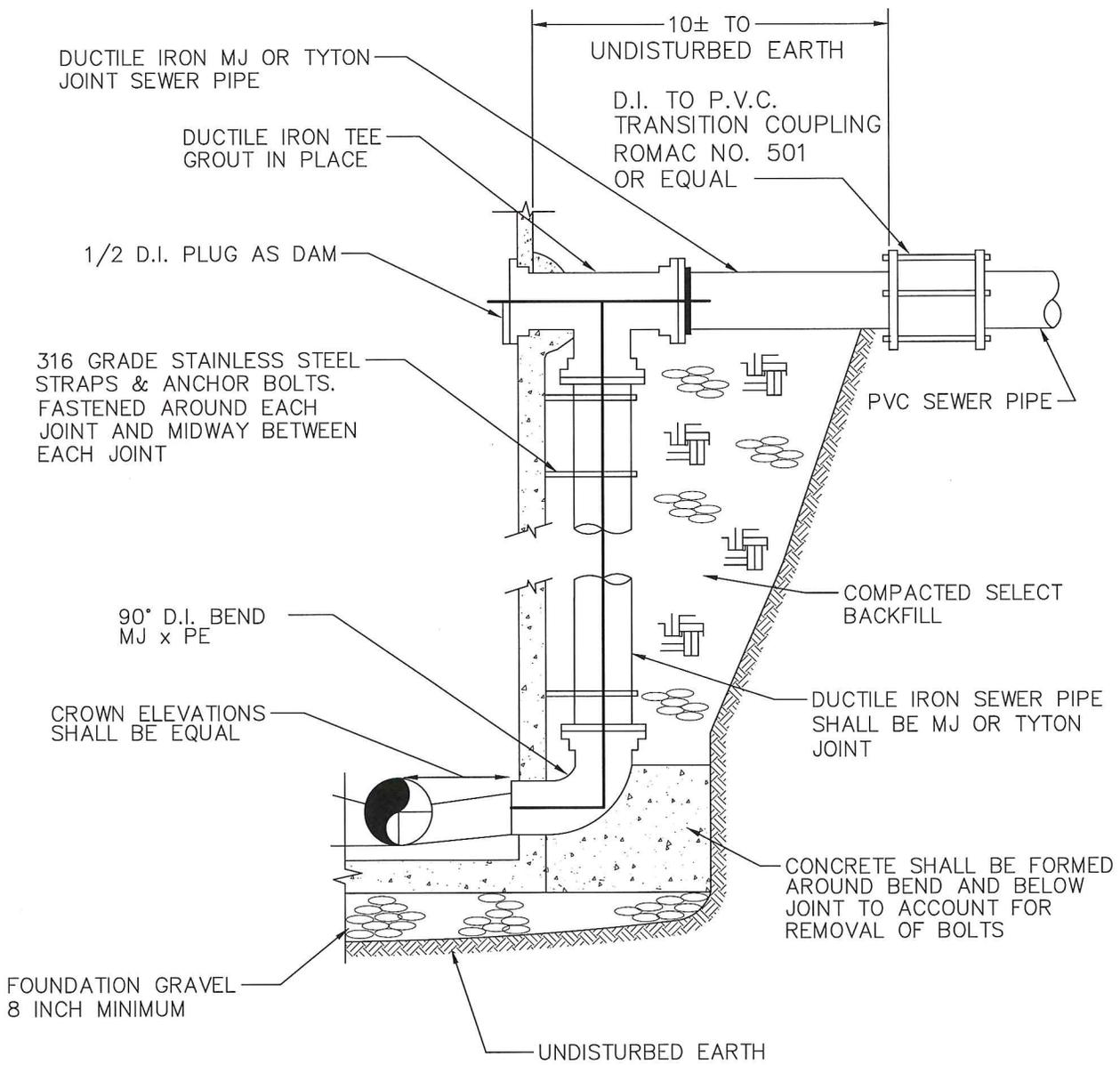
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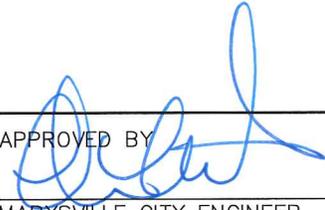
5/15/15  
DATE



INSIDE DROP CONNECTION FOR SANITARY SEWERS

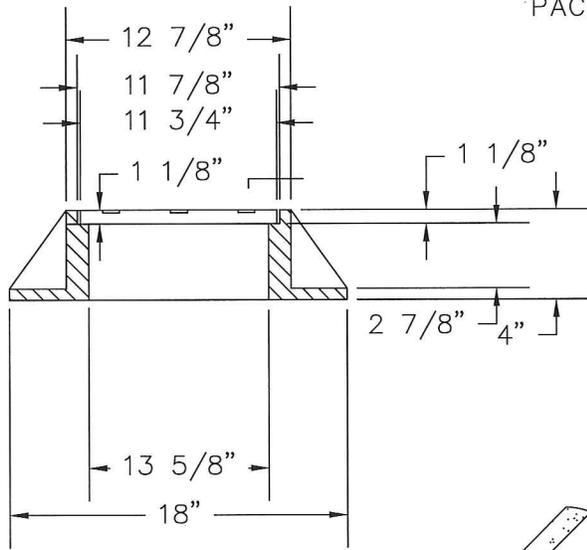
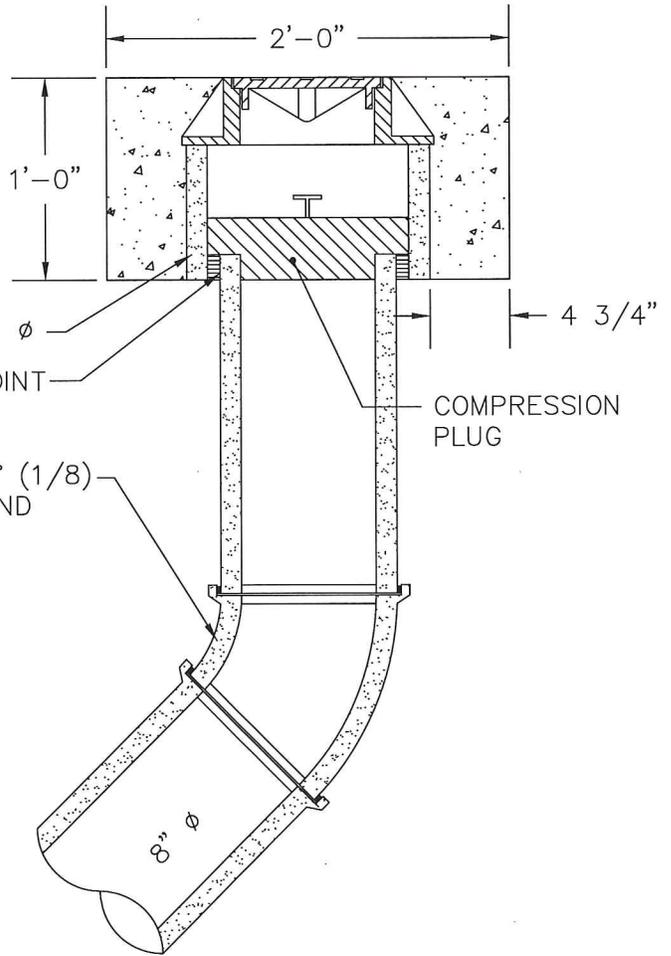
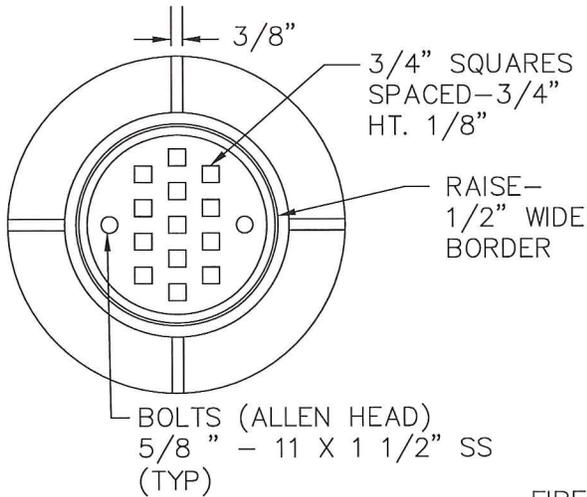


NOTE: USE MEGA LUG FOLLOWERS ON ALL D.I. FITTINGS.

APPROVED BY  5/15/15  
 MARYSVILLE CITY ENGINEER DATE

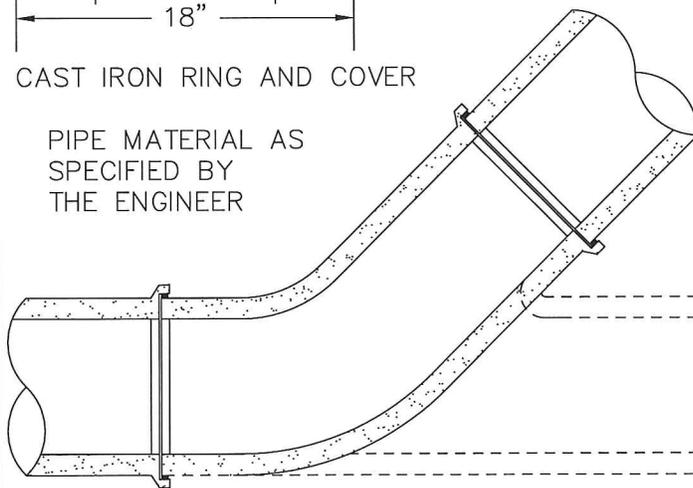
OUTSIDE DROP CONNECTION FOR SANITARY SEWERS





CAST IRON RING AND COVER

PIPE MATERIAL AS SPECIFIED BY THE ENGINEER



PLUG TO BE SEALED IN SAME MANNER AS MAIN SEWER JOINTS

CLEANOUTS NOT IN ROADWAY SHALL HAVE A 3'X3'X4" CONC. PAD AT GROUND LEVEL.

LAST REVISED 03/24/15

APPROVED BY

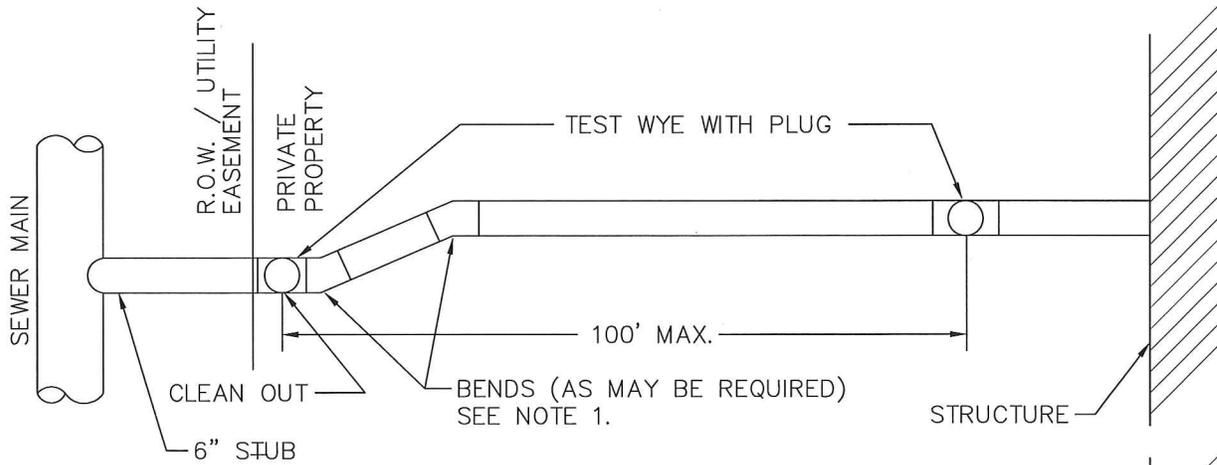
MARYSVILLE CITY ENGINEER

5/15/15  
DATE

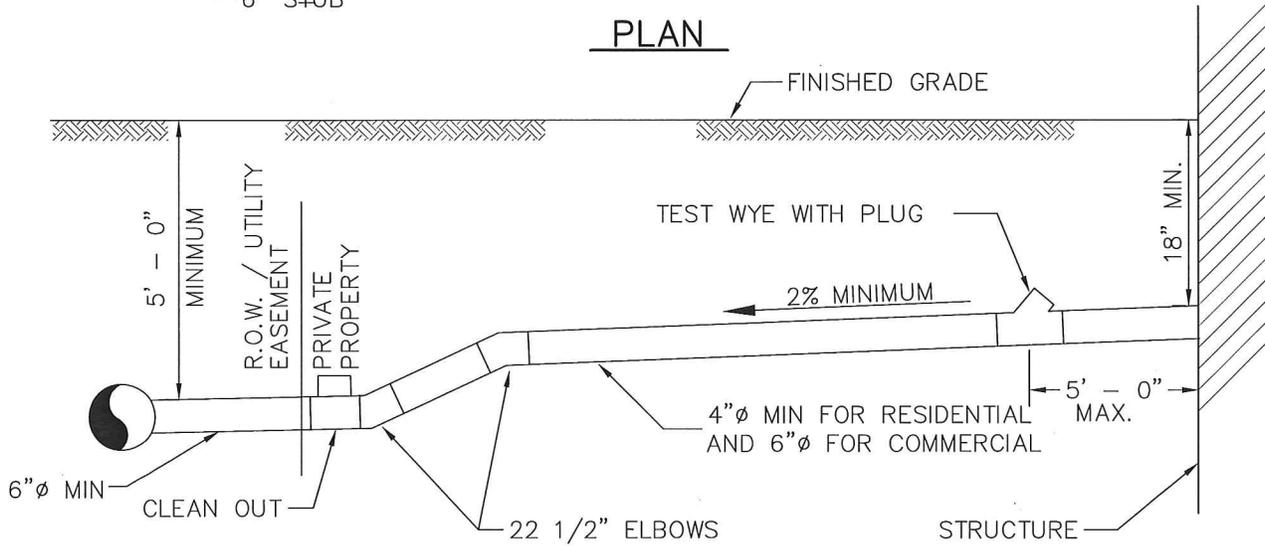


# 8" CLEAN OUT

STANDARD PLAN 5-145-001



**PLAN**



**ELEVATION**

**NOTES:**

1. ELBOWS SHALL NOT BE GREATER THAN 45°
2. CLEAN OUT IS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 45° ACCUMULATED ELBOW/100'.
3. RIGHT-OF-WAY RESTORATION SHALL MATCH OR EXCEED THE ORIGINAL CONDITION.
4. BACKFILL FOR PAVED AREA SHALL BE 5/8" MINUS CRUSHED SURFACING TOP COURSE, COMPACTED IN 12" LIFTS.
5. ALL PLUMBING OUTLETS SHALL BE CONNECTED TO THE SEWER. NO DOWNSPOUTS OR STORM DRAINAGE MAY BE CONNECTED TO THE SEWER SYSTEM.
6. 18" MINIMUM COVERAGE OF PIPE.
7. 5' MINIMUM COVERAGE AT PROPERTY LINE.
8. LAY PIPE IN STRAIGHT LINE BETWEEN BENDS. MAKE ALL CHANGES IN GRADE OR LINE WITH AN ELBOW OR WYE. 90° CHANGE WITH AN ELBOW AND WYE.
9. 6" SEWER PIPE MINIMUM SIZE IN R.O.W. 2% MINIMUM GRADE, 45% MAXIMUM.
10. 4" SEWER PIPE MINIMUM SIZE ON PRIVATE RESIDENTIAL PROPERTY. 6" SEWER PIPE MIN. SIZE ON COMMERCIAL PROPERTIES. 2% MIN GRADE, 45° MAXIMUM.
11. CONSTRUCTION IN RIGHT-OF-WAY SHALL BE PERFORMED BY A REGISTERED LICENSED CONTRACTOR.
12. ALL CONSTRUCTION REQUIRES A PERMIT AND PAYMENT OF FEES. COMPLETE LEGAL DESCRIPTION OF PROPERTY AND DIMENSIONS.
13. AS-BUILT DRAWING SHOWING LOCATION OF SIDE SEWER IN RELATION TO THE HOUSE IS REQUIRED AFTER INSTALLATION.
14. MINIMUM OF 12" BETWEEN 45 DEGREE FITTINGS.

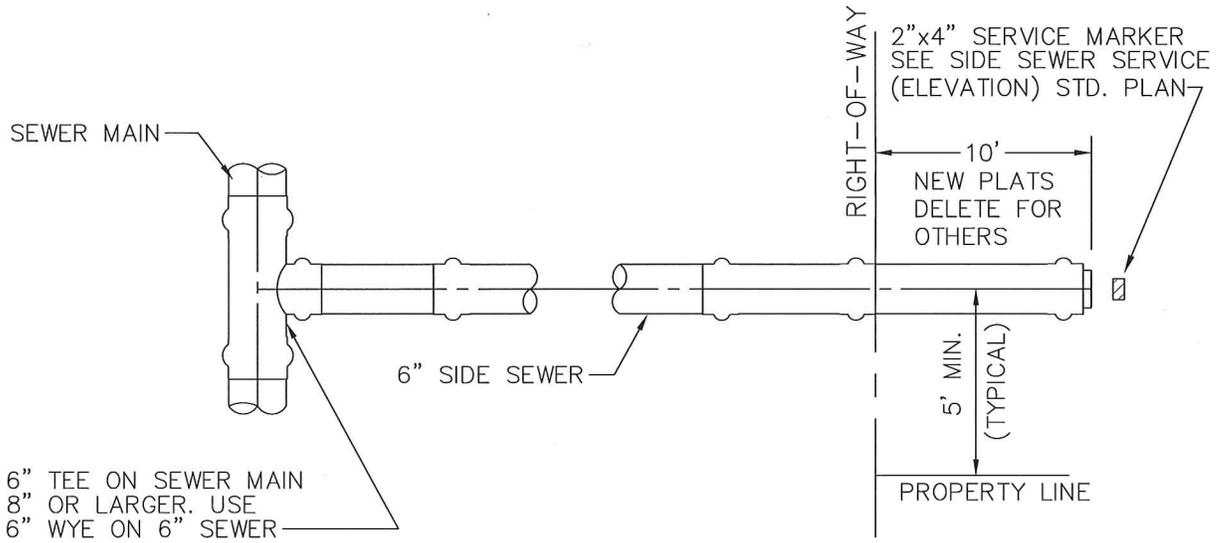
APPROVED BY

*Kevin Nelson* 5/9/05  
 MARYSVILLE CITY ENGINEER DATE

**TYPICAL SIDE SEWER**



STANDARD PLAN 5-150-001



LAST REVISED 03/09/05

APPROVED BY

MARYSVILLE CITY ENGINEER

*Kevin Mester* 5/9/07

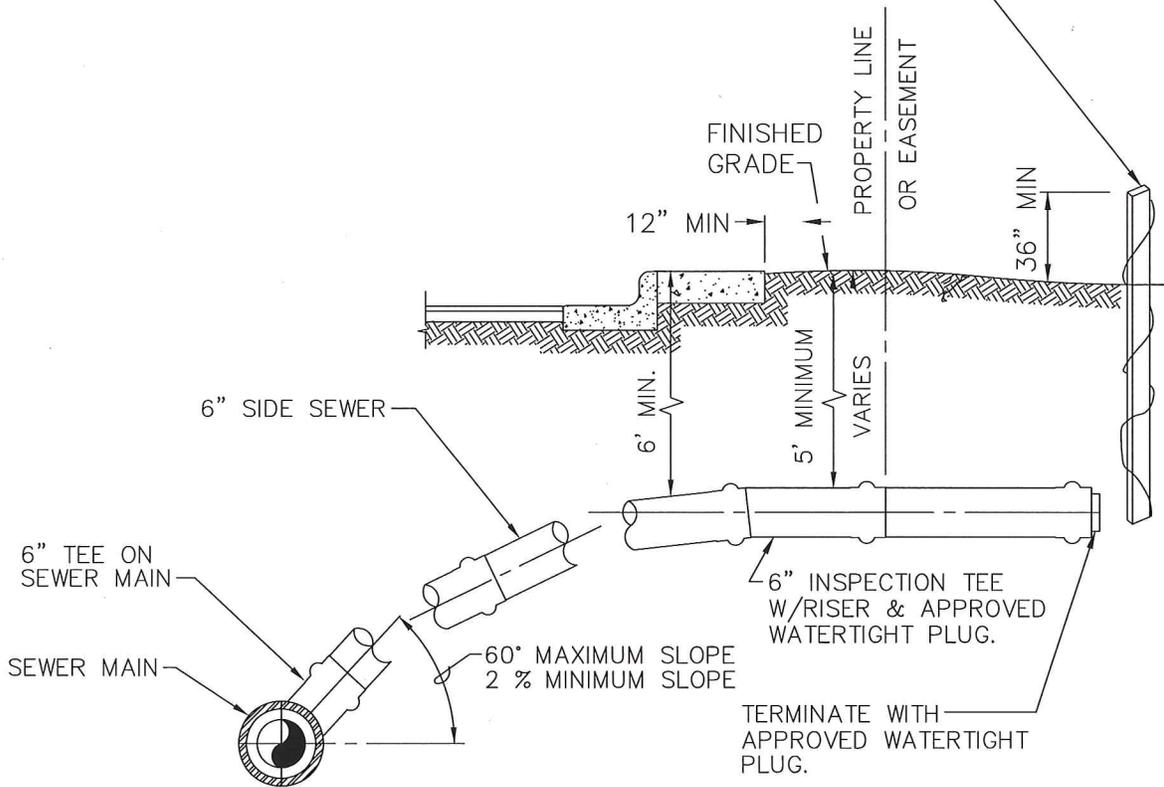
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## SIDE SEWER SERVICE (PLAN)

STANDARD PLAN 5-150-002

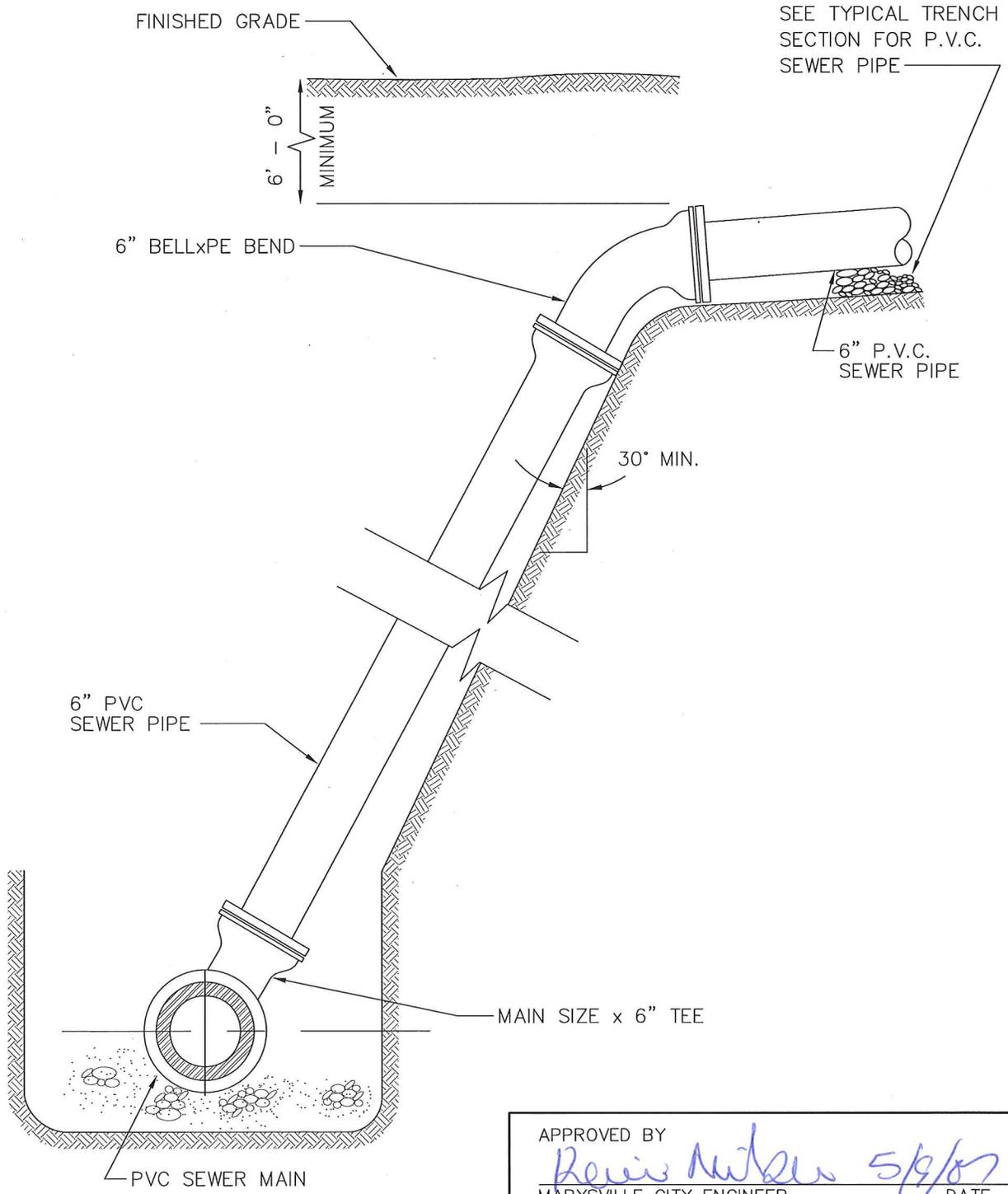
THE LOCATION OF THE SIDE SEWER STUBS AT THE PROPERTY LINE SHALL BE MARKED BY THE CONTRACTOR WITH A 2" x 4" WOODEN STAKE (MINIMUM 8' LONG) BURIED IN THE GROUND TO THE DEPTH OF THE SEWER STUB. THE EXPOSED PORTION OF THE 2" x 4" SHALL BE PAINTED GREEN AND MARKED "SEWER" WITH (2" MINIMUM) WHITE LETTERS. DEPTH OF SIDE SEWER SHALL BE MARKED ON 2" x 4" WITH WHITE PAINT. 12 GAUGE MINIMUM BARE GALVANIZED WIRE SHALL BE PROVIDED TO EXTEND FROM THE CAPPED END OF THE SIDE SEWER TO THE TOP OF SIDE SEWER STAKE. THE WIRE SHALL WRAP AROUND THE 2" x 4" MARKER BUT SHALL NOT BE CONNECTED TO SIDE SEWER PIPE.



APPROVED BY  
*Kevin Anderson* 5/9/07  
 MARYSVILLE CITY ENGINEER DATE

SIDE SEWER SERVICE  
 (ELEVATION)





NOTE:  
SEE TYPICAL TRENCH SECTION  
FOR DUCTILE IRON SEWER PIPE

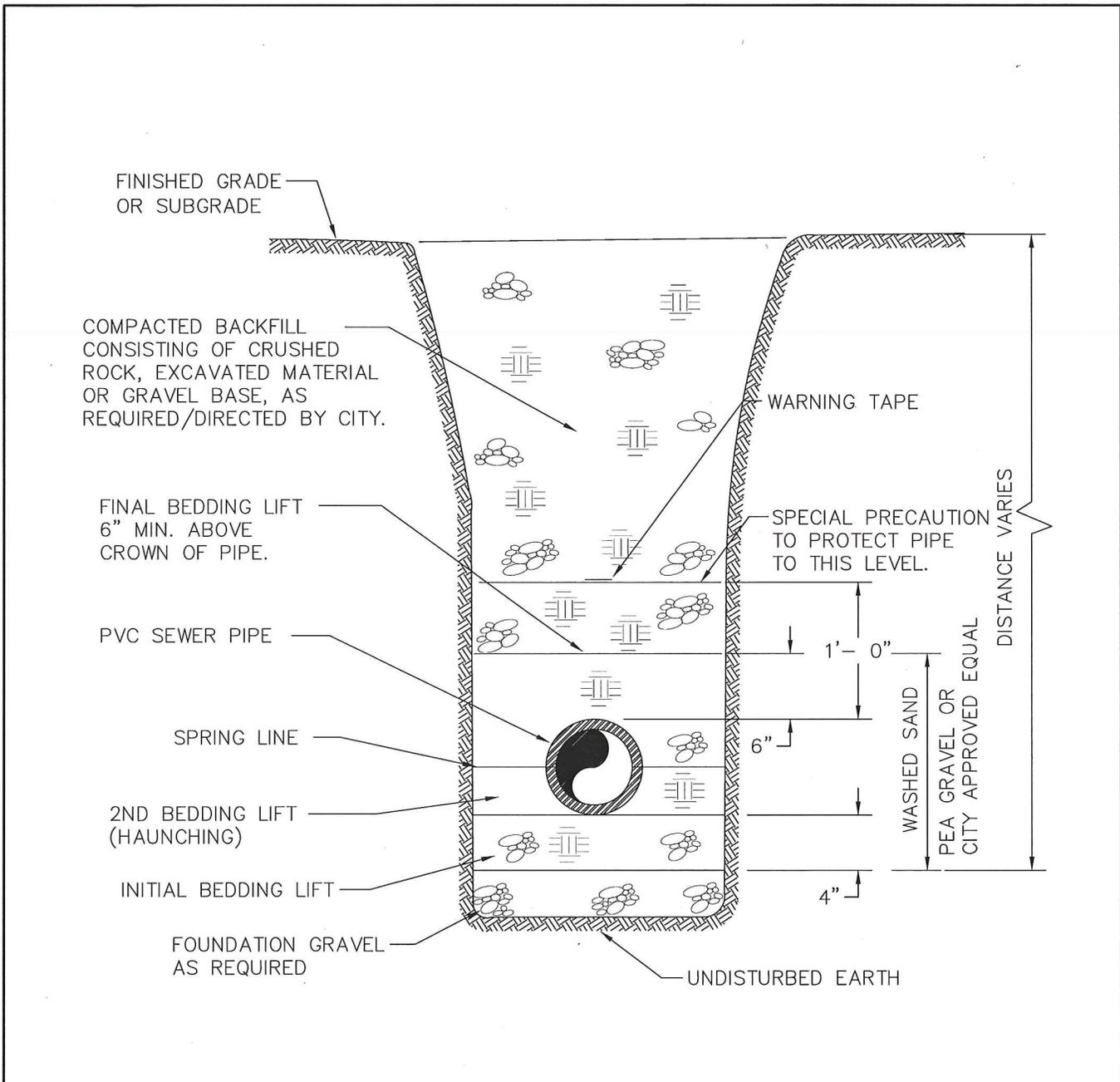
APPROVED BY

*Revis Nelson* 5/9/07  
MARYSVILLE CITY ENGINEER DATE

PVC SIDE  
SEWER VERTICAL  
CONNECTION



STANDARD PLAN 5-150-004



**NOTE:**  
 BACKFILL MATERIAL AND COMPACTION SHALL BE IN CONFORMANCE WITH CITY STANDARDS AND/OR THE STATE OR COUNTY PERMIT REQUIREMENTS (AS MAY BE APPLICABLE).

LAST REVISED 10/23/01

APPROVED BY  
*Kevin Rube* 5/9/07  
 MARYSVILLE CITY ENGINEER DATE



TRENCH  
 (FLEXIBLE PIPE)

STANDARD PLAN 5-175-001