Water Environment Services Sanitary Standards

April 2023

CLACKAMAS
WATER
ENVIRONMENT
SERVICES

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1. Definitions

Words, terms, and acronyms specific to these Standards are defined below.

1.1 Words and Terms

The Water Environment Services (WES) Rules and Regulations (Rules) contains words and terms that apply to and are consistent across the Rules and all adopted standards. Unless the context specifically indicates otherwise, the following words and terms, as used in these Sanitary Standards, shall have the meanings hereinafter designated:

Annexation. A boundary change according to the provisions of ORS Chapter 198.

ASTM Specifications. The standard specifications or methods of ASTM International. Unless otherwise stated, it shall refer to the latest adopted revisions of said specifications.

Board. See the WES Rules.

Bond. See the WES Rules.

Bond, Warranty. A warranty bond is a legal document that guarantees to the Owner that the Contractor who did the work will come back and fix defective work or material should an issue arise during the warranty period specified in the contract.

Building. Any structure containing plumbing.

Building Drain. See the WES Rules.

Building Sewer. See the WES Rules.

Capital Improvement Plan. See the WES Rules.

Cleanout. A sealed aperture extending to the ground surface permitting access to a sanitary sewer pipe for access cleaning and maintenance or testing purposes.

Contractor. A person duly licensed or approved by the State of Oregon to perform the type of work to be done under a permit or contract.

Conveyance System. See the WES Rules. As relates to these Standards, conveyance system refers to the sanitary sewer conveyance system and includes gravity mains, force mains, pumping or lift facilities, manholes, and related facilities.

County. See the WES Rules.

Day. See the WES Rules.

Developer. See the WES Rules. As relates to these Standards, a Developer would propose development that would contribute sewage to the District's public sanitary sewer system.

Development. See the WES Rules.

Director. See the WES Rules.

District. See the WES Rules.

District Personnel. See the WES Rules for definition of District Employee.

Dwelling Unit. See the WES Rules.

Easement. See the WES Rules.

Emergency Work. Work that must be performed to ensure the safety and health of the public or the environment.

Engineer. See the WES Rules.

Developer's Engineer. See the WES Rules.

Developer's Engineer's Inspector (Engineer's Inspector). The Developer's Engineer's Inspector(s) shall be the Developer's Engineer of record, or recognized as representatives of the Developer's Engineer, and their duties shall be to approve materials and workmanship as required by the plans and specifications in accordance with District Sanitary Standards.

Infiltration and Inflow (I&I) or **Inflow and Infiltration.** The United States Environmental Protection Agency defines infiltration and inflow as combined contributions from infiltration and inflow. I&I causes dilution in sanitary sewers. Dilution of sewage decreases the efficiency of treatment and may cause sewage volumes to exceed design capacity. Although inflow is technically different from infiltration, it may be difficult to determine which is causing dilution problems in inaccessible sewers.

A. Infiltration is water other than sanitary wastewater that enters a sewer system from the ground through defective pipes, pipe joints, connections, or manholes. Infiltration does not include inflow.
B. Inflow is water other than sanitary wastewater that enters a sewer system from sources such as roof leaders, cellar/foundation drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, and catch basins. Inflow does not include infiltration.

Inspector. See the WES Rules.

Installer. Either the Owner of the property being served or a Contractor doing work in connection with the installation of a Building Sewer or conveyance system under a permit from the District, City, or County.

May. See the WES Rules.

Owner. See the WES Rules.

Parcel. See the WES Rules.

Performance Surety. Also known as a **Performance Bond.** A performance bond is issued to one party of a contract as a guarantee against the failure of the other party to meet obligations specified in the contract. It is also referred to as a contract bond. A performance bond is usually provided by a bank or an insurance company to make sure a contractor completes designated projects.

Permit. See the WES Rules.

Permittee. See the WES Rules.

Person. See the WES Rules.

Plan(s). Construction plans submitted to the District for review and approval, in accordance with the Sanitary Standards.

Private Sanitary Sewer System. A privately owned and maintained sanitary sewer conveyance system installed to serve non-single-family residential structures on a single ownership property, which cannot legally be further divided, such as apartments, mobile home parks and schools or installed in commercial or industrial subdivisions. A single-family residence with an unattached garage or shop with sanitary facilities is exempt from this definition.

Private Sanitary Sewer Easement. An easement that grants rights from one Owner to another to install and maintain a Building Drain to a Service Connection.

Public Right of Way. See the WES Rules.

Public Sanitary System. See the WES Rules.

Public Sanitary Sewer Easement or **Public Easement.** Any easement in which the District or other public agency has the right to construct and maintain a Public Sanitary Sewer System.

Public Sanitary Sewer Extension. Any extension or addition of the public sanitary conveyance system.

Public Sanitary Sewer Mainline. See the WES Rules for Public Mainline. As relates to these Standards, Public Sanitary Sewer Mainline refers to the portion of the Public Sanitary Sewer System which conveys wastewater through a piping system flowing by gravity.

Sanitary Sewer Mainline. See Public Sanitary Sewer Mainline.

Sanitary Sewer. See the WES Rules.

Sensitive Areas. See the WES Rules.

Service Connection. See the WES Rules.

Sewage. See the WES Rules.

Sewer. See the WES Rules. As relates to these Standards, sewer will typically mean sanitary sewer.

Shall. See the WES Rules.

Storm Sewer. See the WES Rules.

Stormwater. See the WES Rules.

Stormwater Management Facilities. See the WES Rules.

Trunk Sanitary Sewer. Any conveyance system sized and located to serve general topographical areas and mainline sanitary sewers (the minimum pipe size is normally 12-inches in diameter or larger). Trunk Sanitary Sewers are located within public Right-of-Way or Public Sanitary Sewer Easements.

Useful Life. See the WES Rules.

Variance. See the WES Rules.

Waters of the State. See the WES Rules.

Water Resource Recovery Facility. An arrangement of devices, structures, and equipment for treating sewage.

1.2 Abbreviations

Unless the text specifically indicates otherwise, the following abbreviations are used in these standards to refer to the following:

Abbreviation	Definition
AASHTO	American Association of State Hwy and Transportation Officials
APWA	American Public Works Association
ASTM	American Society of Testing and Materials
BMP	Best Management Practice
CDF	controlled density fill
cfm	cubic feet per minute
CFR	Code of Federal Regulations
DEQ	Oregon Department of Environmental Quality
EPSC	Erosion Prevention and Sediment Control
ft.	feet
HDPE	high density polyethylene pipe
IE	invert elevation
I.D.	inside diameter
in.	inches
mm	millimeter
OAR	Oregon Administrative Rules
OD	outside diameter
OR	Oregon
ORS	Oregon Revised Statutes
OSHA	Occupational Safety and Health Authority
PDF	Portable Document Format
psi	pounds per square inch
psig	pounds per square inch gage
PVC	polyvinyl chloride
sec.	seconds
SDR	Standard Dimensional Ratio
Si	Slope (inlet)
So	Slope (outlet)
SS	Sanitary Sewer
ST	Storm Sewer

Abbreviation	Definition
UNI	Unibell Publications
UPC	Uniform plumbing code
WES	Water Environment Services
WQRA	Water Quality Resource Area

2. General Information

These Sanitary Sewer Standards ("Sanitary Standards") present the adopted policies, standards, and specification requirements necessary to meet all provisions of the Water Environment Services ("WES" or "District") Rules and Regulations. Implementing these standards help protect public health and the environment.

This chapter describes the authority, purpose, applicability, and administrative review requirements of these sanitary standards.

2.1 Authority and Purpose

WES, located in Clackamas County, Oregon, is an intergovernmental entity formed pursuant to Oregon Revised Statutes Chapter 190 for the purpose of providing regional sewerage works, including all facilities necessary for collecting, pumping, treating, and disposing of wastewater and sewage within its boundaries. It is further declared to be the policy of the District to provide and offer sewage disposal service for such areas adjacent to the District as may, in the judgment of the District, be feasibly served upon such terms, conditions, and rates as the District shall determine, and as provided in other applicable federal and state laws.

The District, through its Director or other authorized designee or representative, shall have the authority to administer all the requirements, regulations, and provisions set forth in these Sanitary Standards.

The District may promulgate new or amended standards in accordance with the process outlined in the Water Environment Services (WES) Rules and Regulations.

Conformance with these standards shall not be a substitute for, or eliminate the necessity of, conforming with any and all federal, state, and local laws, ordinances, rules and regulations which are now, or may in the future, be in effect.

Any provisions or limitations of these standards are suspended and supplemented by any applicable federal, state, or local requirements existing or adopted subsequent hereto which are more stringent than the provisions and limitations contained herein. In the event of a conflict, the most stringent local, state, or federal regulations generally apply.

The purpose of these Sanitary Standards is to provide a consistent policy under which certain physical aspects of sanitary sewer design will be implemented. Most of the elements contained in this document are public works oriented and most are related to public improvements; however, it is intended these Standards apply to both public and private work designated herein.

2.2 Objectives

The objectives of the Sanitary Standards are as follows:

- To advance public health and welfare.
- To support the long-term operation and maintenance of the Public Sanitary Sewer System.
- To prevent the introduction of pollutants that will interfere with the operation of the Public Sanitary Sewer System or contaminate the resulting biosolids.

- To prevent the introduction of pollutants that will pass through the Public Sanitary Sewer System, inadequately treated, into receiving waters or the atmosphere, or otherwise be incompatible with the system.
- To protect District Personnel who may come into contact with sewage, sludge, and effluent in the course of their employment, as well as protecting the general public.
- To ensure that the District complies with its National Pollutant Discharge Elimination System waste discharge permit conditions.
- To ensure all development shall be planned, designed, constructed, and maintained to:
    - Improve the opportunity to recycle and reclaim wastewater and biosolids from the system.
    - Provide for the equitable distribution of the costs of the Public Sanitary Sewer System.
    - Construct a cost efficient and low maintenance conveyance system.

2.3 Applicability

These Sanitary Standards shall govern design, construction, and upgrading of all publicly and privately financed public sewerage facilities in the District and applicable work within the District, unless it is shown that the District's authority to impose these standards are superseded by another local jurisdiction.

2.4 Variance

Alternative materials and methods will only be accepted if the applicant can demonstrate that the existing standards are not appropriate for a given site and the proposed alternative provides the same or greater level of performance as defined in these standards. Alternate materials or methods not explicitly approved herein will be considered for approval through the variance process outlined below.

2.4.1 Variance Request

A variance request to the (Standards) shall be submitted in writing to the District. The written request for a variance should be submitted to the District prior to land use approval if a land use action is required. Land use conditions of approval are commonly written so there is little, if any, flexibility after land use approval is issued. If land use approval has already been issued or not required, then the variance request should be submitted in writing along with the first plan review submittal.

Once the District approves the plans, a variance request will only be accepted at the discretion of the District, and if the request is the only feasible solution without regards to delays or cost. Only minor variance requests will be considered during the construction phase of the project to address a specific design or construction problem. It is the responsibility of the applicant to obtain all approvals from any local, county, state or federal authority having any jurisdiction or permitting of the activities before proceeding with an approved variance.

This written request shall include the following:

A. The desired variance(s);

B. The reason(s) for the request(s);

C. A comparison between the specification(s) and standard(s), and the variance(s) for performance, function, maintainability, safety, etc.;

References to regionally and/or nationally accepted standards, records of successful use by other agencies, or other supportive information.

2.4.2 Criteria for Variance

The District may grant a variance when the request does not compromise the following: public safety, environmental protection, maintenance/repair/replacement, and when any one of the following conditions are met:

A. Topography or other geographic conditions impose an environmental or safety concern and the request is considered an equivalent alternative, which can accomplish the intent and criteria that is provided in these standards.

B. A minor change to the standard is required to address a specific design or construction problem which, if not enacted, will result in an unreasonable or disproportionate burden or obstacle to development. The financial viability of meeting the requirements of these design standards is not in itself a justification for a design exception.

C. The variance request is in the public interest and requirements for safety, function, appearance, and maintainability are based upon sound Developer's engineering and functionality of the proposed system is a feasible alternative.

All requests will be evaluated on a case-by-case basis, and approval of alternative materials and methods for one development proposal will not imply an approval under similar circumstances in another proposal. Approval of a variance, or denial of a site-specific request shall not constitute a precedent for use at other locations with potentially similar circumstances.

2.4.3 Review Process

The variance request shall be reviewed by the District and a decision will be issued, in writing, to the applicant within 30 calendar-days indicating one of the following:

A. Approve as proposed, or

B. Approve with changes, or

C. Deny with an explanation.

It is the responsibility of the applicant to obtain all approvals from any local, county, state or federal authority having any jurisdiction or permitting of the activities before proceeding with an approved variance.

2.4.4 Appealing Variance Request Decision

The applicant may make a written request to the District to appeal the variance request decision as outlined in the appeals process contained in Section 3.7 of the District Rules and Regulations.

3. General Sanitary Standards

Chapter 3 of the Sanitary Standards presents an overview of the general policies, methods, and processes associated with the Sanitary Standards as a whole.

3.1 General Policy

Public improvements are conditioned through the development review and land use approval process, described, and administered under the local planning department administering the zoning and development ordinance, or by federal, state, or other local government regulation. These Sanitary Standards cannot provide for all situations and are intended to assist, but not to substitute for competent work by design professionals. It is expected that the design professionals will bring to each project the best of skills from their respective disciplines.

A. These Sanitary Standards are not intended to limit unreasonably any innovative or creative effort that could result in better quality, cost savings, or both.

B. Pursuant to the objectives found in Chapter 1 of these Sanitary Standards, any conveyance system designed and constructed shall:

   a. Be of adequate design to carry the expected flow, within the design life, and at sufficient size and depth to serve adjacent properties;

   b. Have sufficient slope as determined by the District to maintain a conveyance system that will self-clean as specified in these Sanitary Standards;

   c. Have sufficient structural strength to withstand all external loads which may be imposed;

   d. Be of materials resistant to both corrosion and erosion with a minimum design life of 100-years;

   e. Be economical and safe to build and maintain; and

   f. Prevent infiltration or inflow of ground and surface waters and exfiltration of sewage.

3.2 Development Policy

When development of a property or tract of land is proposed, all residential dwelling units and commercial, and industrial buildings with sewer drains within the boundaries of the proposed tract shall be connected to the Public Sanitary Sewer System as part of an approved plan.

3.2.1 Existing Onsite Sewage Disposal Systems

All existing onsite sewage disposal systems shall be abandoned per Oregon Department of Environmental Quality (DEQ) Regulations. For additional information contact Clackamas County Septic and Onsite Wastewater Program.

3.2.2 Point of Service for Upstream Parcels

A point of service for upstream parcels shall be provided to facilitate an orderly extension of the Public Sanitary Sewer System. This shall include the extension of Public Sanitary

Sewer Systems in Right-of-Way or easements across the property to serve the upstream properties in a location as approved by the District.

Development projects that construct Public Sanitary Sewer Extensions, which can directly serve adjacent properties may qualify for the establishment of a Reimbursement District as defined in Section 5.6 of the WES Rules and Regulations.

3.2.3 Trunk Line Sanitary Sewers

Trunk line sanitary sewers, if required, will be sized to provide capacity for the entire future development of the upstream basin based on projected zoning. Public Sanitary Sewer System for future development shall be designed per the District's Master Plan or, in absence of such plan, the system shall be developed on a case-by-case basis as approved by the District.

3.3 Developer's Engineering Policy

It shall be the policy of the District to require compliance with ORS 672 for Professional Engineers, Surveyors, Photogrammetrists, and Geologists.

All engineering plans, reports, or documents shall be prepared by a registered professional Developer's Engineer, or by a subordinate employee under the Developer's Engineer's direction and shall be stamped with the Developer's Engineer's seal and signed to indicate the Developer's Engineer's responsibility for the design. It shall be the Developer's Engineer's responsibility to review any proposed Public Sanitary Sewer System, variance, or other change with the District prior to Developer's engineering or proposed design work, to determine any special requirements and/or whether the proposal is permissible. A "Plans Approved for Construction" (or equivalent) stamp of the District on the Plans, etc., for any project, does not in any way relieve the Developer's Engineer of responsibility to meet all requirements of the District or obligation to provide a Public Sanitary Sewer System in accordance with the Rules and Regulations, and Sanitary Standards, and protect life, health, and property of the public. The District reserves the right to change the Plan for any project prior to final acceptance at any time it is determined that the full requirements of the District Rules and Regulations have not been met.

All Drawings submitted for approval shall be stamped and signed by a registered Professional Developer's Engineer. No Plan review or approval shall be made without the Plans being stamped and signed by the Professional Developer's Engineer.

3.4 Sanitary Sewer Standard Detail Drawings

Except as otherwise provided by these Sanitary Standards, the Developer's engineering design and construction shall be in accordance with the most updated revision of the Sanitary Sewer Standard Detail Drawings included in **Appendix B**.

3.5 Approval of Alternate Materials and Methods

Any substitution of materials or alternate methods not explicitly approved herein will be considered for approval as set forth in Section 2.4 of these Sanitary Standards. Persons seeking such approvals shall make application in writing. Approval of any deviation from these Sanitary Standards shall be provided in writing. Approval of minor matters will be made in writing, if requested.

Any alternative materials and/or methods must meet or exceed the minimum requirements set forth in these Sanitary Standards.

The written request is to include, but is not limited to, the manufacturer's specifications and testing results, design drawings, calculations, reason and justification, and other pertinent supporting information.

Any deviations or special problems shall be reviewed on a case-by-case basis and approved by the District. When requested by the District, full design calculations shall be submitted for review with the request for approval.

3.6 Special Design Applications

Special applications not covered in these Sanitary Standards require review and approval by the District. Submittal of full design calculations, supplemental drawings, and other information shall be required before any approval is considered.

4. Public Sanitary Sewer Extension

The provisions presented in this section of the Sanitary Standards specify the responsibilities of the parties involved and the process followed by the District prior to acceptance of a Public Sanitary Sewer Extension that is not constructed by the District. These requirements are intended to meet the goals and objectives of the District in combination with all other state, federal, county, and local laws, and ordinances.

4.1 Sewer Extension Permit

Prior to the commencement of construction of any Public Sanitary Sewer System, a valid Sewer Extension Permit shall be issued by the District in accordance with these Standards. An Extension Permit is required to construct or reconstruct any Public Sanitary Sewer appurtenances which are owned by, or intended to be conveyed to, the District. All other sanitary sewer piping not intended to be conveyed to the District shall be permitted by the Local Plumbing Authority.

The Developer and the Developer's Engineer shall submit a signed Sanitary Sewer Engineering Agreement on a District-supplied form (form can be found online) which outlines the responsibilities of the Developer and Developer's Engineer, with regard to surveying, costing, design, inspection, testing, certification, and as-built requirements of the District for acceptance of the proposed Sewer Extension Permit project.

A pre-construction meeting shall be arranged by the Developer's Engineer to be held at either the District, County, or City offices prior to issuing of the Sewer Extension Permit. Attendees must include the Developer, Developer's Engineer, Contractor, and the District representatives. Other interested parties may also attend the meeting. The purpose of the meeting is to discuss issues surrounding the project including, but not limited to, materials, construction, standard detail drawings, sequencing, Developer's Engineer testing and inspection requirements. If requested by the District, the Contractor shall present certification by the State of Oregon and any other licensing body having jurisdiction over the work to demonstrate appropriate construction qualifications.

It is the sole responsibility of the Developer, Developer's Engineer and Contractor to obtain all other applicable authorization from local agencies, state, and federal approvals prior to proceeding with any construction that is approved by the District.

4.2 Project Construction

The requirements for project construction are defined in the following subsections.

4.2.1 Variance or Deviation from the Approved Plans

No variance, deviation, or minor change from the approved Plans and specifications shall be made without the prior written approval of the District. When any variance or deviation of the approved Plans is requested by the Developer's Engineer, two sets of Plans showing the revisions shall be submitted to the District for approval. No construction of the modified section can commence until these revised Plans are reviewed and approved by the District. Approvals shall be made by the District in writing.

4.2.2 Inspection and Testing

The Developer's Engineer is responsible for all testing and inspection services as required by the District and to certify the material, construction, and testing results to the District. The Developer's Engineer or the Developer's Engineer's Inspector shall be allowed full access to all parts of the work; and shall be furnished with every reasonable facility for ascertaining whether or not the work, as performed, is in accordance with the requirements and intent of the approved Plans and specifications.

The Contractor shall furnish, at the Contractor's own expense, such samples as are customarily required for testing purposes. The District does not furnish inspection of sanitary sewer construction. For this reason, it is imperative that the Developer and/or the Developer's Contractor provide prompt and complete notification to the Developer's Engineer and the District as to the progress of the construction of sanitary sewer improvements.

Notification must be given to the Developer's Engineer when the following work is to be scheduled:

A. Excavation and installation of the Public Sanitary Sewer Mainlines.

B. Compaction testing/proof roll of trench backfill and fill areas.

C. Construction of structures (including manholes, Service Connections, and cleanouts).

D. All required manhole and sanitary sewer line testing, including vacuum, air, mandrel, and video testing.

Failure to give the Developer's Engineer proper notification (48 hours) of the Contractors work schedule may invalidate the work performed and make necessary, testing and inspection from an independent testing laboratory for compliance with the District's construction specifications. Such tests shall be furnished, at no expense to the District.

4.3 Acceptance and Warranty

Acceptance of the Public Sanitary Sewer Extension will be made in writing by the District after all conditions of the Sewer Extension Permit have been met. The following subsections outline the District's post-construction requirements prior to final acceptance.

4.3.1 Video Inspection of Gravity Sewers

After the Developer's Engineer certifies the construction is completed, then the entire Public Sanitary Sewer System shall be video inspected and recorded prior to the District conducting the final construction inspection in preparation of the acceptance of the Public Sanitary Sewer Extension. All pipes shall be thoroughly flushed immediately prior to the video inspection.

The video recording shall:

A. Be in color electronic format acceptable to the Developer's Engineer and be continuous from beginning to end of each pipe run.

B. Be clear, usable, and free of visual distortions; the image in the video shall appear level.

C. Include a visual footage meter recording on the tape.

D. Include a voice recording of suspected deficiencies.

E. Provide a means of gauging the depth of deflection within the pipe system.

F. Be performed by experienced personnel trained in locating pipe and grade breaks, obstacles, and Service Connections by remote video inspection utilizing a 360-degree pan and tilt camera.

G. Identify visually, with audio and on the written report, the location of the beginning and end of each pipe run, the lineal feet of pipe, all deficiencies, the name of the company creating the tape recording, name of the operator, and date and time of the recording.

H. Include a 360-degree inspection of each joint.

I. Include a clear view up each Service Connection.

J. Identify groundwater infiltration sources associated with construction or material defects.

K. Video inspection for District review shall be performed at the end of the project once all construction is complete.

The Developer's Engineer shall review the video recordings and inspection report(s) prior to submitting them to the District.

The video and report shall record all horizontal and vertical deflection in the piping system. Any vertical deflection is unacceptable. Horizontal deflection that creates a ½-inch belly in the Public Sanitary Sewer Piping System is unacceptable. The Developer's Engineer shall be immediately notified, the deficiency corrected, and re-videoed prior to submitting the final video inspection and report to the District.

Once the Developer's Engineer has reviewed and approved the video recording in accordance with these Standards, a copy of the video recordings, and written inspection report(s) shall be submitted to the District for review and approval. Illegible, or incomplete video, or inspection report(s) will be returned to the Developer's Engineer.

The District shall approve the video recording prior to scheduling the District inspection of the Public Sanitary Sewer System.

4.3.2 Test Results

The installation and/or construction of Public Sanitary Sewer System in accordance with the District Standards, including the mainline, manhole, and Service Connection testing shall be observed by the Developer's Engineer or Developer's Engineer's Inspector and the results shall be certified to the District on the approved District forms (form can be found online). All required testing, including but not limited to low air, mandrel or vacuum testing, and video recording shall be performed. Dye testing shall be performed for non-single-family developments.

4.3.3 Service Connection Drawings

Provide appropriate information to locate newly installed Service Connection for each lot or parcel within the project boundaries. Provide stationing, depth, and horizontal dimensions at the end of the pipe to permanent physical objects in the field to assure that the Service Connection can be located after construction is completed. Service connection drawings shall become the property of the District and are public records. The form can be found online.

4.3.4 As-built Plan Requirements

The Developer's Engineer is responsible for record keeping, inspection, and preparation of the as-built drawings. Final as-builts drawings will be submitted as detailed in **Appendix A**. For all Public Sanitary Sewer Extensions, the Developer's Engineer shall submit certified as-built Plan and Profile drawings. Record drawings shall be submitted for all other connections to the Public Sanitary Sewer system. As-built drawings shall meet the District's requirements and shall be of archival quality. Each page shall be stamped and signed by the Developer's Engineer and state, in writing, that this is an as-built drawing. As-built drawings shall become the property of the District and are Public records.

Drawings shall also be submitted electronically in a release of AutoCAD and Portable Document Format (PDF) file acceptable to the District. The electronic submittal shall become the property of the District.

4.3.5 Certification of Completion

A stamped and signed Certificate of Completion (form can be found online) shall be provided by the Developer's Engineer. This statement certifies to the District that all construction methods, workmanship, and materials, have been inspected, tested by approved methods, and found to conform to the approved Plans and the specifications of the District.

4.3.6 Final Inspection

A final inspection of the Public Sanitary Sewer System by the Developer's Engineer shall be conducted to determine that the construction was completed in conformance with Plans, specifications, and these Sanitary Standards. The Developer's Engineer shall inspect and verify that all newly constructed structures meet the District's Sanitary Standards. Once inspected and verified, the Developer's Engineer may notify the District upon completion of construction and request a final inspection conducted by District Personnel. Any deficiencies resulting in non-acceptance of the work shall be identified in writing and presented to the Developer's Engineer for correction. Upon correction of the noted deficiencies the Developer's Engineer shall inspect and verify corrections have been made and then notify the District and request a re-inspection. If the work is accepted, the Developer's Engineer will be notified.

4.3.7 Construction and Developer's Engineering Cost

The Developer's Engineer shall calculate and submit on District forms the actual construction and Developer's engineering cost of the Public Sanitary Sewer Extension. The Construction and Developer's engineering Cost Data Sheet can be found online. District plan review fees shall be based on the cost to construct the Public Sanitary Sewer Extension.

4.3.8 Letter of Conveyance

The Developer/Owner shall convey (at no cost to the District) all right, title, and interest in the Public Sanitary Sewer Extension to the District. The Conveyance of Public Sanitary Sewer Main Extension form can be found online.

4.3.9 Warranty Bond

A warranty bond or cash security in an amount equal to 25-percent of the actual construction and engineering cost to complete the Public Sanitary Sewer Extension shall

be provided to the District by the Developer/Owner at no cost to the District. This surety bond shall guarantee the workmanship and materials of the Public Sanitary Sewer Extension for a minimum period of two-years from the date of acceptance by the District unless a longer period is required by the District. A sample Warranty Bond form can be found online. Upon default, the District may draw upon the surety or available funds to remedy violations or required corrections. The different types of acceptable surety are provided in **Appendix A**.

4.3.10 Letter of Acceptance

Upon completion of all the requirements of the Sewer Extension Permit, District Rules and Regulations, and these Sanitary Standards, the District shall issue a letter stating the District will accept for ownership and maintenance the Public Sanitary Sewer Extension and specify the date the warranty period will begin.

4.3.11 Warranty Period

The Developer/Owner or Contractor's warranty period shall be in effect for a minimum period of two-years from the date specified in the Letter of Acceptance unless a longer period is required by the District.

Prior to the end of the warranty period, the District will conduct a warranty bond inspection of the Public Sanitary Sewer Extension and notify the Developer/Owner, or the Developer's Engineer of any deficiencies found. The request and scheduling of the warranty bond is the responsibility of the Developer/Owner. Any faulty workmanship and/or defective materials which are discovered within the warranty period shall be corrected and/or replaced by the Developer/Owner at no expense to the District. Such warranty period and warranty bond may be extended upon the disclosure of a defect for a minimum of two-years after the correction of the defect is completed at the sole discretion of the District.

All repair work required during the warranty period shall be performed within 30-days of issuance of written notification to the Developer/Owner. Emergency work performed by the District and all work performed by the District due to the nonperformance of the Contractor shall be reimbursed to the District within 30-days of invoice. If the Contractor fails to reimburse the District in 30-days, the District may file a bond claim.

After the warranty inspection and completion of all work required to bring the Public Sanitary Sewer Extension into conformance with these Sanitary Standards, all sureties shall be released unless the warranty period and warranty bond is extended at the sole discretion of the District.

5. Sanitary Sewer Design

This section provides the design requirements required by the District for Public Sanitary Sewer System construction projects.

5.1 General Design Requirements

Except where these Sanitary Standards specify otherwise, the design detail, workmanship, construction specifications, and materials shall be in accordance with the following (in the following order of precedence):

A. WES Rules and Regulations

B. District Sanitary Sewer Standard Detail Drawings

C. District Sanitary Standards

D. District Stormwater Standards

E. Clackamas County Transportation Standard Detail Drawings (if applicable)

F. Local City Standard Detail Drawings (if applicable)

G. Current American Public Works Association (APWA) Standard Specifications and Drawings for Public Works Construction published by the Oregon Chapter of the APWA, and Clackamas County Road Use Ordinance

H. Oregon Department of Transportation (ODOT) Standard Specifications

I. American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications

It is the Developer's Engineer's responsibility to comply with other applicable federal, state, and local regulations, particularly with respect to wetland regulations and other development requirements.

5.1.1 Performance Sanitary Standards

A. Public Sanitary Sewer Extension design shall meet the policies and guidelines of OAR Chapter 340 Division 52 Section 0020 and its updates. Design shall comply with Oregon Department of Environmental Quality (DEQ) sanitary sewer design guidelines.

B. The Public Sanitary Sewer System capacity shall be designed for ultimate development density of the drainage basin. The system shall allow for future system extensions and for future development. The Public Sanitary Sewer System shall be designed to provide gravity conveyance to the lowest Building Drain including from basements of houses, commercial or industrial buildings, and all public and private establishments where possible. Only District owned and maintained regional pump stations that are included in the District's Capital Improvement Plan will be permitted to convey (pump) wastewater collected by the Public Sanitary Sewer System. Private pump stations may be allowed as specified in Section 5.4.9.

Stormwater, including street, roof, or footing drainage, shall not be discharged into the sanitary sewer system but shall be removed by a system of storm drains or by some other method separate from the Public Sanitary Sewer System.

5.2 Sanitary Sewer Requirements

The following subsections provide design details for sanitary sewer construction within the District.

5.2.1 Pipe and Fitting Material and Size

A. All Public Sanitary Sewers shall be designed with materials as specified in these Sanitary Standards. Where required for added strength, C900 or C905 PVC shall be used. Public Sanitary Sewer Mainline, Service Connections, and fitting material shall be the following types or equal when approved in writing by the District:

   a. Polyvinyl Chloride (PVC) Pipe:

      ASTM D3034 SDR 35, 4 to 24-inches

      ASTM C-900 D-1784 DR, 4 to 24-inches (preferred by District)

      ASTM C-905 D-1784 DR, 4 to 24-inches (preferred by District)

   b. High Density Polyethylene (HDPE) Pipe: ASTM D-3035

   c. Tees, Service Connections, and Fittings:

      i. A factory tee shall be installed in the mainline for each Service Connection.

      ii. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered.

      iii. All tees, Service Connections, and fittings shall be of the same materials as the Sanitary Sewer Mainline pipe unless otherwise approved.

      iv. Tees and fittings shall be free from cracks and shall adhere tightly to each joining surface.

      v. All tees and fittings shall have a gasket with the same material as the mainline pipe joint.

B. All Sanitary Sewer Mainlines shall be a minimum diameter of 8-inches and shall begin at a manhole and shall terminate at a manhole, unless otherwise approved by the District.

C. Private sanitary sewer systems constructed on private property shall be permitted by the local plumbing authority and meet the appropriate sections of the Uniform Plumbing Code (UPC), excluding Service Connection within the Public Right-of-Ways and Public Easement that will be constructed in accordance with these Standards.

5.2.2 Design Sewage Flow

A. Design flows shall be determined by using the factors of the specific Sanitary Sewer Master Plan, if available, in which the development is situated.

B. In the absence of a Master Plan the District shall determine the applicable location, depth, slope, and pipe diameter of the Public Sanitary Sewer Mainline.

5.2.3 Minimum Slope Design

The District requires the Public Sanitary Sewer System be designed with the minimum slope of 0.0100-ft/ft (1.0%), except for dead-end lines, for which the District requires a minimum slope of 0.0200-ft/ft (2.0%). See **Table 1** for exceptions based on topography challenged sites where the minimum design slope as stated above cannot be designed. The minimum slope design as specified in the table is based on the number of Service Connections upstream

Newly constructed mainlines in the Public Sanitary Sewer System shall be designed with sufficient slope to obtain a flow and velocity that will self-clean the system.

Table 1. Minimum Pipe Slope Design for 8-inch Diameter Pipe

Number of Homes Upstream	Minimum Pipe Slope for Segment Design
1-5	0.0200-ft/ft, 2-percent
6-20	0.0100-ft/ft, 1-percent
21-40	0.0075-ft/ft, 0.75-percent
>40	0.0050-ft/ft, 0.50-percent

The Developer's Engineer may design pipe slope in accordance with Oregon Administrative Rules (OAR) 340, Division 52 – Review of Plans and Specifications, Appendix A – Sewer Pipelines. The Developer's Engineer must submit calculations that demonstrate the proposed design slope(s) will achieve the minimum velocity based on the anticipated flow including, but not limited to the following design guide criteria.

OAR 340, Division 52, Appendix A, Section (2) Guidelines for Sewer Pipelines:

- Section (2)(b) Velocity (A): Sewers should be laid on a gradient which will produce a mean velocity, when flowing full or half full, of at least 2-feet per second, based upon the Manning formula with "n", the coefficient of roughness, valued at 0.013.
- Section (2)(b) Velocity (B): Sewers with minimal flow such as upper reaches of laterals or those sewers serving few dwellings should be steepened and/or reduced in diameter to approach a 2-feet per second self-cleaning velocity. Actual flows during initial years of use should be carefully evaluated in this regard. (Section 5.2.1 Pipe and Fitting Material and Size specifies that all Sanitary Sewer Mainlines shall be a minimum diameter of 8-inches.)
- Section (2)(b) Velocity (D): The minimum gradient for 8-inch sewers should be no less than 0.4-percent regardless of pipe material.

Anchor Walls: Sanitary sewers on slopes in excess of 20-percent shall be secured with concrete anchor walls. Spacing for anchors shall be as shown in **Table 2**.

Table 2. Minimum Anchor Spacing

Slope (%)	(Center to Center)
20-34	35-feet
35-50	25-feet
51+	15-feet or Concrete Encasement

Impervious Zone: When designing the sewer corridors through steep topography identified on the Plans, an impervious zone shall be placed as required to limit the migration of water through the length of the trench. The Developer's Engineer will make a final determination of the locations and the number required. See 6.3.10 for further details on impervious zones.

5.2.4 Velocity Design

Where flow velocities are determined to be greater than 8-feet per second, the pipe material shall be C900 or C905 PVC and special provision shall be made to protect manholes against erosion and displacement by shock. This may be accomplished by installing one additional manhole to decrease the slope or to split a 90-degree horizontal direction change into two, 45-degree incremental changes. The flow must be fully contained in the channel.

5.2.5 Alignment and Cover

Curved alignments in Public Sanitary Sewer Mainlines or Service Connection are not permitted. All pipe shall be laid on a straight line and grade. Horizontal deflection that creates a ½-inch or more of belly in the Public Sanitary Sewer Piping System is unacceptable. All Public Sanitary Sewer Extensions shall be located within the public Right-of-Way or in a Public Sanitary Sewer Easement as determined by the District. Generally, Public Sanitary Sewer Mainlines within the right of way must be a minimum of 8-feet deep, and 6-feet deep within a Public Easement.

5.2.6 Right-Of-Way

Public Sanitary Sewer Mainlines shall be constructed in a straight line and grade from manhole to manhole, and outside of the normal wheel path of a vehicle. The general location is about 5-feet north or west from the Right-of-Way centerline. All changes in the direction of the pipe shall be made at a manhole. Public Sanitary Sewer Systems shall generally be located in the street Right-of-Way. If streets have curved alignments, the center of the manhole shall not be in the wheel path, sidewalk, curb, or gutter.

5.2.7 Sanitary Sewer Easement

Sanitary Sewer Mainlines shall be placed within a Right-of-Way whenever possible. Sanitary Sewer Mainlines in easements shall only be allowed as determined by the District.

A. All Public Sanitary Sewer Easements relevant to Plan approval shall be reviewed and approved prior to final Plan approval and issuance of the Sewer Extension Permit. All easements granted to the District must be recorded via plat map or deed instrument. The District requires an easement granted to "Water Environment

Services" and will not accept easements granted to the public, or as a public utility easement. Public Sanitary Sewer Easements granted by deed instrument shall be granted on District forms or forms approved by the District. There shall be no cost to the District for obtaining or processing the easements. Public Sanitary Sewer Easements shall provide for restrictions of permanent construction within the easement, ingress and egress for maintenance, reconstruction, and connection to the conveyance system. Some easements may require temporary construction easements adequate to allow construction activities.

B. Subdivision plats shall contain all existing and proposed Public Sanitary Sewer Easements and Private Sanitary Sewer Easements. A Public Sanitary Sewer Easement granted to WES via a plat shall be labeled in accordance with the plat notes.

C. For other than subdivision plats, dedication of Public Sanitary Sewer Easements to the District shall occur by means of recording a Public Sanitary Sewer Easement that encumbers a parcel of property, which references a recorded deed record. All Public Sanitary Sewer Easements must be furnished to the District for review and approval and must be accepted by the District prior to recording. A surveyor shall provide the District with dedication documents, site maps, and descriptions necessary to convey the easements during the plan review process, at which time the width of permanent and temporary easements will be determined. A record of survey meeting all requirements of ORS 209.250, as amended, must accompany the dedication. Acceptance and recording of this dedication deed instrument will be provided free of charge by the District.

D. Placement of permanent structures within the Public Sanitary Sewer Easement shall not be allowed, unless authorized by the District as a separate Encroachment Agreement.

E. When locating Sanitary Sewer Mainlines in Public Sanitary Sewer Easements the mainline shall be centered in the easement, unless otherwise approved by the District, and the conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted use of the Sanitary Sewer Mainline.

F. Sanitary Sewer Mainlines placed in easements along a property line where both properties are owned by the same Owner shall have the location of the mainline and easement line determined by the District.

G. Public Sanitary Sewer Easements for Sanitary Sewer Mainlines shall have a minimum width of 15-feet. Easements for Trunk Sanitary Sewers shall have a minimum easement width of 20-feet. The District has the right to require additional width at the sole discretion of the District. Easements that combine both mainline sanitary sewers and storm sewers shall have a minimum width of 20-feet.

H. Public Sanitary Sewers with more than 8-feet of cover or combined with public storm sewers will require wider easements, which will be determined by the District. A slope of one horizontal to one vertical from the invert of the Sanitary Sewer Mainline to ground surface will be used to determine easement width. Easement widths shall vary from the 15-foot minimum by 5-foot increments; 20, 25-feet, etc.

I. Public Sanitary Sewer Easement locations for Public Sanitary Sewer Mainlines serving a planned unit development, subdivisions, condominium, apartment complex, or commercial/industrial development shall be located in parking lots, private drives, or similar open areas which will permit unobstructed vehicle access for maintenance

by District Personnel. Common easements for other utilities will be reviewed on a case-by-case basis. Separation of utilities must meet DEQ and Oregon Department of Health requirements. Slope easements are required when necessary to encompass cut or fill slopes.

J. Combined easements shall be a minimum of 20-feet wide with a minimum separation of 5-feet between utilities and be approved by the District on a case-by-case basis.

5.2.8 Relation to Water Lines and Other Utilities

No Public Sanitary Sewer shall be located less than 50-feet from any well, spring, or other source of domestic water supply unless approved by the District. All Public Sanitary Sewers or parts thereof that are located within 50-feet of any source of domestic water supply shall be designed of C905 PVC pipe with watertight joints, or of other approved pipe.

The basic separation requirements apply to all gravity and pressure sanitary sewers of 24-inch diameter or less. Trunk Sanitary Sewers may create special hazards because of flow volumes and joint types, and accordingly require additional separation requirements. The special design requirements given below are for the normal conditions found with sewage and water systems. More stringent requirements may also be necessary in areas of high ground water, unstable soil conditions, etc.

A. **No Special Conditions (Parallel)**: A minimum horizontal separation of 10-feet between sanitary sewers and any existing potable water lines, and a minimum vertical separation of 18-inches between the bottom of the water line and the crown of the sanitary sewer, shall be maintained. The distance shall be measured edge to edge.

B. **Justification Required (Parallel)**: When conditions prevent the separations described above, a sanitary sewer may be laid closer than 10-feet horizontally or 18-inches vertically to a water line, provided:

   a. It is laid in a separate trench from the water line.

   b. The elevation of the crown of the Sanitary Sewer Mainline must be at least 18-inches below the bottom of the water line. When this vertical separation cannot be obtained, the sanitary sewer shall be designed of materials and joints that are equivalent to water main standards of construction and shall be pressure tested to ensure water tightness prior to backfilling. Adequate restraint should be provided to allow testing to occur.

   c. If sanitary sewers must be located in the same trench as a potable water line, special construction and mitigation is required. Both water lines and Sanitary Sewer Mainlines shall be designed with a casing pipe of pressure-rated pipe material designed to withstand a minimum static pressure of 150-pounds per square inch (psi). The water line shall be placed on a bench of undisturbed earth with the bottom of the water pipe at least 18-inches above the crown of the sanitary sewer and shall have at least 5-feet of horizontal separation at all times.

C. **Minimum Separation (Perpendicular)**: Sanitary Sewer Mainlines that cross water lines shall be laid below the water lines whenever possible to provide a separation of at least 18-inches between the invert of the water line and the crown of the sanitary sewer. See Special Conditions (Section 5.2.9) if this is not possible.

5.2.9 Special Conditions

When conditions prevent a vertical separation as described above, the design shall be as follows:

A. **Gravity Sanitary Sewers Passing Over or Under Water Lines**: Gravity sanitary sewers shall be designed as specified with material as described below:

   a. Standard bell and spigot C900 or C905 PVC pipe shall be required. The length of sanitary sewer pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water line. The sanitary sewer pipe shall be the longest standard length available from the manufacturer.

   b. Pipe Material: PVC (ASTM C900 or C905 D-1784 DR, 4 to 24-inches)

B. **Water Lines Passing Under Gravity Sanitary Sewers**: Water Lines shall be protected by providing the following:

   a. There shall be a vertical separation of at least 18-inches between the invert of the sanitary sewer and the crown of the water line.

   b. There shall be adequate structural support for the sanitary sewers to prevent excessive deflection of joints and settling on and breaking of the water lines.

   c. The length of sanitary sewer pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water line. The sanitary sewer pipe shall be the longest standard length available from the manufacturer. Any design implementing the measures described in this Section 5.2.9 shall obtain written approval from both the District and local water authority.

5.2.10 Relation to Stream and Drainage Channels

The design requirements in relation to stream and drainage channels are described below.

A. Sanitary sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible and shall be free from change of slope.

B. The Sanitary Sewer Mainline shall be the same material type installed in the entire run from the downstream to the upstream manhole. No fittings will be allowed to transition from different pipe types, manufactures or repairs.

C. The top of all sanitary sewers entering, crossing or adjacent to streams shall be at sufficient depth below the natural bottom of the stream bed to protect the Sanitary Sewer Mainline. One-foot of cover is required where the sanitary sewer is in rock, 3-feet of cover is required in other materials and a minimum of 6-inches cover is required in paved channels.

D. Pipe material shall be bell and spigot C900 or C905 as determined by the District, with the longest pipe length that the manufacturer can provide. The pipe shall extend to a point, where a one-to-one slope, which begins at the top of the bank and slopes down from the bank away from the channel centerline, intersects the top of the pipe.

E. Sanitary sewers located parallel to streams shall be located outside of the stream bed. All manhole covers, at or below the 100-year flood elevation shall be watertight.

F. Check dams are required in trench lines to prevent migration of groundwater.

G. All construction shall be designed to comply with the latest regulations as determined by the Army Corps of Engineers and Department of State Lands for removal and filling in waterways. In addition, all requirements for the Federal Endangered Species Act must be met. The activities authorized by the approval of the request in this application may be subject to other laws and regulations not addressed in this process. River crossings shall be approved on a case-by-case basis.

5.2.11 Minimum Cover

A. All Public Sanitary Sewers shall be laid at sufficient depth to drain Building Sewers, protect against damage from traffic and afford protection from other utilities. Sufficient depth shall mean the cover from the top of the pipe to finish grade along the sanitary sewer alignment.

B. Under normal conditions, Public Sanitary Sewer Mainlines shall be placed with a minimum cover of 8-feet in roadways and 6-feet of cover in Public Sanitary Sewer Easements.

C. In hillside subdivisions, Public Sanitary Sewers shall be placed in the street at a depth sufficient to drain Building Sewers by gravity on the low side of the street, unless otherwise approved by the District.

D. If approved by the District, where less than 3-feet of cover is proposed, the pipe material which will be PVC (ASTM C900 D-1784 DR, 4 to 12-inches or ASTM C905 D-1784 DR, 4 to 12-inches).

5.3 Manholes

The following subsections provide the design requirements for manholes.

5.3.1 Location

Manholes shall be placed at the following locations:

A. At every change in slope, alignment, or size of pipe.

B. At each intersection or junction of a Sanitary Sewer Mainline.

C. Where practical, manholes shall be located at street intersections.

D. At the upper end of all sanitary sewers, except as provided under Section 5.3.

E. At intervals of 500-feet or less. Deviation from this requirement shall be reviewed on a case-by-case basis for approval, considering whether maintenance equipment can adequately service the proposed Sanitary Sewer Mainline.

F. At Service Connections of 8-inches or larger.

G. At new 6-inch Service Connections into an 8-inch mainline.

H. Where required by the Industrial Pretreatment Program for sampling.

Manholes shall not be placed in the following locations:

A. In the wheel path, curb, or gutter.

B. Behind the curb line. Placement of manholes behind the curb shall be reviewed on a case-by-case basis for approval. Consideration shall be given to Sanitary Sewer Mainlines which already exist behind the curb.

5.3.2 Slope of Manhole Channel

Standard elevation differences or the drop across the manholes have been established to compensate for normal energy losses and to prevent surcharging of a sanitary sewer. The intent of this subsection is to prevent the difference in pipe inverts at the manhole wall on steep sanitary sewers from exceeding 1-foot, which renders it impossible to insert closed-circuit television equipment into the outfall mainline if the average slope exceeds 25-percent.

The rules for elevation differences at manholes are provided below:

A. The drop across a standard 48-inch manhole shall be two-tenths (0.20-ft) of a foot unless the mainline sanitary sewer has a slope greater than 20-percent, or otherwise directed by the District.

B. If incoming pipes are smaller in diameter than the outgoing pipe the crowns of all incoming pipes shall match the crown of the outgoing sanitary sewer pipe.

C. For mainline sanitary sewer with slopes greater than 20-percent the slope in the channel will be determined on a case-by-case basis by the District.

D. In general, the slope shall be determined to the center of the manhole. The average between any inlet Slope (Si) and outlet Slope (So) in percent across the manhole shall not exceed 25-percent.

$$\underline{\text{Si + So}} \div 2 = \text{less than } 25\% \text{ (feet per 100-feet)}$$

The above formula will limit the difference between the inlet and outlet inverts measured at the manhole walls from exceeding 1-foot for an average manhole diameter of 4-feet. This formula applies to sanitary sewers with a slope in excess of 20-percent.

Generally, a vertical offset in slope exceeding 25-percent will not be permitted. Exceptions will be the following:

A. When a smaller diameter connects to a larger diameter sanitary sewer.

B. When a grade conflict exists with an existing utility, the maximum vertical drop may not exceed 1-foot or as approved.

C. When a vertical drop greater than 1-foot is approved, an outside drop must be installed.

5.3.3 Drop Manholes

Drop manholes shall only be used in extreme cases of slope difference between existing and proposed Sanitary Sewer Mainlines or when special conditions exist such as a conflict with existing facilities which cannot be relocated. Outside drops into manholes shall be designed per standard detail drawing. Inside drops apparatuses into manholes shall not be allowed.

5.3.4 Rim Elevations of Manholes

In areas used by vehicles (paved or unpaved streets) the manhole rim elevation shall match the finished grades. In other areas the height of the manhole rim shall be 6-inches above finished grade, high-water mark, or above the top of future fill areas.

5.3.5 Design and Size

All manholes shall be a minimum of 48-inches inside diameter. All manholes shall be designed per standard detail drawing.

5.3.6 Connection

Connections to existing manholes shall be designed with the following guidelines:

A. No pipe shall enter an existing manhole where the angle between the incoming flow and the outgoing flow is less than 90-degrees. When the incoming flow and the outgoing flow is less than 90-degrees, two manholes shall be installed. Spacing of such manholes shall be a minimum of 10-feet apart measured outside to outside. An oversized manhole, such as 60-inch, or 72-inch in diameter, may be an option if approved by the District for use.

B. New or existing manhole walls shall be core drilled (not jack hammered) to connect a new Sanitary Sewer Mainline or Service Connection. Core drilled manholes shall include use of a boot to connect the pipe. Sand collars can only be used if approved on a case-by-case basis by the District.

C. New mainlines should enter an existing manhole at a minimum of 0.20-feet of drop across a standard 48-inch manhole.

D. The flow entering the manhole shall follow a smooth unobstructed concrete channel transition from the inlet pipe into the mainline channel. The base and channel of the manhole will be rebuilt if damaged in this process. All manhole and piping apparatuses shall be water-tight to prevent exfiltration and infiltration of ground water.

5.3.7 Anticipated Future Extensions

When future extensions are being designed/constructed, the existing connecting manhole will be cored at the appropriate location and alignment. Stub outs on end manholes shall only be installed when permitted by the District. An exception to this section may be made by the District on a case-by-case basis if the direction of the new mainline cannot be established at the time of construction.

5.3.8 Mainline Cleanout

Cleanouts will not be approved as substitutes for manholes, except temporarily at the upper end of a Sanitary Sewer Mainline that will be extended on the same slope and alignment during the next construction phase. The cleanout shall be removed, and the Sanitary Sewer Mainline extended meeting all design criteria in these Sanitary Standards. All mainline cleanouts will be reviewed and approved by the District on a case-by-case basis.

5.4 Service Connections

The following subsections provide the requirements and responsibilities for Service Connections.

5.4.1 Responsibilities

A property shall be served by a single Service Connection designed, constructed, maintained, repaired and/or replaced in the following manner:

A. Operation and Maintenance of the Service Connection:

a. The Owner(s) that benefits from the Service Connection is solely responsible to own, operate and maintain the Service Connection from the Building Sewer to the Public Sanitary Sewer Mainline, including the connection to the mainline located within a public Right-of-Way or easement.

b. The District is responsible for maintaining Public Sanitary Sewer Mainlines and shall not be responsible for maintenance or repair of damage resulting from inadequate or improper operation of the Service Connection, Building Sewer, or of attached fixtures or appurtenances, such as cleanouts and traps, between the building and Public Sanitary Sewer Mainline.

B. Property Owner Responsibilities for Repairs:

a. Inspections and investigations to determine the condition and functionality of the Service Connection from the building to the Public Sanitary Sewer Mainline.

b. Repairs of structural and non-structural defects for any portion of the Service Connection that is on private property, including the area within easements granted to the District.

C. District Responsibilities for Repairs:

a. Repair of structural defects, as determined by the District, for the portion of the Service Connection that is within the public Right-of-Way.

5.4.2 Diameter

A. Each residential single-family lot shall be served by a single 4-inch diameter Service Connection.

B. The diameter of the Service Connection for lots other than residential single family shall be served by a minimum 4-inch diameter pipe, or large if deemed necessary by Oregon Plumbing Specialty Code or permitted at the sole discretion of the District.

5.4.3 Materials

A. The Service Connection pipe, tee, cleanout, and joint materials shall be designed and constructed of the same material as the Sanitary Sewer Mainline.

B. All couplings, adapters, etc., used to connect dissimilar pipe materials together shall be approved by the District.

5.4.4 Installation

A. Service Connections shall be made by means of a manufactured tee. No Inserta Tees, wyes or grouted connections will be allowed in the extension of public sanitary sewers, unless otherwise approved by the District.

B. Service Connections may be installed into an existing Public Sanitary Sewer Mainline with an installation of an Inserta Tee at the sole discretion of the District. For further details see Section 5.4.10.

C. Manholes are required for Service Connections 8-inches or larger in diameter, and Service Connections shall be a minimum of one-half the diameter mainline. No Service Connection shall be larger in diameter than the mainline.

D. Service Connections for properties zoned industrial use shall provide a sampling manhole constructed to these Standards that provides access for monitoring and

sampling the discharge. The location of the manhole shall be in an area on private property easily accessible by District Personnel.

E. For additional information regarding Service Connection specifications see the Standard Detail drawings.

5.4.5 Location

Generally, the Service Connection shall be located within a Public Right-of-Way, or Public Easement as shown in Standard Detail drawings. Any other proposed location shall be at the sole discretion of the District on a case-by-case basis.

5.4.6 Direct Connection

All Building Sewers and/or sanitary facilities connected to the District Public Sanitary Sewer System shall be directly connected without any intervening private sewage treatment system such as a septic tank, cesspool, or any part of an on-site system, except for permitted Industrial Pretreatment facilities.

5.4.7 Separate Connection

A separate and independent Service Connection shall be provided for each tax lot, parcel of property, or lot of record. The District does not allow shared Service Connections.

A reduced number of connection points or a single point of connection may be utilized to serve parcels of properties for projects such as condominiums, multi-family, commercial and industrial projects, whereas the parcels cannot be further divided. The Owner shall be responsible for the customer account and monthly service charges for all of the properties. The Owner shall not further divide the property, or sell a portion of the development, thus creating a shared Service Connection. If a portion of the property is either sold to another person, or divided to create a separate property, then the Owner shall provide a separate Service Connection connected to the Public Sanitary Sewer System to serve the property.

Any partition of land division that is required to install a Service Connection to serve the additional lot(s), shall construct said Service Connection prior to the recording of the plat, if the Service Connection traverses any part of an adjoining property, common area, private easement, or shared land. The Service Connection will not be required to be constructed to serve the additional lot(s), if the property has direct access to the Public Sanitary Sewer System, and no other jurisdiction is requiring any improvement to be constructed prior to the recording of the plat. Any existing residence not currently connected to the Public Sanitary Sewer System shall construct a Service Connection and connect the residence Building Drain to the Public Sanitary Sewer System prior to the recording of the plat. Any existing Service Connections shall be used where feasible, as determined by WES.

5.4.8 Restricted Connections

No person shall connect any roof, surface, foundation, footing, or exterior area drains to any Service Connection, Building Sewer, or Building Drain which is connected to the Public Sanitary Sewer System. Storm pipes and drains that are connected to the Public Sanitary Sewer System shall be disconnected, and safely conveyed to a Public Storm System.

5.4.9 User Requiring Pumping Facility

If the building is below the available gravity Sanitary Sewer Mainline, the Owner shall install private pumping facilities in accordance with the local plumbing code. Flows from private pumped facilities shall enter the Public Sanitary Sewer Mainline by means of a gravity Service Connection. District shall review and approve all pumped connections on a case-by-case basis at the District's sole discretion.

Privately owned and maintained pump stations that serve multiple ownership properties are prohibited.

A single Owner may utilize a private pumping system permitted by the local plumbing authority, which is owned, maintained, and operated by the Owner for the express purpose of serving only their parcel(s) of property. Each parcel served requires a separate gravity connection to a Service Connection. The private pumping system shall not be located in a Public Easement that encumbers another person's property, or the public Right-of-Way. A pressurized private piping system may be located in a private easement or common areas such as tracts, or private streets, as long as the Owner records the necessary dedication of rights and maintenance responsibilities.

5.4.10 Tap-In Connections

For tap-in connections, the mainline must be at least a minimum of two (2) times the diameter of the Service Connection. Only District Personnel are authorized to tap the Public Sanitary Sewer Mainlines and install a 4- to 18-inch diameter Inserta Tee. The means, material, and method to tap into Public Sanitary Sewer Mainlines greater than 18-inches shall be reviewed and approved by the District, on a case-by-case basis. The installer shall give the District 72 hours advance notice prior to scheduling the tap/inspection. The tap will be scheduled and completed during the District's regularly scheduled business hours. The installer shall excavate completely expose the Public Sanitary Sewer Mainline at the designated point of connection as directed by the District. The District shall tap the Public Sanitary Sewer Mainline and install the 4-inch-diameter Inserta-Tee connection fitting at the Owner's expense. If the installer fails to comply with all local, state and federal safety codes applicable to the work, then the District shall not tap the mainline or perform any inspection, and the tap will be rescheduled. For taps other than a standard 4-inch tap into 3034 PVC, the Owner or contractor must coordinate with the District well in advance of the required tap in case a specialized connections must be ordered in advance.

The District will charge applicable fees to recoup any costs incurred by the District.

5.4.11 Slope and Alignment

The minimum slope for Service Connections shall be 2-percent (¼-inch per foot). In unusual conditions, a slope of 1-percent (1/8-inch per foot) may be proposed by the Owner's Developer's Engineer and approved by the District. Maximum slope for Service Connections shall not be greater than 100-percent slope (45-degrees). All changes in alignment or slope of the pipe shall be made with manufactured fittings. No bends greater than 22.5-degrees, and a totaling 45-degrees shall be allowed. Any piping system constructed on private property shall be required to obtain a plumbing permit issued by the applicable jurisdictional plumbing authority, such as a city or the County.

5.4.12 Minimum Depth

The minimum depth of the Service Connection shall be 6-feet deep at the edge of the Right-of-Way or Public Sanitary Sewer Easement. Service connections which cannot be

laid at the required minimum depth shall be reviewed and approved by the District on case-by-case basis.

5.4.13 Buried Detectable Tape

Green detectable metallic tape labeled “CAUTION BURIED SEWER LINE BELOW” shall be installed 6-inches above the Service Connection pipe along its entire length from the tee connection at the mainline to the top of the green 2-inch x4-inch stake.

Curbs shall be stamped with "SS” in a location of buried sanitary sewers and Service Connections.

5.4.14 Markings

A. Each Service Connection shall be marked with a green 2-inch x 4-inch stake extended from the end of the pipe to at least 1-foot above the ground.

B. The location of the Service Connections shall be indicated by a permanent marker, in one of the following manners:

   a. Where the Service Connections is located in a street with curbs, the connection marker shall be a permanent stamp on the top of the curb: ST – Storm Sewer; SS – Sanitary Sewer.

   b. Where the Service Connection is in a street without curbs, the marker shall be on the sidewalk.

   c. Where the Service Connections is in a street without curbs or sidewalks, the Developer’s Engineer shall present to the District for approval an alternative permanent marking method.

5.4.15 Inspection

Service Connections installed with a mainline extension shall be inspected for workmanship and materials and tested by the Developer’s Engineer. Tap-In Connections not installed with a Public Sanitary Sewer Mainline extension shall be inspected by District Personnel, and, if applicable, the Developer’s Engineer.

6. Construction Requirements

This section provides construction requirements for Public Sanitary Sewer Systems including but not limited to standards relating to sanitary sewer installation, materials, backfill compaction and classification, and testing.

6.1 Erosion Prevention and Sediment Control Required

All construction, regardless of development type or permit status, shall keep sediment laden water and any other forms of stormwater pollution from entering natural drainage systems or the storm drainage system. The requirements for erosion prevention and sediment control (EPSC) shall be implemented in accordance the District's Rules and Regulations, the Stormwater Standards, and the most current version of the EPSC Planning and Design Manual.

6.2 General Construction Materials and Installation

Construction materials and installation shall meet the following specifications unless modified in Sections 6.2 through 6.6 below.

ASTM A48	Manhole Frames and Covers - Gray Iron Castings
ASTM A304	Steel Bars, Alloy, Requirements
ASTM A536-84	Manhole Frames and Covers – Gray Iron Castings
ASTM A615	Billet-Steel Bars for Concrete Reinforcement
ASTM C443	Connections between Precast Manhole Sections
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C923	Connections between Manholes and Pipe
ASTM C1107	Non-Shrink Grout
ASTM D3034	PVC Pipe and Fittings
ASTM D3035	HDPE and connections
ASTM D3212	Elastomeric gasket
ASTM D4832	Testing of Controlled Low Strength Material

6.2.1 Trench Width

Minimum width of trenches in which Sanitary Sewer Mainline is to be laid shall be 12-inches greater than the outside diameter of the pipe. Minimum width of trenches where controlled density fill (CDF) is used as the entire backfill shall be as shown on the Plans or as directed by the Developer's Engineer. In all cases, trenches must be of sufficient width to allow for shoring and permit proper joining of pipe and compaction of the backfill material along sides of the pipe.

6.2.2 Trench Grade

The bottom of the trench shall be carried to the lines and grades shown on the Plans or as established by the Developer's Engineer, with proper allowance for pipe thickness and for gravel bedding. Any part of the trench excavated below grade shall be corrected with material of the type specified in Section 6.2.5, for the full width of the trench.

6.2.3 Shoring and Sheeting

All sheeting, shoring, and bracing shall be designed and installed in accordance with Oregon Occupational Safety and Health Administration (OSHA) Technical Manual for Construction Operations (Chapter 2: Excavation), and the OSHA Excavation Standards (29 CFR 1926.651 and 1926.652). Take special care to prevent movement of the pipe after installation when laid within a moveable trench shield.

6.2.4 Trench Dewatering

A. The Contractor during construction of the sanitary sewer system shall at all times provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until backfill has been completed. Dispose of water in accordance with state and local regulations.

B. The control of groundwater shall be such that softening of the bottom of excavations, or formation of "quick" conditions or "boils" during excavation shall be prevented. Dewatering systems shall be designed and operated to prevent removal of the natural soils.

C. At no time shall stormwater or ground water be permitted to be discharged into the Public Sanitary Sewer System. The discharge of stormwater or ground water in the Public Sanitary Sewer System is a violation of District Rules and Regulations.

6.2.5 Trench Foundation

When, in the opinion of the Developer's Engineer, the material in the bottom of the trench is unsuitable for supporting the pipe, excavate as directed by the Developer's Engineer, and backfill with approved materials to the required grade. Any part of the trench excavated below grade shall be corrected with approved material for the full width of the trench and thoroughly compacted in layers not to exceed 6-inches, to the established grade.

6.3 Sanitary Sewer Installation

6.3.1 Sub-Grade

The bottom of the trench shall be carried to the line and grade shown on the Plans or as established by the Developer's Engineer, with proper allowance for pipe thickness and for gravel pipe bedding.

6.3.2 Pipe Base/Bedding

Bedding material as specified in Section 6.4 shall be placed in the trench to a minimum depth of 6-inches below the bottom of the pipe. The pipe bedding shall be placed and leveled to approximate grade in advance of the pipe laying and shall provide a firm, unyielding support along the entire pipe length. Immediately following the placement of each pipe section, the crushed gravel pipe bedding shall be placed to the springline of

the pipe. Special effort to properly bed the pipe by slicing backfill in the pipe haunches up to the springline shall be provided. The pipe bedding shall be a minimum of 6-inches for Service Connections.

6.3.3 Bell Holes

At the location of each joint, bell holes of ample dimensions shall be dug in the bottom of the pipe bedding to permit the joint to be properly fitted, to permit easy inspection of the entire joint; and to provide uniform bearing for the barrel of the pipe for its entire length.

6.3.4 Preparation of Sanitary Sewer Pipe

All pipes and fittings shall be carefully inspected before being laid and no cracked, broken, or defective pipe or fittings shall be used in the work. Surface irregularities, in the form of air pockets or voids, will be cause for rejection as enumerated in ASTM D3034. The ends of the pipe shall be cleaned with a brush, washed, and thoroughly scrubbed where necessary to remove dirt or other foreign material.

6.3.5 Line and Grade

A. Sanitary sewer pipe shall be laid in full lengths as manufactured and shall be laid on a constant grade and in a straight alignment from manhole to manhole, or cleanout.

B. Survey control hubs for both line and grade shall be provided by the Developer's Engineer in a manner consistent with accepted practices. The Contractor shall establish line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to the trench at whatever intervals necessary to maintain the line and grade. The Contractor shall check line and grade, as necessary. In the event that the limits prescribed in this Section are not met, the work shall be immediately stopped, the Developer's Engineer notified, and the cause remedied before proceeding further with the work.

C. Deviation from the established line and grade shall not exceed ½-inch for line and ¼-inch for grade, provided that such variation does not result in a level or reverse-sloping invert.

D. The vertical variation of the grade line shall not create standing water in a pipe that exceeds ½-inch in height.

6.3.6 Manhole Connections

Unless otherwise provided, connections to existing District manholes shall be made using a core drilling method. Use of a jackhammer or other pneumatic devices is prohibited. Connect PVC pipe to concrete manholes by means of an approved coupling with an elastomeric gasket or flexible sleeve conforming to ASTM C923, (Kor-N-Seal or equal). The use of Portland Cement grout for connecting PVC pipe to manholes is prohibited. The use of a sand collar will only be reviewed and approved by the District on a case-by-case basis.

6.3.7 Pipe Installation

A. The installation of sanitary sewer pipe shall commence at the lowest point in the sanitary sewer system and shall proceed so that the spigot end of the section being laid is placed into the bell end of the pipe already laid. The pipe shall be bell and spigot, same size diameter of pipe from manhole to manhole, same pipe manufacture, same pipe material without any couplings or repairs. Foreign materials

shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

B. Sanitary sewer pipe shall be installed in accordance with the manufacturers' installation procedures and these Sanitary Standards.

C. At no time shall stormwater or ground water be permitted to be discharged into the Public Sanitary Sewer System. The discharge of stormwater or ground water in the Public Sanitary Sewer System is a violation of District Rules and Regulations.

6.3.8 Waterline Crossings

A. Sanitary Sewer Mainline pipe material specifications shall be in accordance with Sections 5.2 and 6. for a minimum distance of approximately 10-feet on either side of a water main crossing, when there will be less than 18-inches of clearance between the outside diameters of the water main and sanitary sewer. One standard length of pressure pipe shall be centered under the waterline.

B. It is required to maintain a consistent material type and specification in the type of sanitary sewer pipe within any manhole-to-manhole run.

6.3.9 Anchor Blocks

Anchor blocks shall be constructed of concrete 1-foot thick parallel to the pipe, extending 1-foot below the bottom of the pipe to 3-feet above the top of the pipe, and extending 1-foot beyond each side of the trench wall.

6.3.10 Impervious Zones

The impervious zone shall be constructed of CDF 2-feet thick parallel to the pipe, extending 1-foot below the bottom of the pipe zone to within 3-feet of the ground surface, and extending 1-foot beyond each side of the trench wall. The Contractor shall minimize the length of trench impacted by installing CDF using temporary forms or other means to no greater than 3-feet along the axis of the pipe. The trench in the top 3-feet shall meet all requirements of the backfill classification shown on the drawings or otherwise specified.

6.3.11 Service Connection Installation

A. The Contractor shall place a 90-degree factory tee at the locations indicated on the Plans or specified by the Developer’s Engineer. The tee shall be installed at a maximum angle of approximately 45-degrees with the horizontal or as directed by the Developer’s Engineer. After the tee is in position, special pipe bedding material and select backfill shall be hand-placed around the tee to prevent any movement of the tee when the next pipe is laid.

B. Unless otherwise specified on the Plans or directed by the Developer’s Engineer, each Service Connection shall be laid in a separate trench on a straight line and gradient from the tee to the end of the Service Connection. The Service Connection shall be at least 6-feet deep at the property line crossing. No Service Connection shall be laid on a grade of less than 2-percent, unless approved by the District and directed by the Developer’s Engineer or shown on the Plans.

C. Unless otherwise directed by the Developer’s Engineer, the Contractor will use a grading line to lay the pipe and the pipe shall be installed with the same accuracy as the mainline sanitary sewer.

D. Service connections and cleanouts shall be installed as shown on the approved plans.

E. Upon extension of the Building Sewer, a cleanout will be permitted by the local building code division and installed near the building foundation in accordance with Oregon Plumbing Specialty Code (OPSC).

6.3.12 Manhole Installation

All manholes shall be made of concrete as specified on the Plans. All manholes shall be a minimum of 48-inches inside diameter. Larger diameter manholes shall be specified per the approved Plans.

Base

A. The base shall be constructed per the standard detail drawing and in locations as noted on the Plans. Knockouts for pipe extensions will be based upon the alignment as shown or directed. Minor adjustments to alignment as directed by the Developer's Engineer may be necessary to better position manholes.

B. The Contractor may, at their option, use precast or poured-in-place manhole bases, provided all details of construction are approved by the Developer's Engineer.

C. Precast manhole bases shall be installed on a level compacted layer of gravel bedding a minimum of 6-inches thick on a suitable foundation. Poured in place bases do not require additional bedding. The concrete base for the manhole shall be constructed so the first section of the manhole has a uniform bearing throughout the full circumference of the manhole wall. Sufficient non-shrink grout shall be deposited on the concrete base to provide a watertight seal between the base and the manhole wall.

D. The manhole shelf shall be integrally poured against the wall and over the pipe stub. Construct the shelf in such a manner that when capacity of the pipe is reached, no portion of the shelf surface is used as part of the cross-sectional flow channel required for free flow through the manhole. Manholes shall have full depth channels placed across the base. The shelf shall have a slope of 1-inch per foot. All areas of the shelf shall freely drain into the channel.

E. The inverts of the manholes shall be constructed in conformance with the details shown on the plans. The manhole channels shall provide a smooth flow-through characteristic. No sharp edges or rough sections which will obstruct the flow of sewerage will be permitted. All cement used in the construction of the channels shall be troweled smooth. All manhole channels must be able to pass a 7-inch x 30-inch cylinder into the mainline pipe.

F. Manholes added over an existing mainline shall have a base which achieves watertight connections to the existing pipe type. Manholes and adjoining pipe shall be watertight. Any noticeable infiltration shall be repaired, in a means and method approved by the District

Manhole Barrel Sections

A. Precast concrete sections for manholes shall be in 1 to 4-foot sections placed in such combinations as to achieve the finish grade shown on the Plans. The joints for the manhole sections shall be made watertight with the use of non-shrink grout or flexible material. The wall sections and flexible material used to join them shall be compatible. The walls shall be constructed true to line and grade as established by the Developer's Engineer. Ample non-shrink grout shall be placed into the groove of

the lower section prior to placing the next barrel section. The entire joint shall be completely filled with non-shrink grout and troweled to a smooth surface. Preformed gaskets may be used in lieu of non-shrink grout type joints and shall be RAM-NEK, manufactured by K.T. Snyder Company, Inc., Houston, Texas; Kent-Seal by Hamilton Kent, Kent, Ohio; or as approved. Manhole sections with a captive groove rubber gasket need not be grouted between sections.

B. Cones shall be eccentric with the wall thickness and reinforcement like that of manhole pipe sections. The tops and bottoms of the cones shall be parallel.

C. Flat-top manhole sections for all size manholes shall be used in lieu of eccentric cones where the depth from shelf to the top of the last barrel section is 4-feet or less. A concentric top is required when the height from the shelf to the top of the last barrel section is 3-feet or less.

Manhole Extensions/Grade Rings

A. Install precast concrete grade rings on top of manhole cones to positively prevent all infiltration of surface or groundwater into manholes.

B. Grade rings shall be laid straight and true and set in a bed of non-shrink grout with the grout carried over the frame. Grade rings shall be set so the tops of the frame are flush with the finish grade or grade of adjoining pavement, or 6-inches above the finish grade in areas outside the Right-of-Way.

C. Extension rings shall be limited to achieve a maximum distance of 28-inches from the top of the first step to the top of the frame.

D. Precast rings shall be constructed to have an opening of 25-inches.

Manhole Frames and Covers

Frames. Standard frames shall have a total height of 10-inches as shown in Clackamas County Department of Transportation and Development Drawing U600. Frames shall be of the type detailed on the approved Plans or equal.

- Suburban frames shall have a total height of 6-inches and are designed for areas of light traffic loading and may be used as approved in non-traffic areas, easement areas and subdivision streets. Suburban frames are prohibited in collector streets, arterial streets, or streets in industrial areas.
- Tamperproof/locking and watertight (secured) frames shall be installed in locations as noted on the approved Plans. Secured frames shall be installed per the manufacture's specifications. On secured frames with internal lugs, one lug shall be centered above the manhole steps.

Covers. Standard Sanitary Sewer Manhole covers shall have a maximum of two, 7/8-inch pick holes.

- Tamperproof/locking covers shall match frame type and shall be installed per the manufacture's specifications.
- Watertight covers shall have no open pick holes and shall be installed per the manufacture's specifications.

Manhole Steps

Steps shall be placed where there are no incoming or outgoing lines. Steps shall be placed a maximum of 12-inches from the shelf and 28-inches from the top of the frame. Steps shall be 12-inches on center. Steps shall extend from the manhole wall 6-inches. Steps in a manhole shall be of the same type. Steps shall be installed straight and true.

Loose steps shall be cause for rejection of that manhole cone or section. Manholes less than 4-feet in depth do not require steps.

Manholes Future Development

The channeling, boot, and water-tight plug for all end manholes, from which future Public Sanitary Sewer Extensions will be extended, shall be designed as determined by the District.

Drop Manholes

Drop manholes shall be outside drops and constructed at the location shown and as detailed on the Plans. The first run of pipe from the drop assembly shall be a full length of PVC, C900 or C905 (match pipe type to drop assembly type). CDF fill must be encased around the drop assemblies up the springline of the top inlet pipe.

Mainline Cleanout Pad and Cover

The cleanout shall be installed as shown on the Plans or as directed by the Developer's Engineer. The cleanout shall be constructed of the same size and material as the mainline. Special attention should be paid to the details for the concrete pad, frame, and cover required. When using PVC pipe for the cleanout, the concrete support block is not required. The cleanout riser shall be protected by the pad and cover but shall not touch or be a structural part of the pad. A watertight end plug shall be installed on the riser. No load from the frame, pad or cover shall be placed on the pipe or plug. Provide compacted ¾-inch minus crushed gravel up and around the cleanout assembly to finish grade.

6.4 Materials

6.4.1 Trench Backfill Stabilization

Trench backfill stabilization material shall be 2½-inch minus clean pit-run gravel, crushed rock, or gravel, having reasonably even gradation from coarse to fine or open graded. Maximum percent passing the ¼-inch screen shall be 20-percent by weight. Gravel shall be placed in thoroughly compacted layers not to exceed 6-inches to the established grade.

6.4.2 Pipe Base and Pipe Zone

Material for pipe base and pipe zone shall be ¾-inch minus crushed gravel, having reasonably even gradation from coarse to fine, in accordance with the Oregon State Highway Commission Standard Specifications for Highway Construction specification for Aggregate and Aggregate Base, Section 02630.10.

6.4.3 Trench Backfill

A. Backfill material specifications above the pipe zone within the Right-of-Way shall be ¾-inch minus crushed gravel, having reasonably even gradation from coarse to fine, in accordance with the Oregon State Highway Commission Standard Specifications for Highway Construction specification for Aggregate and Aggregate Base, Section 02630.10.

B. Backfill material specifications above the pipe zone outside the Right-of-Way shall be of the class (Section 6.5) specified on the approved plans.

C. Service Connection backfill will be the same as that used for the Public Sanitary Sewer Mainline to which they are connected.

6.4.4 Controlled Density Fill (CDF)

CDF shall not be a replacement for stone pipe base/bedded within the pipe zone. The use of CDF may be required for backfill material associated with the installation of public sanitary sewer system. CDF shall be a mixture of Portland cement, pozzolans, fine aggregate, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material. CDF shall be a hardened, dense, non-settling fill with an unconfined compressive strength at 28-days of 100 to 200 psi.

6.4.5 District Manhole Connection

Connections to District manholes shall be made with an elastomeric gasket or flexible sleeve conforming to ASTM C923, (Kor-N-Seal or equal).

6.4.6 Pipe

Pipe shall be PVC gravity sewer pipe conforming to ASTM D-3034, SDR 35. Pipes shall be the following materials:

A. PVC:
    a. ASTM D3034 SDR 35, 4 to 24-inches, or
    b. ASTM C-900 D-1784 DR, 4 to 24-inches (preferred by District), or
    c. ASTM C-905 D-1784 DR, 4 to 24-inches (preferred by District).
B. HDPE: ASTM D-3035

Minimum stiffness shall be 46 psi. Joint type shall be elastomeric gasket conforming to ASTM D3212.

6.5 Backfill

The design standards for backfill compaction are provided below.

6.5.1 General Compaction

A. Backfill material shall not be placed in the trench in such a way as to permit free-fall of the material until a minimum of 2-feet of cover is provided over the top of the pipe.
B. Backfill shall be maintained at proper moisture content so that the material is within 5-percent plus or minus of optimum moisture.
C. Granular backfill shall be placed and compacted in a maximum of 12-inch lifts, and native material backfill shall be placed and compacted in a maximum of 24-inch lifts.
D. Maximum density and optimum moisture will be determined using Method A of AASHTO T-99. Granular backfill material must meet 95-percent compaction, AASHTO T-99 within public streets and paved areas, and native backfill must meet 85-percent compaction of AASHTO T-99 in non-paved or unimproved areas.
E. Compaction testing is required at the minimum frequency of one (1) test every 100-feet of trench, unless otherwise specified by a Geotechnical Developer's Engineer.
F. Native backfill used in Class A shall be compacted to at least 90-percent of maximum density above the pipe zone and to within 3-feet of the ground surface. The top 3-feet shall be compacted to at least 92-percent of maximum density.
G. Imported trench backfill used for Class B, Class C, and the lower portions of Class D trenches where designated shall be mechanically compacted. The full trench depth

to within 1-foot of the ground surface shall be compacted to a least 95-percent of maximum density. The top 1-foot shall be compacted to no less than 100-percent of maximum density prior to placement of asphalt concrete.

H. Unless otherwise noted, the Contractor shall be responsible to provide the proper size, type, and specification of backfill.

6.5.2 Pipe Zone

The pipe zone for both mainline and Service Connection shall be defined as extending from the bottom of the pipe bedding to a point 12-inches above the outside of the pipe for the full width of the trench, for all classes of backfill. The pipe zone shall be backfilled with compacted ¾-inch minus crushed gravel and shall provide a firm, unyielding support along the entire pipe length. Immediately following the placement of each pipe section, the crushed gravel pipe bedding shall be placed and compacted to the springline of the pipe. Special effort to properly bed the pipe by slicing backfill in the pipe haunches up to the springline shall be provided. Backfill shall then be placed and compacted in lifts of not greater than 6-inches to the top of the pipe zone.

6.5.3 Easements

After the Contractor has backfilled the pipe zone of the trench as required, the Contractor shall then backfill the balance of the trench, with the type of backfill specified on the approved plans. The trench backfill shall be mechanically compacted in 1-foot layers, to 95-percent of maximum density in roadways and 85 to 90-percent in all other areas.

6.5.4 Backfill Classifications

The backfill classifications used by the District for construction projects in the Public Sanitary Sewer System are listed below.

Class "A" Backfill

The entire trench above the pipe zone shall be backfilled with native excavated material and compacted to 90-percent of maximum density as per AASHTO T-99 and ODOT/APWA specification 00405. Placement of native backfill material for Class A backfill shall include the working of material to achieve suitable moisture content and compaction to the specified density. In lieu of using native material excavated from the trench for Class A and C backfill, the contractor may at their option place and compact to specified density an approved imported backfill material. Imported material must be approved by the Developer’s Engineer prior to placement. Material shall be earth, gravel, rock, or combinations thereof, free of humus, organic matter, vegetative matter, frozen material, clods, sticks, and debris and containing no stones having a dimension greater than 4-inches. Sand or pea gravel will not be an approved backfill material.

Class "B" Backfill

The trench above the pipe zone shall be backfilled with gravel for trench backfill and compacted to 95-percent of maximum density as per AASHOT T-99 and ODOT/APWA specification 00405, except for the top 10-inches. The top 10-inches of the trench shall be backfilled and compacted in successive layers of 4-inches of 1½-inch minus "Crushed Gravel", and 2-inches of ¾-inch minus "Crushed Gravel".

Class "C" Backfill

The trench above the pipe zone shall be backfilled with gravel for trench backfill and compacted according to the specifications of the District, except for the top 11-inches. The top 11-inches of the trench shall be backfilled and compacted in successive layers with 8-inches of 1½-inch minus "Crushed Gravel", and layers of Asphaltic Concrete.

Class "D" Backfill

CDF shall not be a replacement for stone pipe base/bedding within the pipe zone. When CDF is called out on the plans as a requirement by the Developer's Engineer the entire trench shall be backfilled with CDF, except for the Trench Foundation, Pipe Base/Bedding and Pipe Zone which shall be backfilled with crushed gravel to District specifications. In paved areas the top 3-inches of the trench shall be backfilled and compacted in successive layers with two, 1½-inch layers of Asphaltic Concrete. The use of CDF is required for backfill material associated with the installation of manholes constructed of any material except concrete. Contact the appropriate roadway authority for specifications of CDF backfill within a private street or public Right-of-Way.

6.6 Testing

District standards for testing Sanitary Sewer Mainlines and appurtenances are provided below (see also Section 6.6.5 regarding required video testing).

6.6.1 General

A. Test all gravity Sanitary Sewer Mainlines and Service Connections by "low pressure air testing", all mainlines by deflection testing "mandrel", and video inspection.

B. Test all manholes using the negative pressure (vacuum) method.

C. Ensure all gravity sanitary sewers and appurtenances successfully pass the air test prior to acceptance and are free of visible leakage or infiltration.

D. Conduct a video inspection of all mainline pipe in accordance with the applicable section below.

E. The Contractor may desire to make an air test prior to backfilling for their own purposes; however, the acceptance air test shall be made after backfilling and compaction has been completed to final grade.

F. The testing equipment and personnel shall be subject to the approval of the Developer's Engineer.

G. Acceptance testing shall be conducted on all of the manholes with the exception of existing manholes used to extend new Sanitary Sewer Mainline.

H. The Developer's Engineer or Developer's Engineer's Inspector shall observe all testing and record and submit the results on the District testing forms.

6.6.2 Low- Pressure Air Test

The Developer's Engineer or Developer's Engineer's Inspector shall observe all testing and record and submit the Low-Pressure Air Test results on the District testing forms. A summary of the Low-Pressure Air Test is as follows:

Summary of Method

Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the

section being tested. The Contractor may desire to make an air test prior to backfilling for their own purposes. However, the acceptance air test shall be made after backfilling and compaction has been completed to finish grade.

Preparation of the sewer line

Flush and clean the sewer line prior to testing, to clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to Service Connections.

Infiltration

The District does not allow new construction of sanitary sewer piping systems to have any visible sign of ground or surface water infiltration. If infiltration into the sanitary sewer piping system is visible it will need to be corrected prior to proceeding with any sanitary sewer testing.

Ground Water Determination

Install a ½-inch capped galvanized pipe nipple, approximately 12-inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in-feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.

Procedures

Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM F1417 & UNI-B-6. The pressure gauge used shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625 psi. Pressure-holding time is based on an average holding pressure of 3-pounds per square inch gage (psig) or a drop from 3.5 psi to 2.5 psig above the groundwater pressure.

A. Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psig. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

B. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop-in pressure for the test period. If the pressure has dropped more than 1.0 psig during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.

C. The test procedure may be used as a presumptive test that enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

D. If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31-feet the ground water level is above the invert of the sewer.

Safety

The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed

and braced in such a way as to prevent blowouts. If as much as a force of 250-pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug that is partially deflated before the pipe pressure is released can be dangerous. As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

Calculating Time (T) – Low-Pressure Air Test

A. The pipeline shall be considered acceptable when tested as described herein before if the section under test does not lose air at a rate greater than 0.0015 cubic feet per minute (cfm) per square foot of internal sewer surface. Minimum Testing Times: See **Table 3**.

Table 3. Low Air Test Minimum Testing Time

(T) Minimum, sec.	(d) Pipe Dia., in.	(L) Minimum, ft	(T) for Addition Length (T/L) seconds/foot
340	6	398	0.855
454	8	298	1.520
567	10	239	2.374
680	12	199	3.419
850	15	159	5.342
1020	18	133	7.693
1190	21	114	10.471
1360	24	100	13.676

B. The following formula shall be used for calculating (T) for lengths of pipe and diameter of pipes not shown in the table referenced above.

$$T = (d^2)\left(\frac{L}{42}\right)$$

where

T = test duration, seconds

d = pipe diameter, inches

L = section length, feet

42 = conversion factor

and

Test PSI = (4.0) + (G/2.31)

G = Ground Water height, ft

Low Pressure Air Failed Test

A. If the pipe installation fails to meet these requirements, the Contractor shall determine, at their own expense, the source or sources of leakage, and shall repair or replace all defective materials and correct all faulty workmanship. The type of repairs proposed by the Contractor must be approved by the Developer's Engineer before the repair work is begun.

B. The portion of Sanitary Sewer Mainline that failed to pass the test(s) shall be repaired and retested for low pressure air and mandrel/deflection. The completed pipe installation shall meet the requirements of the air tests before being considered acceptable.

C. Infiltration of groundwater, in any amount, following a successful vacuum or low-pressure air test as specified, shall be considered as evidence that the original test was in error or that subsequent failure of the sanitary sewer system has occurred. The Contractor will be required to correct the infiltration of groundwater. The portion of Sanitary Sewer Mainline that was repaired and/or failed to pass the test(s) shall be repaired and retested for low pressure air and mandrel/deflection tests.

6.6.3 Manhole Vacuum Test

A. Manhole Vacuum Test (Adapted from ASTM C1244-93). The Developer's Engineer or designated inspector shall observe all testing and record and submit the results on the District testing forms.

B. Plug all lift holes and pipes entering the manhole. A vacuum will be drawn, and the vacuum drop over a specified period of time is used to determine the acceptability of the manhole.

C. This is not a routine test. The values recorded are applicable only to the manhole being tested and at the time of testing.

D. Preparation of the Manhole:

   a. Plug all lift holes with an approved non-shrink grout.

   b. Plug all pipes entering the manhole, taking care to securely brace the pipes and plugs from being drawn into the manhole. The manhole shall be set to finish grade and all paving (if applicable) completed.

E. Procedure

   a. Place the test head at the inside of the top of the frame and the seal inflated in accordance with the manufacturer's recommendations.

   b. Draw a vacuum of 10-inches of mercury, with the valve on the vacuum line of the test head closed, and the vacuum pump shut off. With the valves closed measure the time for the vacuum to drop to 9-inches.

   c. The manhole shall pass if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches meets or exceeds the values indicated below.

   d. Using the formulas that follow, the comparable times for a successful vacuum test for different size manholes are:

Table 4. Times for a Successful Vacuum Test for Different Size Manholes

DEPTH (ft)	TIME (sec)		
	Manhole Diameter		
Depth of MH	4-ft	5-ft	6-ft
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

6.6.4 Mandrel Test

The Developer's Engineer or Developer's Engineer's Inspector shall observe all testing and record and submit the results on the District testing forms. In addition to low pressure air testing, sanitary sewers constructed of PVC sewer pipe shall be tested for deflection not less than 30-days after the trench backfill and compaction has been completed.

Mandrel Size

The rigid mandrel shall have an outside diameter (OD) equal to 95-percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for OD controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

Mandrel Design

The rigid mandrel shall be constructed of a metal or rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" if the total number of legs is an odd number. The barrel section of the mandrel shall have an effective length of not less than the nominal diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

Mandrel Type

Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test. Mandrels with removable legs or runners may be accepted on a case-by-case basis. Mechanical devices will not be used to pull the mandrel. The mandrel shall be rigid and nonadjustable with an effective length of not less than its nominal diameter.

Manhole to Manhole

Testing shall be conducted on a manhole-to-manhole basis and shall be done after the line has been completely cleaned and flushed. The tests shall be performed without mechanical pulling devices. Any portion of the sewer which fails to pass the test shall be excavated, repaired or realigned, and retested with both air and deflection tests.

Mandrel/Deflection Failed Test

Any portion of the Sanitary Sewer Mainline which failed to pass the test shall be excavated, repaired, or realigned and retested. The portion of Sanitary Sewer Mainline that failed to pass the test(s) shall be repaired and retested using low pressure air and other relevant tests.

6.6.5 Video Inspection and Reports

A. All newly installed Public Sanitary Sewer Systems shall be inspected by means of a remote video inspection. The video inspections and reports shall be submitted to the District. The Developer's Engineer must review the video inspection and report prior to submitting it to the District.

B. The inspections reports must note important features encountered during the inspection. The speed of travel shall be slow enough to full access the installation inspecting each pipe joint, tee connection, structural deterioration, infiltration and inflow sources, and deposits.

C. The camera must be centered in the pipe to provide accurate distance measurements to provide locations of features in the sewer and these footage measurements shall be displayed and documented on the video. The video inspection must be continuously metered from manhole to manhole. All video recording shall be continuous from structure to structure with no "pausing" of the video recording during each pipeline inspection. The pipe shall be cleaned prior to performing the video inspection to ensure all defects, features and observations are seen and logged.

D. Just prior to beginning the video inspection, while the camera is in place and recording, water shall be introduced into the upstream manhole of each pipe segment until it is observed and recorded flowing past the camera's field of vision in its entirety.

E. The camera shall have a water-level measuring device (ball, cylinder, etc.) attached that has ¼-inch markings to show the depth of water in the pipe during the video inspection.

F. Per these standards the Sanitary Sewer Mainline shall have no more than ½-inch of ponding water to be considered acceptable.

G. Any noted deficiencies shall be remedied, and the applicable section of the mainline re-video inspected prior to submitting the video inspection and reports to the District.

6.6.6 Dye-Testing for Non-Single-Family Residential Properties

Dye-testing shall be used by the Developer's Engineer's Inspector for non-single-family residential properties to confirm that the Public Sanitary Sewer System is not connected to a stormwater/surface water drainage system. Before commencing dye-tests, sewer maps should be reviewed to identify and confirm access to Service Connections. In addition, to avoid costly and unintended false alarms, the Engineer's Inspector or associated field crews should contact key spill response agencies to provide information regarding when and where dye testing is planned to occur. The Engineer's Inspector should also carry a list of phone numbers, if the need arises, to notify spill response agencies in the event dye is released to a stream.

Fluorescent dye is introduced into the Sanitary Sewer Collection System and the most likely/suspected storm sewer manholes and adjacent outfalls or open channel storm drainage systems are inspected to identify potential cross connections. Two or three crews are needed to conduct proper dye-testing. One member of the crew drops the dye into the sewer trunk line, while the other crew member(s) looks for evidence of the dye in downstream sanitary sewer and storm sewer manhole(s) or outfalls to surface drainage systems. To conduct the investigation, a point of interest or down pipe "stopping point" is identified. Dye is first introduced into manholes upstream of the stopping point to determine if they are connected. The process continues in a systematic manner until an upstream manhole can no longer be identified, whereby a branch or trunk of the system can be defined, updated, or corrected.

Table 5 provides key field equipment necessary for dye testing. The equipment needed is not highly specialized. Often, the most important choice is the type of dye used for testing. It is recommended that liquid dye is used; however, solid dye tablets can also be placed in a mesh bag and lowered into a cleanout on a rope. If a longer pipe network is being tested, and dye is not expected to appear for several hours, charcoal packets can be used to detect dye. Charcoal packets can be secured and left in place for a week or two, and then analyzed for the presence of dye.

Table 5. Key Field Equipment for Dye Testing

Maps, Documents	Sewer maps (sufficient detail to locate manholes)
	Site plan and building diagram
	Letter describing investigation
	Identification (e.g., badge or identification card)
	Educational materials (to supplement pollution prevention efforts)
	List of agencies to contact if the dye discharges to a stream
	Name of contact at the District

Equipment to Find and Safely Lift the Manhole Lid	Probe Metal Detector Crowbar Safety equipment (hard hats, eye protection, gloves, safety vests, steel-toed boots, traffic control equipment, protective clothing, gas monitor)
Equipment for Actual Dye Testing	2-way radio, dye (liquid or test strips), high powered lamps or flashlights, water hoses and camera.

The basic drill for dye-tests consists of four steps:

A. Flush or wash dye down the relevant sanitary system, fixture, or manhole.

B. Pop open downgradient sanitary sewer manholes and check to see if any dye appears.

C. Pop open downgradient storm sewer manholes or observe outfalls for potential appearance of dye.

D. If no dye is detected in the sewer manhole after 1 to 2 hours, check down gradient sewer manhole or connections for the presence of dye.

APPENDIX A. Permitting And Submittal Requirements

Appendix A outlines the planning, plan review, and project completion requirements for both sanitary and storm sewer projects and is included in both the Sanitary Standards and the Stormwater Standards. This section is intended to standardize the submittals and clearly outline the minimum requirements. The requirement for a complete submittal package is intended to reduce the overall plan approval processing time.

Review and Permitting Requirements

The following is a generalized overview of the District development review and permitting processes. This process may vary from one application, submittal and/or building permit to another and is only shown as a general outline of procedures and processes involved in the review and approval of projects located within the District. To obtain further information on a specific plan review or permit process contact a Development Review staff member. The Developer shall have ultimate responsibility for compliance with all requirements specified in these Sanitary Standards and the District's Regulations. The Developer shall be directly responsible for all administrative requirements including application for service, submittal of all required Plans, bonds and insurance, and payment of fees.

General Plan Review and Approval Process

This subsection describes the most common elements of the general development review process for a typical partition, subdivision, multi-family, commercial or industrial project. Applicants should discuss their project with the District and local planning authority early to understand the review and approval process required for a specific project.

1. **Pre-Application Conference** – The Applicant may elect to meet with the local planning authority, District, and other related departments to discuss the proposed project to better understand the potential requirements. It is best if the Applicant submits a preliminary concept or plan, so the District is better prepared to discuss the proposed development. Contact the local planning authority to schedule the pre-application meeting. The planning authority will invite the District to the meeting.
2. **Service Provider Letter** – Applicants proposing to develop or redevelop property shall obtain a Service Provider Letter from the District prior to submitting the land-use or design review application to the local planning authority.
3. **Water Quality Resource Area Boundary Verification** – If applicable, prior to the District issuing a Service Provider Letter, the local planning authority must approve a WQRA Boundary Verification for vegetated buffer requirements (see the Buffer Standards).
4. **Conditions of Approval** – The local planning authority will process the land use/design review application and route a copy of the application for District review. The District will review the application and submit comments to the local planning authority to be included as conditions.
5. **Jurisdictional Authority**– If the proposed project is outside the service area boundaries of the District, the Developer must petition for annexation to the District. The annexation must be approved by the Board before final occupancy or plat approval. The Applicant shall submit a complete annexation packet to WES prior to any plan approvals by WES.
6. **Pre-Design Meeting** – The Applicant may elect to coordinate a meeting with the local planning authority and/or the District to discuss the project and requirements outlined in the conditions.

7. **Plan Submittal** – Upon land use approval, the Applicant must submit required fees, civil plans and supporting documentation as specified in these standards for plan review and approval.
8. **Other approvals** – Other permits and approvals may be required prior to the District approving the plans (i.e., County, City, State, or Federal).
9. **Approved Plan(s)** – Plans and applicable building permit applications will be reviewed, approved, and then signed by an authorized representative of the District. If applicable, it may be necessary to hold a Pre-Construction Meeting with the Developer's Engineer, Contractor, Applicant, District, and other related agency representatives to discuss project requirements, including processes to complete the project as specified in the Sanitary and Stormwater Engineering Agreements.
10. **Construction** – The public sanitary and stormwater management infrastructure shall be constructed under the supervision of the Developer's Engineer as specified in the Sanitary and Stormwater Engineering Agreements.
11. **Construction Completed** – Upon final completion of the construction, the Developer's Engineer will certify the project was constructed in accordance with the approved plans, and the as-built plans are an actual record of what was constructed.

    The following items will be completed and submitted prior to requesting the final inspection of the public sanitary and/or stormwater infrastructure:

    i. All sanitary and/or stormwater infrastructure shall be cleaned of sediment and debris.
    ii. A *Certification of Completion* shall be submitted – Certifies the project was constructed in accordance with the approved plans and District Standards.
    iii. If applicable, a *Vegetated Planting Certification* shall be submitted – Certifies water quality plantings were planted in accordance with the approved plans and the Stormwater Standards.
    iv. Two paper copies of the as-built drawings shall be submitted.
    v. If applicable, submit the video testing of the public sanitary and stormwater conveyance piping systems, along with the Contractor's reports for review and approval. The Developer's Engineer shall review the video and reports, and note any deficiencies discovered in the system(s) prior to submitting the items to the District.
    vi. Submit a copy of the Developer's Engineer inspection reports.
    vii. Submit Service Connection drawings prepared by the Developer's Engineer (if required).
12. **Final Inspection** – The District will review the required as-built submittals and, if acceptable, will schedule the final field inspection. All repairs and corrections shall be made prior to the District deeming the project complete.
13. **Final As-built Drawings** – When requested by the District, the Developer's Engineer shall submit the corrected final as-built drawings on paper, electronic CAD, and PDF files of the as-built civil construction plan set.
14. **Warranty Surety** – Upon completion of the public sanitary and stormwater final inspection, the Applicant will submit a sanitary and/or stormwater warranty surety in the amount of 25-percent of the actual cost to construct the public infrastructure. The warranty surety will be held for a minimum period of 2-years from the date of completion, or until all the requested system repairs are completed.

15. **Letter of Completion and Acceptance –** Upon final approval of the construction of the public sanitary and stormwater infrastructure, and all of the above noted items have been reviewed and approved by the District, then the District will issue a letter of completion of the stormwater infrastructure, and letter of acceptance of the public sanitary sewer system and/or Public Stormwater System.
16. **Warranty Surety Inspection** – Between 20 and 24-months after issuance of the letter of completion and acceptance, the District will inspect the public facilities at the request of the Owner. The inspection will include all public sanitary and stormwater infrastructure, included the plantings and other related improvements. Once all deficiencies are corrected, the District will issue a warranty surety release letter.

Service Provider Letter Submittal Requirements

The intent of the Service Provider Letter is that, prior to applying for Land Use/Design Review, the Applicant must demonstrate the proposed development is viable in accordance with District Rules and applicable Standards. The Service Provider Letter will only be issued once the Applicant has provided sufficient plans, reports, studies, and agency approvals needed for preliminary review by the District. Based on the preliminary review, the District may require additional information prior to issuance of the letter or as part of the forthcoming land use application. Receipt of the Service Provider Letter does not imply that all District requirements have been met or guarantee that land use approval for the development will be granted.

Applicants must submit the following to the District for review:

- Preliminary plat (if applicable)
- Preliminary proposal for public and private sanitary infrastructure
- Proposed sanitary system layout, including compliance with minimum design standards
- Points of connection to public sanitary sewer system
- Service proposal for upstream properties
- Preliminary Stormwater Management Plan and Drainage Report
- Site assessment and maps
- Proposed storm drainage system and stormwater facilities:
    - Infiltration, detention, and water quality facilities
    - Conveyance System design
    - Point of discharge
    - Emergency overflow pathway
    - Service proposal for upstream properties
- Soils report and analysis
- Drainage area maps
- Infiltration testing results
- Drainage system analysis (upstream and downstream)
- Sizing and conveyance calculations
- Other supporting reports and information (as deemed necessary by the District)

- BMP Sizing Tool calculations
- WQRA Boundary Verification or Natural Resource Assessment
- Preliminary approval for off-site easements
- Offsite mitigation measures for downstream conveyance

Land Use Submittal Requirements

As part of the land use/design review application process, the local planning agency will route applicable sanitary and stormwater plans and reports to District for comment. The Applicant must provide sufficient plans, reports, studies, and agency approvals needed for preliminary review by the District, as including, but not limited to the Service Plan Submittal Requirements, above. The Applicant's materials shall include any additional information or revisions requested by the District with issuance of the Service Provider Letter.

The land use review stage includes WES issuance of 1) a Service Provider Letter, prior to land use application submittal, and 2) land use conditions of approval, following receipt of a complete land use application from the local planning agency.

Plan Review Submittal Requirements

The Developer's Engineer shall submit sufficient supporting information to indicate that the proposed plan design meets all the provisions within these Standards, including the land-use conditions. The submittal information shall include, but not be limited to, the items listed within this section.

Initial/First submittal requirements:

The following is a list of application submittals required by the District for a typical development:

- Water Quality Resource Area (WQRA) Boundary Verification and WQRA Development Permit, submit to the local planning authority as required (see Buffer Standards)
- Complete set of drawings for the Stormwater Management Plan
- Existing conditions
- Infiltration testing
- Proposed on-site storm drainage system and stormwater facilities
- Proposed grading plan
- Existing and proposed off-site improvements
- EPSC Plan
- Details and notes
- Stormwater Management Report that includes:
    - The engineered or BMP Sizing Tool method used to size the stormwater facilities.
    - A Storm Drainage System/Hydrologic and Hydraulic Calculations Report
    - Hydrology and hydraulic calculations with drainage area maps
    - Tributary drainage areas shall be calculated in table form and identified on maps submitted with the report
    - Geotechnical/Geologist Report

- Infiltration Testing
- Soils Report
- Geology Report

Other submittal requirements required by the District as applicable prior to final plan approval.

- Standard Forms
  - Storm System Engineering Agreement
  - Storm System Construction and Engineering Costs Data Sheet
  - Sanitary Sewer Engineering Agreement
  - Sanitary Sewer Construction and Engineering Costs Data Sheet
- Non-Residential Questionnaire Easements/Agreements as applicable
  - Public/Private Sanitary and Stormwater Easements
  - Public/Private Storm Facility Operation and Maintenance Plan/Agreements

Periodically, the District may require additional information to support design assumptions used for sanitary sewer design. When required, the information shall be included on the Plans or submitted in memorandum form to the District. The following may be required:

- Potential size of drainage basin
- Number of potential EDUs

Sanitary Sewer Extension Submittal

The Public Sanitary Sewer Extension submittal shall include all required information along with any other information requested by the District. The required information includes, but is not limited to the following:

- Two sets of complete civil construction Plans.
- Sanitary Sewer Engineering Agreement (form can be found online).
- Construction and Engineering Cost Estimate (form can be found online).
- Sanitary Plan review fees.

All submittals will be reviewed for completeness and the Developer's Engineer will be notified if required information is missing. Upon acceptance of a complete submittal, subsequent project review and approval steps shall be undertaken.

Partition/Subdivision Plat Review and Approval

The Applicant shall submit a preliminary plat to the local planning authority, who will coordinate plat review with the District. The District will only perform an official review of plats received from the local planning authority. The District will review the plat in accordance with the approved Sanitary Plans and Stormwater Management Plans and return comments to the local planning authority. Prior to final plat approval by the District, the Developer shall address the following:

- All associated agreements and easements shall be reviewed and approved by the District. The District will deliver the signed documents to the County Surveyor's Office at the time of plat approval.
- Sanitary and Stormwater Improvements shall be:
  - Fully constructed in accordance with the approved plans, or

  - The Applicant shall obtain a performance surety for all proposed sanitary and stormwater improvements on the approved plan. If the construction work is partially completed, the surety will be based on a status report submitted by the Developer's Engineer.

- Public easement documents shall include a site plan and specify the entitlements within the boundary of the easement.
- Deferred Improvements – In some situations, the responsibility to construct improvements may be deferred to the future Owner of a specific lot. Deferrals are at the discretion of the District and will be reviewed on a case-by-case basis. All deferred improvement(s) shall be fully constructed and completed in accordance with the Rules and applicable Standards, prior to any future occupancy permit approvals by the District. All responsibilities of the future Owner to construct the deferred improvements shall be stipulated in a separate document recorded as a covenant with the plat.
  - Subdivision Plats – Any deferred improvements must be part of a District-approved subdivision improvement plan.
  - Partition Plats – Eligible improvements are limited to Service Connections, Conveyance System, pervious surfaces, and stormwater facilities that either benefit one lot, or are shared facilities. In the case of shared facilities, the deferred improvements will be the responsibility of the first future lot Owner to submit a building permit application.
  - Other related agreements and documents (i.e., Homeowner's Association covenants, conditions and restrictions; maintenance agreements, etc.)

Plan Submittals

This section contains specific information and drawing specifications for submittals made to the District. This section is intended to standardize the submittals and clearly outline the minimum requirements. The requirement for a complete submittal package is intended to reduce the overall plan approval processing time. Plans will not be reviewed until a complete plan has been submitted. A complete plan shall include at a minimum all requirements listed in this section.

a. Specific Sheet Submittal Requirements and Specifications

The following sheets are required as part of a complete plan submittal:

- Title Sheet
- Composite Utility Plan
- Composite Stormwater Management Plan Cover Sheet
- Stormwater and Sanitary Sewer Plans and Profiles
- Grading Plan
- EPSC Plan
- Vegetated Buffer Planting Plan
- Stormwater Management Facility Planting Plan
- Standard and Non-Standard Drawings/Detail Sheets
- Standard and Non-Standard Construction Notes
- All applicable Standard Drawings shall be included on a separate sheet in a clear and legible size.

b. Title Sheet

As a minimum the following information shall be found on the title sheet:

- Index of Sheets.
- Complete legend of symbols used.
- Vicinity Map to a scale of not less than 1-inch = 800-feet showing the project location.
- Site Plan of the entire project showing street ROW and/or subdivision layout.
- Temporary and permanent benchmarks including their descriptions. Total acreage including streets directly served.

c. Composite Utility Plan

The Composite Utility plan shall be scaled to show the entire site on one sheet unless otherwise approved by the District and shall show:

- All proposed sanitary and storm improvements
- All other proposed improvements
- All existing utilities and utilities adjacent to and within 100-feet of the project
- Existing natural or artificial drainage features
- Tract names and numbers
- Property lines with tax lot numbers and addresses
- Street names at a minimum shall be shown

d. Composite Plan Cover Sheet (separate sanitary and storm)

The following information shall be included on the Composite Plan cover sheet:

- The scale shall be scale-appropriate to fit the entire site on one sheet, unless otherwise approved by the District
- Show the appropriate contour lines to demonstrate the overall site topography. Generally, these are 1-, 2-, 5-, or 10-foot contour lines. The topography must extend a minimum of 50-feet to 100-feet beyond the proposed limits of development
- Show the entire system
- Show the SMFs
- Shade all other utilities not related to sanitary sewer or stormwater drainage systems.
- Show drainageway(s) as existing and/or proposed.
- Show emergency overflow pathway(s) to an acceptable point of discharge.
- Show existing and/or proposed storm drainage and conservation easements.
- Show vegetated buffers and associated sensitive areas.
- Show all site and roadway improvements.
- Show the subdivision, phase lines or plat boundaries.

e. Plan and Profile Views

Plan and profile views shall include the following information:

Plan View

Plan views shall contain as a minimum the following information:

- The scale shall be 1-inch = 50-feet horizontal. Alternative scales may be approved by the District on a case-by-case basis. The scale shall be shown for each plan and profile view.
- Entire sanitary and storm sewers clearly shown and labeled.
- Plan views showing north predominantly to the top or left of each sheet.
- Plan views showing accurate 1- or 2-inch contour lines and extending a minimum of 50-inches to 100-feet beyond the limits of the development. Alternative contour spacing may be approved by the District on a case-by-case basis.
- All proposed extensions of the Conveyance Systems showing mainlines, manholes and Service Connections.
- Manholes identified and stationed to facilitate comparison of the plan view and the profile view.
- Manhole callouts in District format.
- District stationing formats for new lines and manholes.
- Size and type of pipe, backfill material, and location.
- Sanitary/Storm Service Connection tees off the mainline. For each lot being served, show the mainline stationing, pipe size, length, and depth of lateral at end of pipe.
- Public ROW, property, and easement lines.
- Location of water courses, stream and railroad crossings, culverts and storm drains that cross the alignment.
- Subdivision names, roadway names and lot/parcel numbers or tax lot numbers.
- Existing and proposed Sensitive Areas and the required Vegetated Buffer.
- Existing utilities, all manholes, water mains, services, gas mains, underground power, and other utilities and structures, including hydrants, pedestals, signs, mailboxes, light poles, wells, water mains, valves, pumps stations, and blowoff structures, manholes, valves, meter boxes, power poles, handicap ramps, striping, and trees.
- Existing and proposed edge of pavement on both sides of the street, including shoulders, curb, sidewalk, ditch line, culverts, and driveways.
- Plan view including the above items for a minimum distance of 50-feet to a maximum of 500-feet may be required beyond the proposed improvement in order to prevent future improvement conflicts.
- Location and dimensions of all SMFs, including the following:
    - Setbacks from property lines and structures,
    - Facility wall material, if required, and geotextile/waterproofing membrane specifications,
    - Growing medium specifications,
    - Drain rock and filter fabric specifications,
    - All stormwater piping associated with each facility including pipe materials, sizes, slopes, IEs at bends and connections,

  - Ground elevations at catchment locations, channel inverts, top and toe of slope surrounding detention/retention areas,
  - Ground slopes of channel inverts and sides, parking lots, bottoms and sides of facilities and adjacent surroundings,
  - Invert and top or bottom elevations (if applicable) of pipes, catch basins, overflows, manholes or other similar structures.
  - Location of construction fencing used to protect proposed SMFs from compaction and other construction disturbance.
- Location of all drainageways and the 100-year flood plain.
- Show the location and direction of any surface stormwater conveyance path(s).
- Location and detail of all existing facilities on which work is to be performed, i.e., installation, repair, or removal.
- Location and description of all known existing property monuments, including, but not limited to, section corners, quarter corners, donation land claim corners and any other county control monuments.
- Street stationing may be shown on the construction plans, but later removed on the final as-built plans.
- Roof drain connection points shall be shown using the ® symbol.
- Sanitary and storm structures should be easily visible and shown drawn at least 2x the size of the line width and in proportion to the line weight.

Profile View

Profile views shall contain as a minimum the following information:

- Plan and profiles on each sheet shall match and line up on at least one edge of the drawing (i.e., profile to show pipe in same direction as the plan view and lined up plan view over profile).
- The scale shall be 1-inch = 50-feet horizontal and 1-inch = 10-feet vertical. Alternative scales may be approved by the District on a case-by-case basis. The scale shall be shown for each plan and profile view.
- Location of existing and proposed manholes and other appurtenances with each manhole numbered and stationed. Manhole numbers to be provided by District, if applicable. Manhole callouts shall be in the District format. The benchmark used as a basis for vertical control in the design shall be referenced on the plans.
- The location and elevation of an approved benchmark shall be shown on the plans or, if not within the proposed area of work, shall be referenced by number and location. Elevations shall be based on the NGVD88 datum if the project is within ½-mile of a County benchmark. A conversion factor to relate the existing connection point elevations to the plan elevations and benchmark.
- Grid lines using the horizontal and vertical scale.
- Existing and proposed ground and/or pavement surface with elevations noted at critical points.
- Sanitary/Storm lines shall be labeled with the name of the mainline centered under the profile view in large bold letters.

- Sanitary/Storm lines shall be labeled with the pipe size, material, slope (as a %), length and type of backfill between manholes.
- Nonstandard manholes must be labeled with the type (i.e., tamperproof, drop, flat top, etc.).
- Railroad, culvert, ditch, or stream crossings with elevations of the ditch or streambed and casing details.
- All existing and proposed storm, water, and any other crossing utility lines greater than 6-inches in diameter.
- Non-standard SMFs and appurtenances shall show a typical cross-section with dimensions.

f. Grading Plan

Projects requiring grading and/or fill activities will require the submittal and approval of grading plans prior to the beginning of such operations. The District will review the grading plan in the context of the overall Stormwater Management Plan. Generally, an additional grading permit and/or approval are required by the local authority or State agency governing such activities. It is the responsibility of the Applicant to obtain all necessary permits and approvals prior to beginning any grading activity.

Grading plan views shall contain as a minimum the following information:

- Total land area and proposed Disturbed Area,
- Existing topography and impervious area,
- Proposed topography and impervious area,
- 1-, 2-, or 10-foot contour intervals (as applicable),
- Elevations of all existing and proposed streets, alleys, utilities, sanitary and stormwater sewers, and existing buildings and structures,
- Natural or artificial drainageways,
- Limits of flood plains (as applicable),
- Existing and proposed slopes, terraces, or retaining walls,
- All existing and proposed SMFs, drainage structures and/or features, and devices used to protect these areas during construction,
- All stormwater structures/features on-site, upstream, and downstream of the site,
- EPSC Plan (as applicable),
- Drainage calculations when required,
- Drainage easements when required,
- Geotechnical report (if applicable),
- Any other supporting documentation necessary to evaluate the existing and/or proposed site conditions for stormwater management.

g. Erosion Prevention and Sedimentation Control Plan

The general process and requirements for EPSC Plans is outlined in the Stormwater Standards. For specific details on erosion control BMP measures and applications see the **Erosion Prevention and Sediment Control Planning and Design Manual** adopted by the District. A link to this manual can be found on the District website.

If a 1200-C or 1200-CN Permit is required, the EPSC Plan shall meet the requirements of the 1200-C Program, in addition to the following list:

- The total acreage of the site and the total acreage of the proposed Disturbed Area.
- Adjacent offsite drainage patterns indicated by arrows.
- Contours at 2-foot intervals. Where slopes exceed 15-percent, contours may be shown at 5-foot intervals.
- North arrow.
- Existing and proposed structures for the project site.
- Existing and proposed access location for the project site.
- Existing project boundaries, rights-of-way, easements, and jurisdictional boundaries clearly identified by note, symbol, or key.
- Adjacent streets with street names and ROW boundaries.
- Capacity and condition of existing drainage facilities, including roadside or other drainage ditches, that transport surface water onto, across, or from the project site.
- Existing Sensitive Areas, vegetated corridors, and water quality and quantity facilities. For natural drainage features, show direction of flow, drainage hazard areas, and the 100-year floodplain.
- Clearing and grubbing limits.
- Proposed ground contours.
- For multi-phase projects, phasing of any EPSC work clearly indicated on the plan.
- Details of proposed EPSC BMPs.
- EPSC Plan to include a key signifying BMP measure used and placement on EPSC Plan.
- When sedimentation ponds are proposed, at least one cross section detail shall be shown.
- Vegetation/permanent site stabilization measures.
- If submitted independently of the full project plans, a cover sheet with the proposed name of the development, the name and address of the Applicant and Developer, the name and address of the Developer's Engineer, and the land use case file number from the local planning authority.

h. Vegetated Buffer Planting Plan

If restoration of a Water Quality Resource Area or vegetated buffer is required in the **Stormwater Standards**, a plan addressing the requirements shall be submitted.

The construction plans and specifications shall include:

- Water Quality Resource Area and required vegetated buffer boundaries.
- The limits of any approved, temporary construction encroachment.
- Orange construction fencing noted at vegetated buffers as well as at encroachment limits during construction.
- Permanent type fencing and signage at the development and the vegetated buffer boundary noted and details shown.

- Conservation easement documents prepared and easement area shown on the plan.
- Site preparation plan and specifications, including limits of clearing, existing plants, and trees to be preserved, and methods for removal and control of invasive, non-native species, and location and depth of topsoil and or compost to be added to re-vegetation area.

Planting plans and specifications shall include the following information:

- Planting table that documents the common name, scientific name, distribution (planting zone, spacing, and quantity), condition and size of plantings, and installation methods for plant materials listed.
- Mulching rates.
- Plant tagging for identification noted.
- Plant protection methods.
- Seeding mix, methods, rates, and areas delineated.
- Irrigation plan and specifications, including identification of water source, watering timing and frequency, and maintenance of the system.
- Maintenance schedule, including responsible party and contact information; dates of inspection (minimum three per growing season and one prior to onset of growing season); and estimated maintenance schedule (as necessary) over the two-year monitoring period.
- “Good” rated corridor notes (i.e., invasive species removal shall be replanted with native vegetation).
- Access points for installation and maintenance, including vehicle access if available.
- Standard drawing details (north arrow, scale bar, property boundaries, project name, drawing date, Developer’s Engineer and Owner).

i. **Stormwater Management Facility Planting Plan**

The Stormwater Management Facility Planting Plan shall include planting information for each SMF based on requirements of the **Stormwater Standards**.

Planting plan specifications and plans must address all elements that ensure plant survival and overall SMF functional success. At a minimum, landscape specifications and plans must include:

- A planting plan that indicates existing vegetation to be preserved; protective construction fencing; the location of all landscape elements; and the size, species, and location of all proposed plantings. The plant species should be selected and placed in accordance with proper delineation and location of moisture zones where appropriate.
- A plant list or table that includes botanic and common names; size at time of planting; quantity; spacing; type of container; evergreen or deciduous; and other information related to the facility-specific planting in accordance with landscape industry standards. Also include the square footage of each plant zone and the numbers and types of each plant required and provided in each zone.
- A soil analysis for the SMF growing medium (required for all public facilities and may be required for private facilities. A soil analysis is not required for single-family residential sites). The source of the growing medium must be provided. The location of all stockpiles must be indicated on plans, and erosion protection measures included on the EPSC Plan.
- The method of temporary irrigation to be used for the plant establishment period.

- Stormwater Management Facility Planting Plan shall also include all areas requiring protective construction fencing to shield the area from construction traffic and compaction.

j. Landscape Plan

Landscape plans for publicly maintained SMFs shall be prepared, stamped with the seal of, and signed by, a Landscape Architect, registered in the State of Oregon. Plans for privately maintained SMFs do not require the involvement of a Landscape Architect. Landscape Plans shall include the following a detailed landscape plan, at a scale of 1-inch equals 20-feet shall be provided for each landscaped SMF. This plan may be combined with the grading plan. The landscape plan shall include the following:

- Existing vegetation to be preserved and protective construction fencing.
- Areas of SMFs to be designated with construction fencing to protect from construction traffic and compaction.
- Final ground contours at a minimum of a 2-foot contour interval.
- Location of top and toe of slope.
- Limits of embankment designed to impound water.
- Location of all drainage structures as well as any other piped utilities in the vicinity.
- Limits of areas to receive amended topsoil and growing medium.
- A plant list or table, including botanic and common names, size at time of planting, quantity, spacing, type of container, evergreen or deciduous, and other information related to the facility-specific planting, in accordance with landscape industry standards.
- Location of stockpiles (erosion protection measures must be shown on the EPSC Plan).
- Method of temporary irrigation to be used for the establishment period.
- Location of maintenance access, as applicable.

k. Standard Drawings/Detail Sheets

The construction plans shall include a sheet containing all the standard details applicable to a specific project.

The purpose of the District Standard Drawings and Details is to provide basic information as a convenience to those who use them in their designs. These drawings and details are also intended to communicate design standards and practices to the Developer's Engineer.

Detailed drawings shall be included with all construction plans where Standard Drawings do not apply. If a standard drawing, such as a manhole, must be modified to fit existing, or unique conditions, the modified detailed drawing shall be shown on the plan and profile sheet. When appropriate, due to required detail complexity, a separate detail sheet shall be used.

Standard Drawings are available for use on development projects and cannot be modified by designers on a project-by-project basis. It is the responsibility of the Developer's Engineer to incorporate these drawings as originally intended.

Non-standard detail drawings shall be the responsibility of the Developer's Engineer to demonstrate that site conditions require a non-typical device or structure and submit the specifications and supporting documentation to the District for approval. All non-standard details shall be shown on the Stormwater Management Plan.

Stormwater Management Facility Detail sheets are included in the **Stormwater Standards**. A link to additional Standard Details can be found on the District website.

l. General Sanitary/Stormwater Construction Notes

General construction notes required on the plans can be found on the District website or provided upon request. These general construction notes shall be included on the sanitary and Stormwater Management Plans. These notes are required, and the design professional may include other applicable notes they deem necessary.

m. General Sheet Submittal Specifications and As-built Requirements

The following subsections outline general submittal specifications for sheet size, scales, north arrow, text, labeling callout, and title block specification requirements.

Sheet Dimension Requirements

Construction plans shall be clear and legible and submitted on blue-line paper 22 by 34-inches or 24 by 36-inches in size with a 1½-inch clear margin on the left edge and ½-inch margins on all other edges.

Title Block

Located on the bottom edge or at the right side of the drawing, showing the project name, drawing name/type, completed modification date table, the submittal date, drawing number, Developer's Engineer's name, address and official stamp, the Developer/Owner's name, address and, where applicable, the name of the plat of subdivision and/or name of development.

Drawing Scale Requirements

The following general layout guideline shall be used:

- Plan and Profile sheets shall be 1-inch = 50-feet horizontal and 1-inch = 10-feet vertical. The District may approve alternative scales on a case-by-case basis.
- Each sheet shall include a bar scale with text.

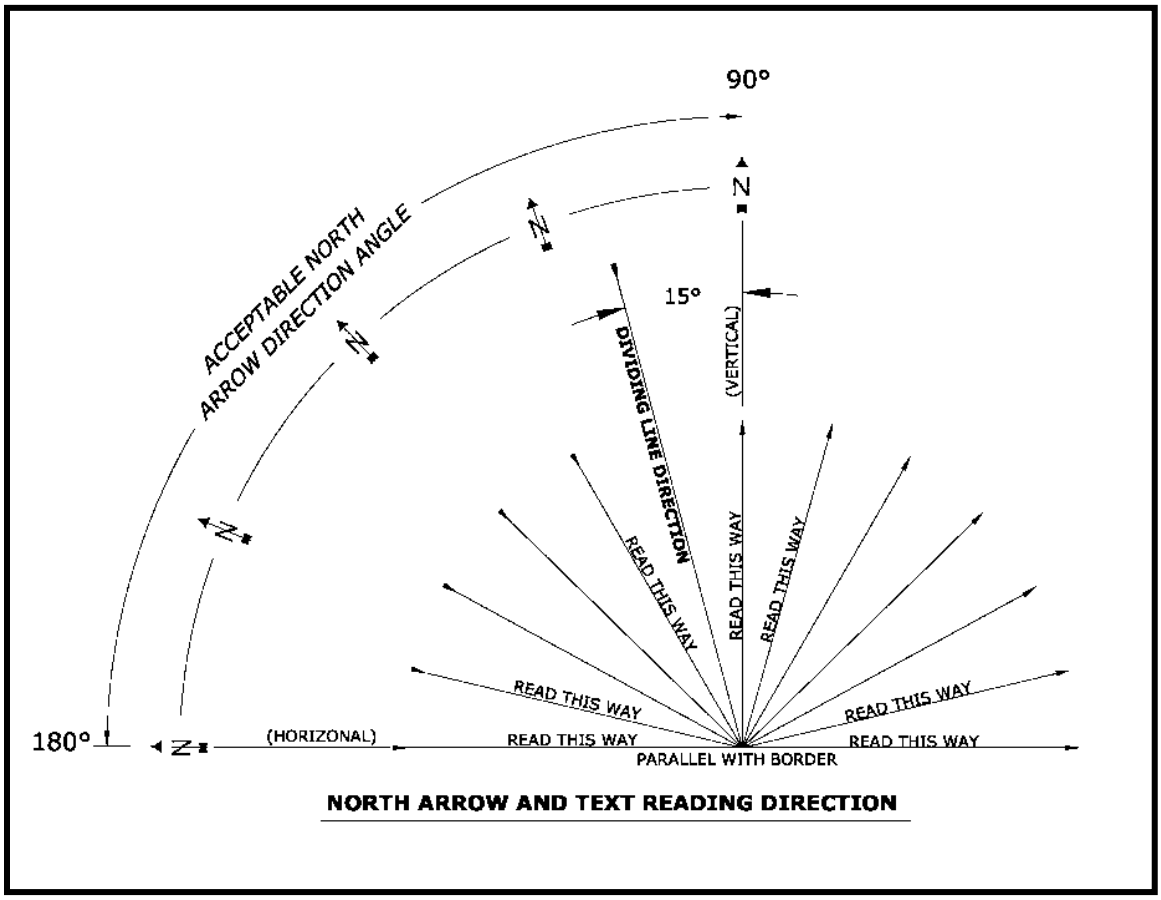
North Arrow Requirements

Each sheet shall include a north arrow. Each separate view on each sheet shall have its own north arrow. The north arrow in each view should face the top (VERTICAL) on the sheet if possible. It is acceptable to align the north arrow off vertical if the project does not fit vertically facing north; it can be rotated counterclockwise as much as 90-degrees.

For acceptable north arrow angle directions see

Figure 1.

Figure 1. North Arrow and Text Reading



Lettering/Text Requirements

- Text Rotation
  - Text should be readable from either the bottom or right edge of the sheet. For acceptable text reading direction, see
  -
  - Figure *1*.
- Lettering Size and Style
  - Lettering Size

- The minimum lettering size shall be eight-hundredths (0.08) of an inch high for existing items and a minimum lettering size shall be ten-hundredths (0.10) of an inch high for new items. Items shall be legible and reproducible.

- Lettering Style
  - Standard text styles should be used. All lettering should be upper case.

Labeling Requirements

- Sanitary and storm structures, proposed and existing, shall be labeled on each sheet.
- All street names are to be labeled in each model space window.
- All tax lots and easements within the development and surrounding area pertaining to the project shall be clearly labeled.
- Non-standard storm structures (e.g., Flat Top Manhole) shall be labeled with the unique structure type after the structure name.

Plan and Profile Views-Structure and Pipe Callouts

Plan View Leader Line Requirements (see Figure 2)

- Leader lines must angle off horizontal and vertical planes from the center point of the structure in plan view. Horizontal and vertical leader lines are acceptable in profile view.
- Leader lines should have an arrow.
- The leader line arrow should touch the edge of the symbol and point to the center of the structure.

Figure 2. Accepted Leader Practice

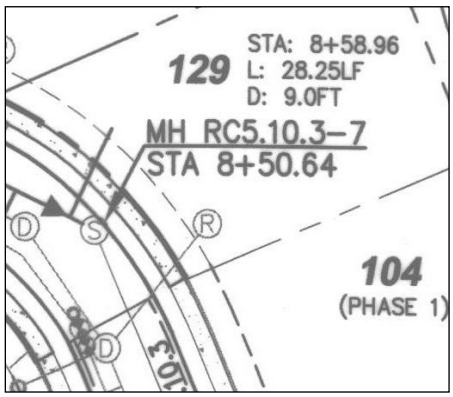
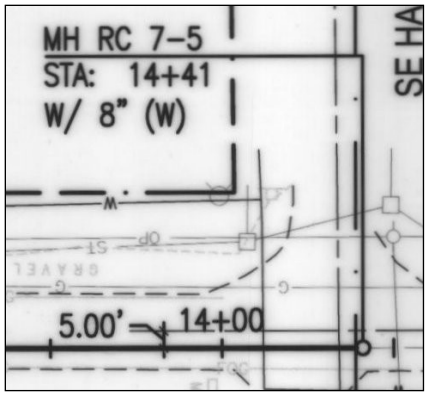


Figure 3. Not Accepted Leader Practice


MH RC 7-5
STA: 14+41
W/ 8" (W)
5.00'
14+00

General Sanitary/Storm Structure Callouts in Plan and Profile Views

Street stationing and other related information is allowed on the construction plans; however, this must be removed on the accepted as-built plans.

Plan View–Non-Typical Manhole Callout:

HV20-1, Flat Top
STA. 15+00

Plan View–Manhole Callout:

MH3B-2
STA 3+49.40

Plan View–Catch Basin and Other Structures:

CB 3B-1
STA 3+70
RIM 486.50
IE OUT 478.40 (8”N)
15.00 LF PVC, 12” ↓
@ S = 35.67%

Profile View–Manhole Callout:

MH3B-2
STA 3+49.40
RIM 486.50
IE IN 478.60 (10”N)
IE OUT 478.40(10”E)

Profile View–Catch Basin and Other Structures:

CB 3B-1
STA 3+70
RIM 486.50
IE OUT 478.40 (8”N)
15.00 LF PVC, 12” ↓
@ S = 35.67%

Profile View–Manhole Callout with Multi IE IN:

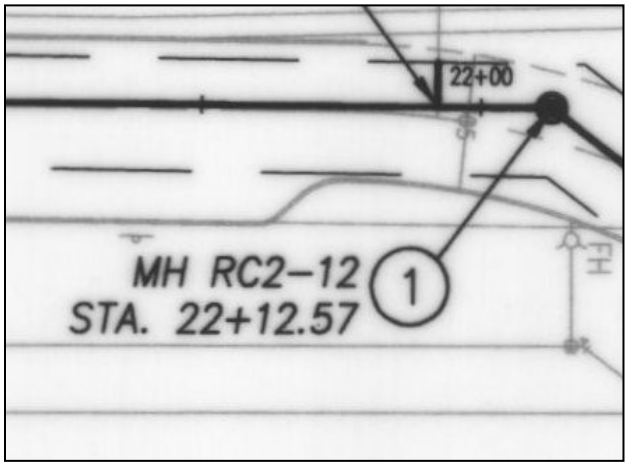
MH3B-2
STA 3+49.40 =
STA 0+00 STM 4
RIM 486.50
IE IN 478.60 (8”N)
IE IN 478.60 (8”E)
IE OUT 478 (8”S)

Reference Balloons

In general, note reference balloons are not allowed. The District will determine the type and format of all callouts on the final as-built drawings if notes are included. If reference balloons are used on construction drawings then the structure name callout must precede the number as shown below in

Figure 4.

Figure 4. Reference Balloon

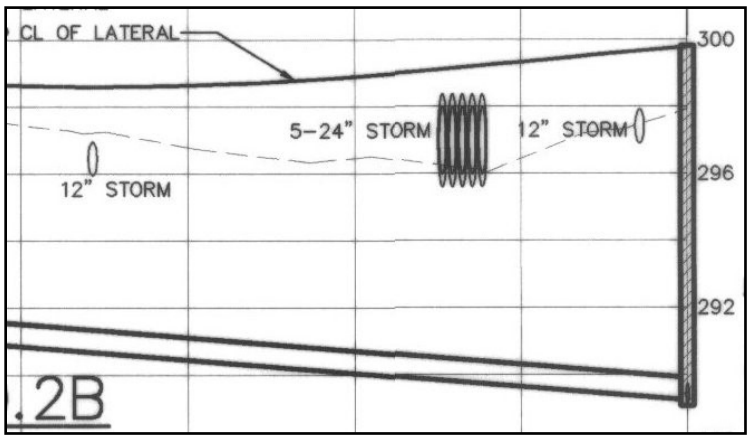


Utility Crossings

Show and label all storm, sanitary, waterline, gas and all other utilities that are 6-inches or larger that cross the pipeline alignment in the profile view. Utility invert and crown elevations may be required if they are in close proximity to a proposed storm line. See

Figure 5.

Figure 5. Utility Profile



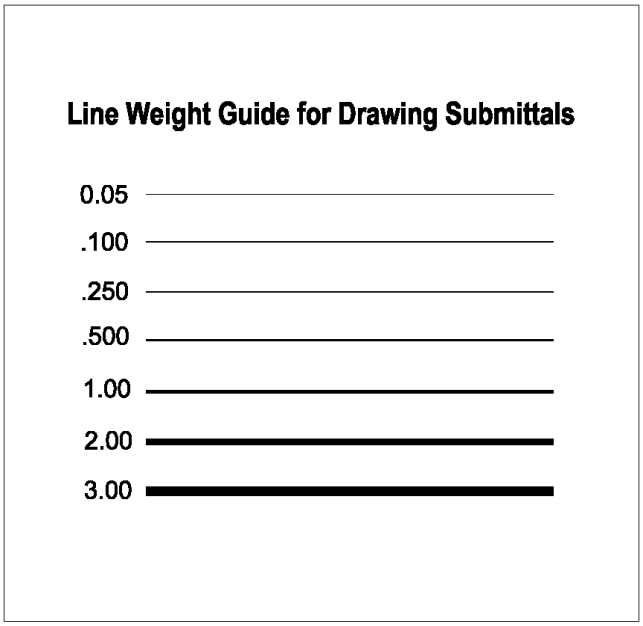
n. Plan and Profile View Sheet Specifications

Plan and Profile Views shall contain the following information:

Follow the Line Weight Guide for Drawing Submittals,

- *Figure 6*.
- Screening layers during plotting will not be permitted for any line types on plots except for widely spaced hatching. Screening lines are not allowed on as-built record drawings.
- The primary structures and pipes (storm) shall appear **BOLD** and stand out against all other background features in both the plan and profile views, i.e., only the applicable conveyance lines and appurtenances should appear bold on submittals.

Figure 6. Line Weight Guide



Plotted Line Widths:

Lines shall be plotted in millimeters and widths and plotted at 1-inch = 50-feet in model space and 1:1 in paper space. The line widths should be plotted the thickness of the lines as illustrated in

Figure 6.

Screening of line weights is prohibited for illustration of line weights. Solid gray lines may be used in place of screening lines.

Plan View:

The plan and profile showing the proposed mainline extensions and Service Connections shall have a line weight of 3.00 millimeter (mm) (black). The sanitary or storm in the background shall have a width of 1.00 mm.

Existing contour lines in the plan view may be drawn as a dashed or solid line type; black or gray; between 0.250-0.500 mm in weight.

Profile View:

Profile view of the proposed system mainline shall be drawn at a line weight of 2.00 mm. Other utilities shown in the background shall be drawn at a line weight of 0.500 mm in either black or gray.

Existing sanitary/storm lines shall be shown in the profile view as a dashed black or a gray line in a line weight of 1.00 mm.

Other associated line specifications for plan and profile views:

Profile view gridlines:

- Primary – 0.250 mm/black
- Secondary – 0.050 mm/black
- Tax lots, parcels, property, and easement lines – 1.00 mm/black
- Roadway improvements – 0.500 mm/black
- All other utilities – 0.250 mm/black or gray
- Subdivision or plat boundary – 2.00 mm/black or gray

As-Built Submittal Requirements

The District requires the sanitary and storm plans shall be as-built prior to the acceptance of the project. As-built drawings are necessary to assure the project was constructed per the approved plans and/or meet the requirements of these Standards. The Developer's Engineer of record is responsible for record keeping, inspection, and preparation of the as-built drawings. Final as-built drawings will be submitted in the following manner, paper(s), CAD files and PDF files.

a) Survey requirements

The following Public Sanitary System structures shall be surveyed, and the as-built elevation and location shall be noted on the final as-built drawings:

i. i.e., ins, outs and rim elevations of the:

- Point of connection, existing downstream manholes, and structures,
- Dead end manholes, cleanouts, and structures,
- Any manhole or structure that may be extended in the future,
- Any substantial change in the approved plans that deviate more than 0.250-feet in elevation or alignment.
    - A table listing the Service Connections for each building lot noting the mainline stationing, the measurement in linear feet of the location of the Service Connection from the center of the upstream and downstream manholes, pipe size, pipe length, and pipe depth at the property line crossing.
    - Show alignment changes, slope changes, IE changes, pipe size changes and changes in construction materials.
    - Measured depth from existing ground surface of all storm, sanitary, waterline and utilities that cross the pipeline alignment in profile.
    - Type of pipe, backfill material and location.

b) Paper As-built Drawing Requirements

As-built drawings shall contain, at a minimum, the following information:

- For all publicly maintained systems and all public and private detention and SMFs, the Developer's Engineer shall submit certified as-built plans and profile drawings.
- Each page shall be stamped by the Developer's Engineer and stated in writing that it is an as-built drawing.
- Show final pipe alignment, slope, pipe size, and pipe material type in the appropriate view.
- Indicate areas of rock removal not completed by standard backhoe, i.e., splitter or blasting.
- As-built drawings and electronic drawings shall become the unencumbered property of the District and are public records that may be distributed as the District deems necessary.
- Two (2) sets of full sized "Draft" as-built drawings on blue-line shall be submitted to the District for review and redline mark-up prior to final paper, electronic file format submittal, and PDF files.
- The final as-built drawings shall be black-line drawings on paper. High quality plotting preferences must be used so the paper, when photocopied and/or scanned, is capable of being reproduced with all details legible at an archival quality.
- On the applicable Plan View sheet show a table listing the following information for each sanitary and/or storm Service Connection; mainline stationing, measurement in linear feet of the location of the Service Connection from the center of the upstream and downstream manholes, pipe size, pipe length, and pipe depth of the service lateral at the property line.
- Street stationing and information not related to the storm system construction is not allowed on the as-built plans; however, this information is acceptable on the construction plans.
- Remove all hatching associated with material type.
- The subdivision name shown in the title block shall match the name shown on the plat.

c) CAD Requirements for As-Built Drawings

General Requirements:

- AutoCAD electronic files must be compatible with the AutoCAD version the District is currently running.
- Standard fonts, shapes and line types are required.
- All drawings are to be plotted in paper space at a scale of 1:1.
- For specific line weight requirements see **Section A.3.7**.
- Show the project boundary in **BOLD** type.
- All manholes, catch basins, fire hydrants, valves, meters, etc. are to be inserted as blocks. All blocks are to be created on layer 0.
- Not allowed are blocked x-refs and preferences or permissions set, so that the District cannot access each layer individually.
- All drawings are to be seamless and drawn in model space.
- Drawings are NOT to be rotated off of world coordinate bases.
- Drawings are to be delivered purged of all unused layers, blocks, line types, and styles.
- The drawing files saved to disk shall be ready to plot when opened and be the same dated file used to plot the as-built.

- SoftDesk point files are not requested and should not be transmitted. Combination files are acceptable.
- The final as-built drawing files are to be saved under one file folder. All drawings, x-refs, plot files, images, text, and shape files are to be in this one file folder.
- Only pertinent files are to be submitted in this project folder. NO revisions, SoftDesk files, log times, or miscellaneous DWGs are to be submitted.
- Before approval will be given, the digital file and hard copy will be evaluated to verify that they are the identical drawings and to make sure all required and only necessary files are included.
- The electronic as-built drawings shall be submitted along with a completed "As-built Release of Liability Form" and all contents shall become the property of the District.
- Provide the CAD as-built project drawings in digital data and saved to compact disk or flash drive for transmittal to the District.
- Use of a self-extracting PKZIP file format is acceptable. Use of compressed file(s) is allowed only if the decompression program is included.

Disks Labeling Requirements:

- Title of project
- The District (WES Log#) project file number
- Specify contents of the disk (DWGs)
- Name of the Developer's engineering firm submitting the files
- The project completion date.

d) PDF File Requirements for As-Built Drawings

AutoCAD electronic files must be compatible with AutoCAD version the District is currently running.

As-built drawings and electronic drawings shall become the unencumbered property of the District and are public records that may be distributed as the District deems necessary.

The PDF files shall represent an exact copy of the as-built drawings.

General Conditions for Performance And Warranty Surety

The District may require the Applicant to submit a surety, cashier's check, or irrevocable letter of credit from an acceptable financial institution to guarantee performance or warranty in completion of the improvements required by these standards. Upon default, the District may draw upon the surety or available funds to complete the remaining work or remedy violations. The different types of acceptable surety are listed below.

a) Surety – Types of Acceptable Guarantees

Surety shall be provided only through State regulated surety companies while assignment or commitment of savings or loan proceeds shall be through State regulated financial institutions. Cash Acknowledgment is a cash surety held directly by the District.

b) Surety Forms

All sureties shall be submitted with forms provided by the District or other authority having jurisdiction to permit or regulate the activity. All sureties are subject to review and approval by the District's legal department.

c) Performance Surety

The Applicant shall provide a Performance Surety acceptable to the District prior to recording of the plat for residential developments or the issuance of building permits for commercial or industrial developments, if the required public improvements are not completed and/or accepted by the District.

The following conditions shall be met prior to acceptance of the Performance Surety:

- The Performance Surety shall be in the amount of 125-percent of the Developer's Engineer's cost estimate for all approved but uncompleted sanitary and stormwater improvements, including landscaping requirements. The Developer's Engineer's cost estimate for the required improvements will be approved by the District.
- Nothing herein shall limit the Owner's responsibility for repair and maintenance to the amount of the surety.

The following conditions shall be met prior to release of the Performance Surety:

- All improvements must be completed as shown on the approved plans and accepted by the District in accordance with the Rules, Regulations, and Standards.
- A warranty surety shall be provided to the District prior to release of the Performance Surety.

If the Applicant fails to comply with the conditions of approval and the approved plans, the District may call upon the Performance Surety to complete the improvements according to the approved plans.

At the end of the surety period when all conditions are satisfied, the residual surety amount shall be released.

d) Warranty Surety

In general, the Warranty Surety is posted by the surety principal to the District to ensure the principal will maintain, repair, replace and be responsible for damage to the improvements for a period of 2-years following the date the District deems the improvements complete and a letter of completion and/or acceptance is issued.

The following conditions shall be met prior to acceptance of the Warranty Surety:

- The Warranty Surety shall be in the amount of 25-percent of the actual constructed cost for all constructed sanitary, stormwater, and vegetated buffer vegetated buffers are covered in the warranty bond improvements. The Developer's Engineer's cost data sheet will be approved by the District.
- The Warranty Surety shall be in favor of the District and be issued for a minimum two-year period from the date of completion of the sanitary or storm system.
- Nothing herein shall limit the Owner's responsibility for repair and maintenance to the amount of the surety.
- Upon notification from the District, the principal shall, within 30-days complete corrective measures to the satisfaction of the District.
- The District may perform emergency work without notice to the principal or surety.
- All work performed by the District due to the nonperformance of the principal or in response to an emergency shall be reimbursed to the District within 30-days of invoice.
- If the principal fails to reimburse the District in 30-days, the District may demand payment from the Surety.

- The warranty period may be extended, if the required improvements show any signs of failure during a final warranty release inspection.

The following conditions shall be met prior to release of the Warranty Surety:

- The Owner or Developer shall perform a thorough cleaning of all sanitary and stormwater improvements.
- The District shall make a determination of final completion in conformance with the approved plans, specifications, and District standards as well as conduct a final warranty surety inspection of all sanitary and stormwater improvements, including landscaping in any SMF and vegetated buffer. If more than 20% of the total area within a SMF or Vegetated Buffer is not in compliance with the approved plans, then the vegetated plantings will be replanted and/or repaired to meet the requirements of the approved plans. If replanting of the SMF or Vegetated Buffer is required, then an additional 1-year warranty surety in the amount of 25-percent of the cost of replanting all of the effected vegetated planting areas shall be required. The additional 1-year warranty surety will be renewed annually until the vegetated plantings are acceptable to the District.
- Any deficiencies resulting in non-acceptance of the work permitted shall be identified in writing on a final punch list and presented to the Developer's Engineer and/or Permittee with a date named for correction and completion. Upon correction of the noted deficiencies and the determination that all work is in conformance with District Standards, the work will be deemed complete and all sureties shall be released.

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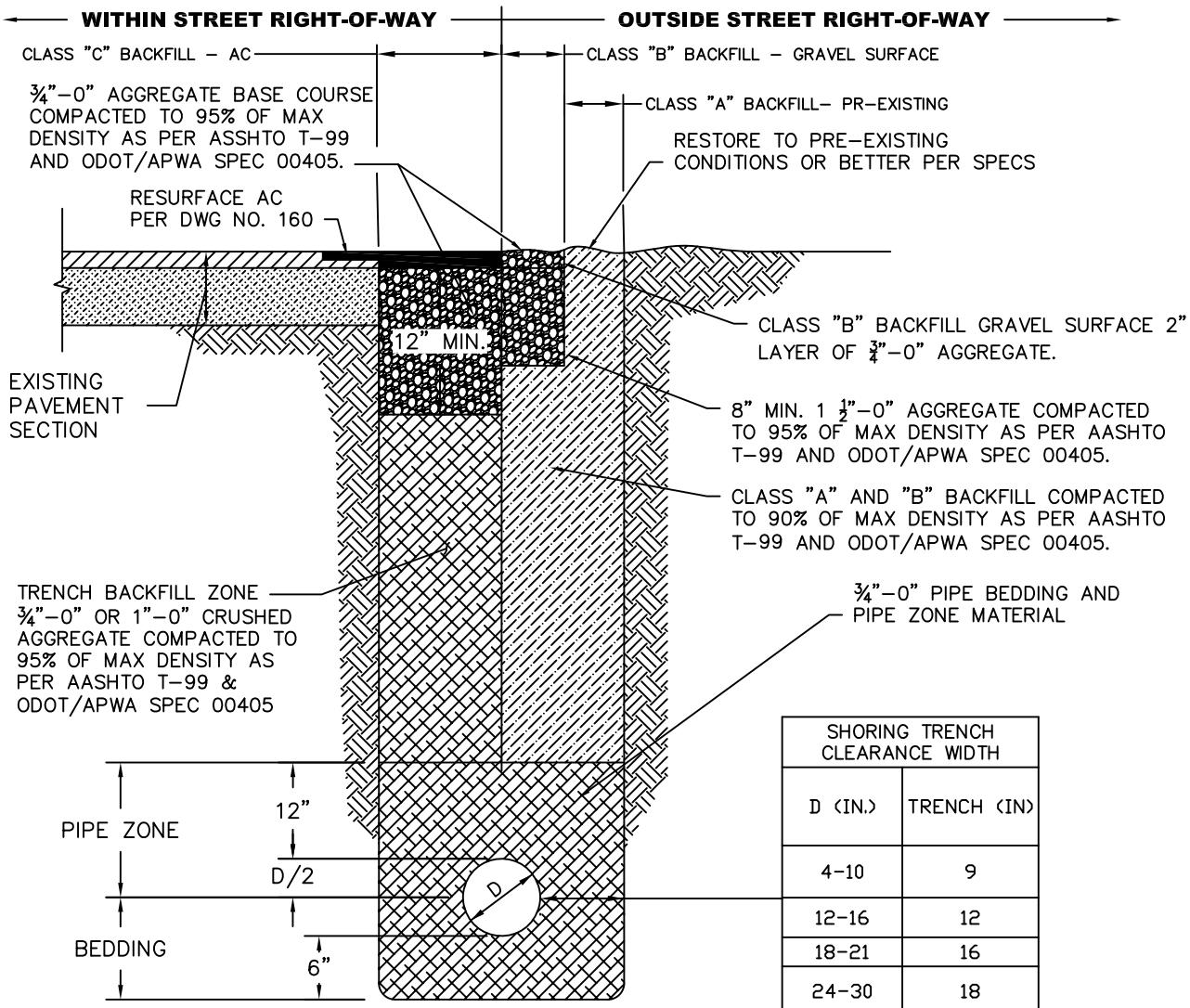
APPENDIX B – SANITARY STANDARD DETAIL DRAWINGS



SHORING TRENCH CLEARANCE WIDTH	
D (IN.)	TRENCH (IN)
4–10	9
12–16	12
18–21	16
24–30	18
36–72	24

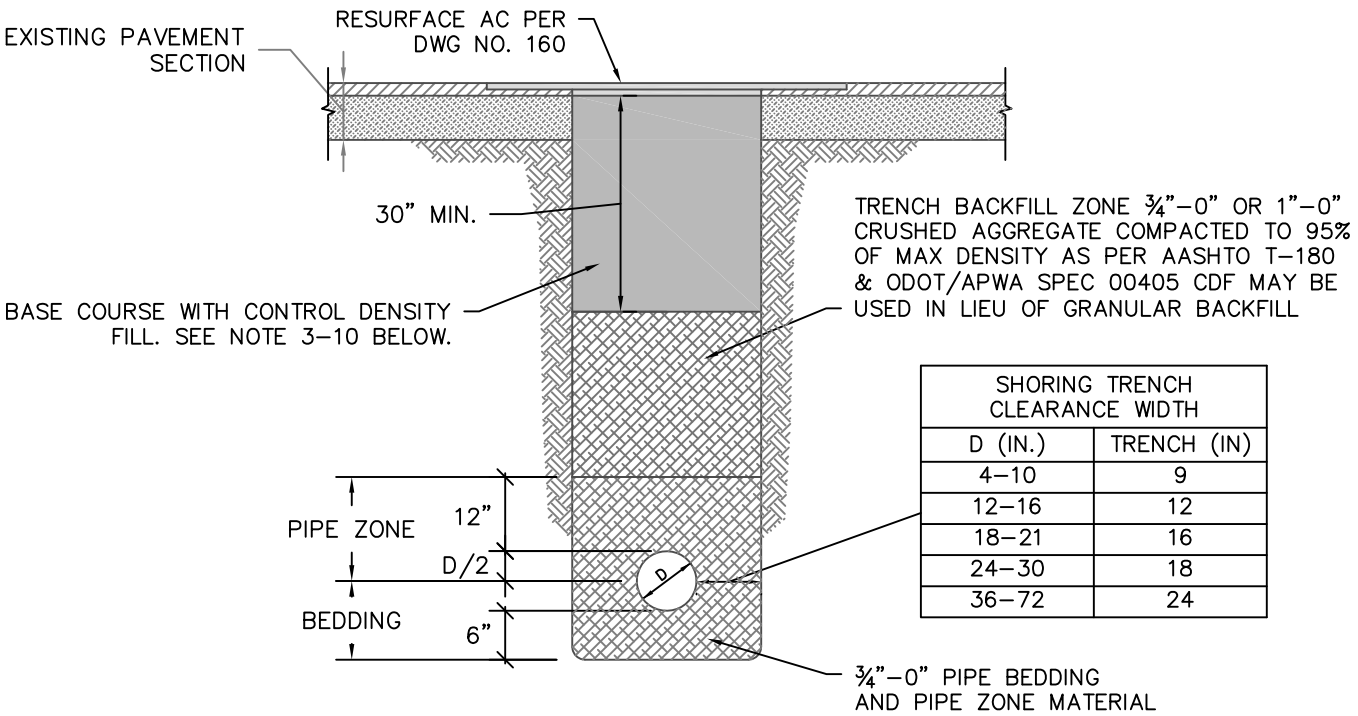
TRENCH RESTORATION GRANULAR BACKFILL (CROSS-SECTION VIEW)

SCALE = N.T.S.

NOTES:

1. PAVEMENT SHALL BE CUT PER STANDARD DRAWING 200.
2. PROVIDE COMPACT TEST RESULTS FOR TRENCH BACKFILL.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. TRENCH RESTORATION CLASS "A", "B" & "C"	*STANDARD DRAWING* SAN -001



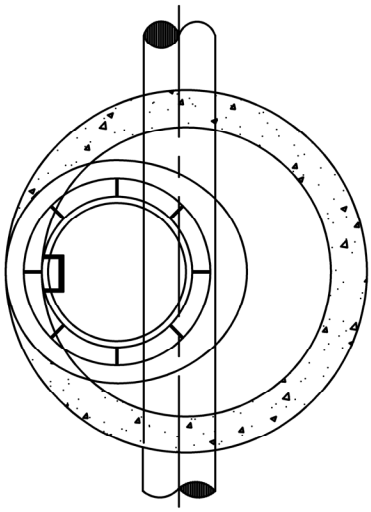
SHORING TRENCH CLEARANCE WIDTH	
D (IN.)	TRENCH (IN)
4–10	9
12–16	12
18–21	16
24–30	18
36–72	24

TRENCH RESTORATION W/ CDF

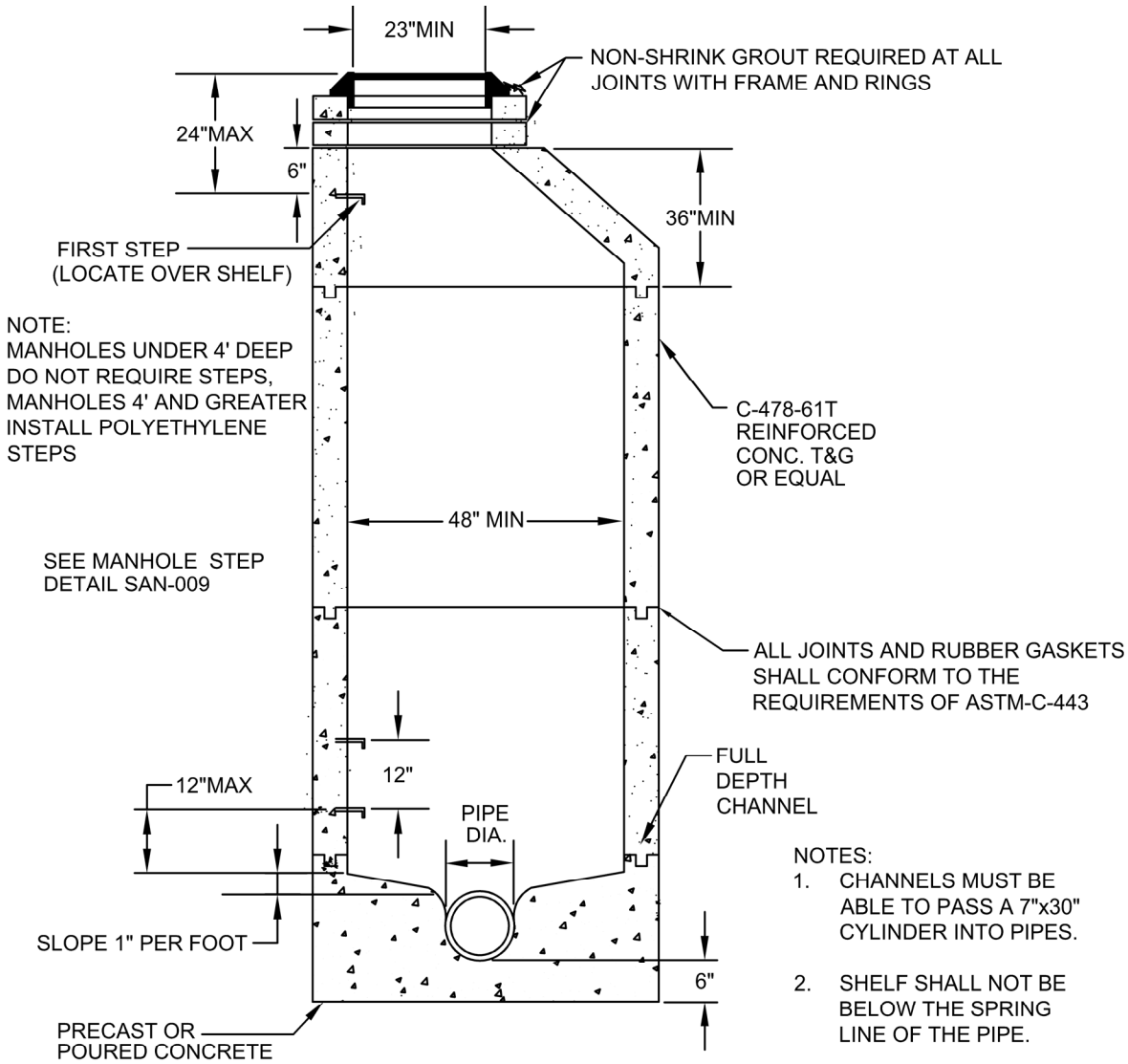
SCALE = N.T.S.

NOTES:

1. SAWCUT EXISTING AC PAVEMENT ACCORDING TO CITY/COUNTY SPECIFICATIONS.
2. CONTROL DENSITY FILL (CDF) CONSISTS OF A MIXTURE OF PORTLAND CEMENT, FLY ASH, AGGREGATES, WATER AND ADMIXTURES PROPORTIONED TO PROVIDE A NON–SEGREGATING, SELF–CONSOLIDATING, FREE–FLOWING MATERIAL WHICH WILL RESULT IN A HARDENED, DENSE, NON–SETTLING FILL PRODUCING UNCONFINED COMPRESSIVE 28 DAY STRENGTH FROM 100 PSI TO A MAXIMUM OF 200 PSI.
3. CONTRACTOR WILL PROVIDE BATCH WEIGHTS SHOWING THE AMOUNTS OF ALL INGREDIENTS IN THE MIX, BATCH TIME, AND THE TOTAL AMOUNT OF THE BATCH.
4. CDF SHALL BE PERFORMANCE BASED AND MEET THE FOLLOWING CRITERIA:
   - TYPE F FLY ASH: 200 LB MIN, TYPE I OR II CEMENT: 50 LB MIN
   - SETTLING SHALL BE LESS THAN ⅛" PER FT DEPTH
   - FINE AGGREGATE (LESS THAN ⅜") SHALL BE USED
   - CONCRETE UNIT WEIGHT SHALL BE 100 PCF MIN
5. CDF SHALL NOT BE PLACED ON FROZEN GROUND. DURING PLACEMENT TEMPERATURE MUST BE AT LEAST **34 DEGREES F. AND RISING.** CDF PLACING SHALL STOP WHEN TEMPERATURE IS 38 DEGREES F OR LESS AND FALLING.
6. TRENCH SECTIONS TO BE FILLED WITH CDF SHALL BE CONTAINED AT EITHER END OF THE TRENCH SECTION BY BULKHEADS OR EARTH FILL.
7. DURING CDF CURE TIME (TYP. 48 HOURS) THE CONTRACTOR SHALL INSTALL STEEL SHEETS OR OTHER PROTECTIVE DEVICES TO ALLOW FOR THE PASSAGE AND SAFETY OF TRAFFIC AND SO NO LOAD IS TRANSFERRED TO THE CDF.
8. CONTRACTOR SHALL ALLOW FOR A MINIMUM 48 HOUR CURE TIME FOR CDF PRIOR TO PLACING ASPHALT. STEEL PLATES ARE NOT ALLOWED IN THE ROADWAY JANUARY THRU MARCH, NOVEMBER AND DECEMBER WITHOUT PRIOR APPROVAL FROM THE CITY AND/OR COUNTY.
9. 30 INCH DEPTH OF CDF MAY BE REDUCED IF CONFLICTING WITH PIPE ZONE BACKFILL.



NOTE:
MANHOLE LID TO BE FLUSH WITH ROADWAY OR 6" ABOVE FINISH GRADE IN EASEMENTS

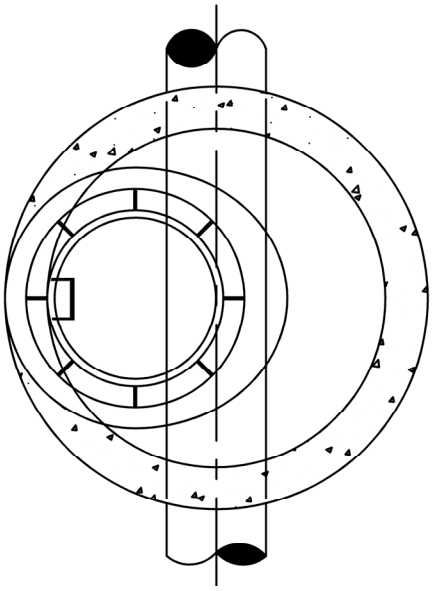


NOTES:

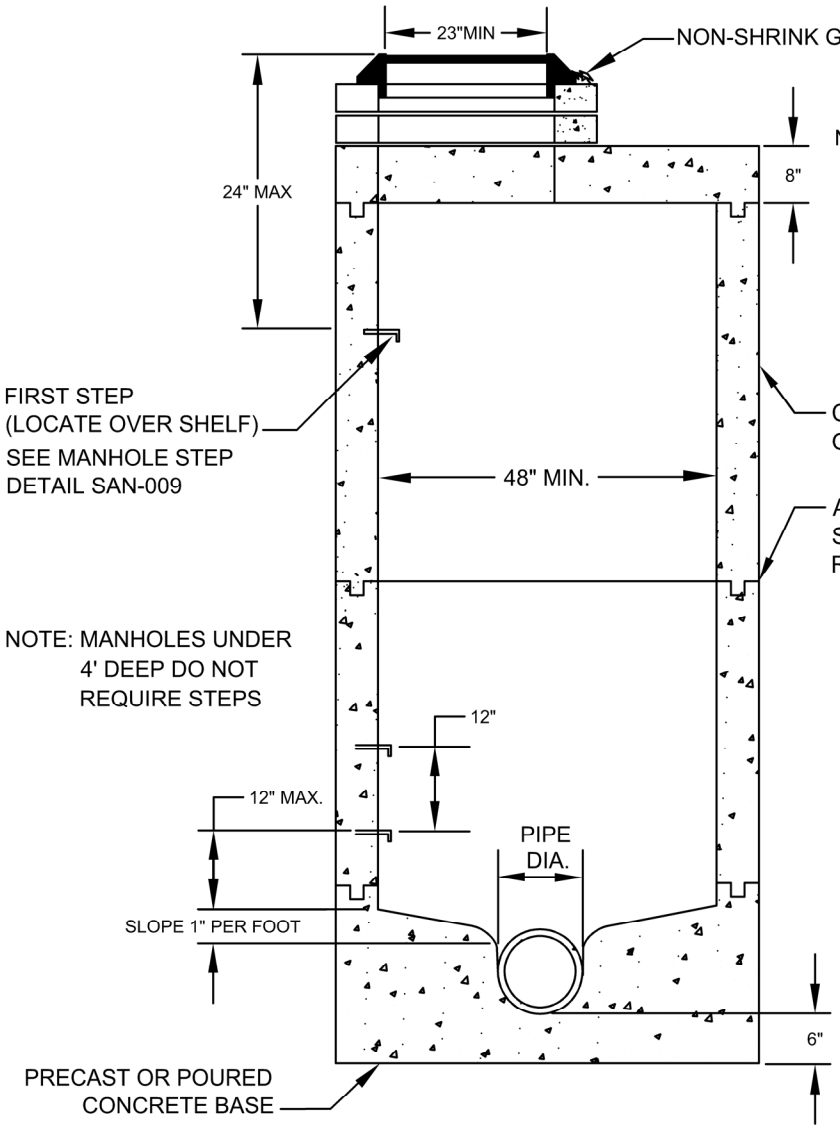
1. CHANNELS MUST BE ABLE TO PASS A 7"x30" CYLINDER INTO PIPES.
2. SHELF SHALL NOT BE BELOW THE SPRING LINE OF THE PIPE.
3. NON-SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.

MANHOLE-TYPICAL

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. MANHOLE-TYPICAL	*STANDARD DRAWING* SAN-003



NOTE: MANHOLE LID TO BE 6" ABOVE FINISH GRADE IN EASMENTS BARREL SECTION IS 3'



NOTE: REQUIRE CONCENTRIC LID WHEN HEIGHT FROM SHELF TO TOP OF LAST BARREL SECTION IS 3' OR LESS.

C-478-61T REINFORCED CONC. T&G OR EQUAL

ALL JOINTS AND RUBBER GASKETS SHALL CONFORM TO THE REQUIREMENTS OF ASTM-C-443

NOTE: MANHOLES UNDER 4' DEEP DO NOT REQUIRE STEPS

NOTES:

1. FLAT TOP IS REQUIRED WHEN HEIGHT FROM SHELF TO TOP OF LAST BARREL SECTION IS 4' OR LESS.
2. CHANNELS MUST BE ABLE TO PASS A 7"x30" CYLINDER INTO PIPES.
3. SHELF SHALL NOT BE BELOW THE SPRING LINE OF THE PIPE.
4. ALLOWED ON CASE BY CASE BASIS.
5. NON-SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.

MANHOLE-FLAT TOP

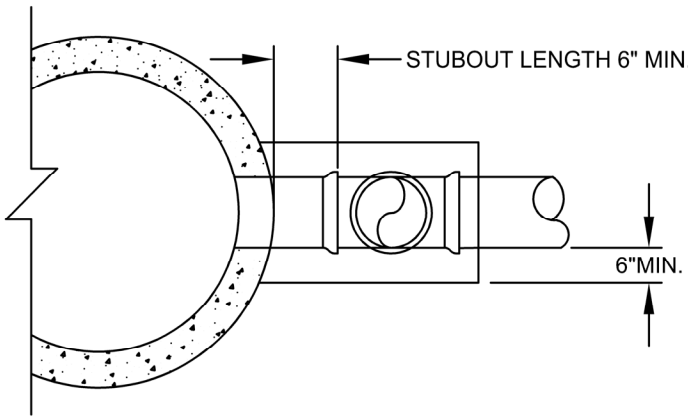
CLACKAMAS WATER ENVIRONMENT SERVICES

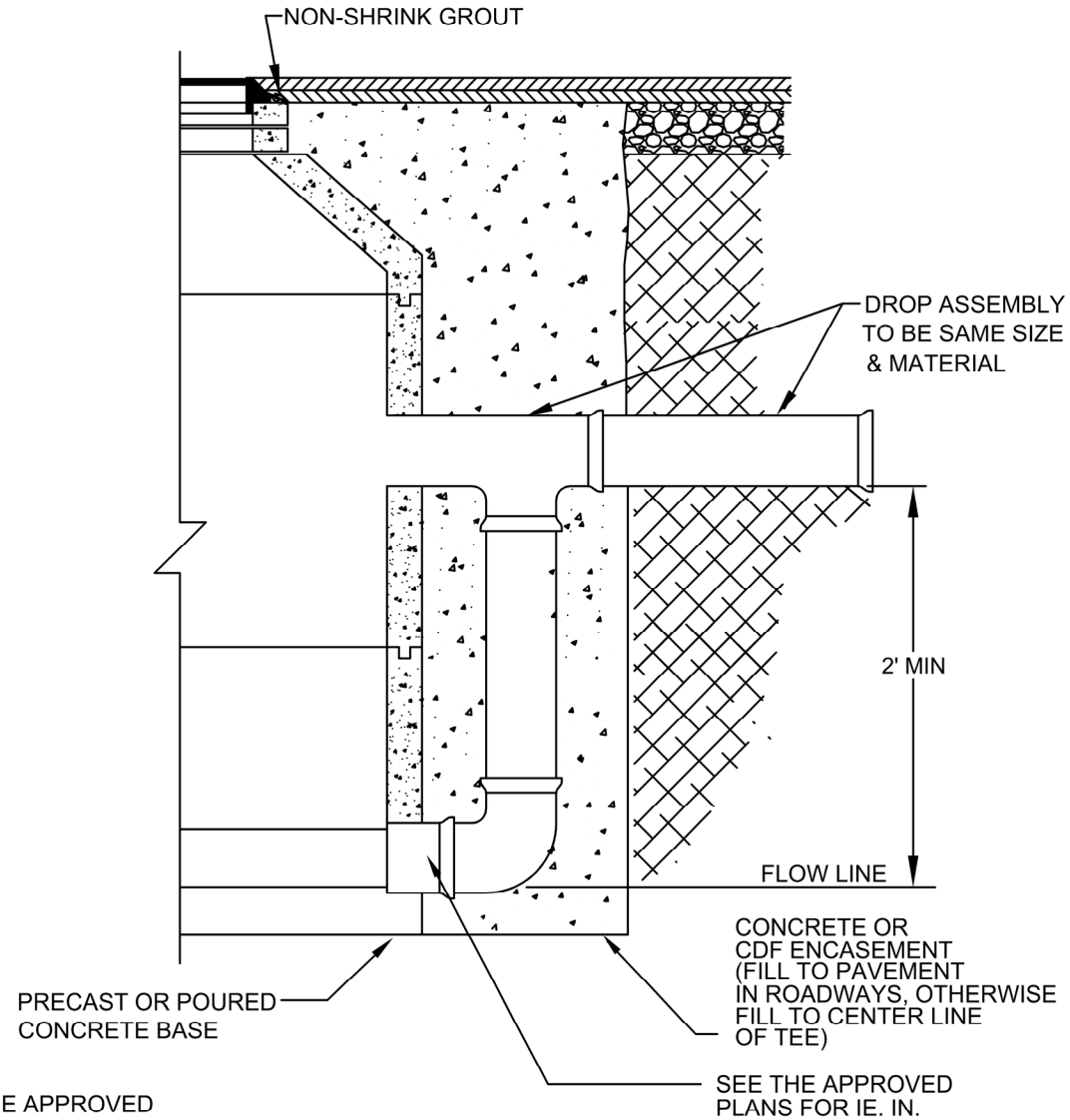
CLACKAMAS WES
150 BEAVERCREEK ROAD
OREGON CITY, OR 97045

APPROVAL DATE: July, 2021 *SCALE:* N.T.S.

MANHOLE-FLAT TOP

STANDARD DRAWING
SAN-004



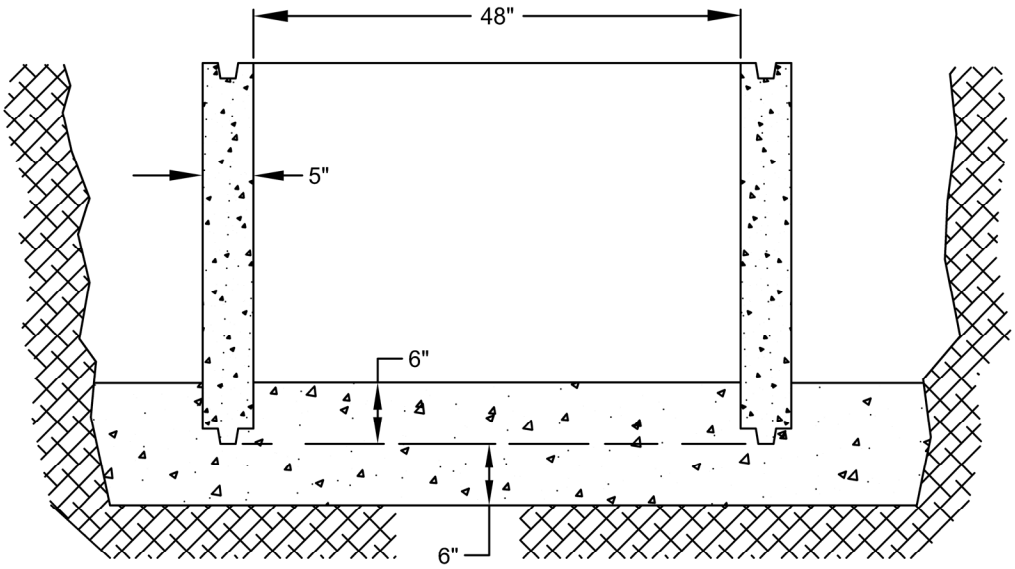


NOTES:

1. SEE THE APPROVED PLANS FOR IE IN & IE OUT ELEVATIONS.
2. NON-SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.

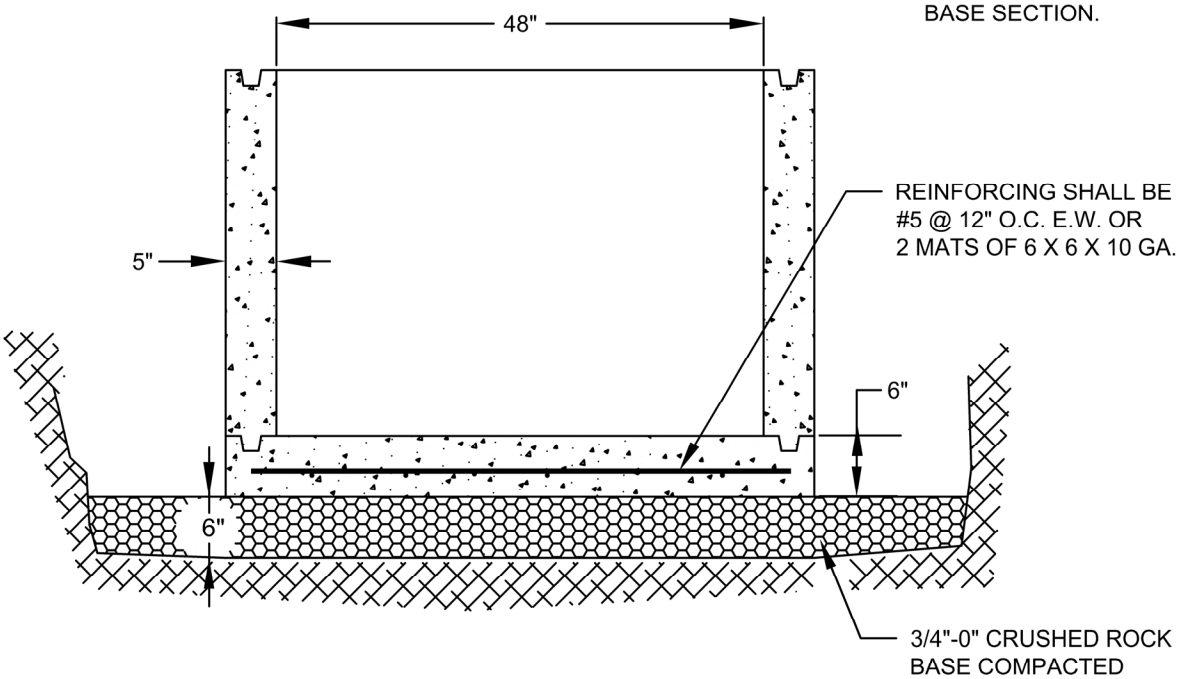
MANHOLE-OUTSIDE DROP

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July. 2022 *SCALE:* N.T.S. MANHOLE-OUTSIDE DROP	*STANDARD DRAWING* SAN-005



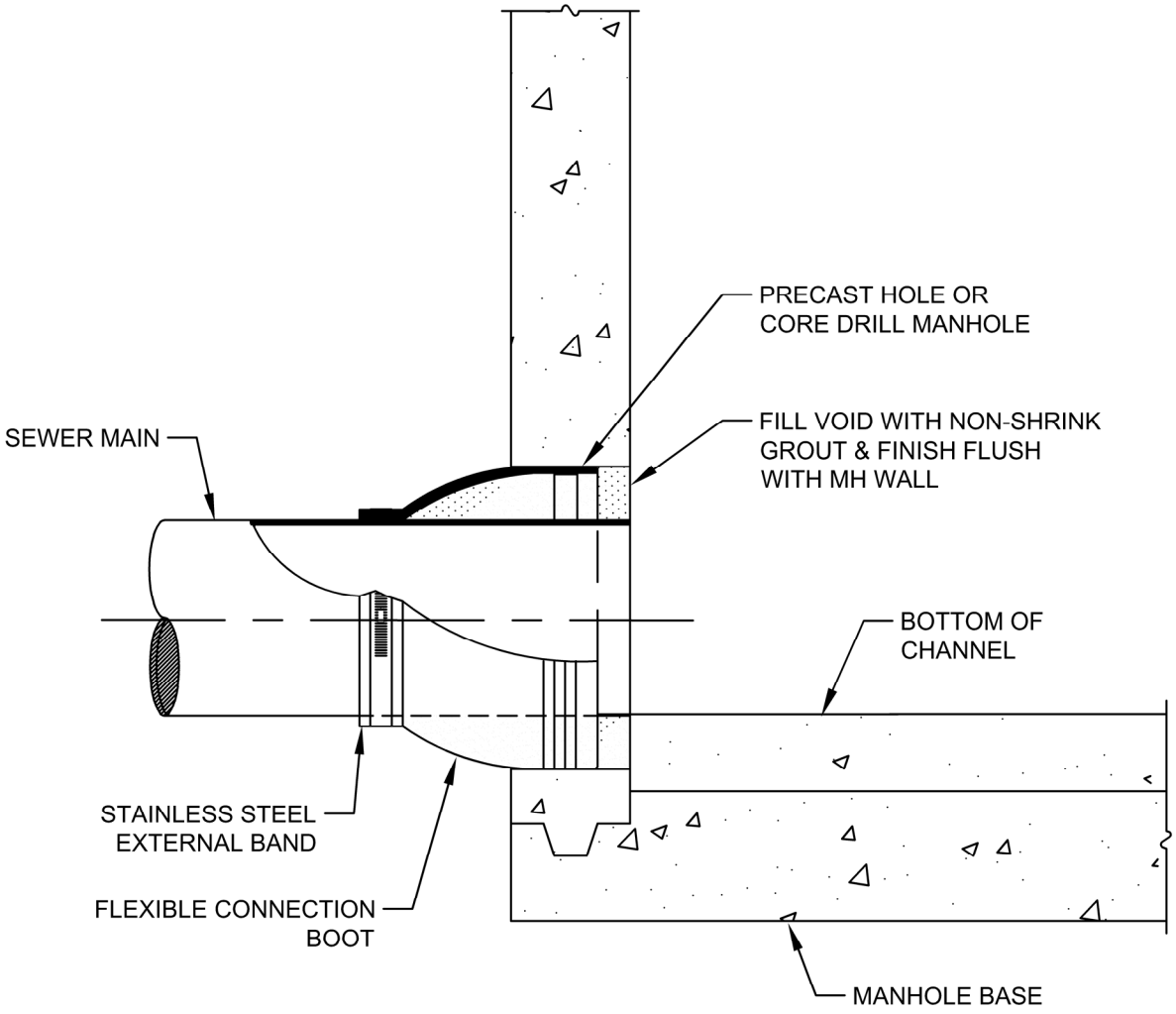
POURED IN PLACE MANHOLE-BASE

NOTE:
1. CONCRETE TO EXTEND 12" OUTSIDE OF MH WALL AND 6" ABOVE THE BOTTOM OF THE BASE SECTION.



PRECAST MANHOLE-BASE

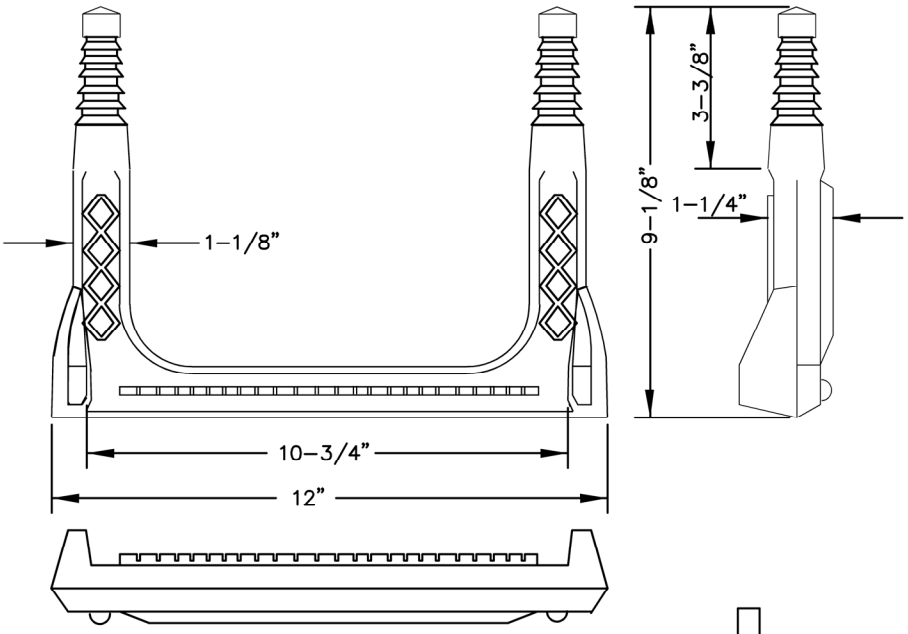
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. MANHOLE-BASE	*STANDARD DRAWING* SAN-006



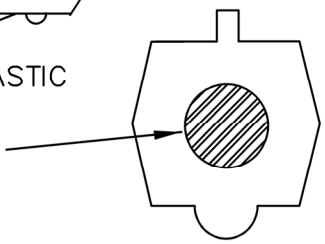
NOTE:
1. NON-SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.

MANHOLE-CONNECTION FLEXIBLE
(KOR-N-SEAL OR EQUAL)

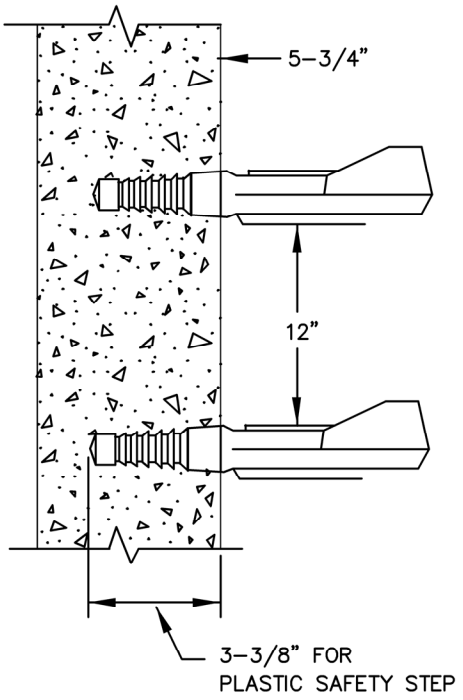
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. MANHOLE-CONNECTION FLEXIBLE	*STANDARD DRAWING* SAN-007



COPOLYMER POLYPROPYLENE PLASTIC



NOTES:
1. ALL STEPS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478.
2. MANHOLE STEPS MUST BE TIGHT AND FIRMLY EMBEDDED.
3. ALL STEPS WITHIN A MANHOLE SHALL BE OF THE SAME DESIGN, TYPE, AND SIZE. (MIXING OF UNMATCHED STEPS IS NOT PERMITTED).



NOTES:

1. STEPS LOCATED AT 12" O.C. LOCATED ON VERTICAL SIDE OF MANHOLE.
2. STEPS A MAXIMUM OF 24" FROM RIM AND 6" FROM TOP OF CONE TO FIRST STEP.

MATERIALS:

PLASTIC:

MUST CONFORM WITH ASTM C-478.
STEEL REINFORCING BAR MINIMUM 1/2" GRADE 60.
MEETING REQUIREMENTS OF ASTM A615 ENCAPSULATED
WITH INJECTION MOLDED COPOLYMER POLYPROPYLENE
WITH SERRATED SURFACES.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July 2022 *SCALE:* N.T.S. MANHOLE - STEP	*STANDARD DRAWING* SAN-008

NOTES:

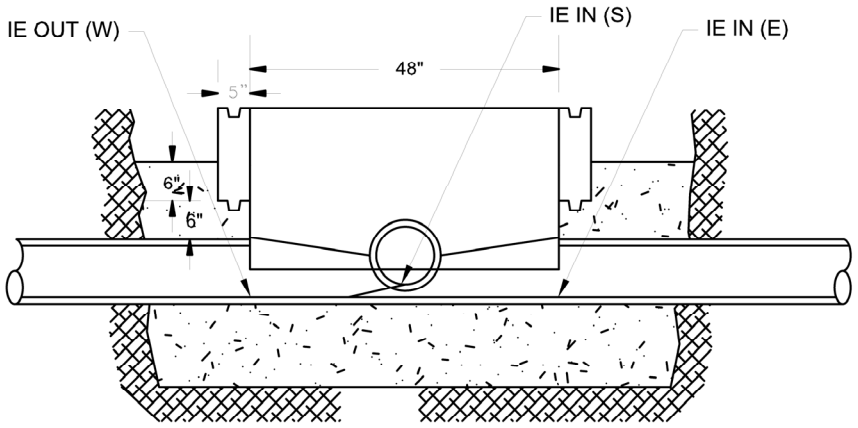
1. CONSTRUCT THE MANHOLE WITH THE IE INS AND OUTS PER THE APPROVED PLANS.

2. WES INSPECTION REQUIRED PRIOR TO BACKFILLING/COVERING THE EXISTING PIPES AND AROUND THE MANHOLE CONTACT OUR OFFICE AT 503-742-4567 AND ASK FOR DEVELOPMENT SERVICES, OR EMAIL WES-PERMIT SERVICES@CLACKAMAS.US TO SCHEDULE THE INSPECTION. INSPECTION RESPONSE TIMES CAN VARY, THEREFORE PLAN TO WORK ACCORDINGLY.

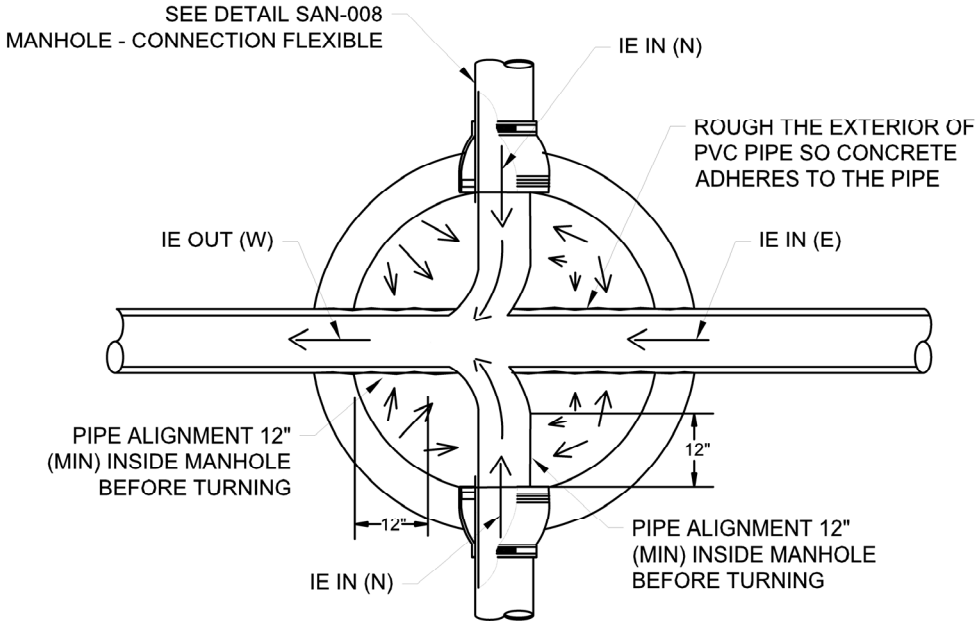
3. SET BARREL SECTION OVER EXISTING CONCRETE PIPE; POUR MANHOLE BASE AND NEW CHANNEL. CUT OUT PIPE AND CLEAN, GROUT AND SMOOTH CHANNEL.

4. CHANNELS MUST PASS A 7-INCHES DIA. BY 30-INCHES LONG CYLINDRICAL OBJECT FOR MAINTENANCE PURPOSES.

5. POURED CONCRETE BASSE TO EXTEND 12-INCHES OUTSIDE OF MANHOLE WALL AND 6-INCHES ABOVE AND BELOW THE BOTTOM OF THE BARRELL SECTION.



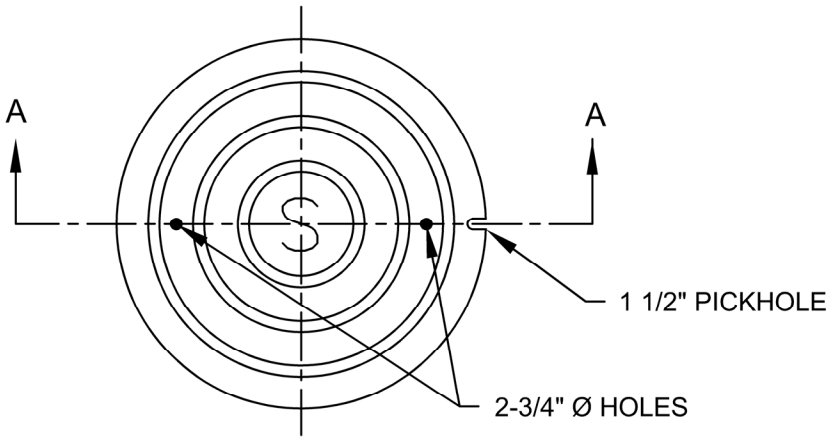
POURED IN PLACE MANHOLE BASE
(SEE DETAIL SAN-007)

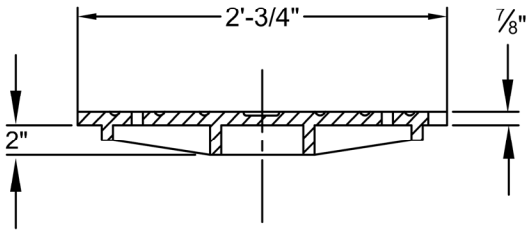


GENERAL PLAN ON
CHANNEL INTERSECTION

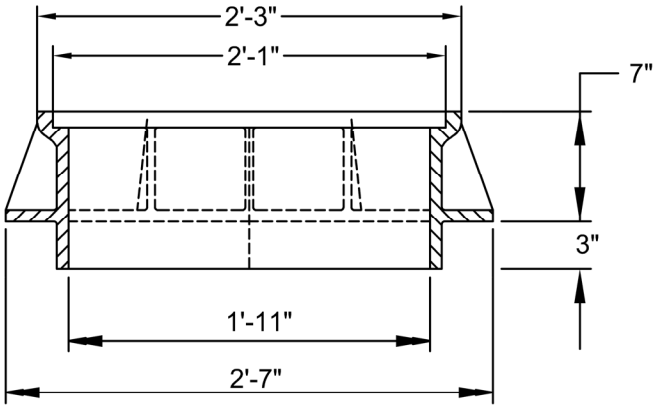
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. MANHOLE - NEW OVER EXISTING PIPE	*STANDARD DRAWING* SAN-009

STANDARD





SECTION A-A



FRAME & COVER STANDARD

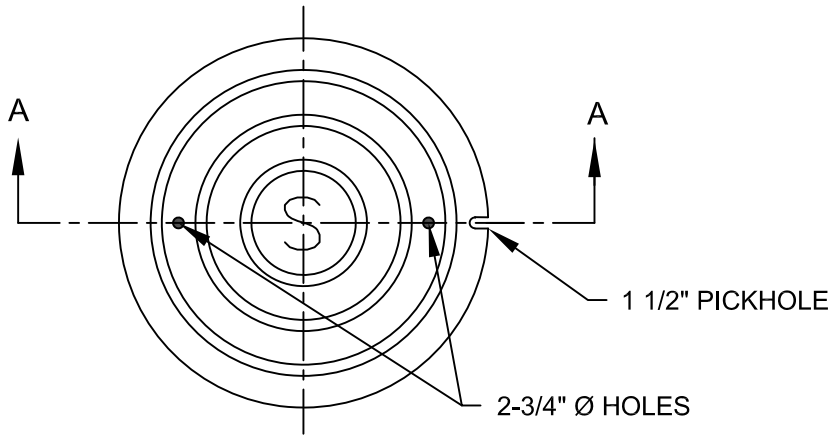
NOTES:

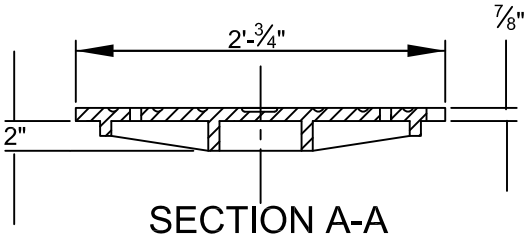
1. STANDARD FRAME AND COVER TO BE USED ON STREETS OR AS NOTED ON CONSTRUCTION PLANS.

2. SANITARY COVER WILL HAVE 2 - 3/4" Ø HOLES AND 1 - 1 1/2" PICKHOLE IN LID FOR LIFTING HOOK.

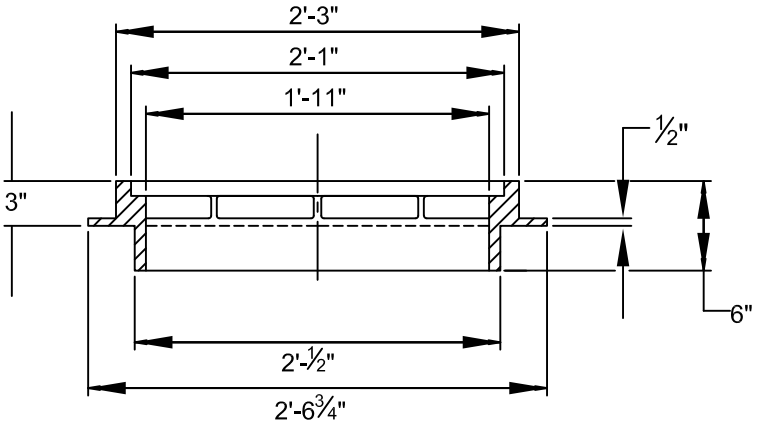
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. STANDARD FRAME & COVER	*STANDARD DRAWING* SAN-010

SUBURBAN





SECTION A-A



FRAME & COVER SUBURBAN

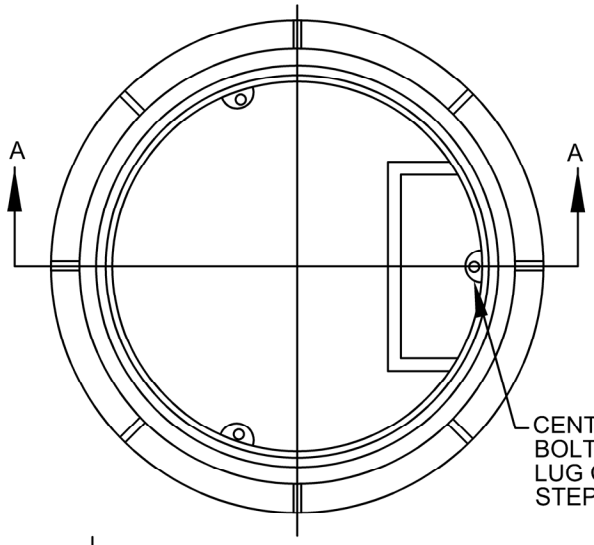
NOTES

1. SUBURBAN FRAME & COVER CAN BE USED IN EASEMENTS OR AS NOTED ON CONSTRUCTION PLANS.

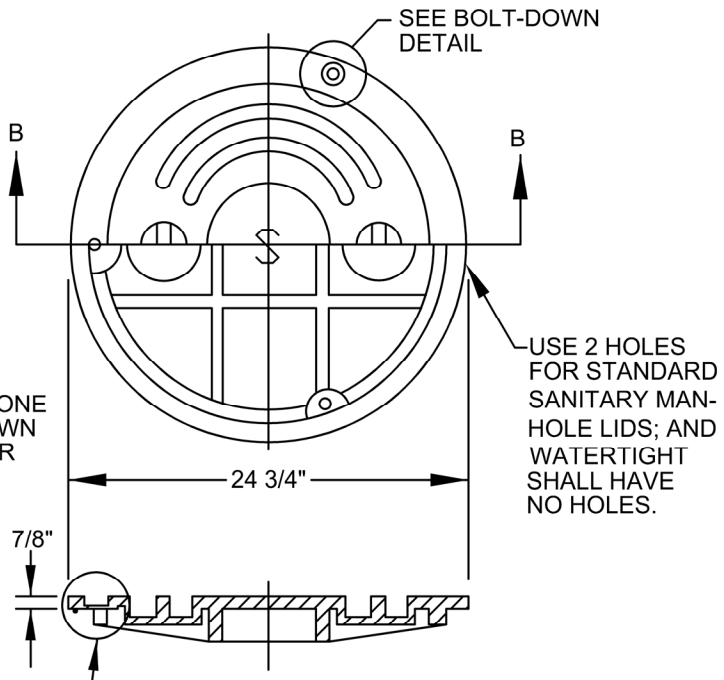
2. SANITARY COVER WILL HAVE 2 -3/4" Ø HOLES AND 1 - 1 1/2" PICKHOLE IN LID FOR LIFTING HOOK.

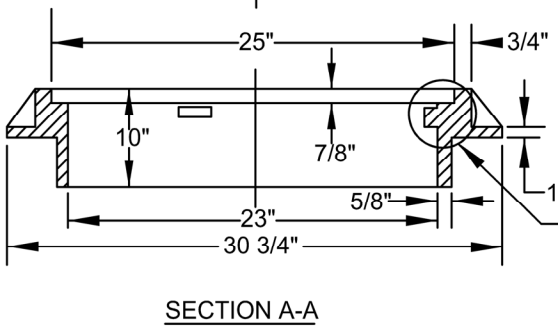
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. SUBURBAN FRAME & COVER	*STANDARD DRAWING* SAN-011

TAMPERPROOF MANHOLE RING



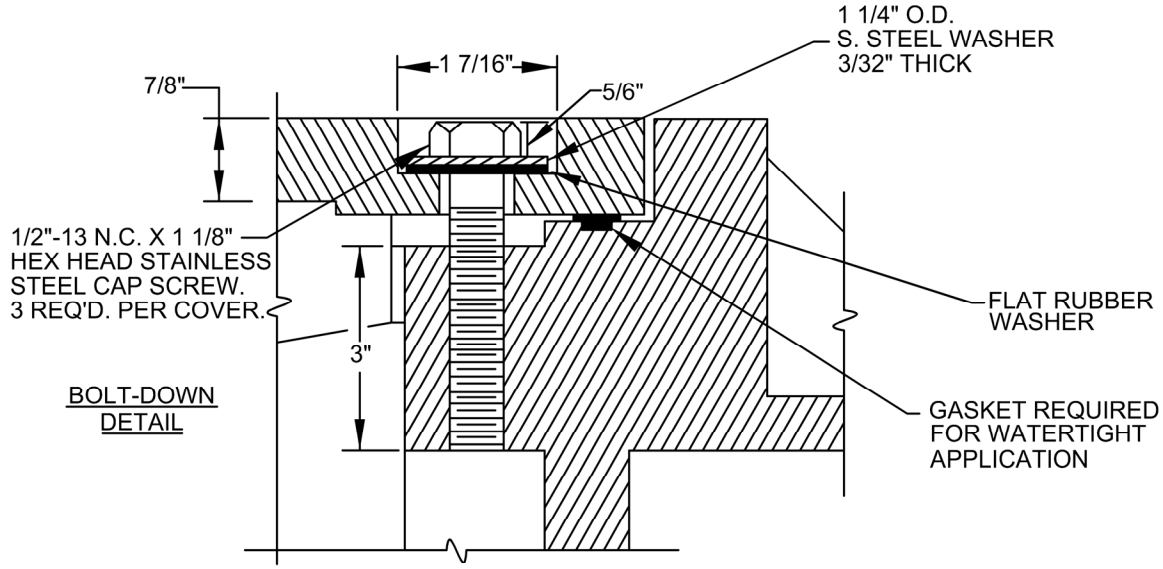
3-BOLT DOWN COVER





SECTION A-A

SECTION B-B



BOLT-DOWN DETAIL

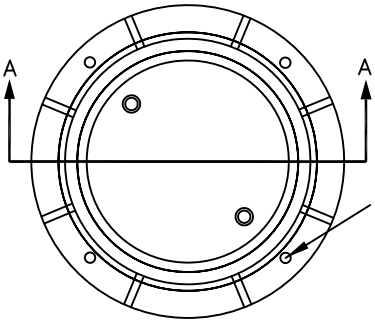
SECURE MANHOLE DETAIL

FOR USE IN TRAFFIC AREAS

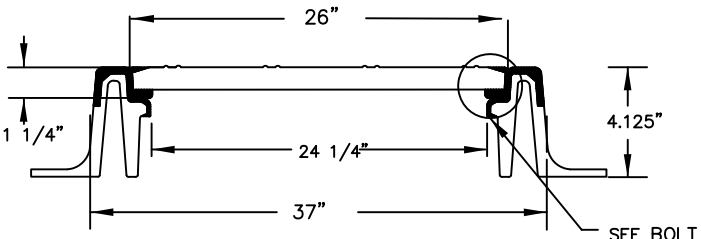
NOTE: COVER AND FRAME SHALL BE OF GRAY CAST IRON A.S.T.M. A-48 CLASSS 30.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. FRAME & COVER SECURE FOR TRAFFIC AREAS	*STANDARD DRAWING* SAN-012

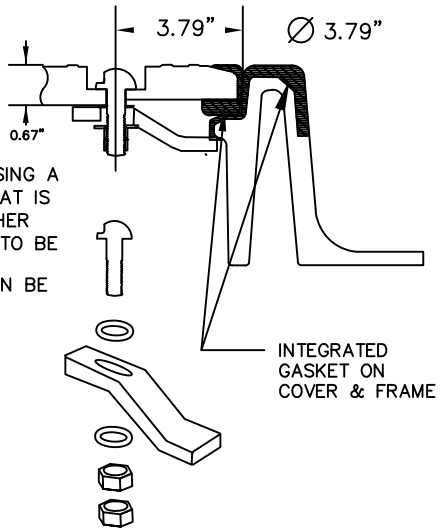
WATERTIGHT MANHOLE RING



FRAME WILL BE ATTACHED TO THE MANHOLE TOP/ CONE SECTION BY USING A "RED HEAD" ANCHOR (OR EQUAL) THAT IS A MIN 1–1/4" O.D. W/S. STEEL WASHER 3/32" THICK. IF GRADE RINGS NEED TO BE INSTALLED, A HOLE WILL BE CORED THROUGH THE RING SO THE BOLT CAN BE ATTACHED TO TOP SECTION.



SECTION A–A

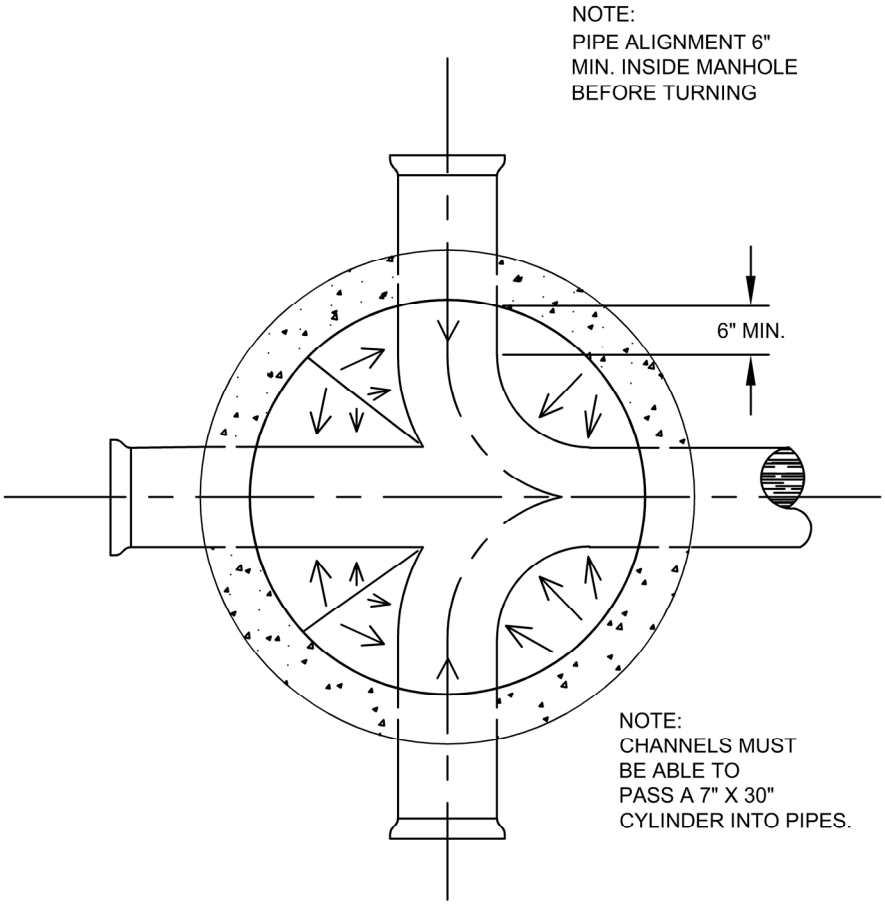


BOLT–DOWN DETAIL

NOTES:

1. COMPOSITE WATERTIGHT/TAMPER PROOF MANHOLE FRAME AND COVER SHALL BE USED IN ALL EASEMENT AND OFF STREET OR BEHIND PROPERTY AREAS SUSCEPTIBLE TO FLOODING.
2. THE WATERTIGHT MANHOLE COVER FRAME SHALL BE GMI 2600 SERIES COMPOSITE FRAME AND COVER MANUFACTURED BY TITUS INDUSTRIAL GROUP, INC. OR ITS EQUAL.
3. THE LOCKING MECHANISM SHALL BE A TWISTLIFT® MANUFACTURED BY TITUS INDUSTRIAL GROUP, INC.OR ITS EQUAL.
4. THE TWISTLIFT® COMPOSITE ACCESS COVER LOCK IS DESIGNED AS A SECURITY BOLT REQUIRING A SPECIAL TOOL TO OPERATE THE QUARTER TURN BOLT AND LIFT THE COVER FROM THE FRAME. IT FUNCTIONS WITH EITHER THE STANDARD CAM LOCK QUARTER TURN PADDLE, OR THE EXTENDED 'SURCHARGE' PADDLE.
5. THE BOLT SHALL BE MACHINED FROM 316 STAINLESS STEEL.
6. THE BOLT FEATURES A DOMED HEAD WITH 3 EQUALLY SPACED 'J' SLOTS RUNNING HORIZONTALLY AROUND THE BOLT HEAD.
7. STANDARD BOLT SIZES ARE 14 MM COARSE THREAD WITH A FLAT MACHINED ON TWO SIDES TO ENGAGE PADDLE.
8. THE PADDLE IS DIE CAST FROM 304 STAINLESS STEEL AND ALSO AVAILABLE IN BOTH STANDARD CAM LOCK DESIGN, OR EXTENDED SURCHARGE CONFIGURATION.
9. THE BOLT AND PADDLE WILL BE ASSEMBLED USING TWO STAINLESS STEEL 14 MM NUT'S, THE BOTTOM NUT IS A STANDARD NUT THAT WILL BE TORQUE TO 35 FT. LBS. TO GIVE THE DESIRED TENSION ON THE BOLT. A SECOND NYLOCK™ LOCK NUT IS USED AS A JAM NUT, AND TORQUE TO 90 FT. LBS. STAINLESS STEEL WASHERS ARE USED TO PROVIDE CONSISTENT TURNING RESISTANCE.
10. A 5/16 STAINLESS STEEL SET SCREW, SET IN A THREADED HOLE IN THE COVER PROVIDES FOR A STOP AT ¼ TURN OF OPERATION.
11. THE BOLT WILL BE OPERATED BY MEANS OF A SPECIALLY MADE OPENING KEY CONSISTING OF A SPECIAL SOCKET ATTACHED TO A 'T' HANDLE USED TO BOTH TURN THE BOLT, AND LIFT OUT THE COVER.
12. ONE SET OF REPLACEMENT OPENING KEYS WILL BE PROVIDED TO WATER ENVIRONMENT SERVICES AT TIME OF INSTALLATION.
13. THE BOLT HEAD IS PROTECTED BY A WEATHER RESISTANT PLASTIC DEBRIS CAP. THE CAP IS INCLUDED WITH EACH LOCK.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. FRAME & COVER WATERTIGHT FOR NON-TRAFFIC AREAS	*STANDARD DRAWING* SAN-013



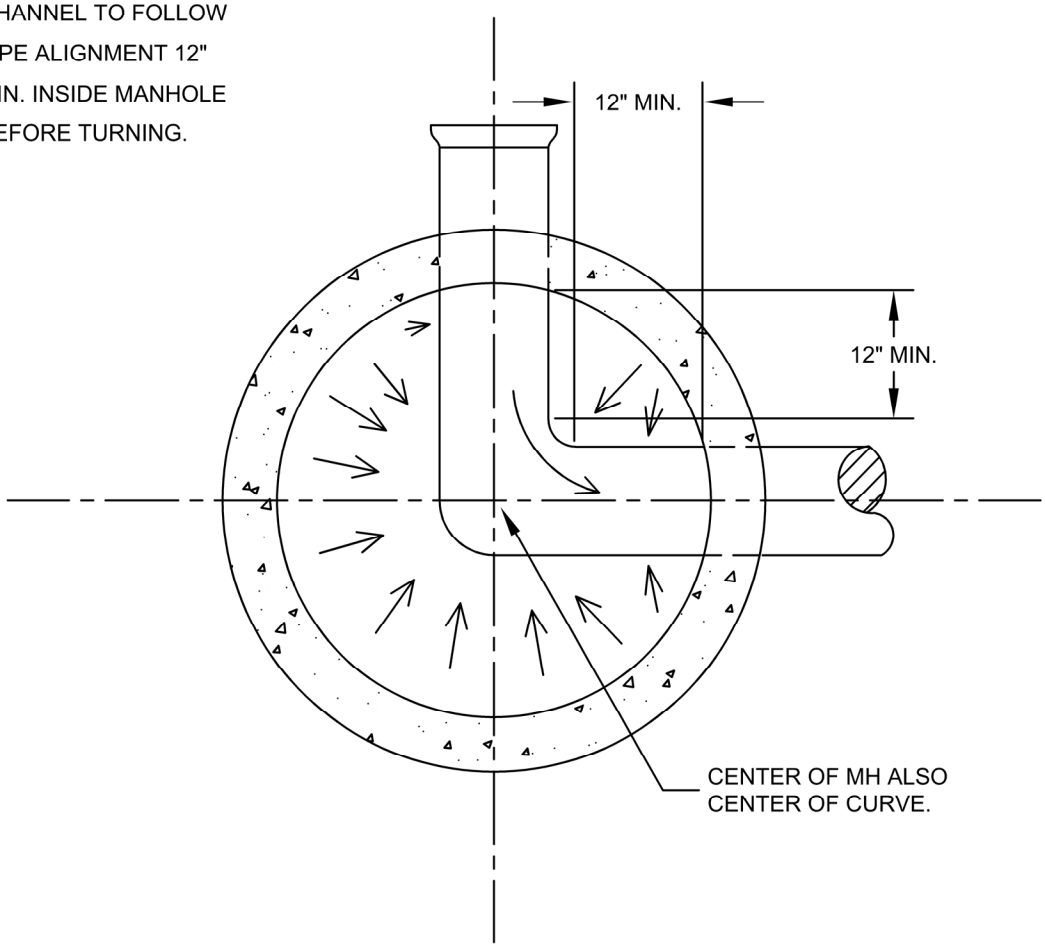
CHANNEL-INTERSECTION

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. CHANNEL-INTERSECTION	*STANDARD DRAWING* SAN-014

NOTES:

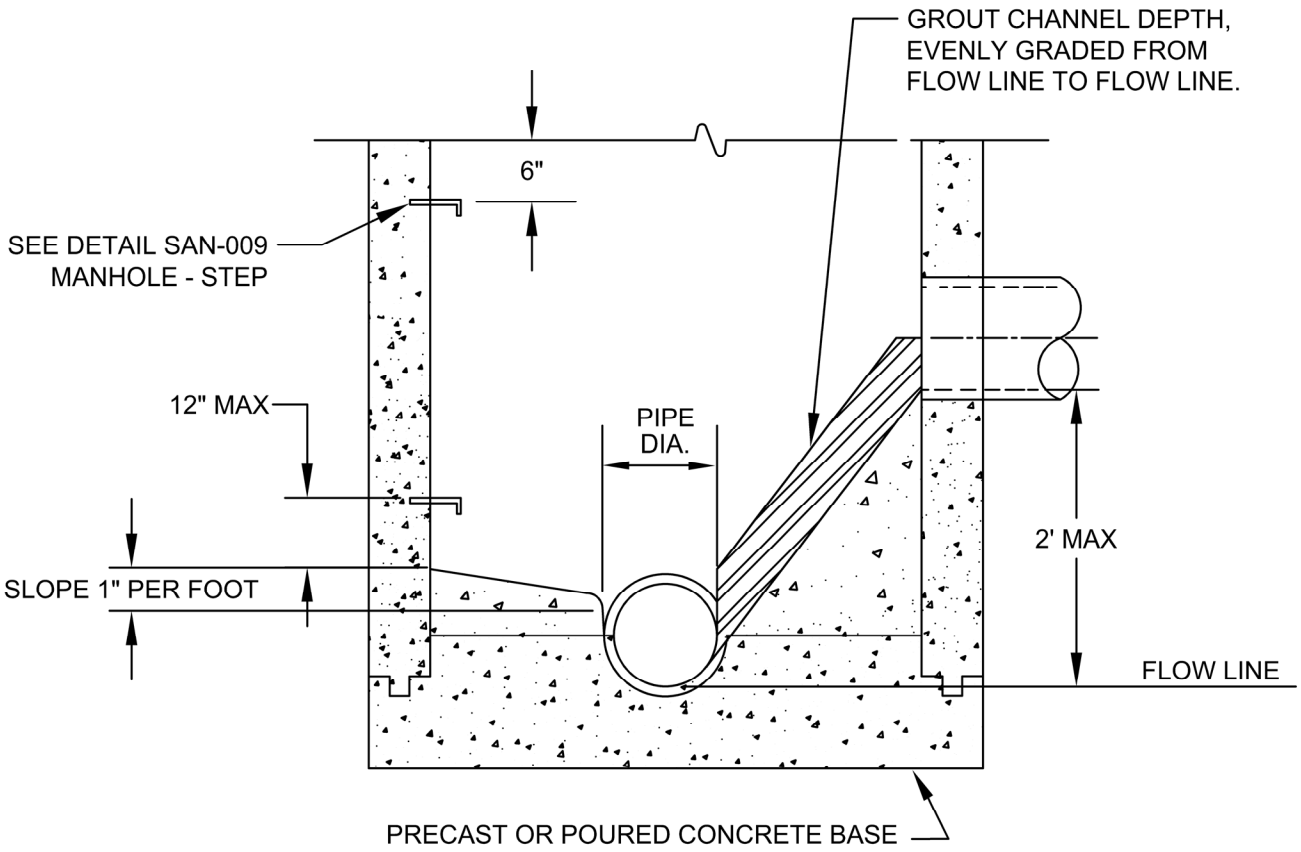
1. CHANNELS MUST BE ABLE TO PASS A 7" X 30" CYLINDER INTO PIPES.

2. CHANNEL TO FOLLOW PIPE ALIGNMENT 12" MIN. INSIDE MANHOLE BEFORE TURNING.



CHANNEL-90 DEGREE MANHOLE

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. CHANNEL-90 DEGREE	*STANDARD DRAWING* SAN-015



CHANNEL-SLIDE

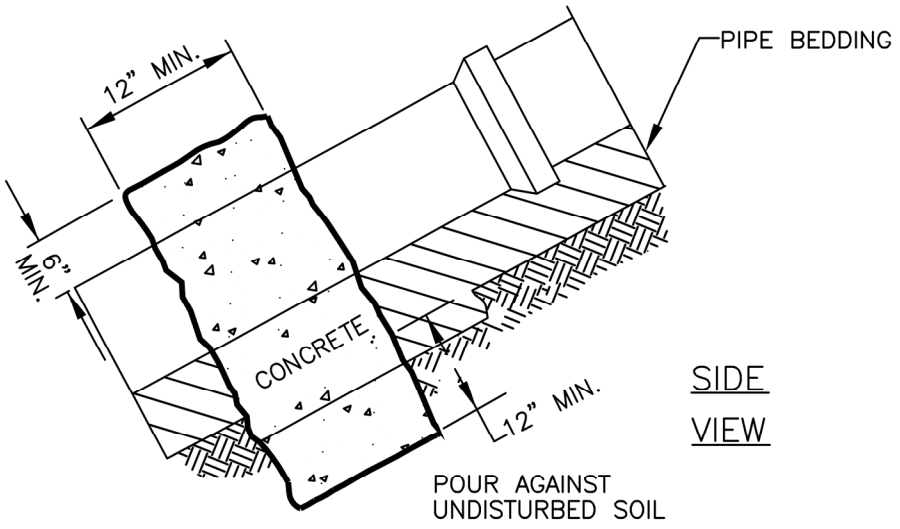
(BY DISTRICT PRE-APPROVAL ONLY)

NOTES:

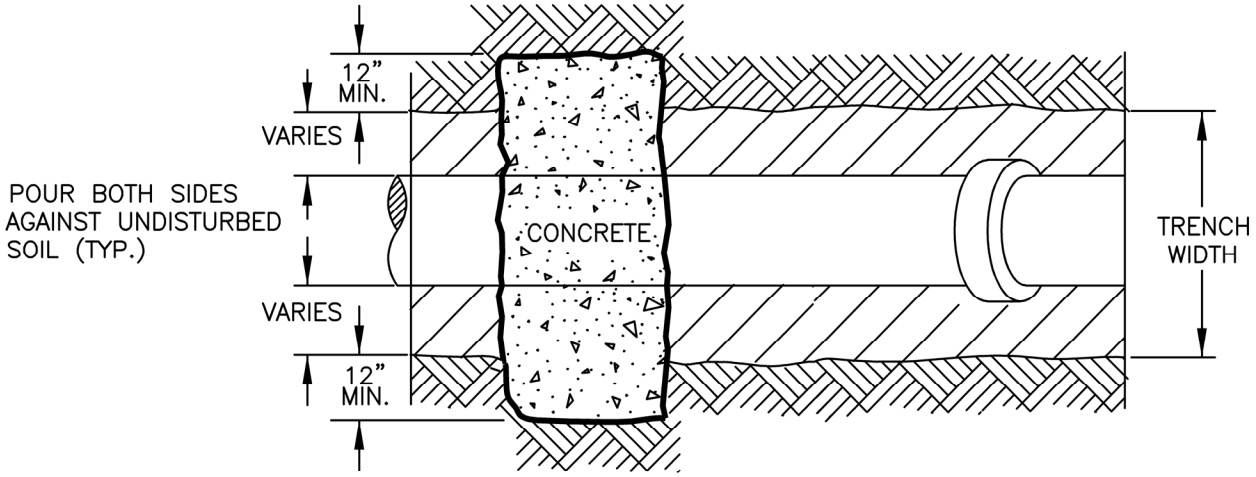
1. CHANNELS MUST BE ABLE TO PASS A 7" X 30" CYLINDER INTO PIPES.

2. GROUT SHALL NOT BE FAST OR RAPID SETTING.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. CHANNEL-SLIDE	*STANDARD DRAWING* SAN-016



SIDE VIEW



PLAN

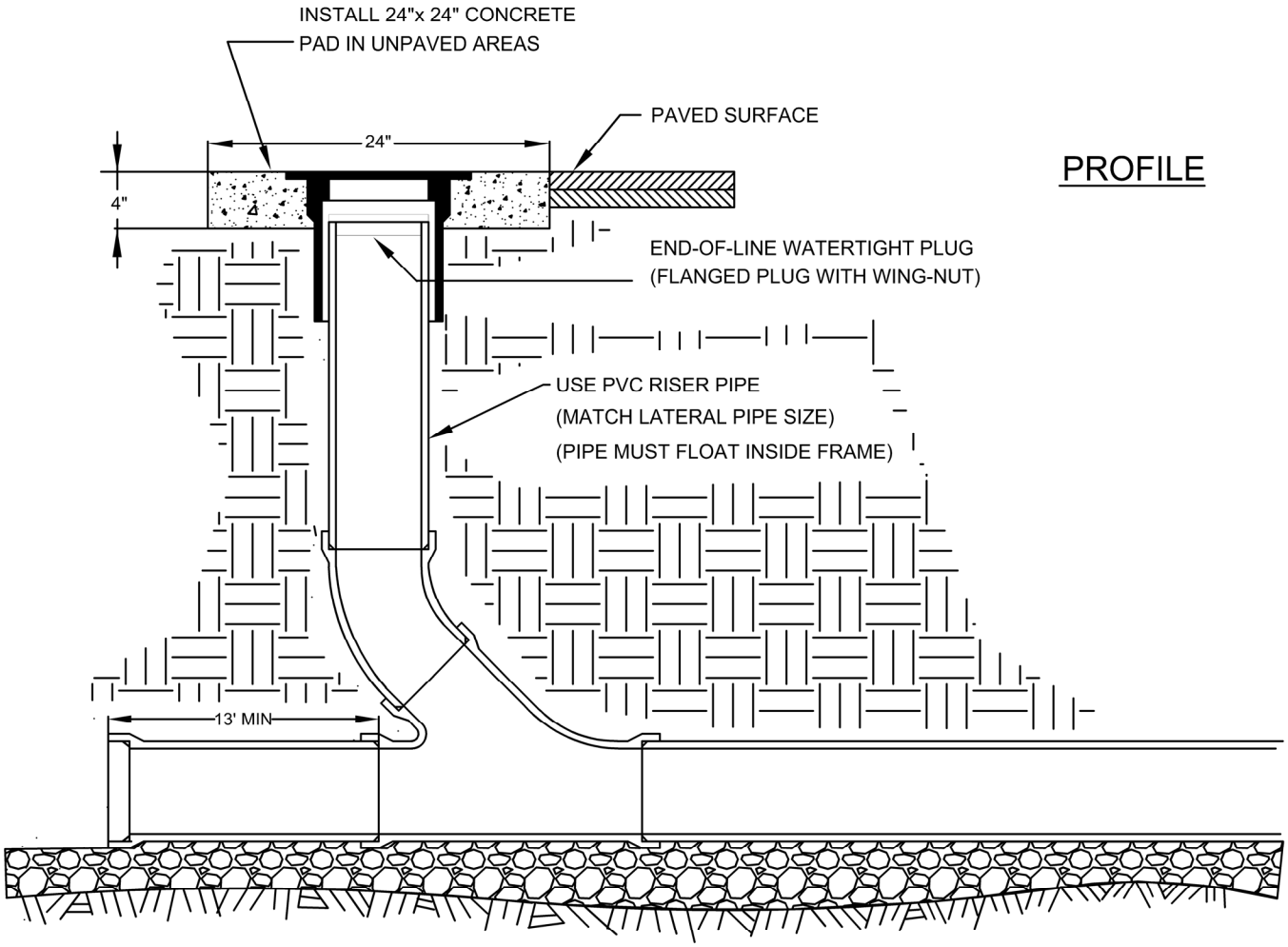
SLOPE FT/FT	MIN. ANCHOR SPACING CENTER TO CENTER
0.20 – 0.34	35'
0.35 – 0.50	25'
0.51+	15' OR CONC. ENCASEMENT

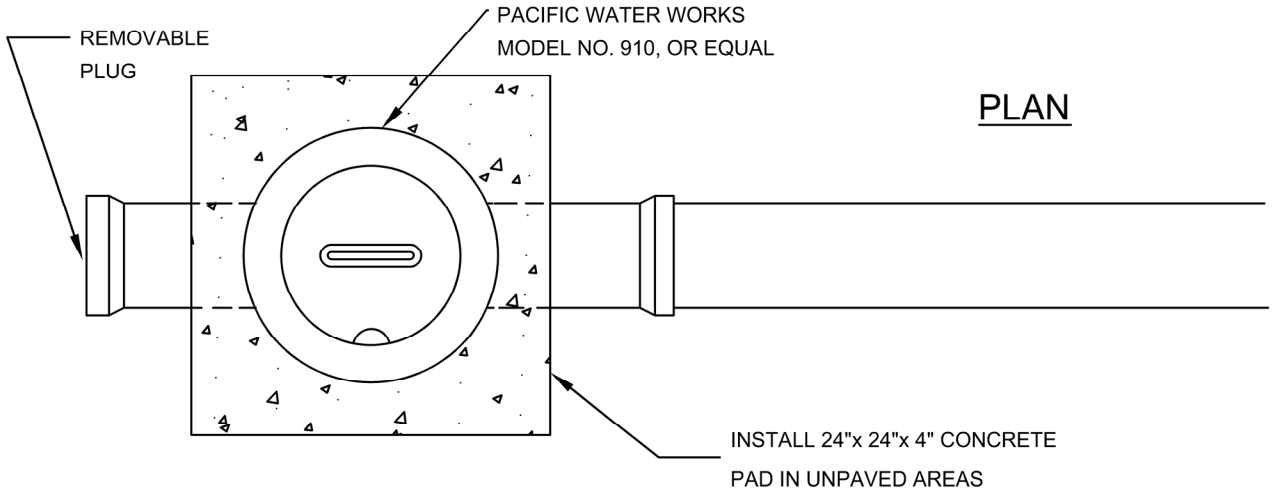
NOTES:

1. CONCRETE ANCHORS TO BE INSTALLED IMMEDIATELY DOWNHILL OF PIPEBELL.
2. CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI. AND 2" TO 4" SLUMP.
3. ODOT "METAL PIPE SLOPE ANCHORS" ARE AN ACCEPTABLE ALTERNATIVE.

ANCHOR WALL

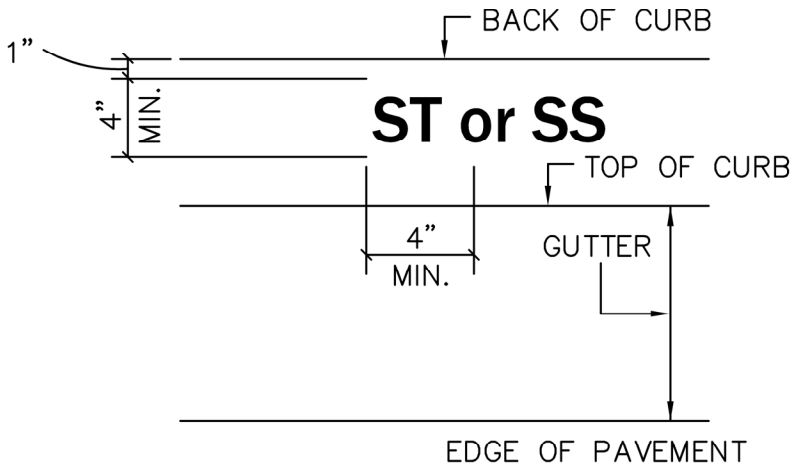
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. ANCHOR WALL	*STANDARD DRAWING* SAN-017





CLEANOUT PAD

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. CLEANOUT PAD	*STANDARD DRAWING* SAN-018



PLAN VIEW
(TYPICAL)

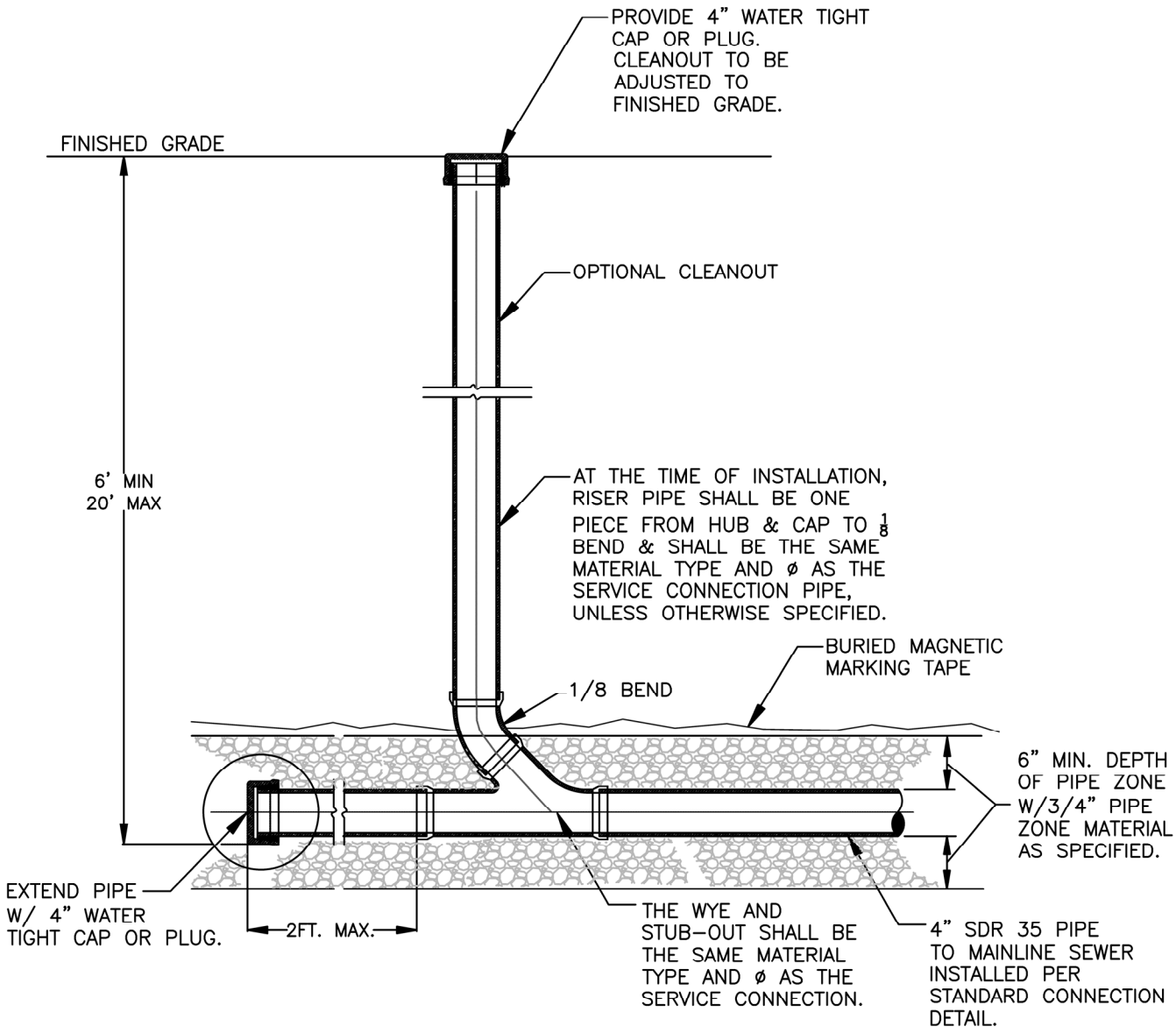
NOTES:

1. ALL STORM AND SANITARY SERVICE LATERALS SHALL BE MARKED APPROXIMATELY AS FOLLOWS:

STORM DRAIN LATERAL	"ST"	TOP OF CURB
SANITARY SEWER LATERAL	"SS"	TOP OF CURB

2. LETTERS SHALL HAVE A 1/2" MAX. WIDTH.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. SANITARY CURB STAMP	*STANDARD DRAWING* SAN-019

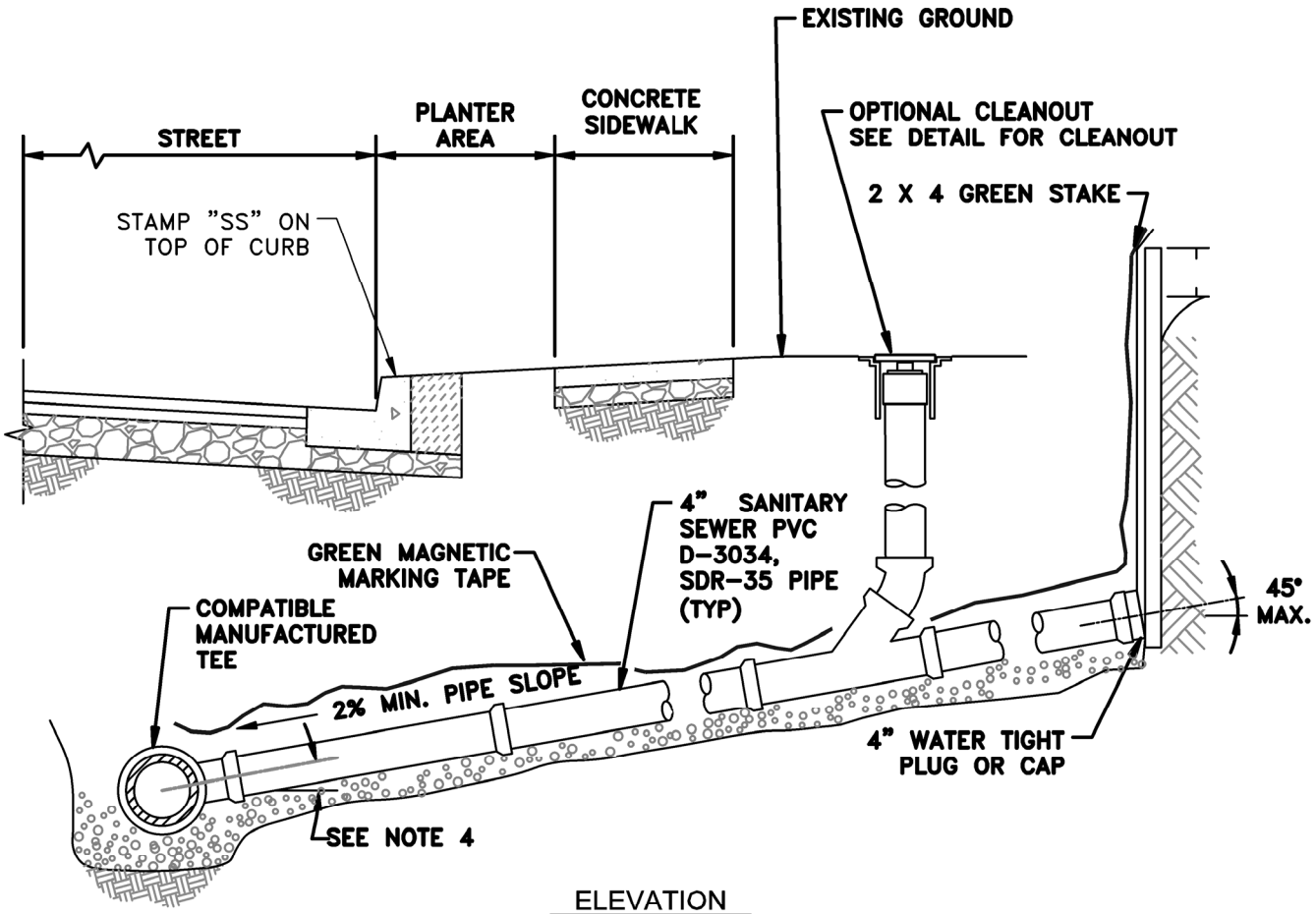


1. ALL PIPE AND FITTINGS SHALL BE ASTM D-3034, SDR 35.

2. ON LOTS WITH EXISTING HOMES, CONTRACTOR SHALL INSTALL APPROVED HUBS AND CAPS FLUSH WITH FINISHED GRADE.

3. CLEANOUTS SHALL NOT BE CONSTRUCTED SO THE CLEANOUTS CAP WILL END UP IN SIDEWALKS, STEPS OR DRIVEWAYS.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. SERVICE CONNECTION CLEANOUT	*STANDARD DRAWING* SAN-020

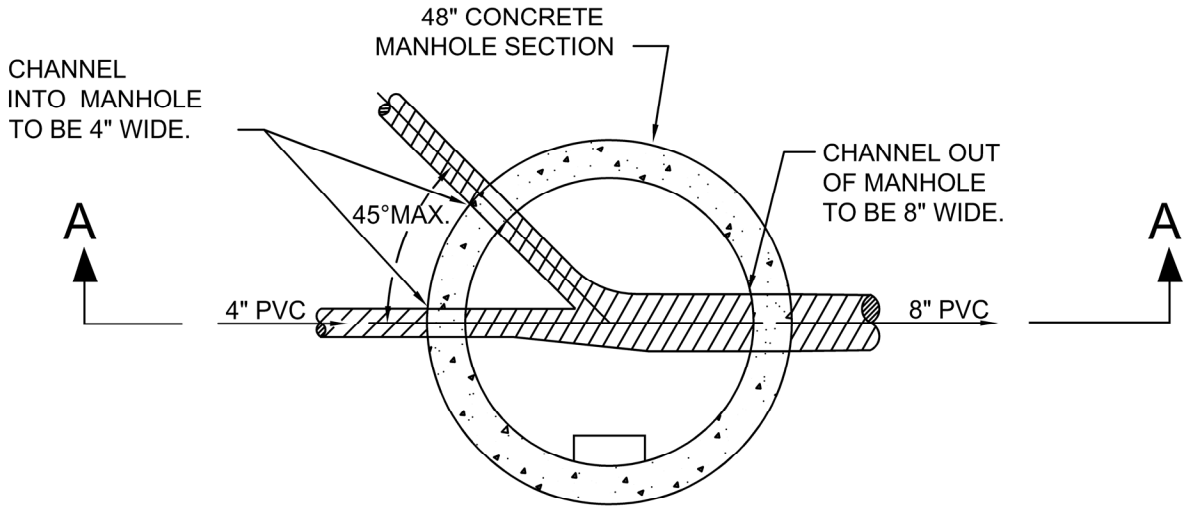


ELEVATION

NOTES:

1. INSTALL OPTIONAL CLEANOUT PER STANDARD DRAWING.
2. VIDEO INSPECT SERVICE CONNECTION IN ACCORDANCE WITH STANDARDS.
3. 2" x 4" TREATED STAKE FROM INVERT TO 1' ABOVE FINISH GRADE. SERVICE CONNECTION MARKER SHALL BE CONTINUOUS AND REMAIN VERTICAL AFTER BACKFILLING. END SHALL BE PAINTED GREEN.
4. CENTERLINE OF SERVICE OUTLET ON TEE SHALL BE ABOVE SPRINGLINE.
5. SANITARY SEWER SERVICE CONNECTIONS SHALL BE A FACTORY TEE INSTALLED 90° PERPENDICULAR TO SANITARY SEWER MAIN.
6. EVERY PROPERTY SHALL HAVE A SEPARATE SERVICE CONNECTED DIRECTLY TO THE MAINLINE, UNLESS OTHERWISE APPROVED BY THE DISTRICT. SHARED SERVICE CONNECTIONS ARE NOT ALLOWED.
7. THE SERVICE CONNECTION LOCATION SHALL GENERALLY BE LOCATED TEN FEET (10') OFFSET FROM THE PROPERTY LINE ON THE LOW SIDE OF LOT.
8. TEES FOR SERVICE CONNECTIONS SHALL BE LOCATED NO CLOSER THAN FIVE FEET (5') TO MANHOLES. SEPARATION BETWEEN WATER LINE, SANITARY SERVICE CONNECTION AND STORM SERVICE CONNECTION SHALL GENERALLY BE TEN FEET (10') WITH A MINIMUM OF FIVE FEET (5').
9. ANY OTHER PROPOSED LOCATION SHALL BE AT THE DISCRETION OF THE DISTRICT ON CASE BY CASE BASIS.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. SERVICE CONNECTION	*STANDARD DRAWING* SAN-021

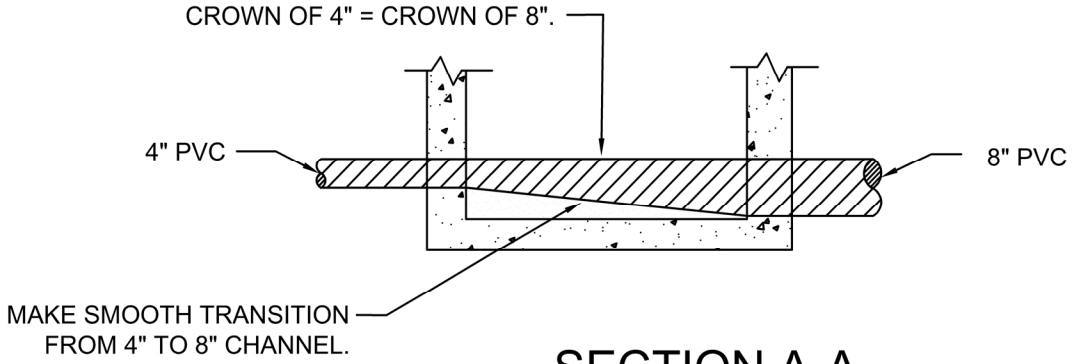


PLAN

NOTE:

1. THIS TYPE OF CONNECTION IS ALLOWED ONLY ON END OF RUN MANHOLES WITH DISTRICT APPROVAL.

2. MAXIMUM NUMBER OF SERVICE CONNECTIONS INTO A MANHOLE IS TWO.

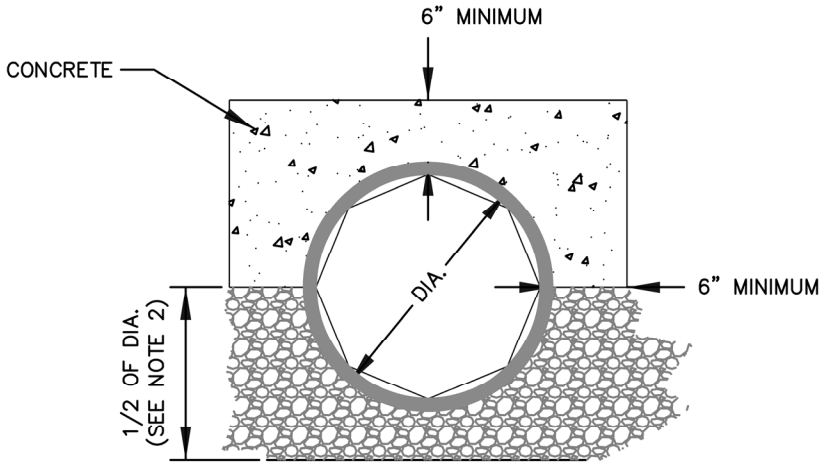


SECTION A-A

SERVICE CONNECTION INTO MANHOLE

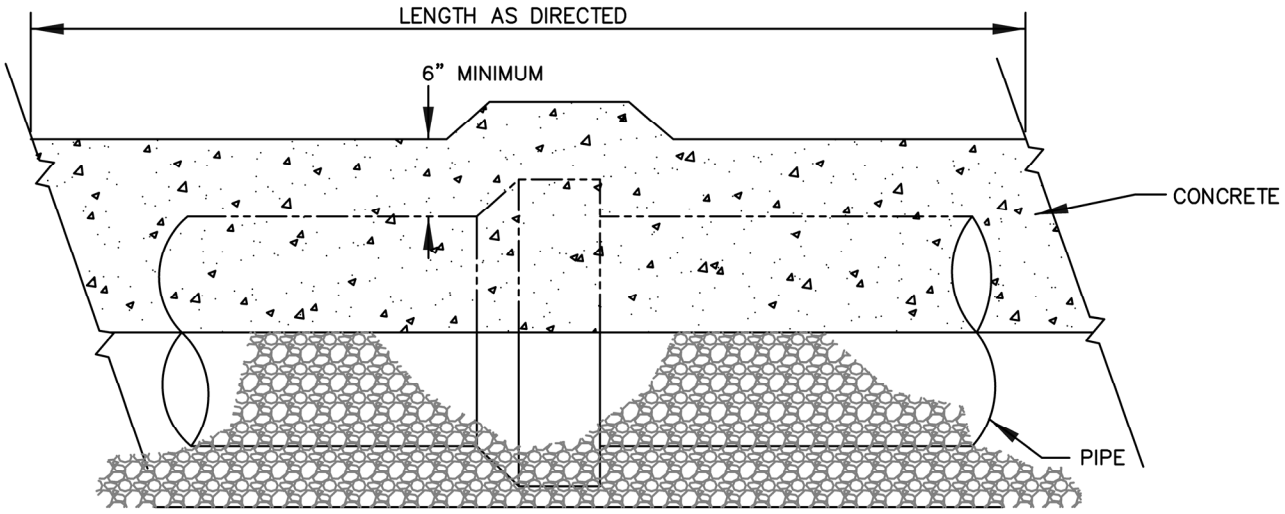
SCALE: NTS

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2022 *SCALE:* N.T.S. SERVICE CONNECTION INTO MANHOLES	*STANDARD DRAWING* SAN-022



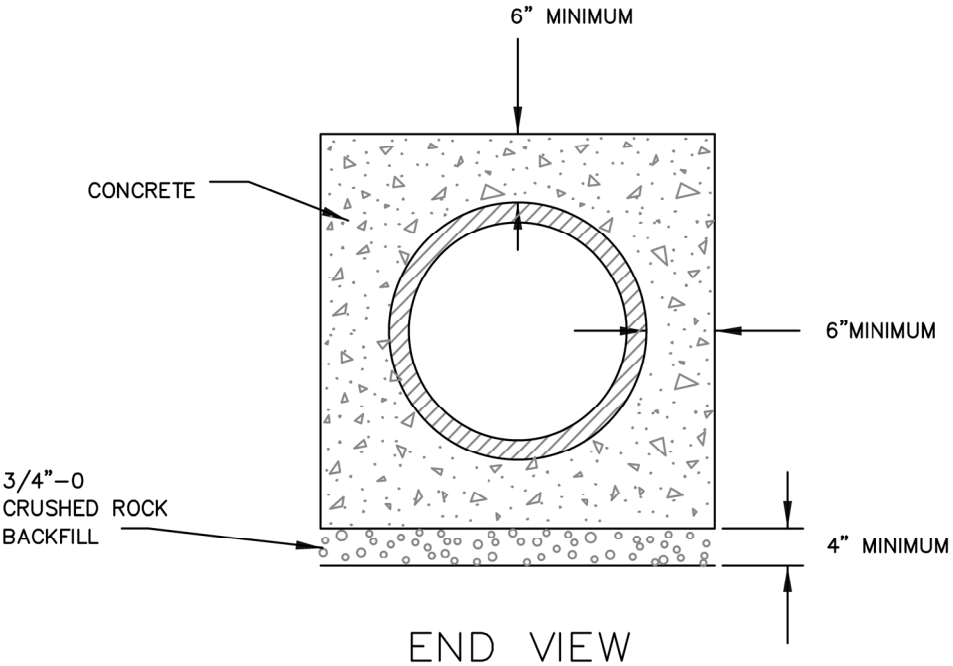
END VIEW

NOTES:
1. CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI AND 2" TO 4" SLUMP.
2. SEE APPLICABLE DETAIL FOR PIPE BEDDING INFORMATION.

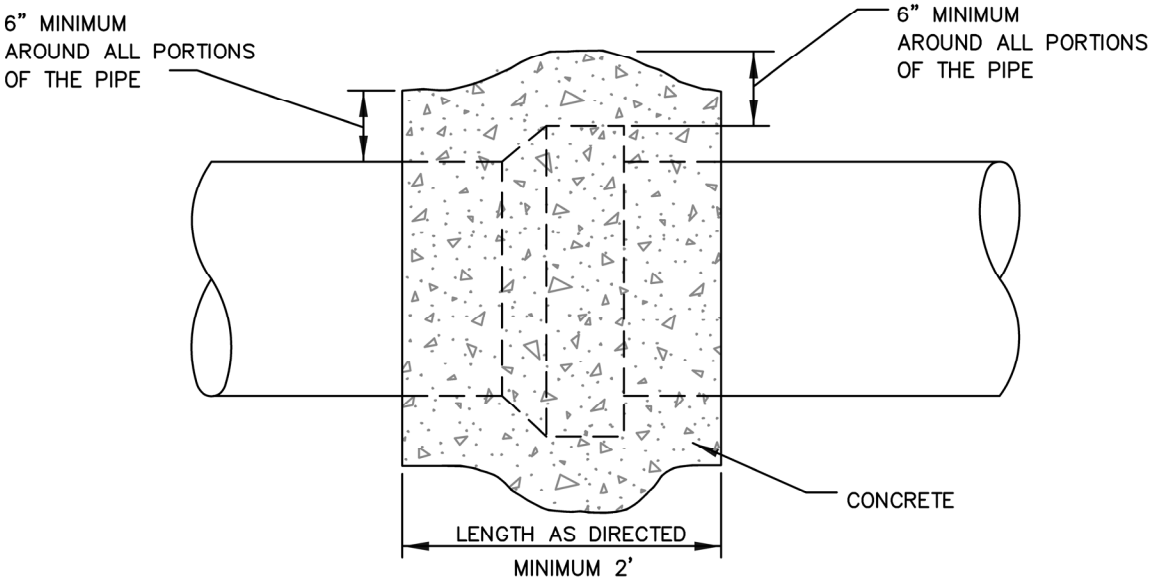


SIDE VIEW

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. CONCRETE CAP	*STANDARD DRAWING* SAN-023



END VIEW

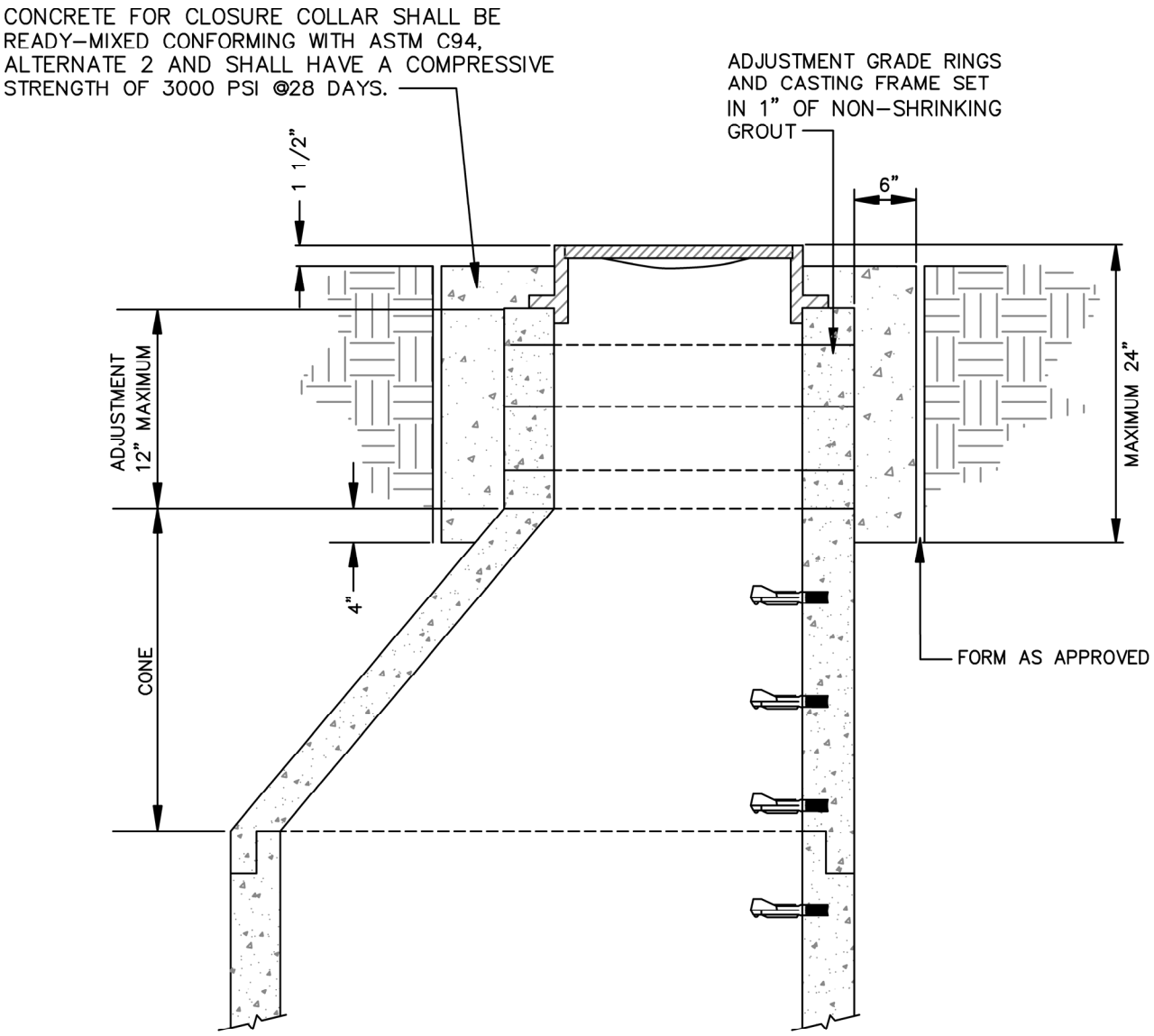


SIDE VIEW

NOTES:
1. CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI AND, 2" TO 4" SLUMP.

2. PRIOR TO INSTALLING THE CONCRETE ENSURE THE JOINT IS SEAL IN A MATTER AS NOT TO ALLOW CONCRETE TO ENTER INTO THE INTERIOR OF PIPE.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. CONCRETE ENCASEMENT/ CLOSURE COLLAR	*STANDARD DRAWING* SAN-024



NOTE:
1. NON-SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.

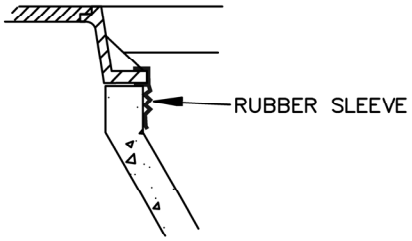
CLACKAMAS WATER ENVIRONMENT SERVICES

CLACKAMAS WES
150 BEAVERCREEK ROAD
OREGON CITY, OR 97045

APPROVAL DATE: July, 2021 *SCALE:* N.T.S.

CONCRETE MANHOLE CLOSURE COLLAR

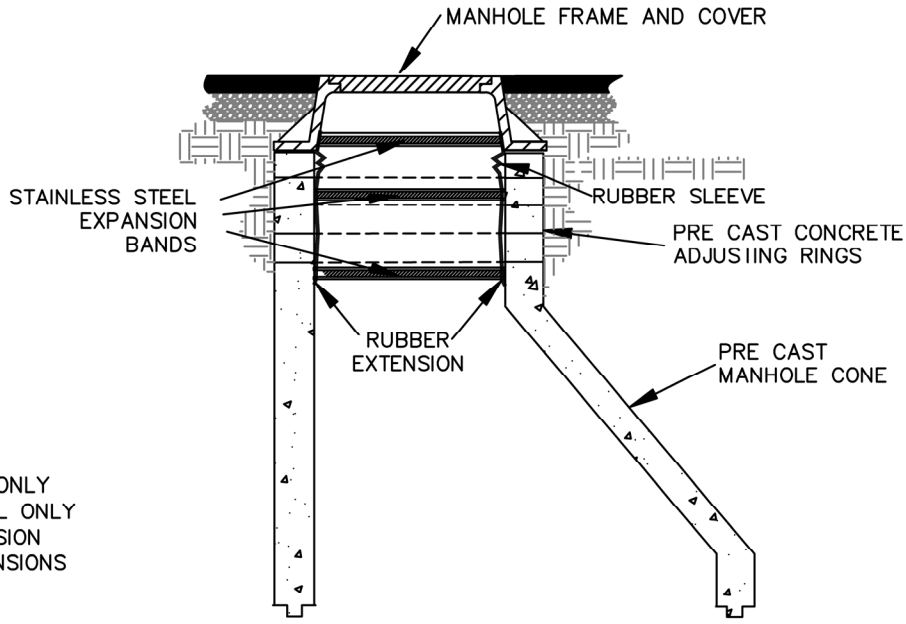
STANDARD DRAWING
SAN-025



NARROW EXTERNAL RUBBER SEAL

TO SPAN CHIMNEY HEIGHTS OF:

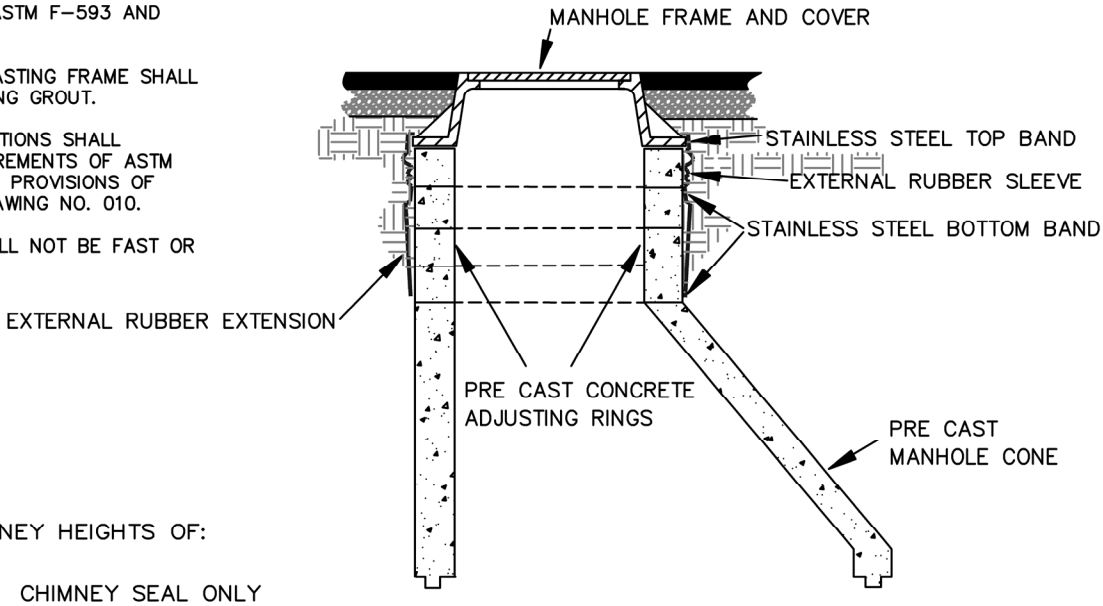
0–3"	–	NARROW (6") SEAL ONLY
OVER 3" – 6 1/2"	–	STANDARD (9") SEAL ONLY
OVER 6 1/2" – 12"	–	STD. SEAL + EXTENSION
OVER 12"	–	SEAL + MULT. EXTENSIONS



INTERNAL MANHOLE CHIMNEY SEAL

NOTES:

1. SLEEVES AND EXTENSIONS SHALL HAVE A MINIMUM OF 3/16" THICKNESS.
2. RUBBER SHALL BE EXTRUDED HIGH GRADE COMPOUND CONFORMING TO ASTM C–923.
3. BANDS SHALL BE FABRICATED FROM 16 GAUGE STAINLESS STEEL CONFORMING TO ASTM A–240, TYPE 304.
4. NUTS AND BOLTS SHALL BE STAINLESS STEEL CONFORMING TO ASTM F–593 AND 594, TYPE 304.
5. ALL GRADE RING AND CASTING FRAME SHALL BE SET IN NON–SHRINKING GROUT.
6. PRE CAST MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C–478, AND APPLICABLE PROVISIONS OF STANDARD MANHOLE DRAWING NO. 010.
7. NON–SHRINK GROUT SHALL NOT BE FAST OR RAPID SETTING.



TO SPAN CHIMNEY HEIGHTS OF:

0–4 1/2"	–	CHIMNEY SEAL ONLY
OVER 4 1/2" – 9"	–	SEAL + 7" EXTENSION
OVER 9"– 12"	–	SEAL + 10" EXTENSION
OVER 12"	–	SEAL + MULT. EXTENSIONS

EXTERNAL MANHOLE CHIMNEY SEAL

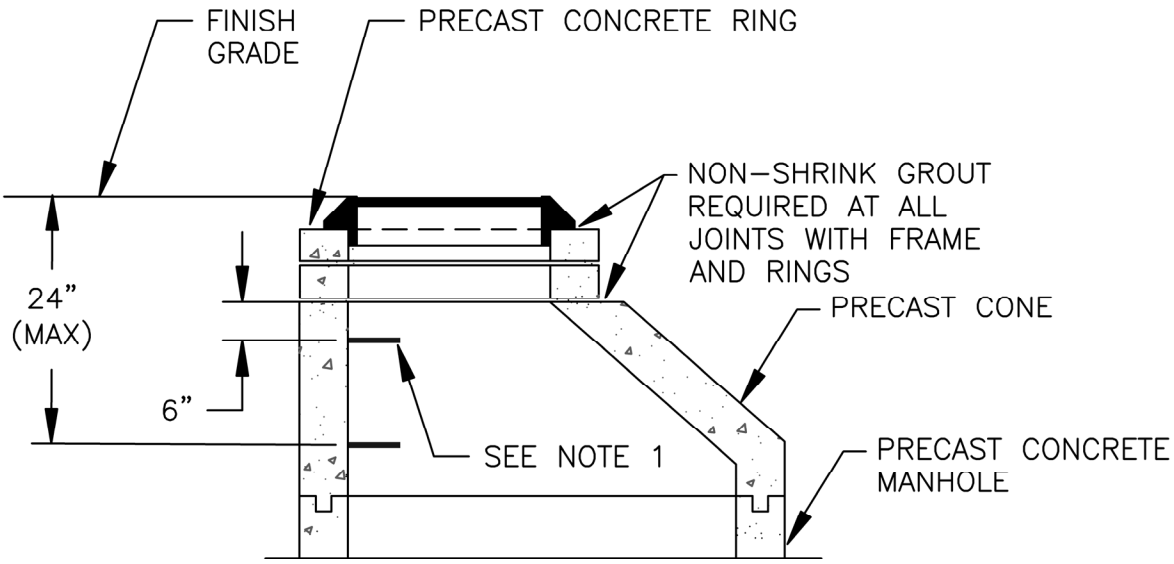
CLACKAMAS WATER ENVIRONMENT SERVICES

CLACKAMAS WES
150 BEAVERCREEK ROAD
OREGON CITY, OR 97045

APPROVAL DATE: July, 2021 *SCALE:* N.T.S.

MANHOLE CHIMNEY SEAL

STANDARD DRAWING
SAN-026

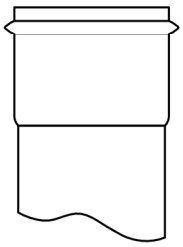


NOTES:

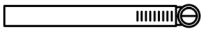
1. FIRST STEP SHALL BE 6" MINIMUM FROM RINGS TO MAXIMUM 24" FROM RIM.

2. NON–SHRINK GROUT SHALL NOT BE RAPID OR FAST SETTING.

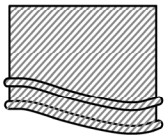
CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. PRECAST RING EXTENSION FOR TYPICAL MANHOLE	*STANDARD DRAWING* SAN-027



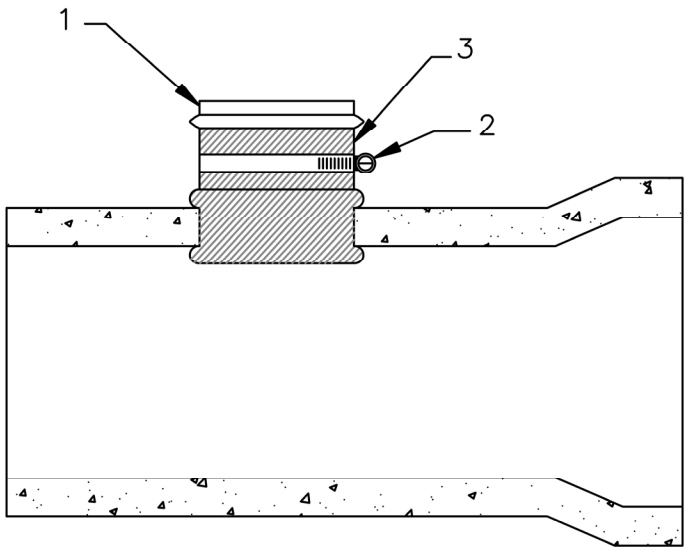
1. PVC HUB SHALL CONFORM TO ASTM 3034, SDR 35 DRIVE INTO CENTER OF RUBBER SLEEVE AFTER SLEEVE IS PLACED IN HOLE.



2. STAINLESS STEEL BAND SECURES UPPER HALF OF RUBBER SLEEVE TO THE PVC HUB. STAINLESS STEEL BAND SHALL BE 300 SERIES, 9/16" BAND WIDTH, CADMIUM PLATED CARBON STEEL, AND ATTACHED WITH HEX HEAD SLOTTED SCREW.



3. COMPLETE RUBBER SLEEVE INCLUDES A MOLDED SEGMENT THAT HOLDS IT IN PLACE.



NOTES:

1. ALL INSERTA–TEE HOLES SHALL BE MACHINE DRILLED AND CORED.
2. INSERTA–TEES ARE NOT ALLOWED IN NEWLY CONSTRUCTED SEWER MAINS.
3. SEWER MAIN SHALL BE TWO SIZES (NOMINAL I.D.) LARGER THAN THE INSERTA–TEE.

CLACKAMAS WATER ENVIRONMENT SERVICES	CLACKAMAS WES 150 BEAVERCREEK ROAD OREGON CITY, OR 97045	*APPROVAL DATE:* July, 2021 *SCALE:* N.T.S. INSERTA TEE	*STANDARD DRAWING* SAN-028