

CITY OF OREGON CITY

PUBLIC WORKS
SANITARY SEWER
DESIGN STANDARDS

RESOLUTION NO. 19-xx
ADOPTED: June xx, 2019

PREPARED BY

Public Works Department

625 Center Street

Oregon City, Oregon 97045-0304
June xx, 2019

RESOLUTION NO. 19-xx

A RESOLUTION ADOPTING UPDATED CITY OF OREGON CITY PUBLIC WORKS
SANITARY SEWER DESIGN STANDARDS.

WHEREAS; the City finds it is necessary to establish and implement uniform engineering design standards for all Public Works Sanitary Sewer projects in the interest of health, safety, and welfare of the residents of the City of Oregon City,

NOW, THEREFORE BE IT RESOLVED BY THE CITY COMMISSION OF THE CITY OF OREGON CITY, AS FOLLOWS:

- Section 1. That the Commission, by this Resolution, adopts the Public Works Sanitary Sewer Design Standards, attached to this resolution as Exhibit "A", for application to all publicly-owned Sanitary Sewer improvements within the City.
- Section 2. The effective date for the Public Works Sanitary Sewer Design Standards shall be the date this resolution is adopted, signed, and approved.
- Section 3. The Public Works Sanitary Sewer Design Standards adopted by this resolution shall supersede the Public Works Sanitary Sewer Design Standards, as adopted June 7, 1993 by resolution 93-38.
- Section 4. That the Commission, by this Resolution, empowers the City Engineer to periodically update these Standards for five years as needed to maintain currency with standard engineering practices and standards.

Adopted, signed and approved this _____ day of _____, 2019.

Mayor

Commissioner

Commissioner

Commissioner

Commissioner

Comprising the City Commission
of Oregon City, Oregon

RESOLUTION NO. 19-xx
Effective _____, 2019

SANITARY SEWER DESIGN STANDARDS

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SECTION I - GENERAL

1.00 PURPOSE

The purpose of these Sanitary Sewer Design 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 and City contract projects; however, it is intended that they apply to both public and private work designated herein.

These Standards cannot provide for all situations. They are intended to assist but not to substitute for competent work by design professionals. It is expected that land surveyors, engineers, and architects will bring to each project the best of skills from their respective disciplines.

The Standards are also not intended to limit unreasonably any innovative or creative effort which could result in better quality, better cost savings, or both. Any proposed departures from the Standards will be judged; however, on the likelihood that such variance will produce a compensating or comparable result, in every way adequate for the user and City resident.

1.01 GOALS

Following from the above purpose, the Standards have the objective of developing a sanitary sewer system which will:

- A. Be consistent with the Oregon City Comprehensive Plan, Oregon City Municipal Code, the Oregon City Sanitary Sewer Master Plan, Tri-City Service District Plans and Policies, the State Plumbing Code, Oregon Department of Environmental Quality (DEQ) Wastewater Permitting Program, the most recent edition of the ODOT/APWA Standard Specifications for Construction, and City Code Chapter 13.08;
- B. Be of adequate design to carry the expected flow, within their design life, and at sufficient depth to serve adjacent properties;
- C. Has sufficient grade to maintain a minimum velocity of two feet (2') per second when flowing half full'
- D. Have sufficient structural strength to resist all expected loads, both internal and external, which may be imposed; and able to preserve the functionality of the sewer system;
- E. Be of materials resistant to both corrosion and erosion, and have a minimum design life of 75 years or the maximum industry standard, whichever is greater;

- F. Be economical and safe to build and maintain; and,
- G. Prevent infiltration and/or inflow of ground and surface waters.

Alternate materials and methods will be considered for approval on the basis of these objectives.

Whenever any conflict exists between the references in 1.01.A. and these standards, the references in 1.01.A. take precedent.

1.02 REVISIONS TO THESE STANDARDS

It is anticipated that revisions to these Standards will be made from time to time. The date appearing on the title page is the date of the latest revision. Users should apply the latest published issue to the work contemplated. The Standard Drawings and Construction Notes referenced in Section III and IV may be revised from time to time as deemed necessary without revision to this overall document.

1.03 SHORTENED DESIGNATION

These City of Oregon City Sanitary Sewer Design Standards shall be cited routinely in the text as the "Standards".

1.04 APPLICABILITY

These Standards shall govern all construction and upgrading of all public and private sanitary sewer facilities in the City of Oregon City and/or applicable work within its service areas.

Permanent sanitary sewer facilities shall be provided to all property (legal lots of record created by a partitioning or subdivision of land as per City of Oregon City Municipal Code within the City of Oregon City per these Standards).

Whenever possible, sewer pipelines shall be located on public property. Where pipelines are required to pass through private property, easements shall be obtained from the property owner.

The public sewer system shall include the sewer mains, manholes, and the service lines up to the curb of edge of pavement. The public sewer system is owned, operated, and maintained by the City of Oregon City unless otherwise noted.

The piping from the City curb or edge of pavement to the point of sanitary sewer use (the building supply line) is subject to the requirements of the Oregon Plumbing Specialty Code. The piping beyond the City curb or edge of pavement is considered privately owned and maintained.

Where applicable, developing property shall provide public sewer extension along their frontage or through their site for extension to undeveloped property.

The design of the following are special problems and are not covered in detail in these Standards:

- a. Sewage Pump Stations
- b. Force Mains
- c. Siphons
- d. Relining of Existing Sewers
- e. Internal Sealing of Existing Sewers
- f. Treatment Plants
- g. Outfall Sewers
- h. Energy Dissipators
- i. Regulating Devices
- j. Flow Measurement Devices
- k. Hydrogen Sulfide and/or Hazardous Gasses

Review and approval of the above special problems by the City Engineer shall be required. When requested by the City, full design calculations shall be submitted for review prior to approval. Additional review and approval of the above special problems where applicable by the Department of Environmental Quality (DEQ) shall be required.

For areas of the City or Urban Growth Boundary that cannot be served by public sewer, internal policies and decisions will determine if the property can be developed.

1.05 REFERENCES

The Standards are intended to be consistent with the most currently adopted provisions of:

- A. Oregon City Municipal Code;
- B. Oregon City Comprehensive Plan;
- C. Oregon City Sanitary Sewer Master Plan
- D. Oregon Statewide Planning Goals and Guidelines;
- E. Oregon Plumbing Specialty Code;
- F. Oregon Administrative Rules, Chapter 340.
- G. Referenced National Trade Standards such as ASTM
- H. Local Trade Standards such as ODOT/APWA
- I. Tri-City Service District (Water Environment Services)

Design shall comply with Oregon Department of Environmental Quality sewer design guidelines.

American Society of Civil Engineers (ASCE) Manual and Report on Engineering Practice, No. 60, Gravity Sanitary Sewer Design and Construction was used as a reference in preparation of the original 1993 design standards

1.06 STANDARD SPECIFICATIONS

The workmanship and materials shall be in accordance with the current edition of the “Standard Specifications for Public Works Construction” except where the Standards provide other design detail. These standards are prepared by the Oregon Chapter of APWA, as modified by the City of Oregon City.

1.07 DEFINITIONS AND TERMS

As-Built Plans/Record Drawing - Plans signed and dated by the Consulting Engineer indicating that the plans have been reviewed and revised, if necessary, to accurately show all known as constructed details of a particular public works project.

Building Drain - The building drain is that part of the lowest piping of the sewer system which receives the discharge from waste and other drainage pipes inside the walls of the building and conveys it to the building sewer, which begins five feet (5') outside the building wall (building foundation).

Building Official - The Building Official of the City of Oregon City or his/her authorized representative.

Building Sewer - That part of the horizontal piping of the sewer system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to the public sewer, private sewer, individual sewage-disposal system, or other point of disposal.

Building Supply - The building supply is the pipe carrying potable sewage from the cleanout near the property line to a building or other point of use or distribution to the lot. Building supply shall also mean sewer service. (See Customer Line)

City - The City of Oregon City, Oregon.

City Engineer - The City Engineer of the City of Oregon City or his/her authorized representative.

Collection Systems - Facilities maintained by the City of Oregon City and Tri-City Service District connected thereto for the collecting, pumping, conveying, and controlling wastewater.

Commercial User - Any user of the sanitary sewer who is neither a residential or industrial user.

Consulting Engineer - The engineer, licensed by the State of Oregon as a Civil Engineer under whose direction plans, profiles, and details for the work are prepared and submitted to the City for review and approval.

Cooling Water - Water other than sewage or industrial waste which is used as a medium for carrying a way excess heat from any apparatus, appliance, mechanism, device, or thing, in which, in the course of such cooling process, is not mixed or co-mingled with any other substance or used as a means of carrying off any other substance, in suspension or in solution, thereby exiting such cooling process in substantially the same condition, save for temperature as when it entered.

Customer Line - That piping connecting the cleanout to the building sewer system. (See Building Supply)

Cut Sheets - Sheets of tabulated data, indicating stationings, structures, fittings, angle points, beginning of curve, points on curve, end of curves, sewer slope, staking offset, various elevations, offset cuts, and sewer depths.

Definition of Words - Wherever, in these Standards, the words directed, required, permitted, ordered, designated, or words of like importance are used, they shall be understood to mean the direction, requirement, permission, or order of designation of the City Engineer. Similarly, the words approved, acceptable, satisfactory, shall mean approved by, acceptable to, or satisfactory to the City Engineer.

Director - The Director of Public Works of the City of Oregon City or his/her authorized representative.

Distribution System - Distribution main sewer and ancillary equipment used to transmit sewage from the supply source to the treatment plant.

Domestic Sewage - The liquid and water borne waste derived from the ordinary living processes, free from industrial wastes, and of such character to permit satisfactory disposal, without special treatment into the public sewer or by means of private sewage disposal system.

Dwelling Unit - A habitable living unit that provides basic living requirements including permanent cooking, and toilet facilities

Easement - Easements are areas along the line of all public sewers which are outside of dedicated rights-of-way, and shall be prepared on approved forms granting rights along the line of the sewer to the City.

Fixture Unit Equivalents - The unit equivalent of plumbing fixtures as tabulated in the Oregon Plumbing Specialty Code.

Flow - The wastewater flow from an industry or institution (daily average), or house connection.

Industrial Waste - A water borne waste and wastewater from an industrial user.

Lateral Sewer - Any sewer line to which a private building sewer connects or may connect. The lateral sewers are located within public right-of-way or easements, and generally connect to the main sewer and extend to the right-of-way or easement. They may also be known as a service lateral or a building service lateral.

Main Sewer - (Public Sewer) - A public sewer which has been or is being constructed to accommodate more than one (1) lateral sewer or to which a building sewer connects or may connect. (Normally eight inches (8") in diameter.)

Multiple Family Dwelling - A building or portion designed thereof for occupancy by two (2) or more families, living independently of each other.

Manufacturer's Name - Any manufacturer's name, specification, catalog number, or type used herein is specified by make and order to establish the standard requirements of the City. Other equivalent makes will be considered for approval, providing they are comparable with this established standard.

Owner - Any individual, partnership, firm, or corporation by whom the consulting engineer has been retained or who, as a property owner, is making arrangements with the City.

Person - Individual, firm, corporation, association, agency, or other entity.

Plans - Construction plans, including system site plans, sewer plans and profiles, cross sections, detailed drawings, etc., or reproductions thereof, approved or to be approved by the City Engineer, which show the location, character, dimensions, and details for the work to be done, in which constitute a supplement to these Standards.

Plumbing System - All plumbing fixtures and traps, or soil, waste, special waste, and vent pipes within a building and to a point five feet (5') outside the building foundation thereof.

Premise - Any lot, parcel, or tract of land owned by a single entity.

Private Collection System - A privately owned and maintained sewer system installed to serve multiunit structures on single ownership properties, 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.

Public Sewer - Any sewer in public right-of-way or public easement operated and maintained by the City.

Residential User - The owner, lessee, or occupant of a single dwelling unit in one (1) structure.

Right-of-Way - All land or interest therein which by deed, conveyance, agreement, easement, dedication, usage, or process of land is reserved for or dedicated to the use of the general public. Within this right-of-way, the City shall have the right to install or maintain sewers and other public utilities.

Roadway - All of the right-of-way dedicated, granted, used or to be used, for transportation purposes.

Sewage - The wastewater derived from human habitation and use of buildings for residential, institutional, or commercial purposes, excluding stormwater and industrial waste.

Sewer - An underground conduit for conveying sewage.

Single Family Dwelling - Any residential building designed to house one (1) family.

Standard Plans or Drawings - The drawings of structures or devices commonly used for City public works infrastructure and referred to on the design plans. These standard drawings are included in Section III, Standard Drawings.

Stormwater - Ground water, surface drainage, subsurface drainage, spring water, well overflow, roof drainage, or other like drainage other than sewage or industrial waste.

Streets or Roads - Any public highway, road, street, avenue, alley, way, easement, or right-of-way used or to be used for a motor vehicle, bicycle, or other legal mode of transportation.

Structures - Those structures designated on the standard plans or drawings as manholes, etc. Detailed drawings of structures or devices commonly used in City work and mentioned in these Standards are included in Section IV, Standard Drawings.

Trunk Sewer - A public sewer ten inches (10") or larger which has been or is being constructed to accommodate more than one (1) main sewer or lateral sewer.

Traveled Way - That portion of the roadway for the movement of motor vehicles, bicycles, or other legal modes of transportation, exclusive of shoulder and auxiliary lanes.

Uniform Plumbing Code - The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition as revised by the State of Oregon, called the "Oregon Plumbing Specialty Code."

1.08 ENGINEERING POLICY

The engineering policy of the City of Oregon City requires strict compliance with Oregon Revised Statute 672 for professional engineers.

All engineering plans, reports, or documents shall be prepared by a registered professional Civil Engineer licensed in the state of Oregon.

These documents may also be prepared by a subordinate employee under his/her direction, and shall be signed by him/her and stamped with his/her seal to indicate his/her responsibility for them. It shall be the consulting engineer's responsibility to review any proposed system, extension, and/or existing system change with the City, before engineering or proposed design work, to determine any special requirements or whether the proposal is permissible. A City approval granted on the plans or other documents, for any job, does not in any way relieve the consulting engineer of his/her responsibility to meet all requirements of the City. A City approval also does not relieve the consulting engineer of his/her obligation to protect the life, health, and property of the public. The plan for any job shall be revised or supplemented at any time it is determined that the full requirements of the City have not been met.

The City will warn a consulting engineer in writing of their conduct for submitting false or inaccurate information of a material nature. The City will also advise the Oregon State Board of Engineering Examiners.

1.09 APPROVAL OF ALTERNATE MATERIALS OR METHODS

Any alternate material or method not explicitly approved herein will be considered for approval on the basis of the objectives set forth in 1.00 PURPOSE. Persons seeking such approvals shall make the request in writing. Approval of any major deviation from these Standards will be in written form. Approval of minor matters will be made in writing if requested.

Any alternate must meet or exceed the minimum requirements set in these Standards.

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

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

1.10 ISSUANCE OF BUILDING PERMITS

Sewer improvements as well as all other public infrastructure improvements are required to be completed and be accepted by the City before any building permits for connection to new single family residential dwellings can be issued.

Building permits may be issued for commercial, industrial, and multi-family projects once city engineering approval has been provided for the plans.

Occupancy may not be granted to a Building until all improvements are complete to the satisfaction of the City Engineer and Building Official.

1.11 TRANSFER OF ENGINEERING RESPONSIBILITY

Project sewer plans shall always have an engineer of record performing the function of consulting engineer. If the consulting engineer is changed during the course of the work, the City shall be notified in writing and the work shall be stopped until the replacement engineer has agreed to accept the responsibilities of the consulting engineer. The new consulting engineer shall provide written notice of accepting project responsibility to the City within seventy-two hours of accepting the position as consulting engineer.

SECTION II - DESIGN

2.00 GENERAL DESIGN CONSIDERATIONS

Design shall comply with Oregon Department of Environmental Quality (DEQ) Sewer design guidelines.

Sanitary sewers shall be designed to remove the domestic sewage and industrial wastes from basements of houses, commercial or industrial buildings, and all public and private establishments where possible.

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 sanitary sewer system.

Unpolluted cooling waters shall be kept out of sanitary sewers.

The overflow drains and filter backwash lines of swimming pools and "hot tubs" shall drain into a sanitary sewer.

In general, sewer systems shall be designed to care for future loads and for ultimate development as predicted in the City's Sanitary Sewer Master Plan.

As a condition of sewer service, all developments will be required to provide public sewers to adjacent upstream parcels in order to provide for an orderly development of the drainage area. This shall include the extension of sewer mains in easements across the property to adjoining properties and across the street frontage of the property to adjoining properties when the main is located in the street right-of-way. This shall include trunk sewers that are oversized to provide capacity for upstream development.

All materials shall be new and undamaged. No rebuilt, reconditioned, or used material will be allowed unless approved by the City Engineer. The same manufacturer of each item shall be used throughout the project.

All work and materials shall conform to the most recent edition of the ODOT/APWA Oregon Standard Specifications for public works construction as adopted and modified by the City of Oregon City.

2.01 SANITARY SEWER SYSTEM CAPACITY (SANITARY SEWER MASTER PLAN)

The City Sanitary Sewer Master Plan studies the City's sewer needs to the City's Urban Growth Boundary. The Master Plan analyzes the City's trunk sewers making recommendations for upgrades and extensions to handle future growth and ultimate development within the existing Urban Growth Boundary. In the process flow design criteria were established and a flow generation computer model was developed.

When required by the City, the Consulting Engineer shall prove to the City that all necessary methods of determining present and future capacity of the sanitary sewer have been considered.

The Consulting Engineer may also need to verify capacity exists within Tri-City Service District.

When required the following shall be included in the design calculations:

DRAINAGE BASIN

A map showing the drainage basin in which the project is located may be required. This map should show the major basins that is consistent with the City's Sanitary Sewer Master Plan, and any applicable amendments and updates thereto.

POPULATION DENSITY

The population density figures shall be obtained from the most recent information obtained for use by the zoning or planning department. If these figures vary from those of the applicable Master Plan estimates, this difference must be noted in the design calculation.

PER CAPITA AVERAGE FLOWS:

The per capita average flows used in the Master Plan shall be used.

FLOW VARIATIONS AND PEAKING FACTOR:

Accepted flow design practice must be employed. A factor must be used, and the method utilized to obtain such factor must coincide with the method used in the Master Plan described above.

INFILTRATION AND INFLOW:

Infiltration and inflow (I&I) must be represented in flow calculations in the design of the sanitary system. I&I rates utilized in the Sanitary Sewer Master Plan shall be used.

SEWAGE FLOWS:

Sewage flows must reflect any reasonably anticipated increase due to the development of the drainage basin upstream from the project being considered.

DESIGN CAPACITY:

Design capacity of main and trunk sewers shall be designated on the following basis:

- a. Main Sewers: Design capacity shall be based on sewers flowing two-thirds (2/3) full.
- b. Trunk Sewers: Design shall be based on sewers flowing full, without head.

2.02 SANITARY SEWER CONSTRUCTION PLANS

a. GENERAL

Complete plans and specifications for all proposed sanitary sewer improvements including any necessary dedications and easements shall be submitted to the Public Works Department, for approval, and must receive the required approval prior to construction permit issuance and beginning of construction. See Section 2.06 for required submittal information.

Plans shall also be submitted for review and approval to Department of Environmental Quality when appropriate.

Improvements shall be constructed as shown on the plans and in accordance with these Standards and Standard Drawings. Equipment and materials shall be installed in compliance with the manufacturer's recommendations, except where a higher quality of workmanship is required by the Plan Specifications and these Standards.

All materials and work shall be in strict accordance with any applicable regulations and requirements of Federal, State, and local authorities. The Contractor may be required to arrange for inspection by these agencies and submit evidence of their approval, when required or requested by the Public Works Department.

Take care to prevent damage to pipe, appurtenances, and other materials and equipment during transportation, unloading, and final placement for installation. Under no circumstances shall materials be dropped or dumped into the trench.

All damaged materials and equipment during construction shall be replaced or repaired to the satisfaction of the Public Works Department.

The Contractor shall maintain safe working conditions for employees, City staff, and the general public in and around trench excavations. Precautions shall be taken to avoid damage to franchise utilities, adjacent properties, existing sewer infrastructure, and public or private landscapes/hardscapes. If any underground utilities are damaged, report damage to Public Works Department Operations.

b. PLAN PREPARATION

Construction plans and specifications shall be prepared by a professional Civil Engineer licensed in the State of Oregon. Plans and specifications shall be prepared in accordance with the following requirements:

- 1) Dimensions - Construction plans shall be clearly and legibly drawn on 24 x 36 inches with a 1-½ inch clear margin on the left side and one inch (1") margins on all other sides unless another format is approved by the City Engineer.
- 2) Scale - Horizontal scale shall be not smaller than 1" = 50'; vertical scale shall be not smaller than 1" = 5' or as approved by the City Engineer. 1" = 20' shall be required when more detail is needed.
- 3) Form - Title Sheet, Overall Utility Plan, Erosion/Sedimentation Control Plan, Grading Plan (if applicable), Plan and Profiles, and Details.

The sewer can be combined with the water plan if the sewer plans are part of a subdivision, commercial development, or City project where other public facilities are involved (water, storm, streets); however, the Consulting Engineer must ensure the notes for the sanitary sewer and water are drafted to distinguish a definite difference between the water and sanitary. For example: Surround all water notes with a cloud symbol and all sewer notes with a box symbol.

2.03 TITLE SHEET

- a) Plan view (site plan) of the entire project, showing street right-of-way and/or subdivision layout to a scale of 1" = 100'. A smaller scale may be used on large projects upon approval of the City Engineer. A project is too large when a minimum dimension of two inches (2") cannot be maintained between the title, system site plan, and vicinity map. A scale of 1" = 200' may be used in this case.

The site plan shall be a composite plan showing all complete properties to be served by the sanitary sewer improvements and properties adjacent to and within 250 feet of those served. The site plan shall also show existing and proposed water lines, tract names and numbers, and lot numbers or property owner's names and street names.

- b) Index of Sheets, including a graphical index if more than one (1) plan sheet.
- c) Complete legend of symbols used.
- d) Vicinity map to a scale of not less than 1" = 800' showing the project location unless another scale is approved by the City Engineer.
- e) Engineer Title Block - Located in lower right hand corner or right edge of paper with scale, north arrow, date, drawing number, the engineer's name, address and official stamp, and where applicable, the owner/developer's name and address as determined by current standards maintained by the City Engineer.
- f) Space for City approval stamp, 3"x3", preferably in the lower right hand corner (to be provided on each sheet of the plan set) as determined by current standards maintained by the City Engineer.
- g) Temporary and permanent bench marks including their descriptions. See comments under profiles.
- h) Current City Standard Construction Notes and other special notes relating to construction methods, or include the City Standard Construction Notes in the Contract Documents with a note on the drawings so indicating.
- i) City Planning File No. or City Capital Improvement Project No.
- j) City G.P.S. Control (see Sec. 2.18 As-built Drawings/Digital Mapping Requirements).

NOTE: If all of the above items cannot be located on the title sheet a different location within the plans may be used upon approval by the City Engineer.

2.04 PLAN AND PROFILES

a. Plan

Plan view of sanitary sewer lines shall be to a scale of 1" = 50' unless a different scale is approved by the City Engineer and shall contain the following information in addition to the above:

- 1) Adjacent street curbs/pavement edge, and property lines, right-of-way and utility easements referenced to property corners, street intersections, or section lines. Adequate two foot (2') contour lines or property corner and curb elevations to help determine if existing basements or proposed daylight basements in new subdivisions can or should be served.
- 2) Location of each manhole and sewer appurtenance shall be numbered and stationed to facilitate checking the plans with the profiles. The stationing shall be tied to existing property corners or street monuments with the relationship of each manhole and cleanout shown to the property corners or street centerline.

Each line with a separate designation (A 0+00. B 0+00. etc.) shall be stationed continuously upgrade from 0+00 at its point of connection to another line (0+00 represents the centerline of the existing manhole or existing plug or cleanout if a main extension).

- 3) Location of each service wye or tee stationed with the size, length, and depth at property line indicated.
- 4) Location of existing water courses, geologic hazards, stream and railroad crossings, gas mains, culverts, water main, storm drains, underground and overhead power and other utilities (including but not limited to gas, electric, telephone, cable, fiber) that cross the alignment within 500 feet of the proposed extension in order to prevent future grade conflicts. All water course crossings must show the 100 year flood plain. This information may be shown on the site plan.
- 5) Location of wells, water main valves, pump stations, fire hydrants and blow-offs within a 100 foot radius of the proposed extension.
- 6) All manholes, water mains, services, gas mains, underground power, and other utilities that either cross the alignment within 250 feet of the terminus of the proposed extension or are adjacent to the proposed extension within the right-of-way or within ten feet (10') of the easement line. The intent is to prevent grade conflicts of all future extensions.

- 7) Location of other proposed public improvements (including but not limited to sanitary sewer, storm sewer, curbs, traffic signals, street lighting, street signage).
- 8) Location of existing private facilities (including but not limited to driveways, retaining walls, mailboxes, trees)
- 9) Location and description of all known existing surveying monuments, including, but not limited to, section corners, quarter corners, donation land claim corners, and City Control Survey monuments. Any monuments removed or destroyed by construction shall be replaced per ORS 209.150. If a boundary control survey or plat is prepared in conjunction with the construction plans, a copy shall be submitted with the construction plans for review. See Section 2.18 As-Built/Digital Mapping Requirements.
- 10) Match lines with sheet number references.

b. Profiles

Profiles for the individual sanitary sewer lines shall be to the same horizontal scale and preferably on the same sheet, drawn immediately below the corresponding plan view to a vertical scale that will provide a 10 to 1 distortion (Example: Horizontal 1" = 50', Vertical 1" = 5' (or as approved) reading from 0+00 left to right. However, if spatial and clarity needs are met better by having plan and profiles on separate sheets, they may be on separate sheets. Other scales are acceptable if approved by the City Engineer. Profiles shall contain at least the following information in addition to the above:

- 1) Location of manholes and other appurtenances with each manhole numbered and stationed as in item a-2 above.
- 2) Profile of the existing and proposed ground and/or pavement surface and sewer invert.
- 3) Size, slope, length, backfill classification, and type of material of the line between consecutive manholes. Type of pipe may be designated by abbreviations listed under Section 2.07.
- 4) Elevation of original ground, finished grade, proposed rim elevation, and sewer inverts at each manhole (Mean Sea Level Datum, U.S.G.S.).

The bench mark used as a basis for vertical control in the design and temporary bench marks set for construction shall be shown on the plans.

Profiles shall be based on one of the following benchmark systems:

- a. City of Oregon City,
- b. ODOT, or
- c. U.S. Geodetic Survey.

- 5) Railroad and culvert crossings, geologic hazard areas, ditch, or stream crossings with elevations of the ditch or stream bed and the 100-year flood elevation profile and casing details. See Section 2.13 (b) and 2.13 (c) for additional plan requirements.
- 6) Utility crossings that conflict with the proposed sewer installation.
- 7) All existing facilities upon which work is to be performed, i.e., installation, repair or removal.

SPECIAL NOTE: If practicable, the consulting engineer shall field locate and verify the alignment, depth, and inverts of all existing facilities shown on the plans that will be crossed by proposed facilities. City as-built records are only to be used as an aid to the consulting engineer when field verifying the existing facilities.

2.05 SANITARY SEWER APPURTENANCES/CONSTRUCTION NOTES

a. Appurtenances

Detailed drawings shall be included for all sanitary sewer appurtenances including manholes, pump stations, siphons, outfall bulkheads, stormwater diversion, etc. Appropriate references to City of Oregon City Standard Drawings may be used in lieu of details actually shown on the plans.

b. Construction Notes

Standard City General Construction Notes and Sanitary Sewer Notes shall be included on the plans, or a statement referencing the City's Standard Construction Notes. These notes may be added to or revised, upon City Engineer approval, to accommodate specific projects.

2.06 PLAN SUBMITTAL, APPROVALS, INSPECTION REQUIREMENTS

Construction plans shall be submitted to the Public Works Department for checking to ensure compliance with these Standards, City of Oregon City Ordinances, and good engineering practice. Submitted plans shall include the following:

1. Engineer's Preliminary Cost Estimate (or Opinion of Probable Cost),
2. Engineering Review Checklist checked by consulting engineer, and
3. A tie to the City horizontal control system. Survey ties to include monuments tied and closure results.

Submitted plans shall also include (if applicable) the following:

1. Supplemental specifications,
2. Soils report and design recommendations,
3. Geotechnical report and design recommendations,
4. Natural Resource report and design recommendations,
5. Easement and right-of-way descriptions and sketches,
6. A tie to the City Bench Mark systems, including closure results,
7. Boundary control survey,

8. Final plat, and
9. Other material as requested by the City Engineer

A 2½ percent plan check fee (or currently established fee, fee is a percentage of an approved engineer's cost estimate), will be levied at the time plans are submitted to the Engineering Division of the Development Services Department. Plans will not be checked until fee is paid.

Once the plans are approved and construction permit issued, the Consulting Engineer for private development projects shall be responsible for providing inspection and surveying services necessary to stake and construct the project. The Consulting Engineer shall prepare the as-built drawings when the project is complete.

The Consulting Engineer preparing the plans for a privately funded public improvement project shall execute a "City of Oregon City, Developer/Engineer Agreement for Public Works Improvements". This agreement provides for the following services from the Consulting Engineer:

1. Perform surveying sufficient to prepare construction plans.
2. Prepare construction plans and specifications, and obtain approvals.
3. Attend a preconstruction meeting.
4. Perform construction staking and inspection.

If the consulting engineer is not furnishing all of the above services, the specific arrangements, i.e., subcontracting, must be supplied to the City. The name, address and telephone number of consulting engineer, surveyor and contact person shall be included.

Should the services of the consulting engineer be terminated or curtailed below the specified tasks, he/she shall correspond with the City so indicating.

The consulting engineer doing inspection for a privately-funded public improvement project shall follow the City's "Minimum Guidelines for Inspection/Observation of Public Works Construction " or similar policy.

It shall be the policy of the City of Oregon City to provide spot check only inspection services for non-public funded public improvements. A 2½ percent inspection fee, (or currently established fee, fee is a percentage of an approved engineer's cost estimate) will be collected at the time the plans are approved. This inspection fee is in addition to the plan check fee. A permit is issued for construction when the following items are provided :

1. Approved Engineering Plan,
2. Engineer's Final Cost Estimate (or Opinion of Probable Cost),
3. Accepted Geotechnical Report (if required),
4. Accepted Natural Resource Pan (if required),
5. Performance Bond,
6. Developer/Engineer Agreement,
7. Erosion Control Permit (if required),
8. Permits from other jurisdiction if working in their right of way,
9. Approval from State of Oregon Health Division (if City does not continue its program to approve plans on behalf of the State),
10. Any other permits required from any other agencies having jurisdiction on the project

A project becomes accepted by the City when construction is complete and the following have been completed or obtained :

1. Two-Year Maintenance Bond
2. Consulting Engineer's Certificate of Completion
3. Completed Punchlist
4. Recorded Subdivision or Easement Document (when required)

A sewer main becomes owned, operated, and maintained by the City once the maintenance period is over any deficiencies have been corrected.

2.07 SANITARY SEWER MASTER PLAN REQUIREMENTS

The City uses the current adopted Sanitary Sewer Master Plan to recommend improvements to the existing and future distribution system. These recommendations shall be included in the design; however, they may be modified based on updating of the Master Plan or updated computer model runs for specific design requirements.

2.08 PIPE MATERIAL

Pipe materials shall conform to the current edition of "Standard Specifications for Public Works Construction" by APWA as adopted and modified by the City.

All public sanitary sewers shall be constructed with PVC 3034 DR 35 pipe. Where required for added strength, Class 50 Ductile Iron pipe shall be used. C900 pipe may be used in place of ductile iron pipe.

Concrete pipe may not be used on mainline and lateral sewers due to high infiltration problems caused by Oregon City's high groundwater. Concrete pipe which is not centrifugally cast has numerous pinholes which add to the infiltration problem. Tests have shown that infiltration is also directly related to the number of joints in the line installed.

Design engineers are encouraged to specify pipe materials that have a long length between joints and which are not porous in nature.

The type of acceptable sewer pipe shall be called out in the Construction Notes or on the plans.

Acceptable abbreviations for existing and proposed types of pipe are as follows:

ABS - Acrylonitrile Butadiene Styrene

AC - Asbestos Cement

CI - Cast Iron

DI - Ductile Iron

PVC - Poly-Vinyl Chloride

VC - Vitrified Clay

NRCP - Non-reinforced Concrete Pipe

RCP - Reinforced Concrete Pipe

A. US Made Products

All materials shall be made in the United States of America unless approved by the City Engineer. Exceptions to US Made may only be approved by the City Engineer if the product is not available in the USA or if the City Engineer determines that the lead time required will negatively affect the general public.

B. Minimum Pipe Cover

MINIMUM PIPE COVER

Type of Pipe	Paved Areas (inches)	Unpaved Areas (inches)
Other Approved Pipe	48	36
RCP Class III	30	18
RCP Class IV	24	12
RCP Class V	18	6
AWWA C900	24	12
AWWA C905	24	12
Ductile Iron	18	6

2.09 PIPE SIZE

Sewer mains (public sewers) shall not be less than eight inches (8") inside diameter, except that for short non-extendable sections up to 250 feet in length the minimum diameter may be reduced to six inches (6") per the Oregon Administrative Rule, Chapter 340, Div. 52, APPENDIX "A". Sewers shall be sized to handle the ultimate flows as determined in the Sewer Master Plan.

Sewer mains (public sewers) shall begin at a manhole and shall terminate at a manhole except that a cleanout may be used at the upper end of a sewer that will be extended on the same grade and alignment during the next construction phase.

2.10 MINIMUM/MAXIMUM SLOPES

A. Minimum Slope

All sanitary sewers shall be laid on a slope which will produce a mean velocity, when flowing full of at least two feet (2') per second, which is based upon Manning's pipe friction formula, using a roughness coefficient, valued at not less than 0.013, or the pipe manufacturer's recommendations, whichever is greater. The minimum acceptable slope for various pipe sizes with an "n" value of 0.013 are listed below:

<u>Inside Pipe Diameter</u>	<u>Slope</u>
(inches)	(feet per 100 feet)
6	0.60 (preferably 1.00)
8	0.40 (preferably 0.75)
10	0.30
12	0.22
15	0.15
18	0.12
21	0.10
24	0.09
27 (and larger)	0.08

The preferable slope shall be used in all cases unless an exception is approved by the City Engineer.

In general, slopes greater than those shown above are desirable and are particularly recommended on the upper ends of sewers. The preferable slope shown shall be used in all cases without exception for the last 400 feet of non-extendable sewers.

In theory, new PVC sewers have a manufacturer's "n" value of 0.009; however, sand and grit as well as slime build-up on the pipe walls renders a true "n" value with time of 0.013; hence, an "n" value of less than 0.013 will not be considered for approval.

Engineers are cautioned not to specify sewers of sizes which are obviously larger than is necessary for satisfactory carrying capacity, but which are specified in order to meet grade requirements, i.e., a ten inch (10") pipe for an eight inch (8") pipe to acquire a decrease in slope.

B. Maximum slopes

Grades (slopes) shall be determined to the center of the manhole. The average between any inlet slope S_i and outlet Slope S_o across the manhole shall not exceed 0.25 foot per foot, or 25%.

$$\frac{S_i + S_o}{2} = \text{less than } 0.25$$

The intent is to prevent the difference in pipe inverts at the manhole wall on steep sewers from exceeding one foot (1'), which with the offset permitted in 2.10 d, renders it impossible to insert a TV camera into the outfall line if the average slope exceeds 0.25 or 25%. Application is to sewers with a slope in excess of 19 percent.

2.11 ELEVATION OFFSET AT MANHOLES

Standards for elevation differences at manholes have been established to compensate for normal energy losses and to prevent surcharging of a sewer by a larger sewer. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the intersection of the sewer centerlines (usually the center of the manhole). The rules for elevation differences at manholes are:

- a) The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer. This is assuming all incoming lines are equal to or smaller than outgoing lines.
- b) If the deflection angle of the sewer alignment at a manhole is less than 45° , the invert elevation difference shall be at least 0.10 foot.
- c) If the deflection angle of the sewer alignment at a manhole is 45° or greater, the invert elevation difference shall be 0.20.
- d) If there is a grade conflict with an existing utility, the maximum offset may be one foot (1') if approved.
- e) The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole.

- f) See Section 2.16d, Drop Manholes.
- g) All connections must enter the manhole through a channel in the base. This includes drop connections, lateral sewer where allowed, and connections to existing manholes.

Where conditions make compliance with these standards impractical, exceptions will be permitted. It will be necessary; however, for the designer to provide a complete analysis of the need for such designs.

2.12 ANCHOR WALLS AND HIGH VELOCITY REQUIREMENTS

Sewers on slopes of twenty percent (20%) or more shall be secured by anchor walls in accordance with the City's Anchor Wall Standard Details. Spacing for anchors shall be per the City's Standard Detail.

Where velocities greater than fifteen feet (15') per second are attained, the pipe material shall be ductile iron and special provision shall be made to protect manholes against erosion and displacement by shock. This may be accomplished by installing additional manholes to decrease the slope or to split a large horizontal direction change into smaller incremental changes.

2.13 MINIMUM DEPTH

All sanitary sewer mains shall be laid at a depth sufficient to drain building sewers, to protect against damage by frost or traffic and to drain basement sewers where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the sewer alignment.

Under normal conditions, sanitary sewer mains in residential areas shall be placed in the street with the following minimum cover:

Lateral Sewer - Four feet (4')

Main and Trunk Sewer

- In the roadway - Eight feet (8')

- In easements - Six feet (6')

Where the topography is relatively flat and existing sewers are shallow (five feet (5') or less), the minimum cover may be three feet (3'). Less than three feet (3') of cover will

require the installation of ductile iron pipe. See Table 2.1 for class of pipe required.

In new residential hillside subdivisions, mainline and lateral sewers shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street (three feet (3') plus 2 percent grade to building site).

Deviation from the above standards will be considered on a case-by-case basis when one (1) of the following circumstances exist:

- a. Underlying rock strata - required: A request in writing to the City Engineer together with submission of a soils report with a plan and profile certifying that bed rock exists three feet (3') below the undisturbed ground surface at all investigated alignments is required.
- b. A ditch or stream must be crossed - required: A plan and profile; horizontal scale 1" = 20', vertical scale 1" = 2' is required.

TABLE NO. 2.1

Pipe Class Requirement

(Sewer less than 3' of Cover)

PIPE SIZE (in.)	DEPTH OF COVER (Ft.)	IN FILLS - USE D. I. class	TRENCH - Use D. I. class
4	0.5	51	51
	1.0	51	51
	1.5	51	51
	2.0	51	51
6	0.5	53	50
	1.0	51	50
	1.5	50	50
	2.0	50	50
8	0.5	54	50
	1.0	52	50
	1.5	50	50
	2.0	50	50

2.14 LOCATION

a. Relation to Water Lines and Other Utilities

No sanitary sewer shall be less than fifty feet (50') from any well, spring, or other source of domestic water supply unless approved by the City Engineer. All sanitary sewers or parts thereof which are located within fifty feet (50') from any such source of domestic water supply shall be constructed of ductile iron water pipe with watertight joints, or by other DEQ approved pipe.

Sanitary sewers and domestic water lines shall not be laid in the same trench. Parallel water and sewer lines shall be located at least ten feet (10') apart horizontally where there is less than 18 inches of vertical clearance between the water and sewer lines. In all instances, in this section and the following sections, distances are measured edge to edge. When physical conditions render this spacing impossible or impractical, then ductile iron water pipe with watertight joints will be required for the sewer line, Construction Standards, as outlined per the Oregon Administrative Rule Chapter 333-61-050, shall be followed.

Wherever it is necessary for sewer and water lines to cross, the crossing should be at an angle of approximately 90 degrees and the sewer shall either be located 18 inches or more below the water line or be constructed of ductile iron water pipe with watertight joints for a distance of nine feet (9') from both sides of the water line.

When a sanitary sewer line is crossing less than 12 inches below a storm drain line which is 12 inches or greater in diameter, the sewer line must be constructed with ductile iron pipe for the structural integrity of the sanitary sewer line. The intent is to prevent broken or deformed sanitary sewer lines installed with storm drains in close proximity.

Where sanitary main or trunk sewers are being designed for installation parallel to other utility pipe or conduit lines, the vertical location shall be in such a manner that will permit future side connections of main or lateral sewers and avoid conflicts with parallel utilities without abrupt changes in vertical slope of the main, lateral side, or building sewers.

b. Sewers in Streets or Easements

Under normal conditions, sewers shall be located in the street right-of-way five feet (5') from the street centerline on the North and West side of the street, unless there is an advantage to locating it on the low side of the street.

If streets have curved alignments, the center of the manhole shall be not less than six feet (6') from the curb face on the West side of the curve nor the sewer centerline less than ten feet (10') from the curb face on the East of the curve. The intent is to prevent a conflict with new storm drain and water lines while still providing for the

least number of manholes required to traverse a curve, and prevent a conflict with survey monuments required by Oregon City Code.

Sewers in easements will be allowed only after all reasonable attempts to place the mains in the right-of-way have been exhausted. Provisions shall be made for vehicular access to manholes and services for preventive maintenance and emergency service.

When it is necessary to locate sewers in easements, the sewer shall be centered in the easement and the conditions of the easement shall be such that the easement shall not be used for any purpose which would interfere with the unrestricted use for sewer main purposes. Under no circumstances shall a building or structure, tree or fence, be placed over a sanitary sewer main or within a sewer easement.

Sewers laid in easements along property lines, with easement's center on the property line, shall have the sewer and the easement centerline offset thirty inches (30") from the property line.

Easements for sewers less than 15 inches in diameter shall have a minimum width of fifteen feet (15'). Sewers greater than 15 inches in diameter, shall have a minimum easement width of twenty feet (20'). Deviations from these minimum widths shall be subject to approval of the City Engineer,

Easement locations for public sewer mains serving a Planned Development, apartment complex, or commercial/industrial development shall be located in parking lots, private drives, or similar open areas which will permit an unobstructed vehicle access for maintenance by City forces.

Sewers with more than six feet (6') of cover and/or inside diameters 24 inches or greater will require wider easements. A slope of one (1) horizontal to one (1) vertical from the sewer invert to ground surface will be used in determining easement width. Easement widths shall vary from the fifteen foot (15') minimum by five foot (5') increments (i.e., 15, 20, feet), etc.

Common placement in the easement of sewer and storm drain line may be allowed under certain conditions subject to approval by the City Engineer. Common easements will be reviewed on a case-by-case basis. Separation of utilities must also meet Oregon State Department of Environmental Quality (DEQ) requirements.

All easements must be furnished to the City for review and approval prior to acceptance by the City Commission and recording. Standard City utility easement document forms and guidelines for preparation of descriptions and sketches shall be used.

c. Relation to Streams and Drainage Channels

Generally the top of all sanitary sewers entering, crossing, or adjacent to streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. One foot (1') of cover is required where the sewer is in rock, three feet (3') of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least six inches (6") below finish grade of the bottom of the channel. Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to provide for future possible stream channel widening. All manhole covers shall be leak proof per City Standard Details at or below the 100 year flood elevation.

Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible.

Pipe material shall be ductile iron Class 50 or C900 with an 18 foot length of pipe centered on the stream or drainage channel centerline. The ductile iron pipe shall extend to a point where a one to one slope, that begins at the top of the bank and slopes down from the bank away from the channel centerline, intersects the top of the pipe.

Concrete encasements, per City Standard Details will be required when the above cover requirements cannot be met. Any deviation from the above requirements will be reviewed on a case-by-case basis.

All crossings of streams and drainage channels shall include a1 geotechnical report addressing design, scour, velocity, erosion, protective measures, etc.

2.15 ALIGNMENT

Sewer lines shall be laid on a straight alignment and uniform slope between consecutive manholes.

Horizontal and vertical curves in sanitary sewers are not permitted.

See related comments under Location, Section 2.14.

2.16 MANHOLES AND CLEANOUTS

a. Cleanouts

Cleanouts will not be approved as substitutes for manholes, except at the upper end of main sewers that will be extended on the same grade and alignment during the next construction phase. All cleanouts will be considered in a case-by-case basis and approved by the City Engineer.

b. Manhole Taps

When an existing manhole is tapped to install a new sewer main or lateral, the new sewer shall enter the manhole with the invert a minimum 0.25 feet below the floor elevation (or shelf) of the manhole and a channel shall be formed in the floor of the manhole to the invert of the existing sewer.

c. Manholes

Manholes shall be placed at the following locations:

- 1) Every change in grade (grade break) or alignment of a sewer.
- 2) Every point of change in size or abrupt invert elevation (drop) change of a sewer.
- 3) Each intersection or junction of a sewer.
- 4) Upper end of all main sewers, except as provided in (a) above.
 - (a) Adjacent to the radius point of a cul-de-sac.
 - (b) In front of the last property or lot being served, ten feet (10') past the common lot line of the adjoining parcel served.
- 5) At intervals of 400 feet or less. Deviation from this requirement will be reviewed on the basis of whether or not flushing and cleaning equipment can adequately service the sewer line.
- 6) At any point where a service lateral or private sewer of eight inches (8") or larger intersects a sewer main.

Manholes shall not be located in the curb or in the gutter. Placement of manholes behind the curb shall be reviewed on a case-by-case basis for approval. Consideration shall be given to those sewers which already exist behind the curb. Also see Section 2.14B, Location, Sewer in Streets or Easements.

Two (2) manholes shall be installed when the horizontal deflection angle between tangents on a sewer main exceeds 105° for a new line connecting into an existing main. Spacing of such manholes shall be a minimum of ten feet (10') outside to outside. The intent is to prevent a new sewer connection from discharging into an existing sewer opposing the existing flow.

Where practical, manholes shall be located at street intersections. All manholes from which future sewer line extensions are anticipated, shall have a pipe stub planned and installed at the grade and direction of the anticipated sewer main extension. Pipe stubs shall be a minimum of eight inches (8") in size and shall protrude at least one foot (1') outside of the manhole base.

Risers shall be used to bring casting to grade. Combined riser sections shall not exceed twelve inches (12") in height between cone and casting.

d. Drop Manholes

Outside drop assemblies shall be provided for pipe lines 12 inches in diameter and smaller when entering a manhole at a distance of more than 24 inches above the invert of the outlet line. The vertical displacement shall be measured at the inside manhole walls and not the manhole centerline. Larger pipe lines shall be introduced into the manhole at the manhole invert. See Section 2.11, Elevation Offset at Manholes.

Drop manholes shall only be used in extreme cases of slope difference between existing and proposed sewer lines or when very special conditions exist such as a conflict with existing facilities which cannot be relocated.

It shall take the written approval of the City Engineer after review of the plans by the Public Works Department.

e. Drop Across the Structure

See Section 2.11, Elevation Offset at Manholes.

f. Monitoring Manhole

A monitoring manhole shall be required at the property line upstream from the manhole connection of the City sewer main for non-residential applications (see Water Environment Services Non-residential questionnaire) as may be required by Tri-City Service District (Water Environment Services), Clackamas County.

g. Miscellaneous

Where manhole rims are two feet (2') or greater above grade of finished ground, the manhole lid shall be made of aluminum.

2.17 LATERAL SEWER SERVICE LATERAL) & PRIVATE COLLECTOR SYSTEMS

A. Lateral Sewer

See definition for lateral sewer under Section 1.07.

Each individual building site shall be connected by a separate private building sewer service line connected to the public sewer. Combined building sewer lines will be permitted only when the property cannot legally be further divided. An example of this is a residential lot with a house and an unattached garage or shop with plumbing facilities.

The minimum inside diameter of a sewer service lateral shall be four inches (4") and shall be equal to or greater than the building sewer diameter. Service laterals to be built to the same construction standards and of the same materials as the sewer mainline.

Service laterals in general shall be placed at 90 degrees to the main sewer line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90 degrees may be approved for special conditions such as cul-de-sac lots. Service line connections shall not be made at manholes, except at cul-de-sacs where the sewer main will not be extended. All connections at manholes shall be considered on a case-by-case basis and approved by the City Engineer.

The minimum slope of lateral sewers shall be 2.00 percent (V• inch per foot) except that for unusual conditions, a slope of 1.00 percent (1/s inch per foot) may be approved. It will be necessary; however, for the designer to provide a complete analysis of the need for any sewer service lateral slope less than 2.00 percent. The maximum slope shall be 100.00 percent (45 degrees or one foot per foot). Deep connection risers (see the Standard Detail for service laterals to deep sewers) or drop connections to manholes must be used where service line slopes would exceed 100 percent.

Tees for service laterals shall be installed at 100% slope and with 1/16 or 1/8 bends installed to provide proper grade for service lateral. Service laterals shall be installed to the street right-of-way line or easement line. A water tight plug shall be installed in end of lateral and a 2" x 4" pressure treated wood marker shall be placed at lateral end, from pipe invert to two feet (2') above the ground. 2" x 4" top to be painted white and marked with an "S" and the depth of the lateral measured from ground to invert of pipe. Curb Sanitary Design Standards 30 June 1993 line to have an "S" stenciled in black paint on face of curb at lateral crossing. A tracer wire (green 18 gauge, insulated copper wire) shall be installed from the mainline to the surface at the 2x4 marker.

Tees shall be located no closer than five feet (5') to manholes or other tees. Tees shall be located near the low side of lots.

Lateral connections shall be a minimum of 18" apart on the mainline.

All sanitary sewer service laterals shall have a 2-Way Cleanout at the right-of-way line per Oregon City Standard Drawings.

B. Building Sewer

The building sewers are those private sewer lines which connect the building drain to the public service lateral, or the private collection system. Building sewers are installed and maintained by property owners.

Building sewers shall conform to the Oregon Plumbing Specialty Code. No roof, surface, foundation, or stormwater drain lines shall be connected to the public sewers.

Building sewers clean-outs shall be installed at the right-of-way and at 100 foot intervals thereafter per the Oregon Plumbing Specialty Code. Building sewers shall have at least four feet (4') of cover at the property line. Generally the topography of the property will dictate how deep the building line must be.

Each individual building site shall be connected by a separate building sewer line connected to the public or private collector sewer. Combined building sewers will be permitted only when the property cannot legally be further divided, subject to approval of City Engineer.

The inside diameter of a building sewer shall be a minimum of four inches (4") and shall be equal to or greater than the building plumbing stub diameter. The minimum inside diameter of building sewers to serve multi-family dwellings or commercial buildings shall be six inches (6"). Fixture unit equivalents in accordance with the Oregon Plumbing Specialty Code shall be used to determine the size of the side sewer.

A building sewer serving a single residence may cross one private property provided a private easement is obtained and the route is approved by the City Engineer.

Minimum sizes and slopes for building sewers, based on the fixture unit equivalents, shall not be less than indicated below:

FIX UNIT EQUIV.	FIXTURE UNITS	4" Dia. Pipe	6" Dia. Pipe	8" Dia Pipe
0-100	Single-Family Residential	2%	N.P.	N.P.
0-800	Other	N.P.	1.1%	N.P.
800-2700	Other	N.P.	3.2%	0.77%

(N.P. = Not Permitted)

A backwater check valve, as specified in Oregon Plumbing Specialty Code, shall be installed when the lowest floor level of a house to be connected to the public main sewer is below a point which is 12 inches above the top of the nearest upstream manhole or cleanout structure. A gate valve in addition to the required backwater check valve is optional but should be considered for installation for additional protection should the backwater valve fail or become clogged with debris.

C. Private Collection System

A private collection system is a privately owned and maintained sewer system installed to serve multi-unit structures on single ownership properties, 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.

Private collection system sewers shall conform to the Oregon Plumbing Specialty Code with the following exceptions:

- 1) Manholes are recommended on lines six inches (6") or larger if there are branches downgradient of six inches (6") or larger that serve more than one (1) structure. The spacing shall be per the Oregon Plumbing Specialty Code (300 feet).
- 2) Manholes are required if a line has the potential of becoming a public line when phasing of a project is involved.
- 3) A manhole is required at the connection to the City Sewer Main.
- 4) The minimum depth for line sizes 6 inches or greater shall be six feet (6') to prevent utility conflicts unless a variance is requested and approved.

- 5) A monitoring manhole is required at the property line upstream from the manhole connection at the City Sewer Main for non-residential applications (see Water Environment Services Non-residential questionnaire) as may be required by Tri-City Service District (Water Environment Services), Clackamas County.
- 6) If the grade requirements of the Oregon Plumbing Specialty Code cannot be met, grade standards for public sewers can be used if manholes are provided, and Clackamas County Plumbing Department approves.

The monitoring manhole shall consist of a standard 48" manhole with the inlet pipeline invert placed 0.4 foot above the outlet invert. The inlet pipe shall extend one foot (1') past the manhole wall and shall be cut in half six inches (6") from the outfall end and the top half of the pipe removed. The channel shall be formed from the outfall end to the outlet line in the usual manner.

The intent is to provide a half round section of pipe inside the manhole into which City personnel will place a flow monitoring equipment.

D. Locating Building Sewers and Private Collection Systems

All building sewers and private collection systems shall have an electrical conductive tracer wire, 18 gauge minimum size, insulated copper, and green sheeting, installed in the trench for the purpose of locating pipe in the future. The tracer wire shall run the length of the installed pipe, with one end located around the mainline or lateral. The other end of the tracer wire shall be of sufficient length for an electrical conductive splice.

2.18 SANITARY SEWERS FOR FLOATING STRUCTURES

- a. Floating structure sanitary sewers shall consist of pressurized flexible main lines insulated against freezing and restrained against transverse movement which are connected to the public main through a monitoring manhole on shore.
- b. Each dwelling containing plumbing facilities shall have a holding tank and grinder pump connected to the pressurized line. Said connection shall be by a detachable coupling with a gate valve and check valve installed downstream of the connection. The gate valve shall be on the pressure line side followed by the check valve before the detachable coupling.

c. Details of the following must be submitted along with plan and profiles:

Mooring methods and devices;

Methods of insulating pipeline against freezing;

Pipeline hangers;

Flexible connections and appurtenances;

Dock or walkway to which facilities are connected.

d. Profiles shall include not only the land based sewer connection but also the high, low, and 100 year flood water surface elevation with details of how the pipeline system is to react to said water surface elevation changes.

2.19 ABANDONING FACILITIES

The Contactor shall seal the open ends of all pipes, etc. that are to be abandoned with an end cap, coupling, or a concrete plug with a thickness equal to the diameter of the pipe which is permanent water tight. The Public Works Department requires that all abandoned piping be severed as close to active piping as practical.

All service lines are required to be abandoned at or near the sewer main. All other parts of the service lines and other appurtenances are to be cut off and removed at 24 inches minimum below finish grade.

Structures (manholes, cleanouts, etc.) shall be removed completely to eliminate conflict with any future utility improvements. Abandonment of structures shall be completed only after piped systems have been properly abandoned.

Abandoned cleanouts in pavement areas shall be cut off 24 inches below grade, removed, gravel filled, and plugged with compacted asphalt. Cleanouts outside of pavement areas shall be cut off 24 inches below grade, removed, and filled with native backfill.

The Public Works Department has first claim to any removed or abandoned sanitary materials. The Contractor shall dispose of all unwanted materials in an approved manner.

2.20 PIPE BEDDING AND TRENCH BACKFILL

All trench excavation shall be in conformance with Oregon City Standard Drawing for Pipe Bedding and Backfill, and shall be classified as either rock or common excavation. All excess material from the trench excavation shall be disposed of to an approved site.

Pipe bedding and trench backfill may be Class A on all sewer lines outside public streets or outside of paved areas. Trench backfill shall be Class B in all public streets or paved areas in the project as outlined in Oregon City Standard Drawing for Pipe Bedding and Backfill. The Class B backfill shall extend a minimum of three feet (3') beyond the edge

of street or hard surfaced areas. CDF Backfill may be required instead of Class B as applicable per Oregon City Pavement Cut Standard.

Trench backfill compaction shall be 95% of AASHTO T-180 Modified Proctor from top of pipe zone up to road base. Contractor to determine type of equipment and method to use to achieve the required compaction. 95% compaction, AASHTO T-180, is required in public streets and paved areas, 85% compaction of AASHTO T-99 in non-paved or unimproved areas.

2.21 TESTING

All sewer lines shall be tested and video inspected by the contractor per latest edition of APWA/ODOT Oregon Standard Specifications for Construction with the exception that, all lines shall be video inspected downstream, with the flow.

All manholes shall be vacuum tested per APWA/ODOT Oregon Standard Specifications for Construction.

2.22 AS-BUILT DRAWINGS/DIGITAL MAPPING REQUIREMENTS

For the purposes of this section, as-built drawings will also mean drawings of record, record drawings, or terms indicative of an attempt to record the as-constructed state of the improvement.

Following completion of construction, the Consulting Engineer shall submit as-built drawings in the form requested by the City Engineer. As-built drawings shall be the same size and format as the construction plans. As-built drawings shall describe all revisions to the previously approved construction plans. The Consulting Engineer shall also certify that the public improvements have been completed in accordance with the City of Oregon City Public Works Standards and Specifications to the best of his/her knowledge. (This is completed with a Certificate of Completion) The words “As-Built Drawing” or “Record Drawing” shall appear as the last entry in the revision block along with the month, day, and year the as-built drawing was prepared. Submission of as-built drawings shall be made within 90 days of acceptance by the City. The cost to produce these as-built drawings shall be included in the Consulting Engineer’s cost estimate for establishing the surety amount for the performance surety. Failure to submit these as-built drawings shall be grounds for withholding final release of the surety amount.

The Consulting Engineer shall provide design calculations and complete test results to the City Engineer.

All as-builts shall follow the most recent version of the City of Oregon City’s “As-Built Drawing and Post Construction Survey Requirements”

The following minimum information shall be noted on sanitary sewer as-built drawings:

1. Generally, the location of manholes (with rim, bottom, and invert elevations), cleanouts, laterals shall be shown.
2. Station and/or property line/corner to manholes and service laterals.
3. Slope of all sewer mains and laterals.
4. Show material type of all sewer mains and laterals.
5. Any other change altering the approved plans.
6. Actual location and depth from finish grade of street of any other utilities encountered during construction.

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City of Oregon City
Public Works Standard Drawings

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