

# **ENGINEERING STANDARDS**



**For**

## **Public Works Construction**

**Trevor Evers**  
**Director of Public Works**  
**February 2010**

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**Chapter 1 – General Design Requirements**

**Chapter 2 – Erosion Control, Clearing and Grading**

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# Chapter 1

## General Design Requirements

City of Washougal Engineering Standards for Public Works Construction  
February 2010  
Director of Public Works: Trevor Evers

**Chapter 1**  
**General Design Requirements**

City of Washougal Engineering Standards for Public Works Construction  
February 2010

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## **CHAPTER 1 - GENERAL DESIGN REQUIREMENTS**

### **1.00 Requirements for Public Improvements**

#### **A. General**

The purpose of this document is to set standards for the design and construction of public improvements. These include street, bikeway, drainage, water, and sanitary sewer improvements as required by the development review process, City ordinance, and other City policies adopted by the City. Standards for site grading, erosion control, parking lot, private street, and driveway construction on private property are also contained in these standards. No such work shall commence prior to City approval of the construction plans. Design submitted shall be stamped by a registered professional engineer licensed to practice in the State of Washington, or as otherwise approved by the Director.

All public improvements and private streets, parking lots, sidewalks, and driveways shall be designed and constructed in such a manner as to be readily accessible to and usable by individuals with disabilities as per the requirements of the Americans with Disabilities Act. This includes providing curb ramps at intersections with pedestrian crosswalks to allow a smooth transition between street and sidewalk elevations.

#### **B. Shortened Designation**

These City of Washougal Engineering Standards shall be cited routinely in the text as the "Standards."

#### **C. Applicability**

These Standards shall govern all new construction and upgrading of facilities both in the right-of-way and on-site for: transportation related facilities; storm drainage facilities and stream channel improvements; sewer and water improvements; and park, recreation, and open space facilities used by the public.

### **1.01 Precedence of Documents**

If there is a conflict between approval documents, the document highest in precedence shall control. The precedence shall be:

- First: Permits from other agencies or jurisdictions, as may be required by law.
- Second: Modifications to the Engineering Standards as approved by the Director.
- Third: Hearing examiner conditions of approval, facilities review, and site development permit.
- Fourth: City of Washougal Ordinances.
- Fifth: City of Washougal Engineering Standards and Standard Drawings.
- Sixth: Plans and details prepared by the design engineer.
- Seventh: WSDOT Standards Specifications for Road, Bridge, and Municipal Construction.

Eighth: Reference specifications.

Supplemental written agreements and approved revisions to plans and specifications by the appropriate jurisdiction will take precedence over documents listed above. Detailed plans shall have precedence over general plans.

## 1.02 Abbreviations and Definitions

Definitions, for these standards, shall be as defined in the Stormwater Management Manual for Western Washington (WWM) or as otherwise listed below:

<i>AASHTO</i>	American Association of State Highway and Transportation Officials.
<i>AC</i>	Asphaltic Concrete.
<i>ACI</i>	American Concrete Institute.
<i>ADA</i>	Americans with Disabilities Act.
<i>ADT</i>	Average Daily Traffic.
<i>ALTA</i>	American Land Title Association.
<i>ANSI</i>	American National Standards Institute.
<i>Appurtenance</i>	Any fixed object located adjacent to the roadway and deemed to be a possible safety hazard or as defined in the WWM.
<i>APWA</i>	American Public Works Association.
<i>ASTM</i>	American Society for Testing and Materials.
<i>AWWA</i>	American Water Works Association.
<i>Bicycle</i>	A vehicle having two tandem wheels, propelled solely by human power.
<i>Bicycle Facilities</i>	A general term denoting improvements and provisions that accommodate or encourage bicycling, including parking facilities, maps, signs, pathways, bike lanes, widened sidewalks, bikeways, and shared roadways designated for bicycle use.
<i>Bicycle Lane (Bike Lane)</i>	A portion of a roadway, which has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists.

<i>Bicycle Path (Off-Street Pathway)</i>	A paved pathway physically separated from motorized vehicular traffic by an open space or barrier within an independent right-of-way.
<i>Bicycle Route (Bike Route)</i>	A segment of a system of bikeways designated by the jurisdiction having authority with appropriate directional and informational markers, with or without a specific bicycle route number, or as designated on a bicycle map, brochure, or guidebook.
<i>Bikeway</i>	Any road, path or way specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.
<i>CARV</i>	Combination Air and Vacuum Release Valve.
<i>CBE</i>	Crushed base equivalent (CBE) is the number that directly relates the traffic coefficient to the required number of inches of rock for street structural sections.
<i>CBR</i>	California Bearing Ratio.
<i>CCCP</i>	City of Washougal Cross Connection Control Plan.
<i>City</i>	City of Washougal.
<i>Contractor</i>	The agent of the developer completing the construction activities associated with a given project.
<i>Developer</i>	The owner and/or their agents or contractors responsible for a given project.
<i>Director</i>	Director of Public Works or their designee.
<i>DOE</i>	Washington State Department of Ecology.
<i>DOH</i>	Washington State Department of Health.
<i>Driveway</i>	A public or private way, located outside of right-of-way, which affords the principle means of providing access to a property.
<i>Engineer</i>	Engineer doing the project design.
<i>EPA</i>	U.S. Environmental Protection Agency.

<i>FEMA</i>	Federal Emergency Management Agency.
Gate	Movable barrier designed and constructed to prohibit or limit motor vehicle access from a public street to private property.
<i>GPS</i>	Global Positioning System.
<i>IBC</i>	International Building Code with Washington amendments.
<i>IFC</i>	International Fire Code with Washington amendments.
<i>IE</i>	Invert Elevation.
<i>IMC</i>	International Mechanical Code with Washington amendments.
<i>IPC</i>	International Plumbing Code with Washington amendments.
<i>Intersection</i>	Refers to the area jointed by two (2) or more roads intersecting. For approaches of a continuous street at an acute curve or some other angle point with different street names.
<i>LID</i>	Low Impact Development.
<i>Low impact development</i>	An approach to stormwater management that emphasizes the use of onsite natural and built features to reduce the impacts of increased flow rates and volumes associated with increases in impervious area.
<i>LID Manual</i>	Low Impact Development, Technical Guidance Manual for Puget Sound
<i>Multi-Use Trail</i>	A pathway designated for pedestrian or bicycle use.
<i>MUTCD</i>	Manual on Uniform Traffic Control Devices.
<i>NEC</i>	National Electric Code with Washington amendments.
<i>OS and Y</i>	Outside Stem and Yoke.
<i>OSHA</i>	Occupational Safety and Health Administration.
<i>Parking Lot</i>	Paved surfaces on private property intended for the movement and storage of six (6) or more vehicles.

<i>PRV</i>	Pressure Reducing Valve.
<i>PSM</i>	Storm Water Management Manual for the Puget Sound Basin.
<i>RCW</i>	Revised Code of Washington.
<i>ROW</i>	Right-of-Way.
<i>Sidewalk</i>	The portion of a street designed for preferential use by pedestrians.
<i>Standards</i>	City of Washougal Engineering Standards.
<i>Standard Drawings</i>	The latest edition of the City of Washougal's standard details for public works construction.
<i>Street</i>	A public or private way, which affords the principal means of access to abutting property.
<i>TCDH</i>	Traffic Control Device Handbook.
<i>TIR</i>	Technical Information Report.
<i>Traffic Coefficient</i>	A number used in determining the structural section of a street.
<i>Trail</i>	In the context of the General Plan - "Trail" is synonymous with Bicycle Path (off-street pathway).
<i>UL</i>	Underwriters Laboratory.
<i>WAC</i>	Washington Administrative Code.
<i>WWHM</i>	Western Washington Hydrologic Model.
<i>WWM</i>	Stormwater Management Manual for Western Washington.

<i>Wetlands</i>	Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Identification and delineation of jurisdictional wetlands and wetland boundaries shall be done by a qualified biologist using applicable State and Federal guidelines.
<i>WMC</i>	Washougal Municipal Code.
<i>WSDOT</i>	The Washington State Department of Transportation.
<i>WSDOT Standard Specifications</i>	The latest edition of the "Standard Specifications for Road, Bridge, and Municipal Construction" as published by the Washington State Department of Transportation and the American Public Works Association.
<i>WSM</i>	City of Washougal Water System Master Plan.

### 1.03 Permits

Permits, approvals, or agreements are required by the City and some-times other jurisdictions, prior to initiating any construction or demolition work elements described within these Standards.

The majority of work covered under these Standards will require multiple permit authority review and approvals. Several types of permits and approvals require prior approval from the authority before a building or other substantial permit can be issued. Any questions regarding information about permits, approvals, and agreements should be directed to the Director.

Grading permits, separate from construction plan approval, for developments may be issued at the discretion of the Director between July 1<sup>st</sup> and August 31<sup>st</sup>, provided that the Director may extend or shorten this time period on a case-by-case basis depending on actual weather conditions. The first review of the development's construction plans shall be completed prior to submittal of the grading permit application to the City.

### 1.04 Submittal Requirements

#### A. General

1. Submittal requirements consist of design plans, grading plans (where required), erosion control plans (where required), drainage calculations, geotechnical reports, and other information as required. Letters of transmittal referencing the project name shall accompany all submittals.

2. The Standard Specifications are hereby adopted and incorporated as part of this document by reference except as modified herein.

B. Design Plan Format

1. The plans shall be submitted on 22" x 34" sheets, landscape format.
2. Vicinity maps shall be located on the first sheet of all plans and shall show the location of the project in respect to the nearest major street intersection.
3. A north arrow shall be shown on each plan view sheet of the plans and adjacent to any other drawing, which is not, oriented the same as other drawings on the sheet.

Site Development Plans shall be organized as follows:

- a. Title sheet to include:
    - (i) Project name
    - (ii) Vicinity map
    - (iii) Name and mailing address of Developer/Owner, engineering firm, survey firm, and geotechnical engineer
    - (iv) City Standard Construction Notes
    - (v) Index of sheets
    - (vi) Notice to excavators
    - (vii) Legend that provides the name and symbol for all symbols used on the subsequent pages
    - (viii) Signature block, in the lower right quadrant, for the Public Works Director, Planning Director, City Engineer, and Fire Chief
  - b. Composite utility plan: include existing public and private utilities, and proposed public improvements.
  - c. Sanitary sewer and water, including fire hydrant locations.
  - d. Street and storm sewer, showing existing and finished contours at 2-foot intervals.
  - e. Grading and erosion control plan with maximum contour intervals of 2 feet. Contours shall extend offsite a minimum of 50 feet. This sheet shall also note the source of information, date of field work, and location of original document.
  - f. Approved preliminary plat (if it is a subdivision).
  - g. Landscape plan including sidewalks, bikeways, retaining walls, landscaping, irrigation, and lighting.
  - h. Signing and striping plan.
5. Details - All City Standard Drawings and details shall be full size.

6. The scale shall be 1-inch = 5 feet vertically, and 1-inch = 20 feet horizontally for all drawings. A scale of 1-inch = 10 feet may be used for more detailed drawings such as intersection drawings. The composite utility plan may be at a smaller scale if needed. Scale shall be shown with north arrow and within a title block.
7. Letter size shall not be smaller than 0.10 of an inch high.
8. The location and elevation of a National Geodetic Survey, United States Geological Survey, Clark County, or City of Washougal bench mark shall be shown. No other datum shall be used without permission of the City. Temporary control bench marks and elevations shall also be shown on the plans.
9. A title block shall appear on each sheet of the plan set and shall be placed in the lower right-hand corner of the sheet across the right-hand edge of the sheet. The title block shall include the name of the project, the engineering firm, the Owner, the sheet title, and the sheet number.
10. The seal of the registered Washington Professional Engineer responsible for preparation of the plans shall appear on each sheet.
11. The description and date of all revisions to the plans shall be shown on each sheet affected, and shall be approved and dated by the registered Professional Engineer of record as evidenced by an original signature or initial.
12. Through use of standard drafting symbols, indicate the location and direction of view for all sections.
13. The following statement shall appear on the cover sheet of all plans at a location immediately above or below the development engineer's professional stamp:

"I hereby certify that these plans, and related design, were prepared in strict conformance with the City of Washougal's Engineering Standards for Public Works Construction."
14. Plans for private utility work shall be submitted with construction plans.

#### C. Plan View

Plan views shall show the following:

1. Right-of-way, property, tract, and easement lines (existing and proposed).
2. Subdivision name, lot numbers, street names, and other identifying labels. Subdivision and street names are subject to the approval of the City Planning Director, Fire Chief, and County Surveyor.
3. Location and stationing of existing and proposed street center lines and curb faces.
4. Horizontal alignment and curve data of street center lines and curb returns.
5. Existing underground utilities and trees over 6-inches in diameter within the construction limit.
6. Location of existing buildings, wells, septic tanks, drain fields, fuel tanks, and any other buried structures. An ALTA survey shall be required for at least 100 feet

surrounding any of the above items to remain.

7. Location, stationing, and size of all mains and service lines for storm drainage, sanitary sewer, and water; and location of all fire hydrants. Sanitary sewer lateral locations are required in a 'Lateral Table'. Stationing shall be located in relationship to the street stationing at all manholes or other key locations.
8. Match lines with sheet number references.
9. Provisions for cross-connection control must be clearly shown on the plans, including any retro-fitting of existing water service connections and existing auxiliary water supplies, conversions to City of Washougal water service that are required as a condition of development approval, upgrading of existing service connections by replacement of same, and any other cross connection control required by state and local rules and codes.
10. Street stationing to be noted at a minimum of 100-foot stations.
11. Top of curb elevations along curb returns at quarter-delta's and 100-foot stations.
12. Location of the low points of street grades and curb returns.
13. Sidewalk locations. This shall include ramps, transitions in location or width, and relationship with driveways. Differentiate what sidewalks are proposed to be constructed with the street and what sidewalks are proposed to be constructed with the buildings, with hatching. Crown lines along portions of streets transitional from one typical section to another.
14. Centerline stationing of all intersecting streets.
15. Location and description of existing survey monuments, including but not limited to: section corners, quarter corners, donation land claim corners, and City bench marks.
16. Location of proposed street intersection monument boxes.
17. FEMA designated 100-year flood plains and flood ways, or areas of flooding during a 100-year storm event.
18. Wetland areas and storm water quality undisturbed corridors (buffer strips).
19. Legend.
20. Developer's name, address, and phone number.
21. Any additional information that the City deems necessary.

#### D. Profile View

Profile Views shall show the following:

1. Stationing, elevations, vertical curve data (including curve k factors), and slopes for center of streets or top of curbs. For off-set or super elevation cross-sections, both curbs shall be profiled. Where curbs are not to be constructed, center line of street and ditch inverts shall be shown.
2. Original ground along the center line, and if necessary at the edges of the right-

of-way if grade differences are significant.

3. Center line, top of curb, and gutter flow lines of existing streets for a distance of at least 300 feet each way at intersections with proposed streets. For stub streets that may be extended in the future, the vertical alignment shall be designed for at least 300 feet beyond the scope of the proposed construction. At the discretion of the City Engineer, additional design information concerning the vertical and horizontal alignment of future street extensions may be required.
4. Vertical alignment of streets, including existing center line monumentation.
5. The top of curb for all cul-de-sacs, eyebrows, and curb returns.
6. All proposed drainage facilities; all invert and top elevations, slopes, materials, bedding, and backfill.
7. Existing drainage facilities, including off-site facilities, upstream and downstream that affect the design (i.e. downstream restrictions that back water onto project site). In addition, base flood elevations shall be shown on the profile.
8. Profiles for ditch and creek flowlines shall extend a minimum of 200 feet beyond the project, both upstream and downstream. Typical cross sections at 50-foot intervals shall also be submitted.
9. Designate structures using alpha or numeric labels on profiles to correspond to plan view notation.
10. Profile for existing and proposed storm, sanitary, and water mains. Profiles for water mains less than 12- inches in diameter shall not be required unless so directed by the City Engineer.
11. All existing and proposed sanitary, water, storm lines, and other utilities crossing the profile.

#### E. Site Grading Plan

The City of Washougal requires a site-grading plan as part of the application for any development that involves the excavation or fill of greater than 50 cubic yards of material. Grading contours (existing & proposed) shall be at no more than 2-foot intervals, and shall extend off-site a minimum of 50 feet. This sheet shall also note source of information, date of fieldwork, and location of original document.

All soil disturbing construction activity must adhere to the requirements of Chapter 2. A detailed erosion control plan shall be shown in conjunction with the site-grading plan.

#### F. Detail Sheets

Detail sheets shall be provided as part of the Site Development Plans. The detail sheet shall show all City Standard Drawings and special details necessary for the project.

All City Standard Drawings and details shall be full size.

#### G. Other Requirements

Other information to be shown on the construction drawings or other submittals includes:

The design elements such as:

- a. Street classification;
- b. Design speed;
- c. Super elevation;
- d. Average Daily Traffic (ADT) or Design Hourly Volume (DHV).

Structural construction plans and the necessary calculations stamped by a structural engineer shall be submitted for proposed structures (i.e. walls, box culverts, bridges). A letter from the engineer approving installation of the structure shall be submitted prior to as-built approval.

Any additional information that the Director deems necessary to review the plans and assure compliance with design standards.

#### H. Preliminary Stormwater Plan Purpose

The purpose of the preliminary stormwater plan is to allow the City to determine whether a proposal will meet the requirements of these standards

1. The preliminary stormwater plan submittal shall consist of:
  - a. A preliminary development plan.
  - b. A preliminary technical information report (TIR) prepared in the standardized format described in the sections below.
2. The preliminary stormwater plan shall identify how stormwater runoff, that originates on the site or flows through the site, is currently controlled and how this will change with the proposed development or redevelopment project.
3. The project engineer shall include a statement that all the required information is included in the preliminary stormwater plan and that the proposed stormwater facilities are feasible. All plans, studies, and reports that are part of the preliminary and final stormwater plans shall be signed and dated by the registered soil scientist and the professional civil engineer(s) (registered in the state of Washington) responsible for preparation of the report.
4. To ensure adequate public review and avoid multiple reviews of preliminary reports by City staff, the preliminary stormwater plan shall not be significantly modified after public notice of the final SEPA determination without issuance of a new SEPA determination.
5. A preliminary stormwater plan shall be submitted with a land use application.

#### I. Preliminary Development Plan

The preliminary development plan shall consist of 22-inch x 34-inch drawings and may be included in the design plans.

The preliminary development plan shall show the character of the existing site and proposed features, including but not limited to:

1. Existing and proposed property boundaries, easements, and rights-of-way.
2. Existing and proposed contours with a 2-foot maximum contour interval, unless the Director determines a lesser interval is sufficient to show drainage patterns and basin boundaries.
3. Offsite areas contributing runoff to the site.
4. Natural and manmade drainage features adjacent to the site, including existing and proposed (if known) stormwater facilities.
5. Existing onsite water wells, known agricultural drain tiles, areas of potential slope instability, structures, utilities, and septic tanks and drain fields.
6. Location of the 100-year floodplain, floodways, and shoreline management area limits on the site.
7. Existing water resource features on and adjacent to the site, including streams, wetlands, springs, sinks, and stormwater facilities.
8. Existing and proposed drainage flow routes for each threshold discharge area (TDA) to and from the site, including bypass flows.
9. Proposed location of structural source control BMPs implemented in accordance with Minimum Requirement 3 (Source Control of Pollution), where applicable.
10. Point of discharge locations from the proposed project site that preserve the natural drainage patterns and existing outfall locations, in accordance with Minimum Requirement 4 (Preservation of Natural Drainage Systems and Outfalls).
11. Areas of the project site where onsite stormwater management BMPs will be effectively implemented, in accordance with Minimum Requirement 5 (Onsite Stormwater Management), including low impact development BMPs. The plan shall show the areas of retained native vegetation, required flow lengths, and vegetated flow paths for proper implementation of these BMPs.
12. All existing drainage facilities, including structural water quality or flow control BMPs and conveyance systems.
13. Existing and proposed pollution-generating pervious surfaces (PGPS), including lawn, landscaped areas, and pasture areas.
14. Existing areas of the site predominantly covered by native vegetation (i.e., native trees, shrubs, and herbaceous plants as defined by the Washington State Department of Ecology [Ecology]) and areas of native vegetation to be preserved under proposed conditions.
15. Approximate location and size of proposed runoff treatment and flow control facilities implemented in accordance with Minimum Requirements 6 and 7.
16. The delineated wetland boundary (for sites that discharge stormwater to a wetland, either directly or indirectly through a conveyance system, and must meet Minimum Requirement 8 [Wetlands Protection]).

17. A conceptual grading plan that verifies the constructability of a stormwater facility (for sites with slopes greater than 5 percent).
18. The Director may require additional site or vicinity information if needed to determine the feasibility of the stormwater proposal.

J. Preliminary Technical Information Report (TIR)

The preliminary TIR shall contain all technical information and analyses necessary to determine that the proposed stormwater facilities are feasible. The required contents of the preliminary TIR are identified below.

**Table of Contents**

1. List of section headings and their respective page numbers.
2. List of tables with page numbers.
3. List of figures with page numbers.
4. List of attachments, numbered.
5. List of references.

**Map Submittals**

All maps shall contain a scale and north arrow.

1. **Vicinity Map:** All vicinity maps shall clearly show the project site.
2. **Soils Map:** The soils map shall show soils within the contributing area that drains to the site itself. Soils maps may be obtained from the following sources:
  - Updated version of the Soil Survey of Clark County, Washington, originally published in 1972 and updated by the Natural Resources Conservation Service (NRCS).
  - Geographic information system (GIS) maps of soils from Clark County GIS.
  - Washington soil survey data as available on the NRCS website (<http://soils.usda.gov/>).
  - If the maps do not appear to accurately represent the soils on the site, the applicant is responsible for verifying the actual soils on the site.
3. **Other Maps:** The following additional maps shall be required in the situations noted:
  - Wellhead Protection. If the site lies within the 10-year time-of-travel zone of a public water supply well or within a Category I or II critical aquifer recharge area (CARA), maps showing all of the zones of contribution that overlap the site are required.
  - Floodplains. If a floodplain mapped by the Federal Emergency Management Agency (FEMA) exists on or adjacent to the site, a map showing the floodplain is required.

- Shoreline Management Area. If the site requires a shoreline permit, a map showing the boundary of the shoreline management area in relation to the site is required.

### **Section A – Project Overview**

1. Describe the site location.
2. Describe the topography, natural drainage patterns, vegetative ground cover, and presence of critical areas. Critical areas that receive runoff from the site shall be described to a minimum of ¼ mile away from the site boundary.
3. Identify and discuss existing onsite stormwater systems and their functions.
4. Identify and discuss site parameters that influence stormwater system design.
5. Describe drainage to and from adjacent properties.
6. For agricultural sites with drain tiles, discuss the impact of construction on the drain tiles, site drainage, and the impact of the drainage tiles on proposed stormwater facilities.
7. Describe adjacent areas, including streams, lakes, rivers, wetland and buffer areas, residential areas, and roads that might be affected by the construction project.
8. Generally describe proposed site construction, size of improvements, and proposed methods of mitigating stormwater runoff quantity and quality impacts.

### **Section B – Minimum Requirements**

Describe the land-disturbing activity and document the applicable minimum requirements for the project site. (See Chapter 4 of this manual for guidance.) Include the following information in table format:

1. The amount of existing impervious surface.
2. The amount of new impervious surface.
3. The amount of replaced impervious surface.
4. The amount of native vegetation converted to lawn or landscaping.
5. The amount of native vegetation converted to pasture.
6. The total amount of land-disturbing activity.

Provide a statement that confirms the minimum requirements that will apply to the development activity. For land-disturbing activities where minimum requirements 1 through 10 must be met:

1. Provide the amount of effective impervious area in each TDA, and document through an approved continuous runoff simulation model (e.g., the Western Washington Hydrologic Model [WWHM]) the increase in the 100-year flood frequency from pre-developed to developed conditions for each TDA.
2. List the TDAs that must meet the runoff control requirements listed in Minimum Requirement

3. List the TDAs that must meet the flow control requirements listed in Minimum Requirement 7.
4. List the TDAs that must meet the wetlands protection requirements listed in Minimum Requirement 8.

### **Section C – Soils Evaluation**

1. Describe the site's suitability for stormwater infiltration for flow control, runoff treatment, and low impact development (LID) measures.
2. Identify water table elevations, flow directions (where available), and data on seasonal water table fluctuations with minimum and maximum water table elevations where these may affect stormwater facilities.
3. Identify and describe soil parameters and design methods for use in hydrologic and hydraulic design of proposed facilities.
4. Report findings of testing and analysis used to determine the infiltration rate.
5. Where unstable or complex soil conditions exist that may significantly affect the design of stormwater facilities, the Director may require a preliminary soils report that addresses stormwater design considerations arising from soil conditions. The preliminary soils report shall be prepared by a registered professional engineer, licensed in the state of Washington, proficient in geotechnical investigation and engineering or a registered soil scientist. The preliminary soils report shall include a soils map developed using the criteria set in the NRCS National Soil Survey Handbook (NRCS 2007) and the SCS Soil Survey Manual (SCS 1993), at a minimum scale of 1:5,000 (12.7 inch/mile).

### **Section D – Source Control**

If the development activity includes any of the activities listed in Section 2.2 of Volume IV of the Stormwater Management Manual for Western Washington (WWM), identify the source control BMPs to be used with the land-disturbing activity.

### **Section E – Onsite Stormwater Management BMPs**

1. On the preliminary development plan or other maps, show the site areas where onsite stormwater management BMPs will be effectively implemented. (See Volume III, Chapter 3 and Volume V, Chapter 5 of the WWM). The plan must show the areas of retained native vegetation and required flow lengths and vegetated flow paths, as required for proper implementation of each onsite stormwater BMP. Arrows must show the stormwater flow path to each BMP.
2. Identify and describe geotechnical studies or other information used to complete the analysis and design of each onsite stormwater BMP.
3. Identify the criteria (and their sources) used to complete analyses for each onsite stormwater BMP.
4. Describe how design criteria will be met for each proposed onsite stormwater management BMP.

5. Describe any onsite application of LID measures planned for the project. Provide a plan that shows the proposed location and approximate size of each LID facility.
6. Identify and describe any assumptions used to complete the analysis.
7. Describe site suitability, including hydrologic soil groups, slopes, area of native vegetation, and adequate location of each BMP.

### **Section F – Runoff Treatment Analysis and Design**

For land-disturbing activities where the thresholds within Minimum Requirement 6 indicate that runoff treatment facilities are required:

1. Document the level of treatment required (basic, enhanced, phosphorus, oil/water separation), based on procedures in Volume V, Chapter 2 of the WWM.
2. Provide background and description to support the selection of the treatment BMPs being proposed. Include an analysis of initial implementation costs and long-term maintenance costs.
3. Identify geotechnical or soils studies or other information used to complete the analysis and design.
4. Identify the BMPs used in the design, and their sources.
5. Summarize the results of the runoff treatment design and describe how the proposed design meets the requirements of the WWM.
6. Provide a table that lists the amount of pollution-generating pervious surfaces (PGPS) and pollution-generating impervious surfaces (PGIS).

### **Section G – Flow Control Analysis and Design**

For land-disturbing activities where the thresholds within Minimum Requirement 7 indicate that flow control facilities are required:

1. Identify the site's suitability for stormwater infiltration for flow control, including tested infiltration rates, logs of soil borings, and other information.
2. Identify and describe geotechnical or other studies used to complete the analysis and design.
3. If infiltration cannot be provided for flow control, provide the following additional information:
  - Identify the areas where flow control credits can be obtained for dispersion, LID, or other measures, per the requirements in the WWM.
  - Provide the approximate sizing and location of flow control facilities for each TDA, per Volume III of the WWM.
  - Identify the criteria (and their sources) used to complete the analyses, including pre-developed and post-developed land use characteristics.
  - Complete a hydrologic analysis for existing and developed site conditions, in accordance with the requirements of Chapter 2, Volume III of the WWM, using

an approved continuous runoff simulation model (the Clark County version of WWHM). Compute existing and developed flow durations for all subbasins. Provide an output table from the continuous flow model.

- Include and reference all hydrologic computations, equations, graphs, and any other aids necessary to clearly show the methodology and results.
  - Include all maps, exhibits, graphics, and references used to determine existing and developed site hydrology.
4. Submit electronic copies of the WWHM (.wdm, .prj, .usi) project files upon request.

### **Section H – Wetlands Protection**

For projects with stormwater discharges to a wetland and/or wetland buffer, either directly or indirectly through a conveyance system, the preliminary TIR shall describe wetland protection measures to be implemented in accordance with Minimum Requirement 8. The narrative shall describe the measures that will maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

Submit three (3) complete copies for review.

### **K. Final Stormwater Plan**

1. Purpose. In accordance with Minimum Requirement 1 (as defined in Chapter 4 and the WWM), the final stormwater plan shall provide final engineering design and construction drawings for the stormwater aspects of a proposed new development or redevelopment project. The final stormwater plan shall be submitted and approved by the Director before construction of the development can begin.

2. Final Stormwater Plan Submittal

The final stormwater plan submittal shall include the following:

- a. Any conditions of approval from the land use process.
- b. Any easements, covenants, or agreements necessary to permit construction.
- c. Final engineering plans that provide sufficient detail to allow construction of the stormwater facilities. These plans shall be stamped, signed, and dated by the engineer(s), registered in the state of Washington, responsible for hydrologic, hydraulic, geotechnical, structural, and general civil engineering design and by the project engineer responsible for the preparation of the final stormwater plan. The final engineering plan shall show all utilities to ensure that conflicts between proposed utility lines do not exist.
- d. The approved preliminary stormwater plan, with an explanation of any differences between the design concepts included in the preliminary and final stormwater plans. If a final stormwater plan differs from the approved preliminary stormwater plan in a manner that, in the opinion of the Director, raises material water quality or quantity control issues, it shall require another SEPA determination (if subject to the State Environmental Policy Act [SEPA])

and a plat alteration.

- e. A final development plan (which may be a part of the final engineering plans or a separate plan). See the requirements identified below.
- f. A final technical information report (TIR). See the requirements identified below.
- g. A construction stormwater pollution prevention plan (SWPPP). See Section 3.5 below.

#### L. Final Development Plan

The final development plan shall be consistent with the preliminary development plan and may be combined with the final engineering plans. In addition to the information required in the preliminary development plan, the final plan requires the following information:

- 1. Threshold discharge area (TDA) delineations, and total impervious and pervious area delineations and acreages by TDA.
- 2. The acreage of pollution-generating pervious surfaces (PGPS) and pollution-generating impervious surfaces (PGIS) used in the hydraulic/hydrologic calculations both onsite and offsite that contribute surface runoff.
- 3. Directions and lengths of overland, pipe, and channel flow.
- 4. Outfall points from each TDA and overflow routes for the 100-year storm.
- 5. Onsite conveyance systems, including pipes, catch basins, channels, ditches, swales, and culverts.
- 6. Primary flow path arrows for drainage under developed conditions, with the calculated flow rates. Cross-reference the flow rates to the hydrological model output file used to calculate the flow rates.
- 7. Approved location for storm runoff from the building lots.
- 8. The Director may require additional site or vicinity information if needed to determine the feasibility of the stormwater proposal.

#### M. Final Technical Information Report (TIR)

The final TIR shall be a comprehensive report, supplemental to the final engineering plans, that contains all technical information and analyses necessary to complete final engineering plans based on sound engineering practices and appropriate geotechnical, hydrologic, hydraulic, and water quality design.

The final TIR shall be stamped, signed, and dated by the professional engineer(s), registered in the state of Washington, responsible for hydrologic, hydraulic, geotechnical, structural, and general civil engineering design.

The required contents of the final TIR, which is part of the final stormwater plan, are identified below.

### **Table of Contents**

See the preliminary TIR requirements.

### **Map Submittals**

See the preliminary TIR requirements.

### **Section A – Project Overview**

Provide the information from the preliminary TIR, with the following additional elements:

1. Reference the conceptual design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual design contained within the final engineering plans.

### **Section B – Minimum Requirements**

Provide the information from Section B of the preliminary TIR, revised as necessary for the final design. Confirm the applicable minimum requirements identified in the preliminary TIR. For land-disturbing activities where minimum requirements 1 through 10 must be met, provide the required information listed in Section B of the preliminary TIR, revised to reflect the final design.

### **Section C – Soils Evaluation**

See the preliminary TIR requirements.

### **Section D – Source Control**

See the preliminary TIR requirements.

### **Section E – Onsite Stormwater Management BMPs**

Provide the information from the preliminary TIR, with the following additional elements:

1. Reference the conceptual design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual design contained within the final engineering plans.
3. For bioretention systems, provide the following:
  - a. The proposed soil matrix for the facility.
  - b. The planting plan, listing proposed plant types and locations.
  - c. Detail drawings, including the following:
    - If an underdrain is used, show drain rock, pipe, and filter fabric specifications.
    - All stormwater piping associated with the facility, including catch basin, pipe materials, sizes, slopes, and invert elevations.
    - Rain garden width, length, side slopes, and maximum design water depth.

- Irrigation system, if installed.
  - Designs for any retaining walls proposed. Structural walls shall meet City building permit requirements.
4. For porous pavements, provide the following:
    - a. Supporting design calculations showing adequate infiltration rates to accommodate flows from all impervious surfaces directed onto any porous pavement.
    - b. Geotextile specification.
    - c. Base material gradation.
    - d. Asphalt mix design and void calculations.
    - e. Acceptance test procedures.
  5. Detail drawings, including the following:
    - a. Geotextile
    - b. Base material
    - c. Asphalt layer
  6. For reversed slope sidewalks, show the following:
    - a. Details on the planting plan for any areas receiving water from reversed slope sidewalks.

#### **Section F – Runoff Treatment Analysis and Design**

For land-disturbing activities where the thresholds within Minimum Requirement 6 indicate that runoff treatment facilities are required, provide the information from the preliminary TIR, with the following additional elements:

1. Reference the conceptual runoff treatment design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual runoff treatment design contained in the preliminary stormwater plan.
3. Complete a detailed analysis and design of all proposed runoff treatment system elements, in accordance with Volume V of the WWM. Reference runoff treatment system elements to labeled points shown on the site location map or final development plan.
4. Include and reference all computations, equations, charts, nomographs, detail drawings, and other tabular or graphic aids used to design water quality system elements in the technical appendix.
5. Summarize the results of the runoff treatment design, and describe how the proposed design meets the requirements of the WWM.

#### **Section G - Flow Control Analysis and Design**

For land-disturbing activities where the thresholds within Minimum Requirement 7 indicate that flow control facilities are required:

1. Identify revisions to the conceptual design proposed in the preliminary stormwater plan.
2. Identify initial conditions, including stream base flows, beginning water surface elevations, hydraulic or energy grade lines, initial groundwater elevations, beginning storage volumes, and other data or assumptions used to complete the analyses of initial conditions. Reference the sources of information.
3. Describe any assumptions used to complete the analysis, including flow credits through the use of onsite stormwater BMPs or LID measures.
4. Complete a detailed hydrologic analysis for existing and developed site conditions, in accordance with the requirements of Chapter 2, Volume III of the WWM, using an approved continuous runoff simulation model (the Clark County version of WWHM). Compute pre-developed and developed flow durations for all subbasins. Provide an output table from the continuous flow model, including the following:
  - a. Flow rates for the 2, 10, and 100-year return periods for pre-developed and developed conditions.
  - b. A table listing the pass/fail rates for each flow level where duration statistics were calculated.
  - c. A graph showing the flow rate on the y axis and percent time exceeding on the x axis for pre-developed conditions and post-developed mitigated conditions, from 50 percent of the 2-year through the 50-year flow rate.
5. Provide a hydraulic analysis of pipes and/or channels that lead to and/or from the outlet structure. The analysis should confirm the capacity of pipes and channels to convey the peak flow rates for the 2, 10, 50, and 100-year return period flow rate with the water surface elevation of the pond at the elevation for those return period flow rates.
6. Submit electronic copies of the WWHM (.wdm, .prj, .usi) project files to allow reviewers to run the model and confirm the model results.
7. Refer to labeled points shown on the site location map and development plan.
8. Include and reference all hydrologic and hydraulic computations, equations, rating curves, stage/storage/discharge tables, graphs, and any other aids necessary to clearly show the methodology and results.
9. Include all maps, exhibits, graphics, and references used to determine existing and developed site hydrology.

#### **Section H - Flow Control System Plan**

1. Provide an illustrative sketch of the flow control facility and its appurtenances.
2. Show basic measurements necessary to confirm storage volumes.

3. Show all orifice, weir, and flow restrictor dimensions and elevations.
4. The sketch shall correspond with final engineering plans. Alternatively, a final site grading plan that incorporates the above information may be included as an attachment to the final stormwater plan.
5. Provide electronic copies of the drawings used for analysis, measurement, and design inputs for the hydrologic analysis submitted with the final drawing in one of the following approved file formats: Portable Document Format (.pdf), AutoCAD (.dwg, .dxf), or MicroStation (.dgn).

### **Section I – Wetlands Protection**

For projects with stormwater discharges to a wetland or wetland buffer, either directly or indirectly through a conveyance system, the TIR shall describe wetland protection measures to be implemented, in accordance with Minimum Requirement 8. The narrative shall describe the measures that will maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

### **Section J – Other Permits**

Construction of roads and stormwater facilities may require additional permits from other agencies. These permits may contain requirements that affect the design of the stormwater system. This section lists the titles of other possible required permits, the agencies that require the permits, and the permit requirements, if known, that affect the final stormwater plan. Approved permits that are critical to the feasibility of the stormwater facility design shall be included in this section.

### **Section K – Conveyance Systems Analysis and Design**

1. Reference the conceptual drainage design proposed in the preliminary stormwater plan.
2. In the technical appendix, include and reference all computations, equations, charts, nomographs, detail drawings, and other tabular or graphic aids used to design water quality system elements.
3. Identify revisions to the conceptual drainage design contained in the preliminary stormwater plan.
4. Identify the criteria used to complete the analyses and their sources.
5. Identify and discuss initial conditions, including stream base flows, beginning water surface elevations, hydraulic or energy grade lines, beginning storage elevations, and other data or assumptions used to complete the analyses of initial conditions. Reference the sources of information.
6. Describe any assumptions used to complete the analyses.
7. Complete a detailed hydraulic analysis of all proposed collection and conveyance system elements and existing collection and conveyance elements, including outfall structures and outlet protection that influence the design or are affected by the

proposal, in accordance with Section 4.05 of these standards. Identify, compute, reference, verify, summarize and tabulate the following:

- a. Design flows and velocities and conveyance element capacities for all conveyance elements within the development.
- b. The 10-year recurrence interval stage for detention facility outfalls. Provide stage-frequency documentation from WWHM.
- c. The existing 100-year floodplain elevations and lateral limits for all channels, and no net loss of conveyance or storage capacity from development.
- d. The conveyance system elements to labeled points shown on the site location map or development plan.
- e. The capacity of each conveyance system element to convey design flow and discharge at non-erosive velocities and the capacity of the onsite conveyance system to convey design flows that result from ultimate build-out of upstream areas.
- f. All hydraulic computations, equations, pipe flow tables, flow profile computations, charts, nomographs, detail drawings, and other tabular or graphic aids used to design and confirm the performance of conveyance systems.
- g. The results of system analyses, and how the proposed design meets the requirements of these standards.

#### **Section L – Offsite Analysis**

If applicable, provide the results of an offsite analysis prepared in accordance with Chapter 4 (Offsite Analysis and Mitigation) of this manual (see exemptions in Chapter 4.)

#### **Section M—Approval Conditions Summary**

List each preliminary approval condition related to stormwater control, wetlands, wetland buffers, floodplains, and other water-related issues and explain how the final design addresses or conforms to each condition.

#### **Section N – Special Reports and Studies**

Where site-specific characteristics, such as critical areas as described in the WMC, present difficult drainage and water quality design problems, the Director may require additional information or the preparation of special reports and studies that further address the specific site characteristics, the potential for impacts associated with the development, and the measures that would be implemented to mitigate impacts. Special reports shall be prepared by professionals with expertise in the particular area of analysis, who shall date, sign, stamp, and otherwise certify the report. Subjects of special reports may include, but are not be limited to:

1. Geotechnical
2. Wetlands

3. Floodplains and floodways
4. Groundwater
5. Structural design
6. Fluvial geomorphology (erosion and deposition)

All special reports and studies shall be included in the technical appendix.

### **Section O – Groundwater Monitoring Program**

Where required, a groundwater monitoring program shall be included in the final stormwater plan. The groundwater monitoring program shall be prepared by a person with expertise in groundwater contamination investigation, prevention, and monitoring and shall clearly describe a comprehensive groundwater testing and evaluation program designed to ensure compliance with federal and state of Washington laws and these standards. The Director will review proposed groundwater monitoring programs on a site-specific basis.

### **Section P – Maintenance and Operations Manual**

The project engineer shall prepare maintenance and operations manual for each stormwater control or treatment facility to be privately maintained and for those that constitute an experimental system to be maintained by the City. The manual, which may be brief, shall be written in an orderly and concise format that clearly describes the design and operation of the facility. The manual shall also provide an outline of required maintenance tasks, with recommended frequencies at which each task should be performed. The manual shall contain or reference procedures from the latest version of Clark County's Stormwater Facility Maintenance Manual.

### **Technical Appendix**

All TIRs shall contain a technical appendix that includes all computations completed in the preparation of the TIR, together with copies of referenced data, charts, graphs, nomographs, hydrographs, stage-storage discharge tables, maps, exhibits, and all other information required to clearly describe the stormwater flow control and runoff treatment design for the proposed development activity. The format of the technical appendix shall follow as closely as possible the section format of the TIR and shall be adequately cross-referenced to ensure that the design may be easily followed, checked, and verified. The technical appendix shall also contain all special reports and studies, other than those included as attachments to the TIR.

Submit three (3) complete copies for review.

1. Review and Approval. All final stormwater reports require approval by the Director. Approval is only for conformance with City of Washougal standards and does not relieve the engineer of record of responsibility for the design.
2. Stormwater treatment and control facilities in urban residential subdivisions and short plats shall be located on separate tracts which are recommended, but not required, to meet minimum zoning lot size requirements. The plat or other dedication instrument shall indicate tract disposition in the event of City

abandonment or vacation.

### **1.05 Professional Qualifications**

Professionals in the technical fields of Civil Engineering, Electrical Engineering, Geotechnical Engineering, Landscape Architecture, Soils Engineering, Structural Engineering, and Surveying who prepare or are responsible for the process of obtaining required permits/approvals shall be currently licensed or registered in the State of Washington and qualified by both experience and educational background in the specific technical areas as warranted by the specific needs of the proposed development project.

### **1.06 Changes to these Engineering Standards**

From time to time changes may be needed to add, delete, or modify the provisions of these Standards. The Director may propose changes to these Standards and upon approval of the City Council; they shall become effective and shall be incorporated into the existing provisions.

### **1.07 Design Modification Process**

#### **A. Submittal**

1. Requests to modify City Standards shall be submitted in writing by the Developer's engineer to the Director. This written request shall state the desired modifications(s), the reason(s) for the request(s) and a comparison between the specification(s), standard(s), and the modification(s).
2. Any request for modification or variance of City Standards should be documented with reference to nationally accepted specifications/standards.

#### **B. Review**

1. The request to modify shall be reviewed by the Director, who shall consult the appropriate review authorities and make one of the following decisions:
  - a. Approve as is,
  - b. Approve with changes, or
  - c. Deny with an explanation.
2. The modification, if approved, is for project specific use. Approval of a request shall not constitute a precedent.

#### **C. Appeal**

1. All decisions regarding these standards shall be considered type 1 decisions and may be appealed to the Hearings Examiner in accordance with the WMC.

#### **D. Criteria for Modification of Specification Standards**

1. The Director may grant a modification to the adopted specifications or standards when all of the following conditions are met:
  - a. The specification or standard does not apply in the particular application.
  - b. Topography, right-of-way, or other geographic conditions impose an unusual or unique hardship on the applicant and an equivalent alternative which can accomplish the same design is available that does not compromise public safety or accessibility for the disabled.
  - c. A change to a specification or standard is required to address a specific design or construction problem which if not enacted will result in an undue hardship.

### **1.08 Securities**

Under certain circumstances or as required by code, securities may be required by the City to guarantee the performance of, or correct permitted work. The amount of security shall cover the City's cost to correct deficiencies. The type and amount of security shall be per code or, if not specified, be at the discretion of the Director. Types of securities include but are not limited to cash deposits, assigned savings, and bonds. Securities shall be released by the City upon satisfactory completion of the required work and satisfaction of any additional previously specified stipulations related to the work being performed.

Prior to final acceptance of the construction of any public improvements associated with any private project, the Developer shall furnish the City of Washougal with the following:

- A. A two (2) year maintenance bond, as follows:
  1. In an amount equal to 20% of the cost of said public improvements (verified by a professional engineer licensed in the State of Washington and approved by the City).
  2. For a period of two (2) years following the date the plat is recorded or the as-builts are signed, whichever is later.
  3. In compliance with all requirements of a Contract Bond as specified in Section 1-03.4 of the WSDOT Standard Specifications.
- B. A performance bond, as follows:
  1. In compliance with the requirements of Section 1-03.4 of the WSDOT Standard Specifications for all improvements not installed at the time of final acceptance (as approved by the Director) and shall remain in effect until such time as released in writing by the Director.
  2. In an amount equal to 150% of the cost of said improvements (estimated by a professional engineer licensed in the State of Washington and approved by the City).
  3. May not be used for the top lift of asphalt, street lights or any other improvement the Director deems necessary for the health and safety of the public.

## **1.09 Errors and Omissions**

At the discretion of the City, any significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of any approvals and/or stoppage of any or all of the permitted work. It shall be the responsibility of the Developer to show reason why such work should continue, and make such changes in plans that may be required by the City before the plans are re-approved.

## **1.10 Inspection**

### **A. General Requirements**

1. Work performed within the public right-of-way, or as described in these Standards; whether by or for private developer, City forces, or a City Contractor, shall be done to the satisfaction of the City and in accordance with the Standard Specifications, any approved plans, and these Standards. Unless otherwise approved, any revision to construction plans must be approved by the City before being implemented.
2. The City shall have authority to enforce the Standards as well as other referenced or pertinent specifications. The City will appoint project engineers, assistants, and inspectors as necessary to inspect the work and they will exercise such authority as the Director may delegate.
3. It is the responsibility of the Developer, Contractor, or their agents to have an approved set of plans, and/or permits on the job site wherever work is being performed.

It is the responsibility of the Developer, Contractor, or their agents to notify the City in advance of the commencement of any authorized work. A preconstruction conference and/or field review are required before the commencement of any work.

4. Failure to comply with the provisions of these standards may result in stop work orders, removal of work accomplished, or other penalties as established by ordinance.

### **B. Substitution of Materials**

It is not the intent of these Standards to exclude other equipment or materials of equal value, quality, or merit. Whenever a product is designated, or manufacturer's name, brand, or item designation is given or described, it shall be understood that the words "or approved equal" follows such name, designation, or description, whether in fact they do so or not. Determination of quality in reference to the project design requirement will be made by the Director. A Contractor shall not use an "equal" product without prior written approval of the Director.

### **C. City Inspector's Activities.** Inspecting services provided by the City shall include:

1. Monitoring both work progress and performance testing results.
2. Performance of administrative and coordination activities as required supporting the processing and completion of the project.

3. Issuance of a corrective notice to the Contractor to make corrections to the work. The City's Project Inspector, at the discretion of the Director, may post a stop work order.
4. Maintaining a completion file containing the following:
  - a. The original of the project completion certification; and
  - b. A complete copy of the report file initialed by the City's Project Inspector;  
-and-
  - c. The results of material tests, compaction tests, and soil analysis as detailed in the construction file.
5. Inform the Director of all proposed plan changes, material changes, corrective notices, stop work orders, or errors or omissions in the approved plans or specifications as soon as practical. Any revision to the approved plans must be at the direction of the Engineer. It shall be at the discretion of the City's Project Inspector as to whether the revision is significant enough to warrant review by the Director. If so, the Developer's engineer shall submit five (5) copies of the revised plans to the City for approval. No work affected by the revision shall be done until approved by the Director.

#### **1.11 Contractor's Responsibility for Scheduling**

##### **A. Sequence of Operations**

1. The Contractor shall plan construction work and execute operations with a minimum of interference with the operation of the existing public facilities, including but not limited to, water, sewer, and roads. It may be necessary to perform certain parts of the construction work outside normal working hours in order to avoid undesirable conditions, and it shall be the obligation of the Contractor to perform this work at such times. This scheduling, however, is subject to the City's approval and does not relieve the Contractor from making work available for inspection.
2. The Contractor shall notify the City at least 48 hours (two full working days) prior to any City inspection. Connections between existing work and new work shall not be made until necessary inspection and tests have been completed on the new work and it is found to conform in all respects to the requirements of the plans and specifications.

##### **B. Inspections Steps**

1. The following items of work shall be inspected by the City:
  - a. Street or sidewalk work and subgrade (also tested by the Contractor) prior to placement of crushed surfacing.
  - b. Crushed surfacing (also tested by the Contractor) prior to placement of paving, curb, or sidewalks.
  - c. Notify the City prior to the placement of any paving, curb, or sidewalks.

2. Other items of inspection notification are included under the various items of work outlined in these Standards.

C. Progress of Construction

1. Construction shall proceed in a systematic manner that will result in a minimum of inconvenience to the public.
2. In the case of a pipe-laying job for sanitary sewer, storm drainage, and water improvements the trenching equipment at no time shall be greater than 100 feet ahead of the pipe-laying crew, without written permission from the Director.
3. The trench shall be backfilled so that no section of the trench or pipe is left open longer than 24 hours. Trenches located in a right-of-way or public street shall be completely backfilled or plated before the Contractor leaves the site each day. All piping is to be plugged with a serviceable expansion plug at the end of each workday.

**1.12 Contractor's Requirement for Testing**

A. General

1. Testing shall be performed by a certified independent testing lab hired by the Developer or Developer's contractor with the results being supplied to the Director. The Developer shall pay the cost of all testing as outlined herein.
2. The testing is not intended to relieve the Contractor from any liability for the trench restoration. It is intended to show the inspector and the City that the restoration meets these specifications.

B. Asphalt Testing

1. Compaction of all lifts of asphalt as specified in the Standard Specifications. Number of tests required:
  - a. For streets provide one (1) test per every 5,000 square feet of surface area.
  - b. For surface restoration of utility trenches provide one (1) test per every 200 feet of trench.

C. Subgrade and Crushed Surfacing Testing

1. Compaction testing as specified in the Standard Specifications. Number of tests required:
  - a. For streets, provide one test of the subgrade and one test of the crushed surfacing for every 5,000 square feet of surface area of pavement, curb, and sidewalk.

D. Bedding and Backfill for Utility Trenches

1. Compaction testing as specified in the Standard Specifications. Number of tests required:
  - a. For utility trenches provide one test at top of bedding for every 500 feet of trench.

- b. For utility trenches provide one test for each lift of backfill for every 500 feet of trench.

E. Embankment for Subgrade

1. Compaction testing as specified in the Standard Specification. Number of tests required:
  - a. For each location where the fill is deeper than two (2) feet or greater than 300 cubic yards, provide one test per every two (2) vertical feet and every 500 cubic yards.

### **1.13 Safety Requirements**

The Contractor is responsible for observing the safety of the work and all persons and property coming into contact with the work. The Contractor shall conduct his work in such a manner as to comply with all the requirements prescribed by OSHA. The City Project Inspector's role is not one of supervision or safety management, but is one of observation only.

Nothing contained in this section or elsewhere in these standards shall be interpreted to obligate the City to act in any situation, nor shift the Owner's responsibility for safety compliance to the City. No responsibility for the safety of the work or for construction means, methods, techniques, sequences, or procedures shall be attached to the City by virtue of its action or inaction under this section.

### **1.14 Preservation, Restoration, and Cleanup**

A. Site Restoration and Cleanup

1. The Contractor shall keep the premises clean and orderly at all times during the work and leave the project free of rubbish or excess materials of any kind upon completion of the work. During construction, the Contractor shall stockpile excavated materials so as to do the least damage to adjacent lawns, grassed areas, gardens, shrubbery, trees, or fences, regardless of the ownership of these areas. All excavated materials shall be removed from these areas, and these surfaces shall be left in a condition equivalent to their original condition and free from all rocks, gravel, boulders, or other foreign material. Stockpiling of construction materials shall not be allowed on existing public rights-of way.
2. All existing storm systems adjacent to the project area shall be cleaned and flushed with a vacator truck and/or sewer jetter, and original drainage restored. Sediment, rock, and other debris shall be collected and disposed of in a proper manner. In no case shall debris be flushed down a storm or sanitary sewer for disposal. All damaged/impaired storm facilities, irrigation, and house drainage pipes, drain tiles, sewer laterals, and culverts shall be repaired expeditiously.
3. All areas disturbed by the Contractor's operations inside dedicated rights-of-way or easements shall be restored to original condition. Areas outside of the easements or rights-of-way which are disturbed by the Contractor's operations shall be restored to their original or better condition in a method acceptable to the property owner. The

Contractor shall obtain a written release from such property owners for any claims of injury or property damage prior to final acceptance of the work by the City.

**B. Street Cleanup**

1. The Contractor shall clean all spilled dirt, gravel, or other foreign material caused by the construction operations from all streets and roads at the conclusion of each day's operation unless it poses an erosion control threat. If any spilled material poses an erosion control threat, it shall be cleaned immediately. Cleaning shall be by grader and front-end loader, supplemented by power brushing, and hand labor, unless otherwise approved by the City. The Contractor shall follow the City's erosion control procedures.
2. As soon as practical after completion of all paving and gravel shoulder resurfacing, the Contractor shall remove all dirt, mud, rock, gravel, and other foreign material from the paved surface and storm drainage system.

**C. Stream and Creek Crossings**

1. The Contractor shall comply with all provisions of the permits required by the Washington State Departments of Wildlife and Fisheries, the U.S. Army Corps of Engineers, Washington State Department of Ecology, and the Washougal Municipal Code.
2. Before any work may be performed in any stream, the method of operation and the schedule of such work shall be approved in writing by the Director.

**D. Protection of Property**

1. The Contractor shall exercise all due care in protecting property along the route of the improvement. This protection shall include, but not be limited to, trees, yards, fences, drainage lines, mailboxes, driveways, shrubs, and lawns. If any of the above has been disturbed, they shall be restored to as near their original condition as possible.

**E. Use of Explosives**

1. All use of explosives is to follow Washington State Law.
2. Surrounding property owners affected by blasting are to be notified well in advance of the use of explosives.
3. Use of explosives should be done to limit the effects on surrounding neighbors.
4. Blasting permits are required per WMC.

**1.15 Railroad Crossings**

**A. General**

1. Crossings of railroad rights-of-way shall be done in a manner, which conforms with the requirements of the railroad having jurisdiction. If any bonds and/or certificates of insurance protection are required, they shall be furnished by the Contractor or Owner to the railroad company with the City as an additionally-named insured.

**B. Permits or Easements**

1. Crossing agreements, permits, and/or easements for such crossings will be obtained by the applicant and all the terms of such permits or easements shall be met by the Owner and Contractor.

**1.16 Penalties**

Failure to comply with these Standards will be cause for withholding or withdrawing approval of plans or plats, forfeiture of bond, withholding Temporary and/or Final Certificate of Occupancy, and/or other penalties as provided by law.

## Chapter 2

# Erosion Control, Clearing and Grading

City of Washougal Engineering Standards for Public Works Construction

February 2010

Director of Public Works: Trevor Evers

**Chapter 2**  
**Erosion Control, Clearing and Grading**  
City of Washougal Engineering Standards for Public Works Construction  
February 2010

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## **CHAPTER 2 – LAND ALTERING ACTIVITIES**

### **2.00 General**

The Standards established by this chapter are intended to represent the minimum design standards for land altering activities (clearing, grading, and erosion control work). Compliance with these Standards does not relieve the designer of the responsibility to apply sound professional judgment to protect the health, safety, and welfare of the general public. Additionally, since these are minimum standards, special site conditions and environmental constraints may require a greater level of protection than would normally be required under these Standards. The designer must apply these Standards bearing in mind these constraints.

Conditions may change after land altering activities, or construction has started due to unforeseen conditions. Design elements of the proposed project may have to be changed to comply with the conditions of any permits, codes and regulations, or these Standards.

The primary objective of this chapter is the control of erosion at its source as a means of controlling water pollution, flooding, and habitat damage downstream. Typical examples of techniques for source control are limiting cleared areas (especially on steep terrain or adjacent to other sensitive areas), seasonal limits on work, mulching, hydroseeding or covering cleared areas as soon as work has finished, control of land use in sensitive areas, and establishment and maintenance of setbacks and buffer areas.

Secondary containment measures must be provided to backup the above measures in case of failure. These backup measures include desilting ponds and sediment traps, filter fencing and straw bales, catch basin filtration, and management plans. One method cannot be relied on without the other - both are mandatory to protect property, lives, and habitat.

Land alteration activities are those activities which are commonly referred to as clearing (the act of vegetation removal from the land surface by mechanical or chemical means - often referred to as land clearing), grubbing (the act of root vegetation removal from beneath the surface of the earth - usually in association with clearing), excavation (the mechanical removal of earth material), filling (deposition of earth material placed by artificial means), grading (excavation or filling or combination thereof), compaction (densification of earth material by artificial means), stockpiling (temporary deposition of earth material placed by artificial means), and stabilizing (counteracting the actions of gravity, wind, or water).

### **2.01 Seasonal Limits**

Land alteration operations shall be limited by the seasonal limitations specified below:

- A. When land alteration activities are interrupted by heavy rain, operations shall not be resumed until the City determines that erosion control facilities are operating satisfactorily;
- B. Work shall be stopped and the site shall be secured from erosion at any time when weather conditions change or the threat of heavy rain makes erosion problems likely, as determined by the Director;

From October 1st through April 30th, no soils shall remain exposed for more than two (2) days. From May 1st through September 30th, no soils shall remain exposed for more than seven (7) days; and

- C. No earthwork shall take place on slopes in excess of 25% between the dates of October 1<sup>st</sup> and May 1<sup>st</sup>. This period may be shortened or extended according to the Director.

## **2.02 Preservation of Existing Vegetation**

- A. Existing vegetation shall be preserved whenever possible.
- B. All excavations and fills in the proximity of trees and shrubs shall be kept outside the dripline of said trees and shrubs. The dripline of said trees and shrubs shall be clearly marked with orange construction fencing.

## **2.03 Temporary Erosion/Sedimentation Control**

- A. Prior to any land altering activity, devices for interception of all runoff from the cleared area shall be installed. Said interception shall preclude discharging silt-laden runoff from the proposed land development to downstream properties to the maximum extent possible with the best available technology. Said interception shall cause all silt-laden runoff to be conveyed by open swale or other means to whatever temporary facility is necessary or required to remove silt from said runoff prior to discharge to downstream properties. Sequence of work shall be specified on the plans.
- B. Care shall be taken so as to deposit no material from sites of land alteration activity onto public rights-of-way and/or adjoining properties. If such depositions occur, it shall be the responsibility of the Permittee to immediately remove such material and restore to the original conditions.
- C. Since site conditions may change rapidly during construction due to construction activity, weather, and other factors, it should be anticipated that the erosion control measures on the approved plan might become ineffective. Under special conditions, measures additional to those showing on the plan may be required by the City, in order to control erosion and sedimentation.
- D. General Methods of Erosion and Sedimentation Controls. The types of controls as outlined in the Western Washington Manual shall be utilized in such combination as is necessary to achieve the level of erosion control required by these Standards and meet water quality objectives. Erosion control facilities shall be periodically inspected and maintenance performed in order to ensure their proper functioning as required by the approved erosion and sedimentation control management plan.

- E. Small and large parcel developments shall implement erosion control plan(s) as required by the following:
1. Construction vehicle access shall be limited, wherever possible, to only one (1) route. Access points shall be stabilized with 2- to 4-inch diameter gravel to minimize tracking of sediment (mud) onto public roads. Evidence of tracking of material from a construction site may require construction activities to cease until corrections are made. Vehicles not performing a construction activity shall not be permitted off-street. Worker personal vehicles shall be parked on adjacent streets or other approved areas.
  2. Roadways. If sediment is transported onto a road surface, the roads shall be cleaned thoroughly at the end of the workday, or more often if necessary. Significant soil deposits shall be removed from roads by shoveling or sweeping. Street washing, which must be approved by the Director, shall be allowed only after sediment is removed in this manner. Prior to washing, all inlets and down-stream facilities must be protected.
  3. Clearing Limits. At the site, clearly mark all clearing limits and/or any easements, setbacks, sensitive/critical areas and their buffers, trees, and drainage courses.
  4. Exposed Soils. All exposed and un-worked soils shall be stabilized by suitable application of BMP's, including but not limited to sod or other vegetation, plastic covering, mulching, or application of ground base on areas to be paved. All BMP's shall be selected, designed, and maintained in accordance with the BMP manual. Construction materials such as lumber shall be delivered and stored on designated locations that are stabilized and protected from erosion.
  5. Staging. Sediment ponds and traps, perimeter dikes, sediment barriers, and other BMP's intended to trap sediment on-site shall be constructed as a first step in grading. These BMP's shall be stabilized and functional before land-disturbing activities take place. Earthen structures such as dams, dikes, and diversions shall be seeded and mulched according to the timing noted above.
  6. Infiltration Systems. Permanent infiltration systems shall be isolated and protected from sedimentation by sediment traps, sacrificial systems, duplicate systems, or redundant systems.
  7. Waterways. Properties and waterways downstream from development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site. Acceptable BMP's include temporary or permanent detention ponds and temporary infiltration BMP's limiting the discharge from a 2-year storm to one-half (1/2) the pre-development 2-year storm peak runoff rate.
  8. Water bodies and adjacent properties. Water bodies and adjacent properties shall be protected from sediment deposition by appropriate use of vegetative buffer strips, sediment barriers or filters, dikes, mulching, or by a combination of these measures and other appropriate BMP's. Each owner, builder, or permit holder shall install and

- maintain inlet protection on storm drain inlets impacted from construction activity on their site.
9. **Conveyance Systems.** All temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected velocity of flow from a 2-year, 24-hour frequency storm for the developed condition. Stabilization adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems. BMP's shall be selected, designed, and maintained in accordance with the BMP manual. Outlet protection shall also include energy dissipation structures or devices that retard peak flows to non-erosive conditions.
  10. **Storm Inlets.** All storm drain inlets shall be protected so that stormwater runoff shall not enter the conveyance system without first being filtered or otherwise treated to remove sediment. BMP's shall be selected, designed, and maintained in accordance with the BMP manual. Other BMP's may be utilized, provided they have prior approval by the Director.
  11. **Maintenance.** All erosion and sediment control BMP's shall be inspected, maintained, and repaired as needed to ensure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with the BMP manual or approved site plan. Damaged BMP's shall be replaced or repaired.
  12. **Underground Utility Construction.** The construction of underground utility lines shall be subject to the following criteria:
    - a. Where feasible, no more than 500 feet of trench shall be opened at one time;
    - b. Excavated material shall be placed to minimize runoff into the trench and adjacent roadway consistent with safety and space considerations;
    - c. Trench dewatering devices shall discharge into a sediment trap or sediment pond;
    - d. BMP's shall be used to control erosion during and after construction.
  13. **Construction Site Dewatering.** Dewatering devices shall discharge into a sediment trap or sediment pond.
  14. **Control of Pollutants Other Than Sediment on Construction Sites.** All pollutants other than sediment that occur on-site during development shall be handled and disposed of in a manner that does not cause contamination of stormwater.
  15. **Removal of Temporary BMP's.** All temporary erosion and sediment control BMP's shall be removed within 30 days after final site stabilization is achieved or after the temporary BMP's are no longer needed. Trapped sediment shall be removed or stabilized on-site. Disturbed soil areas resulting from removal shall be permanently stabilized.

## **2.04 Permanent Erosion Control and Vegetation Restoration**

- A. Permanent erosion control shall be required per the requirements of the Western Washington Manual.
- B. Vegetation shall be restored on those areas of the site disturbed by the land alteration activity which are not covered by permanent impervious surface improvements (i.e. buildings, parking lots, etc.) at the earliest possible time consistent with appropriate planting times. The soil shall be stabilized prior to vegetation restoration since vegetation alone cannot provide an effective erosion control cover and prevent soil slippage on a soil that is not stable due to its texture, structure, water movement, or excessive slope.
- C. In no case will the period between the land alteration operation and final and complete restorative, or permanent erosion control, vegetation planting for a given project or project phase be longer than one (1) year. Said planting shall restore the vegetation on site to a condition equal to or better than the precleared condition to the maximum extent possible. Temporary erosion and sedimentation control measures shall be maintained in full operating condition for all areas to be restored until said restoration is complete and the site fully stabilized.

## **2.05 100-Year Flood Plain**

- A. Encroachments, including fills, new construction, substantial improvements, and other development within the regulatory floodway that would result in any increase in flood levels during the occurrence of the "100-year" flood discharge shall be prohibited.
- B. "100-year flood" means the flood having a one percent (1%) chance of being equaled or exceeded in any given year.
- C. Delineation of the "100-year" flood plain shall be in accordance with the elevations established by the U.S. Geological Survey's Flood Insurance Study (latest published edition) for the U.S. Department of Housing and Urban Development.

## **2.06 Land Altering Activities on Environmentally Sensitive Lands**

Land altering activities shall be prohibited in sensitive areas, unless otherwise approved.

## **2.07 Environmental Protection During Construction**

- A. General Policy and Requirements
  - 1. It is the policy of the City of Washougal to require temporary and permanent measures for all construction projects to lessen the adverse effects of construction on the environment.

The Contractor shall properly install, operate, and maintain both temporary and permanent works as provided in this section or in an approved plan, to protect the environment during the term of the project.

The City may, in addition, require that a construction project be scheduled so as to minimize erosion or other environmental harm.

Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any federal, state, or other local authority.

2. For all projects, the prohibitions and regulations of this section shall apply. The City may temporarily suspend the work or require additional protection measures if it appears, based upon observed conditions of the project, that the approved plan is insufficient to prevent environmental harm and that such suspension or additional measures will prevent or minimize such harm.

#### B. Air Pollution Control

1. Dust. Dust shall be minimized to the extent practicable, utilizing all measures necessary, including but not limited to:
  - a. Sprinkling haul and access roads and other exposed dust-producing areas with water. Obtaining water from a hydrant will require specific authorization from the applicable water jurisdiction.
  - b. Applying DOE approved dust palliatives on access and haul roads.
  - c. Establishing temporary vegetative cover.
  - d. Placing wood chips or other effective mulches on vehicle and pedestrian use areas.
  - e. Maintaining the proper moisture condition on all fill surfaces.
  - f. Pre-wetting cut and borrow area surfaces.
  - g. Use of covered haul equipment.
2. Fumes, Smoke, and Odors.
  - a. Tires, oils, paints, asphalts, coated metals, or other such materials will not be permitted in combustible waste piles, and will not be burned at the construction site. They will be removed from the site in accordance with DOT rules and regulations as they are no longer deemed necessary for use in the construction process.
  - b. Open burning shall not be permitted unless approved by the Southwest Washington Air Pollution Control Authority and the City Fire Chief's Office.
  - c. Open burning shall not be permitted within 1,000 feet of a structure or within 250 feet of the drip line of any standing timber or flammable growth.
  - d. Open burning shall not be permitted during a local air inversion or other climatic

conditions that may result in a smoke pall hanging over a built-up area or community.

Open burning shall not be permitted when climatic and moisture conditions are contributing to high danger of forest or range fires as determined by city, state, or federal authorities.

All open burning shall be constantly attended by a crew with a supply of fire-fighting tools and equipment. The number and size of fires shall be limited to such that the burning crew can adequately control them.

#### C. Maintaining Surface Water Quality

1. Construction between stream banks shall be kept to a minimum.
2. Pollutants such as fuels, lubricants, bitumens, raw sewage, and other harmful materials shall not be discharged into or near rivers, streams, or impoundments. Sterilizing water from water line construction activities shall not be directly discharged into the public storm drainage system.
3. The use of water from a stream or impoundment shall not result in altering the temperature of the water body enough to affect aquatic life.

#### D. Fish and Wildlife Habitat Preservation

1. The construction shall be done in a manner to minimize the adverse effects on wildlife and fishery resources.
2. The requirements of local, state, and federal agencies charged with wildlife and fish protection shall be adhered to by the entire construction work force.

#### E. Control of Noise Levels

Construction noise shall be minimized by the use of proper engine mufflers, protective sound reducing enclosures, and other sound barriers. Construction activities producing excessive noise that cannot be reduced by mechanical means shall be restricted to locations where their sound impact is reduced to a minimum at the edge of the work area. All construction noise shall be in accordance with the WMC and WAC 173-60.

#### F. Natural Vegetation

1. As far as is practicable and as required through a land use approval; the natural vegetation shall be protected and left in place. Work areas shall be carefully located and marked to reduce potential damage. Trees shall not be used as anchors for stabilizing working equipment.
2. During clearing operations, trees shall not be permitted to fall outside the work area. In areas designated for selective cutting or clearing, care in falling and removing trees and brush shall be taken to avoid injuring trees and shrubs to be left in place. All remaining debris from cutting or removing trees is to be removed from the site. The natural grade is to be restored and reseeded.

#### G. Historical and Archaeological Areas

1. When burial sites, buried camp areas, village sites, and other distinctive archaeological or historical items are uncovered, or other items suspected of being of historical or archaeological significance are encountered, the Contractor shall report the matter to the City and the state liaison officer. Construction operations shall be stopped until the appropriate authorities can examine the area and give clearance to proceed with the work.
2. Under the Natural Historical Preservation Act, state liaison officers shall be notified when historical or archaeological items are unearthed.
3. The Washington Criminal Code prohibits disinterment of a corpse without permission of the appropriate authorities.

#### H. Use of Pesticides

1. The use of pesticides including insecticides, herbicides, defoliant, soil sterilants, and so forth, must strictly adhere to federal, state, county, and local restrictions. Time, area, method, and rate of application must be approved by all relevant authorities and their requirements followed.
2. All materials delivered to the job site shall be covered and protected from the weather. None of the materials shall be exposed during storage. Waste material, rinsing fluids, and other such material shall be disposed of in such a manner that pollution of groundwater, surface water, or the air does not occur. In no case shall toxic materials be dumped into drainageways.
3. All personnel shall stay out of sprayed areas for the prescribed time. All such areas should be fenced, appropriately signed, or otherwise protected to restrict entry.

### **2.08 Signage**

Erosion control signage approved by the Director shall be installed at each point of entry for any subdivision or short plat prior to issuance of provisional acceptance by the City.

Signs may be purchased from Clark County. Removal of signage shall occur no sooner than the latter of: certificates of occupancy have been issued for seventy percent (70%) of the lots; or there being less than ten (10) unoccupied lots remaining within the development; or as determined by the Director.

### **2.09 Contractor Certification**

All development activities performed by licensed contractors shall be supervised by an individual who shall have successfully completed formal training in erosion and sediment control during construction by a recognized organization acceptable to the Director. A certification of successful completion of such training shall be submitted at the pre-construction conference. This shall not apply to residential homeowners constructing their own development activity.

# Chapter 3

## Streets

City of Washougal Engineering Standards for Public Works Construction

February 2010

Director of Public Works: Trevor Evers

# Chapter 3

## Streets

City of Washougal Engineering Standards for Public Works Construction  
February 2010

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# Chapter 3

## Streets

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August 2005

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## CHAPTER 3 - STREETS

### 3.00 Functional Classification

The functional classification of existing and proposed roads is established by the City on an individual basis using the existing land use and existing operational characteristics. Washougal classifies roads and streets as follows:

#### A. Principal Arterial

These facilities are the supporting elements of both the principal routes and collector systems. Principal arterials, in combination with principal routes, are intended to provide a high level of mobility for travel within the region. All trips from one sub-area through an adjacent sub-area traveling to other points in the region should occur on a principal arterial or principal route.

Access is generally limited to intersections with other arterials and collectors. Direct land access is minimal and controlled. The level of fixed route transit service is high; bicycle and pedestrian activities are low.

#### B. Minor Arterial

The minor arterial system complements and supports the principal systems, but is primarily oriented toward travel within and between adjacent sub-areas. An adequate minor arterial system is needed to ensure that these movements do not occur on principal routes or principal arterials. These facilities provide connections to major activity centers and provide access from the principal and major arterial systems into each sub-area.

They serve through traffic and provide direct access for commercial, industrial, office, and multi-family development, but generally, not for residential properties. Since minor arterials serve a more localized area, fixed route transit, bicycle, and pedestrian activities are moderate.

#### C. Collectors (Urban, Industrial/Commercial, and Residential)

Collector streets connect local traffic within a subarea to arterial roads. Service to adjacent land uses is subordinate to traffic movement. Access to abutting properties and parking is controlled through the use of raised channelization, driveway spacing, bicycle and/or pedestrian lanes, and pavement markings. Typically, collector streets are not continuous for any great length, nor do they form a connected network by themselves. Since collector streets connect arterial networks and also connect neighborhoods to commercial areas as well as each other, fixed route transit service is low while bicycle and pedestrian activities range from moderate to high. Access to abutting lots is limited.

#### D. Residential Access

Residential access streets serve to distribute traffic from collectors and provide direct access for abutting properties. Through trips are discouraged and parking is allowed. Transit use is low while the neighborhood's focus provides for high levels of pedestrian

use.

### E. Local Residential

Local residential streets provide access to adjoining properties within a neighborhood. Through trips are discouraged and parking is allowed. No fixed route transit usage and the neighborhood focus is for bicycle and pedestrian use. Services a very limited number of houses.

### 3.01 Access

Access to public streets shall conform to the requirements of Section 3.19. The Director shall have the authority to limit access and designate access locations on public streets under the jurisdiction of the City. Access to streets and highways under Clark County or State of Washington jurisdiction must be formally approved by those entities at the applicant's initiative and expense.

### 3.02 Street Widths

The figures below show the road width standards by the functional classification of the road. The Director will determine functional classification for all new streets based on the transportation system plan recommendations. It should be noted that public utility easements beyond the right-of-way are typically required.

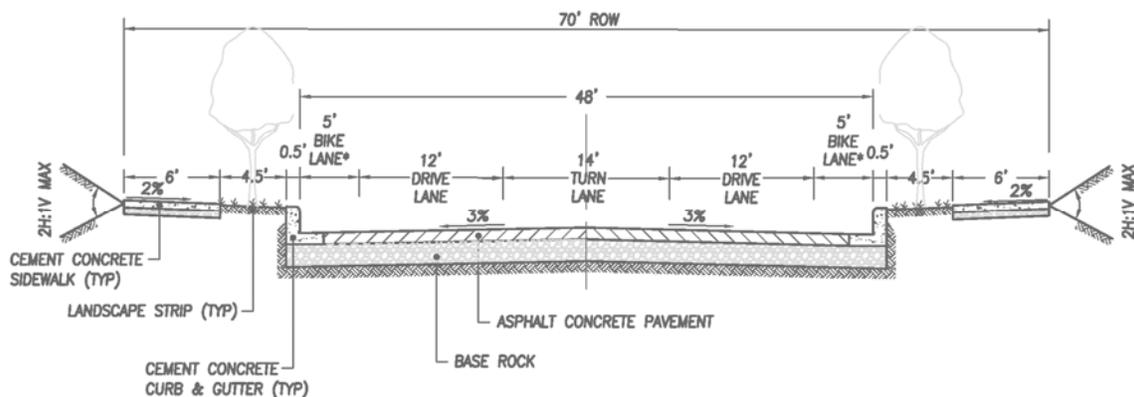
Right-of-way may be needed in addition to that shown in Figures 1 thru 8 to accommodate the increased number of lanes at intersections.

### **Figure 3-1: 5-Lane Principal Arterial**

Design Volume: 24,000 ADT

Design Speed: 45 mph

**\*Provide bike lanes where required by the TSP**

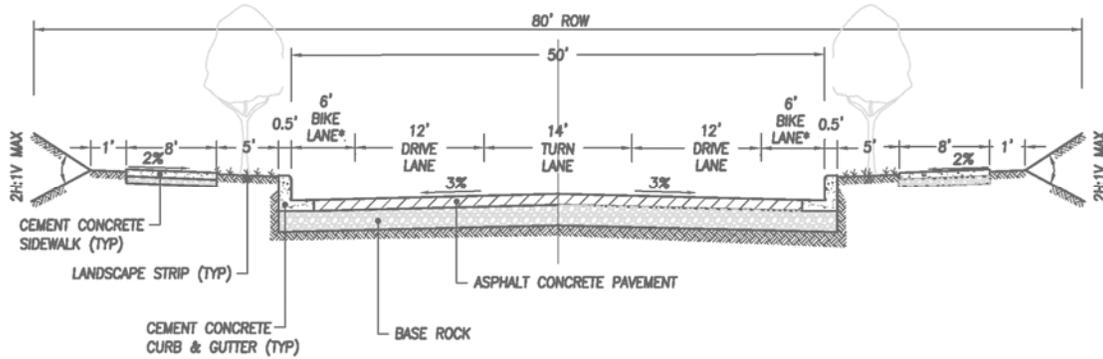


**Figure 3-2: 3-Lane Principal Arterial**

Design Volume: 24,000 ADT

Design Speed: 45 mph

**\*Provide bike lanes where required by the TSP**

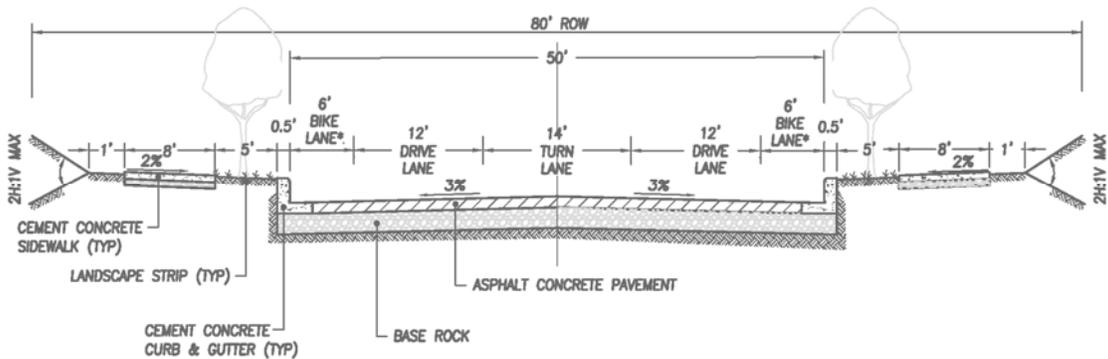


**Figure 3-3: Minor Arterial**

Design Volume: 24,000 ADT

Design Speed: 40 mph

**\*Provide bike lanes where required by the TSP**

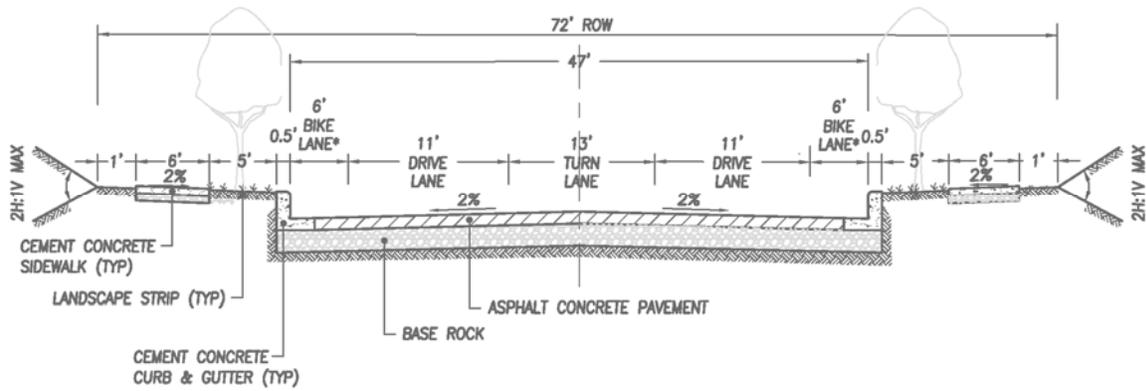


**Figure 3-4: 3-Lane Urban Collector**

Design Volume: 12,000 ADT

Design Speed: 40 mph

**\*Provide bike lanes where required by the TSP**

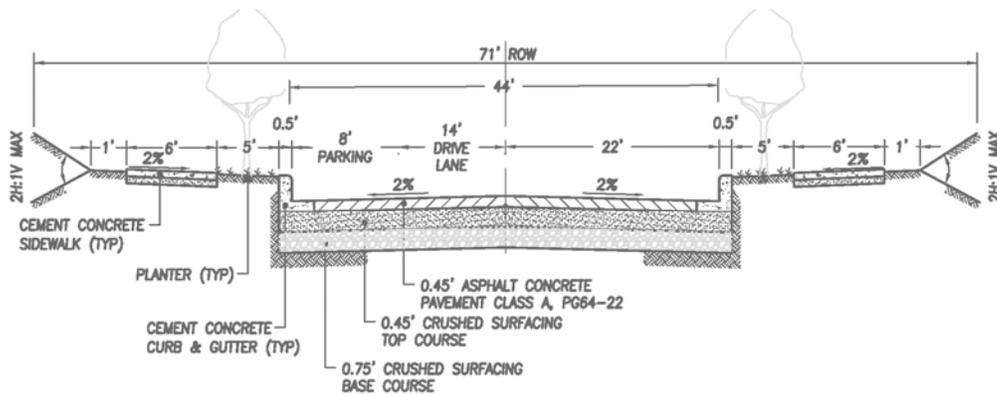


**Figure 3-5: 2-Lane Urban Collector**

Design Volume: 12,000 ADT

Design Speed: 40 mph

**\*Provide bike lanes where required by the TSP**

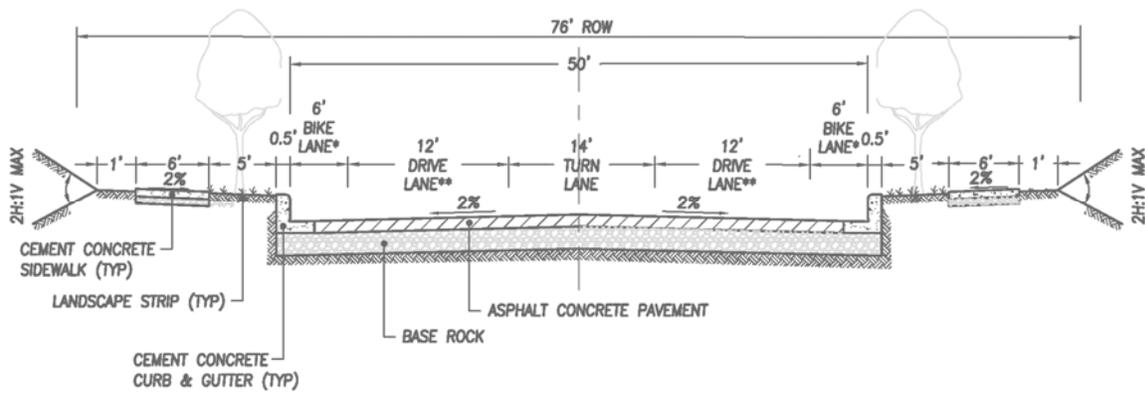


**Figure 3-6: Industrial/Commercial Collector**

Design Volume: 10,000 ADT      Design Speed: 35 mph

**\*Provide bike lanes where required by the TSP**

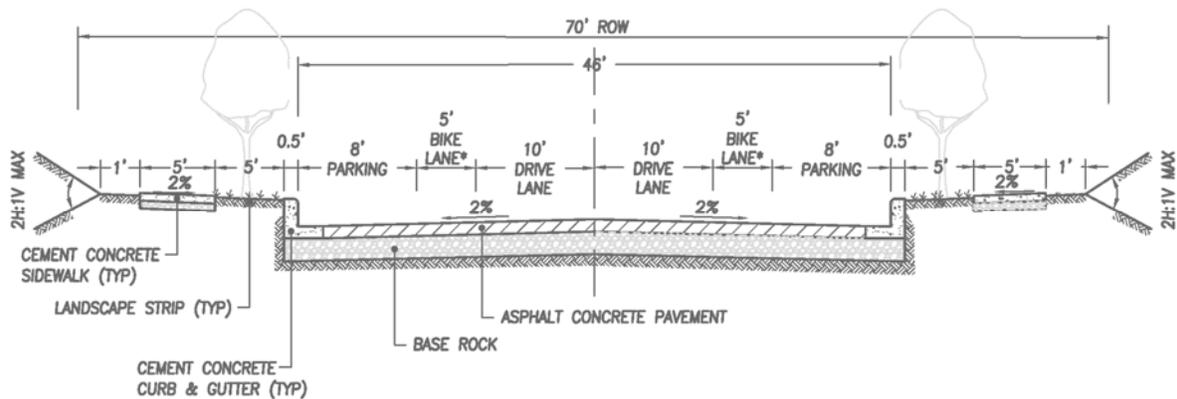
**\*\* Drive lanes shall be 14' wide when no bike lanes are provided**



**Figure 3-7: Residential Collector**

Design Volume: 5,000 ADT      Design Speed: 25 mph

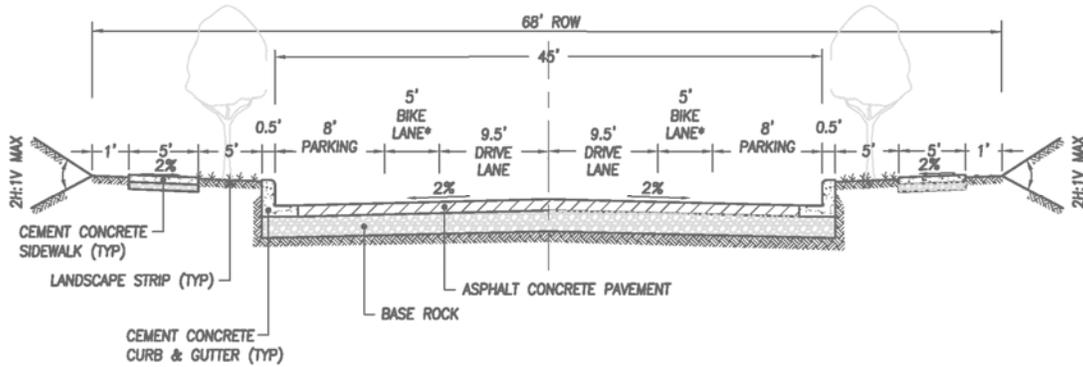
**\*Provide bike lanes where required by the TSP**



**Figure 3-8: Residential Access**

Design Volume: 2,000 ADT      Design Speed: 25 mph

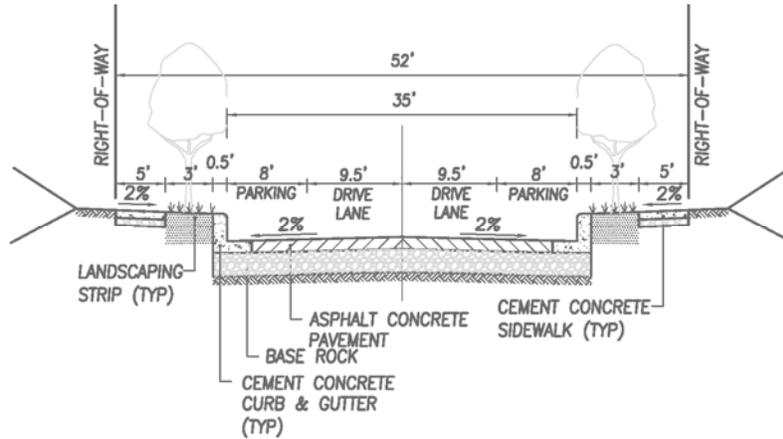
**\*Provide bike lanes where required by the TSP**



**Figure 3-9: Residential Local**

Design Volume: 500 ADT      Design Speed: 25 mph

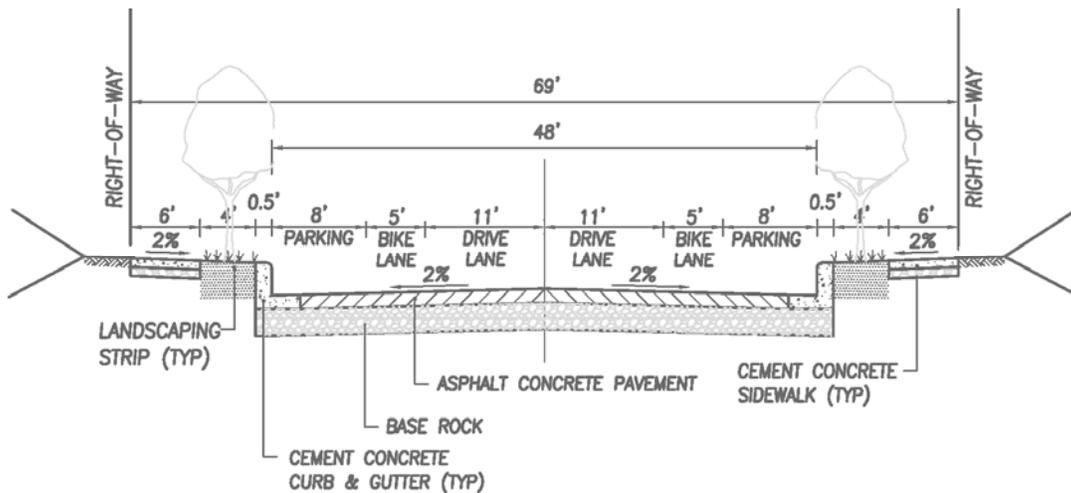
**\*Provide bike lanes where required by the TSP**



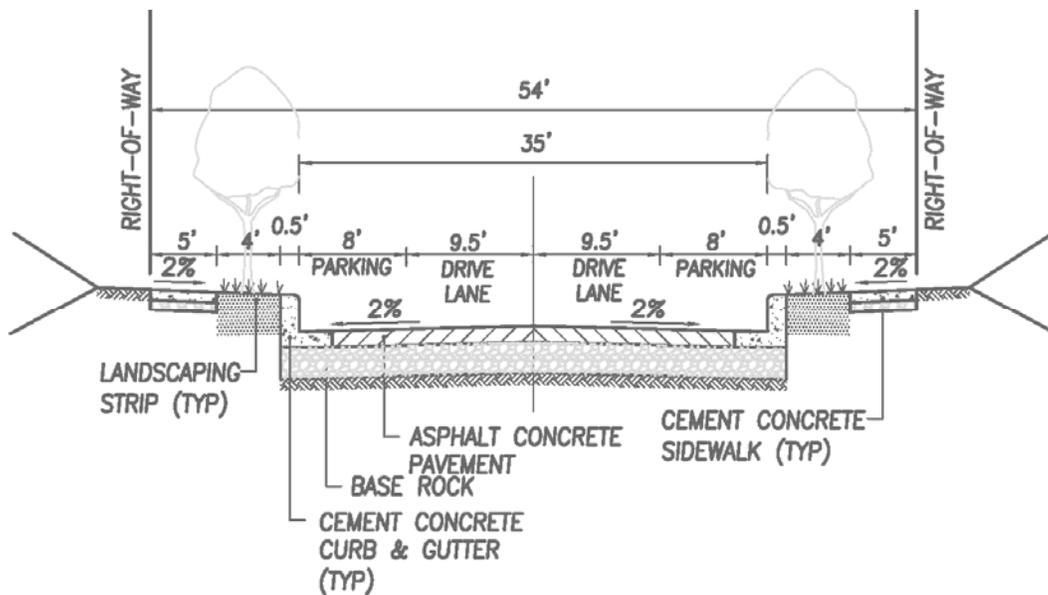
### 3.03 Town Center District

The Town Center District shall be defined by Chapter 18.35 of the Washougal Municipal Code. The figures below show the road width standards by the functional classification of the road. The Director will determine functional classification for all new streets based on the recommendations of Chapter 18.35 of the WMC.

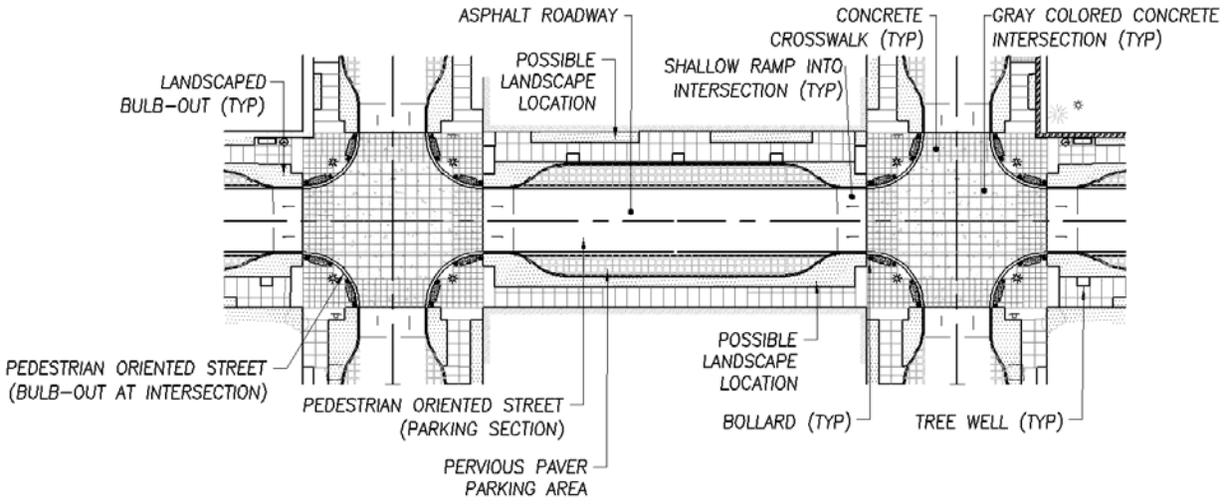
**Figure 3-10: Vehicular-Oriented Street**



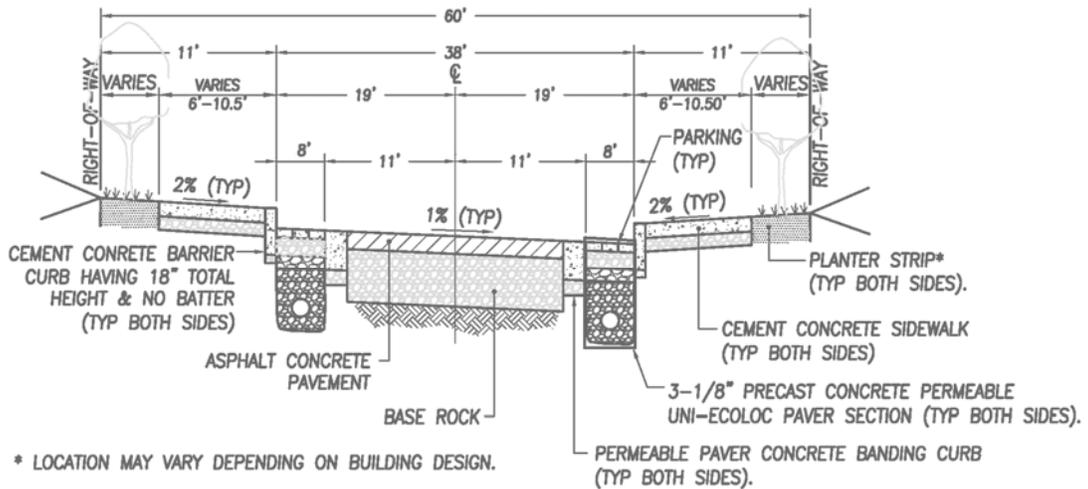
**Figure 3-11: Neighborhood Street**



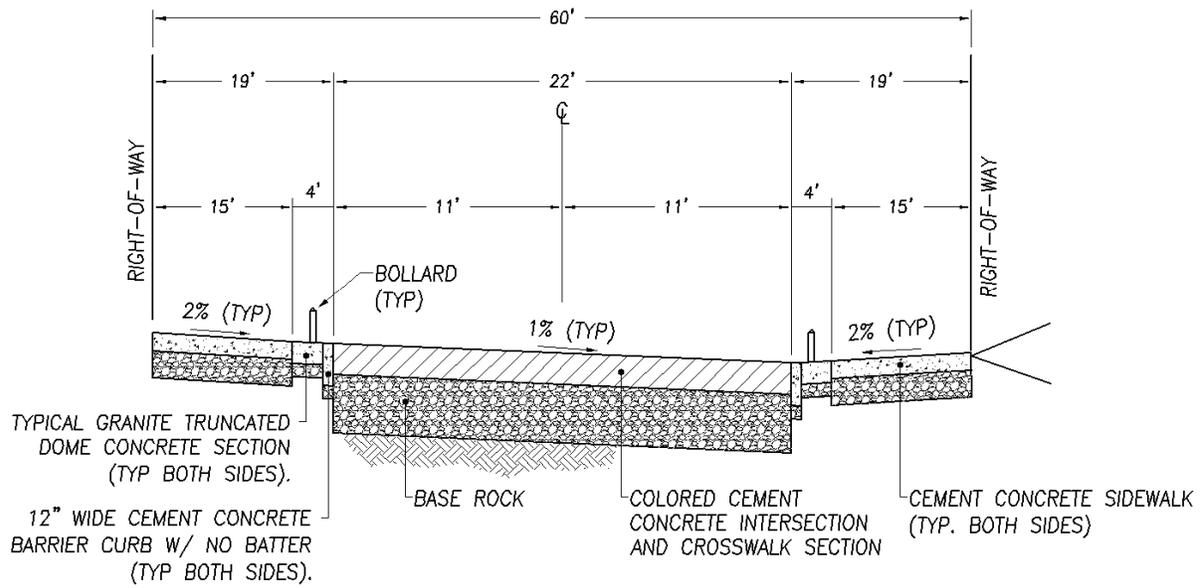
**Figure 3-12: Typical Pedestrian Oriented Intersection**



**Figure 3-13: Pedestrian Oriented Street (Parking Section)**



**Figure 3-14: Pedestrian Oriented Street (Bulb-Out Section)**



### 3.04 Surfacing Requirements

The pavement structure thickness identified for these soil and roadway types is required unless a site-specific pavement design is done. The total pavement structure shall not exceed two and one half (2.5) feet. Asphalt concrete pavement shall be HMA Class A, PG 64-22 per the Standard Specifications. Subgrade reinforcement geotextiles shall be installed over all A-6 and A-7 soils prior to constructing the base and surfacing.

<b><u>Table 3.1</u></b> <b><u>Principal Arterial</u></b> <b><u>Surfacing Requirements</u></b>		
<b>AASHTO Soil Type</b>	<b>Asphalt Concrete Pavement Thickness</b>	<b>Base Rock Thickness</b>
A – 1	0.55'	0.40'
A – 2	0.55'	0.55'
A – 3	0.55'	0.80'
A – 4	0.60'	1.00'
A – 5	0.60'	1.35'
A – 6	0.60'	1.80'
A – 7	0.90'	1.45'
Other	No Section Estimated	

<b><u>Table 3.2</u></b> <b><u>Minor Arterial</u></b> <b><u>Surfacing Requirements</u></b>		
<b>AASHTO Soil Type</b>	<b>Asphalt Concrete Pavement Thickness</b>	<b>Base Rock Thickness</b>
A – 1	0.50'	0.40'
A – 2	0.50'	0.50'
A – 3	0.50'	0.75'
A – 4	0.50'	1.10'
A – 5	0.50'	1.45'
A – 6	0.55'	1.65'
A – 7	0.75'	1.65'
Other	No Section Estimated	

<b><u>Table 3.3</u></b> <b><u>Urban, Industrial/Commercial, Residential</u></b> <b><u>Collector and</u></b> <b><u>Vehicular- Oriented Street</u></b> <b><u>Surfacing Requirements</u></b>		
<u>AASHTO</u> <u>Soil Type</u>	<u>Asphalt Concrete</u> <u>Pavement Thickness</u>	<u>Base</u> <u>Rock</u> <u>Thickness</u>
A – 1	0.45'	0.45'
A – 2	0.45'	0.45'
A – 3	0.45'	0.55'
A – 4	0.45'	0.85'
A – 5	0.45'	1.15'
A – 6	0.45'	1.55'
A – 7	0.50'	2.00'
Other	No Section Estimated	

<b><u>Table 3.4</u></b> <b><u>Residential Access,</u></b> <b><u>Residential Local, Neighborhood and</u></b> <b><u>Pedestrian Oriented Street</u></b> <b><u>Surfacing Requirements</u></b>		
<u>AASHTO</u> <u>Soil Type</u>	<u>Asphalt Concrete</u> <u>Pavement Thickness</u>	<u>Base</u> <u>Rock</u> <u>Thickness</u>
A – 1	0.35'	0.50'
A – 2	0.35'	0.50'
A – 3	0.35'	0.50'
A – 4	0.35'	0.60'
A – 5	0.35'	0.90'
A – 6	0.35'	1.20'
A – 7	0.40'	1.60'
Other	No Section Estimated	

### **3.05 Design Speed**

The minimum design speed for each road classification shall be as shown in Figures 3-1 thru 3-9 or as otherwise approved by the Director.

### **3.06 Horizontal Alignment**

- A. Horizontal alignment shall be designed per AASHTO guidelines.
- B. Super elevations may only be used with the written approval of the Director. Where super elevation is used, street curves should be designed per AASHTO guidelines, except that the maximum super elevation rate of 0.04 shall be used.
- C. Off-set crown cross-sections are not acceptable as super elevation sections.

### **3.07 Vertical Alignment**

- A. Street alignments shall meet the following requirements:
  - 1. Minimum tangent street gradients shall be one-half percent (0.5%) along the crown and curb;
  - 2. Maximum street gradients shall be fifteen percent (15%) for residential streets, and ten percent (10%) for all other streets;
  - 3. Local streets intersecting with a residential collector or greater functional classification street or streets intended to be posted with a stop sign shall provide a landing averaging five percent (5%) or less. Landings are that portion of the street within 20 feet of the projected curb line of the intersecting street at full improvement;
  - 4. Grade changes of more than one percent (1%) shall be accomplished with vertical curves;
  - 5. At street intersections, the crown of the major (higher classification) street shall continue through the intersection. The roadway section of the minor street will flatten to match the longitudinal grade of the major street at the projected curb line;
  - 6. Street grades, intersections, and super elevation transitions shall be designed to not allow concentrations of storm water to flow across the travel lanes; and
  - 7. Streets intersected by streets not constructed to full urban standards shall be designed to match both present and future (as far as practicable) vertical alignments of the intersecting street. The requirements of this manual shall be met for both present and future conditions.
  - 8. When new streets are built adjacent to or crossing drainage ways, the following standards shall govern the vertical alignment:

**Table 3.5  
Vertical Alignments and Flood Plains**

<u>FUNCTIONAL CLASSIFICATION</u>	<u>VERTICAL STANDARD</u>
Arterial Streets	Travel lanes at or above the 50-year flood elevation but not lower than 6-inches below the 100-year flood elevation.
All other streets	Travel lanes at or above the 25-year flood elevation but not lower than 6-inches below the 50-year flood elevation.

- B. If alternate access is available for properties served by a particular local street, a design could be considered for approval by the Director that would set the travel lanes at or above the 10-year flood elevation but not lower than 6-inches below the 25-year flood event.
- C. Vertical curves shall be designed per AASHTO guidelines.
- D. On sloping approaches, including commercial driveways, garage entrances, and private street openings, landings are not to exceed two (2) feet difference in elevation for a distance of thirty (30) feet approaching an arterial or twenty (20) feet approaching a local collector or industrial, measured from the back of sidewalk or the back of curb if no sidewalk exists.

**3.08 Transitions**

- A. Street width transitions from a narrower width to a wider width shall be designed with a 5:1 taper. Street width transitions from a wider width to a narrower width shall be designed with a 10:1 taper. Delineators, as approved by the City, shall be installed to define the configuration.

In situations where a tapered transition cannot be provided, a type III barricade shall be installed at the end of the wider section of the street and a taper shall be appointed and delineated as approved by the Director. If the wider section does not provide an additional travel lane, only a barricade is required without the transition.

- B. Lane transitions shall be designed per AASHTO guidelines.

**3.09 Dedications and Guarantees**

- A. Right-of-way shall be deeded for streets and other improvements as required per Figures 3-1 thru 3-9 to accommodate motorized and non-motorized transportation, landscaping, utility, and buffer requirements.

Public utility tracts for all public systems shall be provided as required. Specific requirements for sewer, water, and storm drainage easements are detailed in the relevant chapters. Particular design features of a road may necessitate slope, wall, or drainage easements. Such easements may be required by the Director in conjunction with

dedication or acquisition of rights-of-way and other standard easements (temporary construction, right-of-entry, sidewalk, pedestrian, street lighting, and traffic control devices, etc.).

B. Special Access Easements or Tracts.

1. Where it is necessary to facilitate pedestrian circulation between neighborhoods, schools, shopping, or other activity centers, public access easements or tracts shall be dedicated.
2. Improvements to the easement shall include a sidewalk or trail consistent with other non-motorized facilities in the area. Fences shall be constructed along access easements in residential areas where buildings will be located nearer than fifty (50) feet to the edge of the easement. Traffic diverters or bollards shall be installed at the direction of the Director.
3. Pedestrian access easements or tracts shall be a minimum of fifteen (15) feet wide. If the easement is over one-hundred and fifty (150) feet in length, the width shall be twenty (20) feet. Structure setbacks shall be a minimum of fifteen (15) feet from the edge of the easement or tract.

C. All subdivisions and short subdivisions (short plats) will be required to deed additional right-of-way, as a condition of approval of the subdivision, where the existing right-of-way for a public street is not adequate to incorporate necessary frontage improvements for public safety and provide compatibility with the area's circulation system.

All short subdivisions (short plats) will be required to deed additional right-of-way, as a condition of approval of the short plat, under one or more of the following conditions:

1. The short plat abuts an existing substandard public street and the additional right-of-way is necessary to incorporate future frontage improvements necessary for public safety, or
2. Additional right-of-way is needed to provide right-of-way for the extension of existing public street improvements necessary for public safety, or
3. Additional right-of-way is needed to provide future street improvements necessary for public safety for planned new public streets.

D. All recording costs for easements created by private development shall be borne by the Developer.

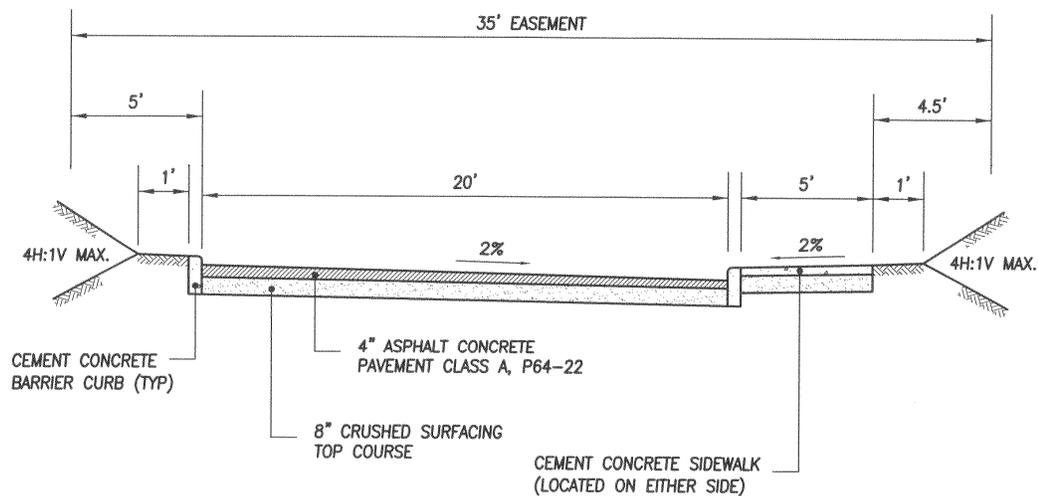
E. Prior to commencing construction of any component of the public street or sidewalk, the Developer shall submit to the City an approved performance bond in accordance with the requirements of Section 1.08 of these Standards.

### 3.10 Private Streets

- A. **Criteria for Authorization.** It is the City of Washougal's policy to discourage private streets and to only permit them under unusual circumstances. Private streets may be permitted only if they meet all the following conditions:
1. A road modification for the street has been approved by the Director,
  2. Covenants have been approved, recorded, and verified with the City which provide for maintenance of the private streets and associated parking areas by owners in the development, and
  3. Provisions are made for the streets to be open at all times for emergency and public service vehicles, and
  4. The private streets will not obstruct public street circulation, and
  5. The following conditions exist:
    - a. The plat or short plat street will ultimately serve no more than four (4) single family lots or the roadways serve commercial or industrial facilities where no circulation continuity is necessary; and
    - b. The Director determines that no other access is available and the private road is adequate for the area it is to service,
    - c. The private road shall not connect two public roads,
    - d. No public utilities shall be located within the private street without approval from the Director.
- B. **Notice.** A statement is required on the face of any plat or short plat containing a private road with the following: "The City of Washougal has no responsibility to improve or maintain the private roads contained within, or private roads providing access to the property described in this plat."
- C. **Easements.** Private roads shall be constructed within easements with an easement width equal to the width of the surfacing (pavement and sidewalk) plus ten (10) feet (five (5) feet on each side).

- D. Construction Requirements. Private streets shall conform to public street construction standards with the following exceptions:

**Figure 3-15: Private Street Typical Section**



1. The maximum grade for private roadways shall be fifteen percent (15%); and
  2. The street shall be signed “No Parking.”
- E. Acceptance as Public Streets. Acceptance of private streets as public streets will be considered if the street meets all applicable public street standards contained herein.

### 3.11 Street Frontage Improvements

- A. All residential subdivisions, commercial developments, industrial developments, and short plats shall install street frontage improvements at the time of construction as detailed in their subdivision or short plat approval, as detailed in their approved building plans, or as directed by the Director. Such improvements may include curb and gutter; sidewalk; storm drainage; street lighting system; traffic signal modification, relocation or installation; utility relocation; landscaping and irrigation; and street widening per these Standards. The frontage street shall be reconstructed from the center line of the proposed, or existing, street width, whichever is greater.
- B. Frontage improvements shall include a 2-inch inlay of the half width of the street located away from the development if construction occurs on that side of the street, unless it is shown through a road modification that the life of the street is less than five (5) years.

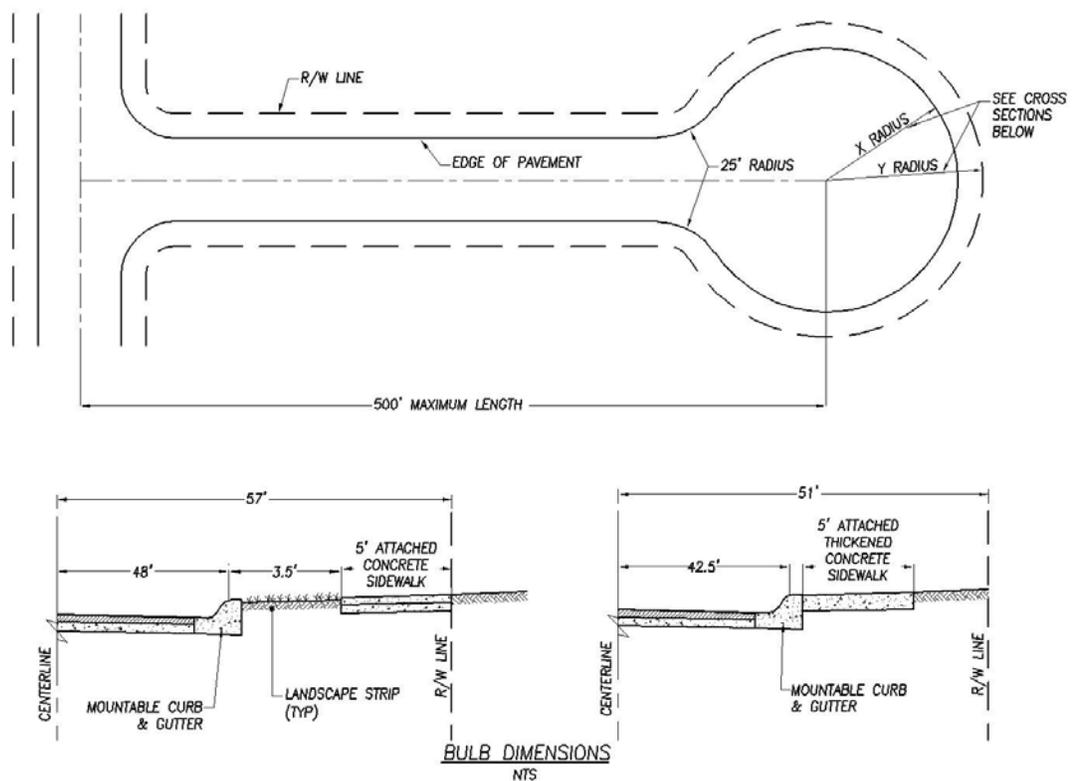
### 3.12 Street Ends

#### A. Cul-de-sacs:

Cul-de-sacs shall be provided at all public and private street ends on all streets that are longer than one hundred fifty (150) feet and up to five-hundred (500) feet in length, measured from the centerline of the intersecting road to the center of the cul-de-sac.

1. No dead end street shall be allowed that obstructs public street circulation.

**Figure 3-16: Cul-De-Sac Dimensions**



2. All street ends shall be paved and signed “No Parking.”
3. The minimum curb radius for transitions into cul-de-sac bulbs shall be twenty-five (25) feet, and the right-of-way radius shall be sufficient to maintain the same right-of-way to curb spacing as in the adjacent portion of the road.

B. Hammerheads:

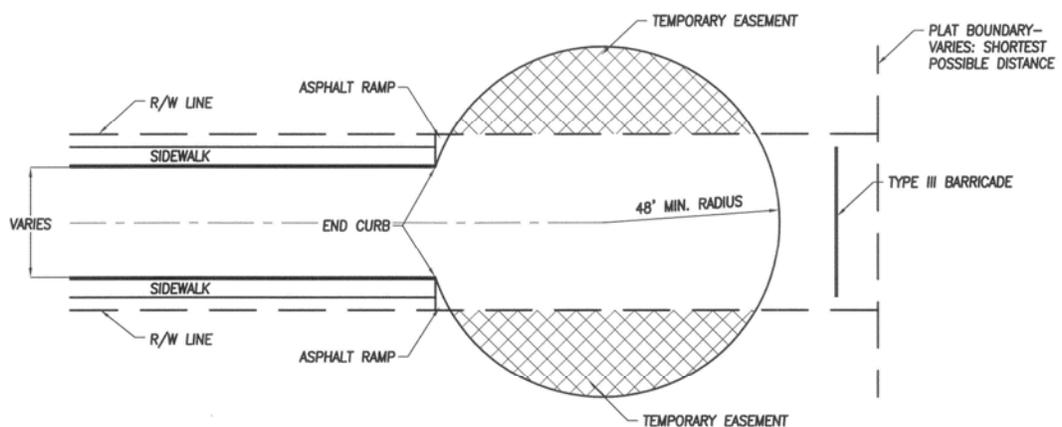
Hammerheads may be used on private streets in lieu of a cul-de-sac. The hammerhead shall be signed “No Parking.” A driveway shall not be used as part of the hammerhead.

C. Temporary Dead Ends:

Where a street is temporarily dead ended, turn around provisions must be provided where the road serves more than one (1) lot or is greater than one-hundred fifty (150) feet in length.

1. A cul-de-sac with a minimum radius of forty-eight (48) feet shall be provided.

**Figure 3-17: Temporary Cul-De-Sac**



NOTES:

1. BARRICADE REQUIRED AT END OF BULB.
2. ALTERNATIVE DESIGNS FOR TEMPORARY TURN-AROUNDS MAY BE APPROVED THROUGH THE ROAD MODIFICATION PROCESS.

2. All temporary dead ends shall have a type III barricade with signage denoting a future street extension and “No Parking.”
3. All temporary dead ends shall be removed by the Developer responsible for extending the road.

D. Cul-de-sacs, eyebrows, and turnaround areas shall be allowed only on local streets and commercial/industrial streets.

- E. An eyebrow corner may be used on a local street where expected ADT will not exceed five-hundred (500) vehicles per day or as otherwise approved by the Director. Minimum curb radius on the outside of an eyebrow corner is forty-one (41) feet; minimum right-of-way radius is forty-nine (49) feet. Eyebrow geometry shall be evaluated on the basis of turning requirements for Fire Department vehicles.

### **3.13 Medians**

A median shall be in addition to, not part of, the specified road width. Where raised medians are allowed, the following criteria must be met:

- A. Landscaping and irrigation may be required. Plans shall be prepared by a qualified Landscape Architect.
- B. Shall be designed so as not to limit turning radius or sight distance at intersections.
  - 1. The raised median shall be set back at least two (2) feet from the median lane on both sides.
  - 2. Street lighting shall be sufficient to provide illumination of the raised median.
  - 3. Objects, such as trees, shrubs, signs, and light poles shall not physically or visually interfere with vehicle or pedestrian traffic in the travel way.
  - 4. The style and design of the raised median shall be site specific. The raised median shall be safe for the design speed, and shall be subject to approval by the Director.

### **3.14 Intersections**

The following specifies the minimum requirements for intersections:

- A. Angle between intersections.
  - 1. The interior angle at intersecting streets shall be kept as near to ninety degrees ( $90^{\circ}$ ) as possible and in no case shall it be less than seventy-five degrees ( $75^{\circ}$ ), nor more than fifteen degrees ( $15^{\circ}$ ), from the ninety ( $90^{\circ}$ ). A tangent section shall be carried a minimum of fifty (50) feet each side of intersecting right-of-way lines.
- B. Minimum center line offset of adjacent and/or opposing streets:
  - 1. Residential – one hundred and sixty (160) feet
  - 2. Residential or arterials intersecting arterials – three-hundred (300) feet

C. Curb returns:

1. Minimum curb radii at intersections shall be shown in Table 3.6 for the various functional classifications. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way to curb spacing as the upper classified street.
2. Sidewalk access ramps shall be provided at all corners of all intersections, regardless of curb type.

**Table 3.6**  
**Curb Return Radii (Feet)**  
**Edge of Pavement/Curb -Minimums**

<u>Street Classification</u>	<u>Principal/Minor Arterial Street</u>	<u>Urban Collector Street</u>	<u>Residential Collector Street</u>	<u>Industrial/ Commercial Collector Street</u>	<u>Residential Access/Local Street</u>
Major/Minor Arterial Street	55	50	30	40	25
Urban Collector Street	50	40	30	40	25
Residential Collector Street	30	30	20	30	15
Commercial/ Industrial Collector Street	55	40	30	40	25
Residential Access/ Local Street	25	25	20	15	15

- D. It is the policy of the City to have the Developer's engineer evaluate safe intersection sight distance using the principles and methods recommended by AASHTO.
- E. Traffic control will be as specified in the Manual of Uniform Traffic Control Devices (M.U.T.C.D.) or as modified by the Engineer as a result of appropriate traffic engineering studies.
- F. Traffic signal modification, relocation, or installation is required when roadway or driveway geometrics interfere with existing signal facilities, or would result in an un-signalized approach, or intersection that meets signal warrants.

### **3.15 Sight Obstruction Requirements**

- A. Sight distance should be maintained at all driveways, buildings, or garage entrances where structures, wing walls, etc. are located adjacent to, or in close proximity to, a pedestrian walkway.
- B. Sight lines to traffic control devices (signs, signals, etc.) should not be obscured by landscaping, street furniture, marquees, awnings, or other obstructions. Refer to AASHTO for required sightlines.

### **3.16 Survey Monuments**

A survey monument shall be located in an intersection for all subdivisions and short plats greater or equal to four (4) lots. At least one monument shall be placed for every intersection or every thirty (30) lots, whichever is less.

### **3.17 Concrete Sidewalks**

All sidewalks shall maintain the full design width around obstructions that cannot be relocated. Additional right-of-way (or easement) may be required to either relocate the obstruction or meander the sidewalk.

Sidewalks shall meander no more than six (6) feet from the curb at all pedestrian crossings and at driveways.

### **3.18 Multi-Use Trails**

- A. Multi-use trails shall be a minimum of ten (10) feet wide. Access easements shall comply with Section 3.087C.
- B. Surfacing shall be crushed rock or asphalt at the discretion of the Director.
- C. Multi-use trails shall be a minimum of six (6) feet from the edge of the vehicular travel way unless no practicable alternative exists and when approved by the Director.
- D. Maximum grade is fifteen percent (15%). Minimum curve radius is ten (10) feet. Maximum grade may be increased to twenty percent (20%) for a maximum of one-hundred and fifty (150) feet with additional surfacing requirements and the approval of the Director.
- E. Access easement termination (Type II Barricades) shall be installed as directed by the Director. A temporary connection shall be provided to the street.

### **3.19 Driveways**

#### **A. General Requirements**

1. Standard residential or commercial driveways shall be required for all developments.
2. A private intersection opening shall be used in lieu of a conventional driveway in commercial areas where the following criteria are met:
  - a. Projected driveway usage is greater than two-thousand (2,000) vehicles per day.
  - b. In any case where traffic signalization is approved, warranted, and provided.
  - c. A minimum 100-foot storage area is provided between the street and any turning or parking maneuvers within the development.
  - d. The opening is at least one-hundred and fifty (150) feet from any other intersection opening, including driveways.
  - e. The opening is at least one-hundred and fifty (150) feet away from any other driveway on the property frontage under control of the applicant.
  - f. Easement dedication for traffic control devices.

#### **B. Conditions of Approval**

1. Driveways directly giving access onto arterials may be denied if alternate access is available.
2. All abandoned driveway areas on the street frontage to be improved shall be removed and new curb, gutter, and sidewalk shall be installed.
3. No commercial/industrial driveway shall be approved where backing onto the sidewalk or street will occur.
4. No residential driveway shall be approved where backing onto a street classified, as an arterial or collector street will occur.
5. Single family residential lots shall have one (1) driveway access.
6. Left turns from and to a driveway may be restricted as a development condition or in the future if such maneuvers are found to be unduly hazardous.
7. Driveways shall be aligned wherever possible with existing driveways on the opposite side of the street.
8. Commercial driveways shall be offset a minimum of one-hundred (100) feet from an intersection. Residential driveways shall serve a single lot and be located as far away from the intersection that the lot will allow with a minimum of five (5) feet separation between the lot line and the driveway edge.

9. All driveways shall be angled ninety-degrees (90°) to the street, unless designated as right turn only with the approval of the Director.
10. A joint driveway may be used to serve a maximum of three (3) single-family residential lots under the following conditions:
  - a. The driveway is located within a minimum 20-foot easement.
  - b. It is no longer than 150 feet long.
  - c. It is a minimum of sixteen (16) feet in width.

C. Design Criteria:

1. Width.

- a. Two-way multi-family residential driveways shall have a minimum width of eighteen (18) feet and a maximum width of twenty-two (22) feet. Two-way commercial, or industrial, driveways shall have a minimum width of twenty-four (24) and a maximum width of thirty-five (35) feet. A turning diagram shall be provided with all commercial, and industrial, driveway submittals showing adequate driveway width for the largest vehicle. A wider commercial, or industrial, driveway width may be approved by the Director where a substantial percentage of oversized vehicle traffic exists. In this case the driveway should be sized to accommodate the largest vehicles. Where intersection openings are approved the width shall be as determined by the Director.
  - b. One-way multi-family residential driveways shall have a minimum width of ten (10) feet and a maximum width of twelve (12) feet. One-way commercial, or industrial, driveways shall be designed for the largest vehicle with a minimum driveway width of twelve (12) feet. A turning diagram shall be provided with all commercial, and industrial, driveway submittals showing adequate width for the largest vehicle.
  - c. Single family residential driveways shall be a minimum width of ten (10) feet and a maximum width of twenty-four (24) feet.
  - d. Commercial, and industrial, driveways shall have a minimum centerline separation (adjacent and/or opposing) of one hundred and sixty (160) feet.
2. Parking lot circulation needs shall be met on site. The public right-of-way shall not be utilized as part of a one-way parking lot flow.
  3. Driveways shall be designed with a maximum slope of 15%, Grade changes of more than two percent (2%) shall be accomplished with vertical curves, designed in accordance with AASHTO guidelines.

4. Clearance from structures. No object (including fire hydrants, light or power poles, street trees) shall be placed or allowed to remain within six (6) feet of the driveway edge.
  - a. Where the building facade or other design element is less than ten (10) feet behind the sidewalk, both pedestrian and vehicular sight distance shall be maintained.
5. Sight Distance. Sight distance shall be designed per AASHTO guidelines.
6. Maximum driveway grade shall be fifteen percent (15%).

### **3.20 Gates and Other Barriers**

All gate installations shall satisfy the following standards:

- A. A turnaround shall be provided adjacent to the gate. The turnaround shall allow passenger and delivery vehicles to exit the site without backing. The minimum turning radius for the turnaround shall be twenty-five (25) feet.
- B. A sign shall be located at a point visible from nearest the public roadway intersection indicating, "locked gate ahead."
- C. All gates shall be equipped with an "Opticom" automatic vehicle identification system. The emergency access system shall lock the gate open until manually overridden, and the detector/receiver shall be programmed to recognize the City's emergency vehicle code. In lieu of the foregoing system, the applicant may propose an equivalent system subject to acceptance by the City.
- D. All gates shall include an activation system for use by private property owners. This system shall operate independently of the emergency access system and may utilize key pads, magnetic cards, radio transmitters, or other mechanisms approved by the City.
- E. All gates shall include auxiliary power supply, which shall automatically lock the gate open in the event of a power outage.
- F. There shall be pedestrian access around all gates.
- G. Gate construction shall be of wrought iron or other material approved by the City. The gate and related equipment shall be coated in a manner to prevent corrosion.
- H. The gate height shall not exceed 60-inches above the paved surface of the roadway and shall be constructed in a manner so as to allow viewing of obstructions located within the swing path of the gate.

- I. If the gate obstructs access to water, sewer, or stormwater utilities owned and maintained by the City, the City shall be provided with eight (8) activation devices, eight (8) keys, or the access code to the gate.

### **3.21 Bridges**

- A. A bridge shall be defined as a structure spanning twenty (20) feet or more.
- B. Design Principles.

All bridges, whether on public or private roadways and driveways, shall meet the minimum requirements set forth in the latest addition of "Standard Specifications for Highway Bridges," adopted by AASHTO. All new bridges shall be designed to carry an AASHTO HS-20-44 live load or greater.

- C. Geometrics.

1. In the general case, the bridge shall comprise the full width and configuration of the road being served (traveled way plus curb, sidewalk, walkway, bike lane, and/or shoulder on one or both sides). Provisions for utilities shall be required unless approved otherwise by the Director. Traffic and pedestrian railings or combination traffic-pedestrian railings shall meet AASHTO specifications.
2. Overhead vertical clearances on the traveled street or under overpasses shall be sixteen and one-half (16.5) feet minimum.

### **3.22 Landscaping in the Right-of-Way, Easements, and Access Tracts**

- A. Plantings established in the right-of-way shall be maintained by the abutting property owner.
- B. Any existing planting areas within the right-of-way that are disturbed by construction activity shall be restored to their original condition.
- C. Any plantings or other improvements placed within the right-of-way (by abutting property owners) are subject to removal when the right-of-way is needed for public use. The property owner is responsible for removing any landscaping or other improvements upon official notice. The property owners shall be responsible for survival of the relocated plantings.

D. Plantings within the right-of-way shall comply with the following provisions:

1. All landscaping shall comply with the sight distance provisions of these standards, unless otherwise approved by the Director. No trees shall be planted within thirty (30) feet of an intersection measured from the closest curb.
2. Where existing landscaping maintained by the City exists, every effort shall be taken to protect and preserve the existing vegetation during construction. Plants shall be relocated or removed only upon approval of the Public Works Departments. Damaged landscape areas shall be restored prior to issuing a final occupancy permit.
3. In areas where an existing landscaping concept or pattern has been established or approved, all new landscaping shall conform to the intent of the concept. Plantings shall be of a similar variety, size, and spacing to those already established and/or approved for the area.
4. All trees planted in areas with adjacent pedestrian usage shall maintain seven (7) feet of clearance to the lowest branches.
5. No low growing vegetation is to extend beyond the curb. Trees must have no limbs or other vegetation extending beyond the curb line or edge of asphalt for a distance of seven and one half (7 1/2) feet above the road surface.
6. Approval from the Public Works Department must be received before trees are planted in or adjacent to sidewalk sections.

### **3.23 Street Illumination**

Street lighting is required for all public streets and at the intersections of public and private streets. The street lighting design shall be submitted, reviewed, and approved by the Clark Public Utilities prior to final plat approval. The installation cost of all street lighting shall be paid for by the Developer.

Street lighting is not required on private streets within a plat. The City does not install or maintain private street lighting systems. On private streets, all street light maintenance and power cost shall be paid by the Developer, homeowner, or homeowners association.

Streetlights shall be located two and one half (2.5) feet from face of curb and be CPUD acorn style luminaries.

A. Commercial

1. Street lighting is required on all public street frontages. The Developer is responsible for design, installation, or relocation of new or existing lighting. Commercial development shall replace existing lighting systems on power poles with a new lighting system serviced by underground power if the system will not

conflict with essential distribution lines.

**B. General Considerations**

1. All public street light designs shall be prepared by a licensed engineer experienced in lighting design. Design will be submitted to Clark Public Utilities for review and approval.
2. All public street light systems shall be accessible for public maintenance by a wheeled vehicle weighing twenty-thousand pounds (20,000 lbs.).
3. All street light installations including wiring, conduit, and power connections shall be located underground. Exceptions include existing residential areas with existing above ground utilities may have street lighting installed on the existing power poles, with the approval of the Director.

**3.24 Traffic Control and Signing**

**A. Traffic Control Devices.**

All traffic control devices shall conform to the "Manual on Uniform Traffic Control Devices" (M.U.T.C.D.) and be reviewed and approved by the Director.

**B. Signing.**

In new plats, the Developer shall install all traffic control signs, which shall include but not be limited to street name, parking, stop, dead end, and pedestrian signing. Signs shall be located two and one half (2.5) feet from face of curb. The Developer will be responsible for supplying and installing the required signs, posts, and hardware.

**C. Pavement Marking:**

1. In new plats or commercial developments, pavement markings, including buttons, paint, thermoplastics, and delineators will be required for roadway safety within, but not limited to, one hundred fifty (150) feet of an intersection. Such markings shall be provided and installed by the Developer.
2. All materials shall conform to the Standard Specifications.
3. All markings shall conform to the current "Manual on Uniform Traffic Control Devices" (M.U.T.C.D.).

**D. Temporary Traffic Control:**

1. It is the responsibility of the Developer to provide adequate temporary traffic control to ensure traffic safety during construction activities.

2. Plans meeting the requirements of Section 1-10 of the Standard Specifications shall be reviewed and approved by the Director prior to any temporary traffic control being installed.
  3. All traffic control devices shall conform to the "Manual on Uniform Traffic Control Devices" (M.U.T.C.D.).
- E. Traffic Signal Modification. Traffic signal modification designs shall be prepared by a licensed engineer experienced in traffic signal design.
- F. All traffic control devices, posts, foundations, hardware, signs, and markers are to be installed by the Developer.

### **3.25 Appurtenances**

- A. All appurtenances shall be located a minimum of two and one half (2.5) feet behind the face of the curb to the face of the object. Where no curb exists the distance from the edge of the travel way to the face of the object shall be at least six (6) feet.
- B. All breakaway objects shall be located a minimum of two and one half (2.5) feet behind the face of curb to the face of the object. All objects having properties up to that of a 4"x 4" wooden post shall be considered breakaway.
- C. Appurtenances shall be located outside of the sidewalk area except when the sidewalk is widened around the appurtenance to the satisfaction of the Director.

### **3.26 Franchise Utilities**

- A. Non-City owned franchise utilities are required to relocate existing facilities at their own expense when a conflict results between their facilities and public street improvements. The improvement work must be required by the non-City owned utility in order for the relocation work to be the financial responsibility of the utility; otherwise all costs shall be the responsibility of the Developer. Any relocation of a utility shall be underground.
- B. All non-City owned franchise utility distribution or collection systems including power, telephone, natural gas, and T.V. cable in new plats or short plats shall be installed underground prior to paving.
- C. As a minimum on all new single-family plats and short plats, a minimum 5-foot wide common or individual non-exclusive utility easement shall be provided connecting any lots without public street frontage to a public street. Easements for existing or future utility lines, which do not lie along rear or side lot lines, shall be of a width specified by the serving utility.

### **3.27 Safety Railings**

- A. Safety railings shall be constructed of 2-inch galvanized steel pipe or aluminum with vertical supports ten (10) feet on center and three (3) horizontal railings 14-inches on center, the lowest railing center being 14-inches above finished grade. All joints shall be welded, cold galvanized if welded after galvanizing, and the entire safety railing may be painted or vinyl coated to assure corrosion protection and a pleasing appearance. Railings shall be erected and adjusted, if necessary, after initially set to assure a

continuous line and grade.

- B. Wooden railings may be used when approved by the Engineer. Wooden railings shall be sturdily constructed of pressure treated timbers and galvanized carriage bolts (no nails allowed). Posts shall be minimum 4" x 4" on 4-foot centers. Three (3), 3" x 6" rails shall be bolted to the posts. Alternate designs may be considered.

### **3.28 Trench Backfill and Restoration**

All materials and workmanship shall be per these standards and in accordance with the Standard Specifications except where otherwise noted in these Standards. A 2-inch inlay of the streets half width shall be completed for all trench restorations in line with the roadway. A 2 inch inlay of twice the trench width after completion of the work shall be completed for all trench restorations perpendicular with the roadway. The edge of the inlay shall be no closer than two (2) feet from the edge of the trench.

### **3.29 Postal Regulations**

All developments and construction projects shall construct mailboxes in compliance with the current Postal Development Code.

# Chapter 4

## Storm Drainage

City of Washougal Engineering Standards for Public Works Construction  
February 2010  
Director of Public Works: Trevor Evers

**Chapter 4**  
**Storm Drainage**

City of Washougal Engineering Standards for Public Works Construction  
February 2010

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## CHAPTER 4 - STORM DRAINAGE

### 4.00 General

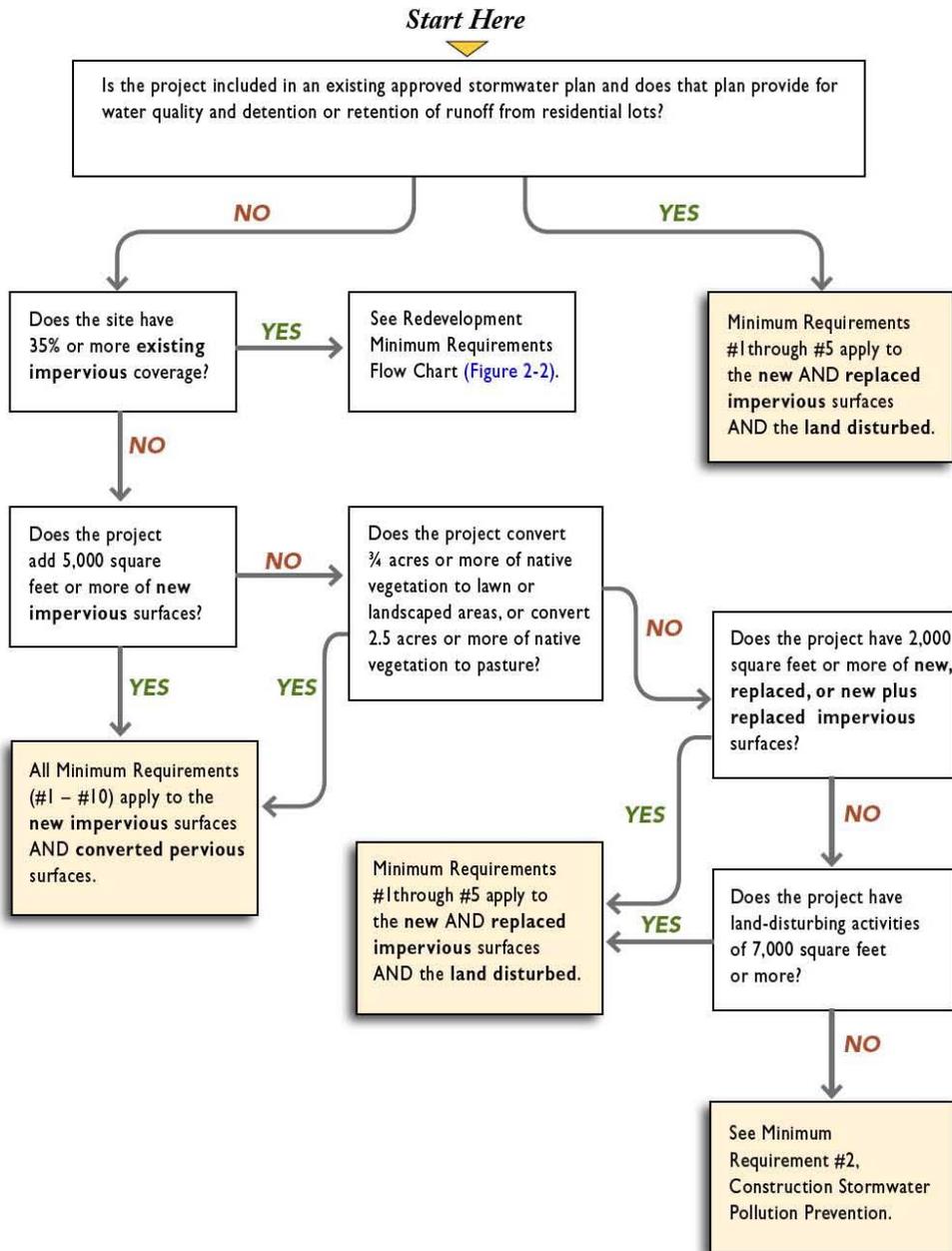
- A. The City of Washougal has established the requirements for design of facilities intended to protect the public health, safety, and welfare from damage due to flooding. Beyond that level of protection, additional measures are specified in this chapter that are intended to minimize any potential flooding damage and allow for efficient operation, repair, and maintenance of the storm drainage system.
- B. All plans, studies, and reports shall be stamped, signed, and dated by:
  - 1. The professional civil engineer(s), registered in the state of Washington, responsible for their preparation, and
  - 2. The project engineer responsible for preparation of the stormwater management plans, and;
  - 3. Registered soil scientist, if appropriate,
- C. If site conditions are appropriate and groundwater quality will not be impaired, infiltration is the preferred BMP. Direct discharge of untreated stormwater to groundwater is prohibited. All discharges to groundwater shall comply with the following state laws: the Water Pollution Control Act (90.48 RCW), the Water Resources Act (90.54 RCW), and Water Quality Standards for Ground Waters of the State of Washington (WAC 173-200). Infiltration may be limited near public water supply wells.
- D. These requirements shall apply to all storm drainage facilities in existing and proposed public rights-of-way, public drainage easements, and tracts of common ownership in the City. Storm drainage systems include, but are not limited to inlets, pipes, ditches, creeks, rivers, wetlands, and storm water quality and quantity facilities.
- E. Design and construction of drainage facilities, including but not limited to open channels, conveyance pipe, and inlets shall be in compliance with the latest edition of the City's ordinances, these Standards, the Standard Details, the latest edition of the WSDOT Standards for Road, Bridge and Municipal Construction, and the " Stormwater Management Manual for Western Washington " (prepared by the Washington State Department of Ecology, 2005). The City has adopted the Western Washington Manual with the following notations:
  - 1. Stormwater quality requirements are amended by Section 4.07 of these Standards.
  - 2. Stormwater quantity management requirements are amended by Section 4.08 of these Standards.
  - 3. All steps within structures must comply with OSHA standards. There shall be no more than 24-inches between the top of the casting and the rung of the top step.

4. Inside drops are prohibited unless specifically approved by the Director. Inside drops, if allowed, must be constructed with pipe and installed in a 60-inch or larger diameter manhole.
5. All pipes shall be installed with prefabricated watertight joints and fittings.
6. All backfill material shall be referenced per Standard Specifications and the City of Washougal Standard Details.
7. No private storm sewer shall be located within any lot other than the lot, which is the site of the building or structure served by such sewer. The exception to this will be common areas in planned unit developments, and/or City rights-of-way, or as otherwise approved by the Director.
8. Where provisions of this chapter conflict with the Western Washington Manual or other cited design guidance, this chapter shall take precedence.
9. All storm systems shall consist of ADS N-12 pipe or an approved equal.
10. Curb inlets shall be used with curb and gutter road sections up to eight percent (8%) in tangential grade. Where the tangential grade exceeds eight percent (8%), combination curb inlets shall be used.
11. Whenever possible, stormwater facilities shall be multi-use and designed to include pedestrian, educational, aesthetic and social functions.

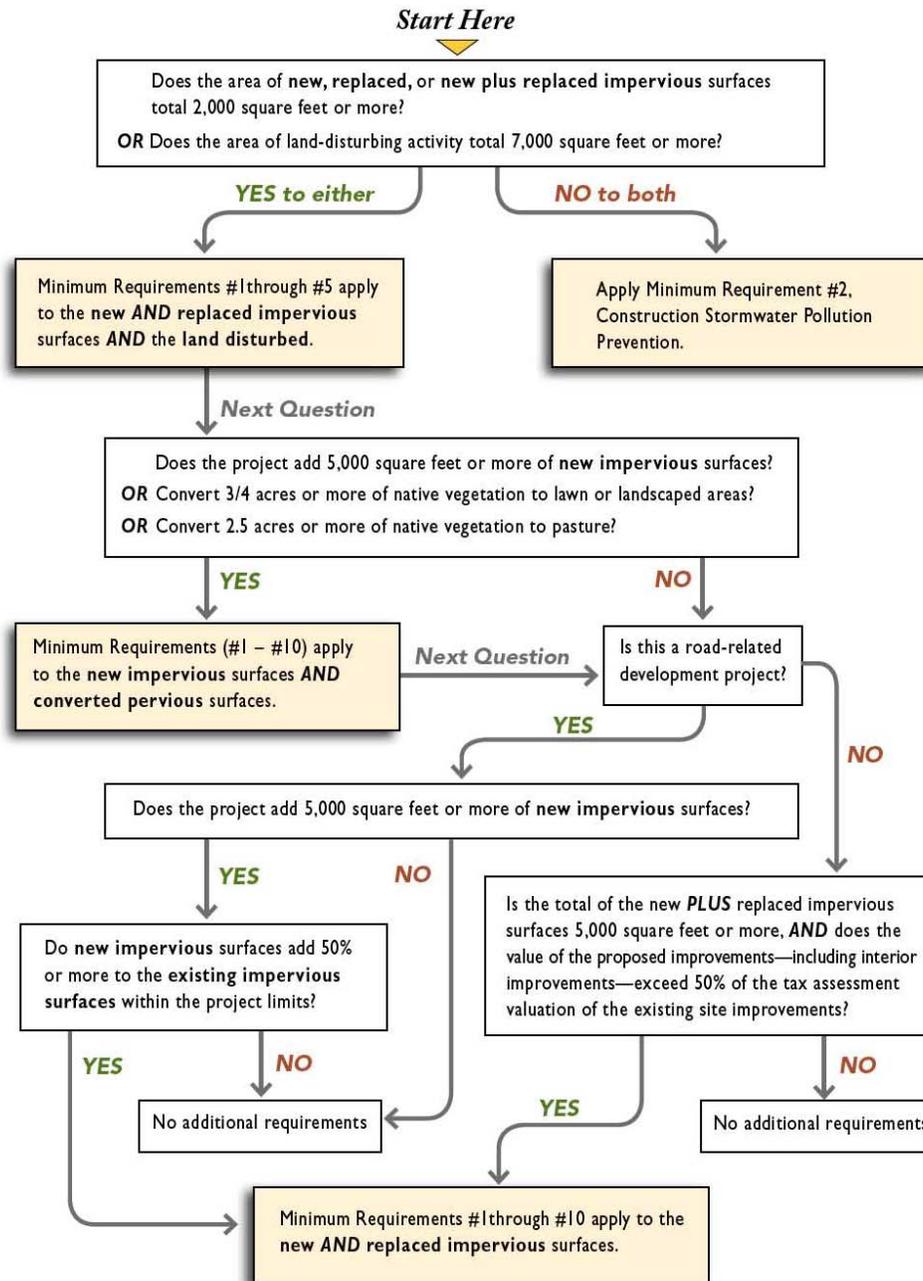
#### **4.01 Applicability**

- A. The provisions of this chapter apply to all development and redevelopment activities that are outlined in Figure 4-1 and 4-2.

**Figure 4-1: New Development Flow Chart**



**Figure 4-2: Redevelopment Flow Chart**



B. Exemptions:

1. The following activities are exempt from the minimum requirements:
  - a. Commercial agricultural and forest practices regulated under WAC Title 222, except for Class IV General Forest Practices that are conversions from timberland to other uses.
  - b. Normal landscape maintenance activities and gardening.
  - c. Any emergency project that is immediately necessary for the protection of life, property, or natural resources.
  - d. The following road maintenance projects:
    - i) Pothole and square cut patching
    - ii) Overlaying existing asphalt and concrete pavement without expanding the area of coverage
    - iii) Shoulder grading
    - iv) Regrading/reshaping drainage systems
    - v) Crack Sealing
    - vi) Resurfacing with in-kind material without expanding the road prism
    - vii) Vegetation management
  - e. The Director may determine exemptions on a case-by-case basis provided adequate justification for deviation is given.
2. The following activities shall be exempted from their respective minimum requirements:
  - a. The construction of single-family homes, duplexes, and their accessory structures are exempt from minimum requirements 6 through 11, provided the following conditions are met:
    - i) The project site is included in a stormwater plan previously approved by the City.
    - ii) The stormwater plan provides for water quality and detention or retention of runoff from residential lots
  - b. Drainage projects that do not create new underground injection control wells are exempt from Minimum Requirement 6.
  - c. Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics, as determined by the Director, are subject only to Minimum Requirement 2.
  - d. New development and redevelopment that meets the criteria for Flow Control-Exempt Surface Waters are exempt from Minimum Requirement 7:

#### **4.02 Minimum Requirements**

The minimum requirements as noted above are found in the SMMWW and this document. They are:

1. Preparation of Stormwater Site Plans
2. Construction Stormwater Pollution Prevention
3. Source Control Pollution
4. Preservation of Natural Drainage Systems and Outfalls
5. Onsite Stormwater Management
6. Runoff Treatment
7. Flow Control
8. Wetlands Protection
9. Basin/Watershed Planning
10. Operation and Maintenance

#### **4.03 Emerging Technologies and Experimental BMPs**

Emerging technologies and experimental best management practices are those which have not been fully tested and evaluated by the Department of Ecology and are not included as accepted practices in these standards or the Western Washington Manual. Experimental BMPs that are adequately tested, proven effective, and approved by DOE shall be incorporated into this chapter as standard or accepted BMPs. All BMPs must be accepted by the Director.

#### **4.04 General Standards**

##### **A. General**

1. No more than seven thousand (7,000) square feet of impervious surfacing, including but not limited to roadway pavement, driveways, and sidewalk shall drain to an inlet.

##### **B. Roof Drains**

1. Provisions must be made for gravity drainage of roofs and foundation drains for all new buildings and structures. In areas where infiltration of roof runoff is not feasible, roof drains and foundation drains shall be piped to the stormwater system.
2. In single-family residential developments where the measured infiltration rate is equal to or greater than 8-inches per hour, roof drains shall be discharged to an on-site infiltration system. The system shall include an approved emergency overflow to the public storm system or any approved outfall.
3. Roof downspout systems may be installed without observation wells.
4. The system shall be designed to discharge a minimum 2-year, 24-hour design storm into the ground. Runoff from roofs during the 10 and 100-year storms shall be

included in the post development design flow of the site facility(s) unless provided for in the roof system. Infiltration tests shall be provided for all proposed roof downspout systems prior to final stormwater report approval.

5. The Director may waive the requirement to infiltrate roof drains upon written findings by a qualified geo-technical engineer demonstrating that such infiltration is unsuitable and roof runoff is conveyed to an approved water quantity control facility.
6. All drains must drain to the street through weep holes in the curb unless otherwise approved by the Director. Weep holes shall be installed at the lowest corner of the lot in conjunction with construction of the curb. If it is determined that a weep hole is providing consistent runoff into the road, directing the drain into the back of a catch basin may be acceptable upon the approval of the Director.

#### C. Fencing of Stormwater Facilities

1. Stormwater treatment and runoff control facilities located in or adjacent to residential areas shall be fenced unless these facilities are constructed as part of a development amenity such as a park or the Director waives the fencing requirement due to special circumstances.
2. Stormwater treatment and runoff control facilities, other than those described in subsection one (1) of this section, shall be fenced if they pose safety risks to the public.
3. The size and type of fence shall be six (6) feet high green vinyl coated chain link fencing unless otherwise approved by the Director.
4. Access to stormwater facilities for maintenance shall be provided to the satisfaction of the Director.

#### D. Side Slopes of Stormwater Facilities

1. Side slopes of stormwater facilities shall be no steeper than three to one (3:1) within the area of submergence.
2. For facilities to be maintained by the City, vertical slopes are allowed if all the following conditions are met:
  - a. No more than seventy-five percent (75%) of the perimeter of the stormwater facility shall have vertical sides;
  - b. Vertical sides more than two (2) feet high shall have guardrail or be fenced;
  - c. Access for maintenance of facilities is provided; and
  - d. Side slopes in a biofiltration treatment area shall be no steeper than three to one (3:1).
3. For facilities, on commercial or industrial sites, that will not be maintained by the City, slopes steeper than three to one (3:1) are allowed if all the following conditions are met:

- a. Side slopes in a biofiltration treatment area shall be no steeper than three to one (3:1);
    - b. Adequate long-term erosion control is provided;
    - c. No more than seventy-five percent (75%) of the perimeter of the stormwater facility shall have vertical sides;
    - d. Vertical sides more than three (3) feet high shall be fenced;
    - e. The maintenance and operations manual for the facility shall demonstrate that the facility can be maintained.
  4. Side slopes steeper than two to one (2:1) may be allowed by the Director for specialized development activity, such as stream bank reconstruction, where all the following conditions are met:
    - a. Side slopes do not need to be mowed, and
    - b. Adequate long-term erosion control and slope stability is provided.
- E. Drainage Structure Labeling and Signage
1. All inlets shall install numbered steel badges purchased from the city.
  2. Signs shall be installed at all stormwater facilities in accordance with the standard details.
- F. Stormwater Rights-of-Way
1. Rights-of-way shall be provided to the City for access and maintenance of all conveyance systems (including streams, if utilized), or other facilities as deemed appropriate by the Director, within the development site, which are to be maintained by the City. The minimum widths of rights-of-way shall be as follows, although the Director may require increased widths when necessary to insure adequate area for equipment access and maintenance:
    - a. Pipes with an inside diameter less than or equal to 36-inches: twenty (20) feet;
    - b. Pipes with an inside diameter greater than 36-inches: twenty (20) feet, plus the pipe's inside diameter;
    - c. Pipes shall be located with their center line one-quarter (1/4) the easement width from an adjacent property line;
    - d. Channels: top width of channel plus fifteen (15) feet on one side.
  2. Rights-of-ways shall have a 12-foot wide all weather surface.
  3. No buildings or other structures that prevent access are permitted within rights-of-way. Fences crossing rights-of-way shall provide gates of sufficient width to provide access by maintenance vehicles.

#### 4.05 Conveyance System Standards

- A. Storm drain conveyance systems shall be designed in accordance with the requirements of Chapter 6 of these Standards with the following notations:
1. Stormwater conveyance elements to transport water within and from a development activity site shall be sized to carry flows from the "design storm" from the contributing drainage area. Sizing shall be based upon the projected full build-out of the contributing drainage area and be fully compatible with existing downstream conveyance elements and flow conditions.
  2. Open channel conveyance systems incorporating water quality treatment, habitat improvement, and emergency overland flood relief routes shall be utilized to the maximum extent practicable.
  3. For stormwater conveyance design, the "design storms" shall be as follows:
    - a. 10-year storm: contributing drainage areas less than 40-acres;
    - b. 25-year storm: contributing drainage areas of 40-acres or more;
    - c. 100-year storm: culverts with contributing drainage areas greater than 200-acres, culverts in areas of special flood hazard as described in Federal Emergency Management Agency (FEMA) maps and reports for Clark County or the City of Washougal, culverts where upsizing in order to meet design requirements for the 100- year storm is required.
    - d. Development sites shall be planned to be able to pass a 100-year storm through the site.
    - e. Closed conveyance system elements shall be designed to operate in an open flow, not pressure flow regime except during the 100-year storm.
  4. All storm pipes shall be constructed of ADS or approved equal. All storm pipes with less than three (3) feet of cover shall be Ductile Iron.
  5. The minimum mainline size shall be 12-inch. The minimum lateral size shall be 10-inch.
  6. Storm manholes with a mainline pipe that is entering or exiting at a slope of fifteen percent (15%) or greater shall be pre-channeled.
  7. For the purposes of designing open or closed channel conveyance systems and collection systems (catch basins and inlets), one of the following methods shall be used to determine the peak flow rate for the design storm:
    - **Santa Barbara Urban Hydrograph (SBUH) method:** This method shall be used only for basins of less than 1,000 acres.
    - **Rational Method:** This method can be used for basins of less than 25 acres, with a time of concentration of less than 100 minutes.
- B. Unless otherwise approved by the Director, all new storm drains shall be television

inspected at no cost to the City. The Developer's contractor shall pay all costs associated with TV'ing new public storm pipe along with existing sections of pipe, which are disturbed or affected by new construction. Prior to conducting the television inspection, the Contractor shall clean, by use of a sewer-cleaner, all sediment and debris from the system. One (1) copy of the television inspection on DVD shall be provided to the City public works department for inspection and approval prior to placing the final lift of pavement.

#### **4.06 Water Quality Standards**

##### **A. General**

1. The water quality BMPs shall be sited, designed, and constructed in accordance with the requirements detailed in the Western Washington Manual for each BMP, with the following exceptions:
2. Underdrains are required if the swale slope is less than two percent (2%); and
3. When placed within a detention basin, calculations shall be provided that demonstrate that the peak stage during the 2-year storm is lower than the minimum swale elevation.

##### **B. Water Quality Treatment Storm**

Treatment BMPs shall be sized to treat the water quality design storm as defined by the WWM.

##### **C. Source Control BMPs**

In addition to the other water quality treatment requirements in this section, commercial and industrial development activities and redevelopment shall, to the maximum extent practicable, be designed in accordance with Volume IV of the Western Washington Manual and utilize BMPs specified in the WWM.

#### **4.07 Water Quantity Standards**

##### **A. General**

1. All development activities and redevelopment, unless exempted in Section 4.04 of this chapter, shall provide quantity control of stormwater runoff in accordance with the requirements of this section.
2. Natural drainage flow routes to streams and wetlands shall be maintained, and discharges from the site shall occur at the natural location(s) and elevation(s), to the maximum extent practicable.
3. Transfer of runoff from one basin to another is prohibited.
4. Surface water exiting a parcel shall be discharged with adequate energy dissipaters within the development site to prevent downstream damage.
5. No development within an urban growth area shall be allowed to increase the volume or rate of stormwater runoff onto an adjacent property or block existing drainage

from adjacent lots.

6. All lots within the urban growth area must be designed to provide positive drainage from bottom of footings to an approved stormwater system. Positive drainage may be accomplished by swales, drywells, french drains, laterals to the storm system, laterals behind the curb or within a public utility easement, an approved backyard or side yard system, or some other method acceptable to the building official and/or Director.

**B. Hydrologic and Hydraulic Analysis**

1. Hydrologic and hydraulic analysis shall be in accordance with Volume III of the WWM.
  - a. Soil mapping. The applicant shall utilize the Hydrologic Soil Groups for Soils in Clark County. (Source: SCS TR-55, Second Edition, June 1986, Exhibit A-1. Revisions made from SCS, Soils Interpretation Record, Form #5, September 1988.) Alternatively, hydrological soil groups can be developed by a registered soil scientist using criteria set in the USDA, SCS National Soils Handbook; and
  - b. Isopluvial Maps for Design Storms. When applicable, the applicant shall utilize the Isopluvial Maps for Design Storms in Clark County. (Source: NOAA Atlas 2, Precipitation--Frequency Atlas for the Western United States, Volume IX--Washington.)
2. For designing wet pools and other volume-based water quality facilities, the Santa Barbara Urban Hydrograph (SBUH) method shall be used. For designing all other stormwater facilities, a continuous simulation hydrologic model shall be used.

**C. Storm Retention/Infiltration Facilities:**

1. Except as limited for commercial and industrial sites, infiltration of the 100-year storm is the preferred method for all stormwater disposals from development sites where local soil types and groundwater conditions are suitable, if water quality treatment is provided prior to infiltration. Soil suitability for infiltration shall be determined by a qualified geo-technical engineer through both approved field-testing and laboratory testing.
2. The design infiltration rate for infiltration systems shall be limited to one-half (1/2) the measured infiltration rate. Infiltration rates shall be tested on-site for all soils.

**D. Storm Detention Facilities:**

If a site is proposed to be constructed in phases, the first phase shall have a storm water quantity facility designed and built to accommodate the ultimate development of the site.

## **4.08 Low Impact Development (LID)**

### **A. General**

The BMPs listed in this chapter are intended to mitigate the impacts associated with surface water runoff generated from roads, driveways, rooftops, and other forms of impervious surfaces. Individual LID BMPs can be used to manage runoff from specific areas or distributed throughout a development to manage runoff where possible. However, LID BMPs are only a part of the low impact development practice. LID BMPs and the general construction layout shall be used in concert with a site's natural features to result in a planned low impact development

Planned low impact developments preserve and use a site's natural features such as open spaces, robust native vegetation, natural depressions, wetlands, and other areas that naturally use runoff. Natural features are preserved through the use of sustainable construction practices such as clustered lots, narrower streets, and loops instead of cul-de-sacs. Preserving natural features first, LID BMPs are then integrated into the development of the site to further use and return runoff to the environment naturally. The Puget Sound Action Team has recommended that developments defined as planned low impact developments be designed to reduce conventionally sized detention ponds by at least 40 to 80 percent (PSAT and WSU 2005). This reduction greatly reduces the reliance on traditional flow control and treatment facilities.

Planned low impact development is the preferred stormwater management practice, followed by the use of distributed individual LID BMPs. In addition, other stormwater management BMPs are available to help reach the goal of sustainable stormwater management.

Low impact development BMPs and practices shall be designed and constructed in accordance with the LID Manual.

### **B. Credits**

Through the use of LID BMPs identified in this chapter, runoff treatment and flow control facilities required under Minimum Requirement 6 (Runoff Treatment) and Minimum Requirement 7 (Flow Control) may be reduced in size. Runoff treatment/flow control facility credits for LID BMPs are described in Volume III, Appendix C of the WWM and in the design standards of this chapter.

### **C. Education**

Education measures describing the functions of conservation areas and LID BMPs shall be implemented during the initial and all successive sales of properties using LID BMPs. Brochures or plans shall provide the following:

1. An overview describing the function and need for natural resource protection, vegetation retention areas, and LID BMPs.
2. A description of the tree/plant species located within the vegetation retention areas and guidelines for protection of the vegetation.

3. Stewardship and management plans.
4. Contacts for questions on maintenance needs and enforcement.

The developer shall provide brochures and plans to the initial property owner and to the City upon the sale of the property.

#### D. Monitoring

One-year bonds shall be required, and the developer shall replace vegetation if one-third or more of the vegetation, based on plant count, dies within the first year of operation of an LID BMP.

The City shall have access to all public and private LID BMPs for monitoring, as determined necessary by the City.

#### E. Inspection

The City shall inspect the LID BMPs during construction of the facility and upon completion of the facility.

#### F. Ownership

1. Private Property. LID facilities located on private property that receives runoff from only the private property shall be owned and maintained by the private property owner.
2. Public Property. LID facilities located on public property that receive any runoff from public property shall be owned and maintained by the City.
3. Public Right-of-Way

LID facilities located in a public right-of-way that receive all runoff from private property and/or residential street runoff shall be owned by the City. Maintenance shall be the responsibility of the owner(s) of the private property contributing runoff to the facility and/or the homeowners association regulating the property and residential streets contributing flows to the facility.

LID facilities located in the public right-of-way shall be constructed in coordination and sequenced with the construction of all other utilities in the right-of-way in a manner that prevents impacts to the intended function of the LID facility.

#### G. Maintenance Plan

A maintenance plan shall be distributed to the initial property owner and City by the developer and kept on record with the City for distribution to future property owners. The maintenance plan shall include the following:

1. A base map of all LID BMPs on the property.
2. A narrative describing what to inspect and the maintenance requirements for each type of BMP used, along with intervals for conducting all maintenance activities. Information about required maintenance can be found in the sections that describe each BMP, above.

## 4.09 Infiltration

### A. DOE Underground Injection Control (UIC)

Ecology classifies some stormwater infiltration facilities as Underground Injection Control (UIC) wells. These include below-surface infiltration facilities such as drywells and perforated pipes. The two major requirements of Ecology's UIC regulations are to register UICs and to provide measures for the protection of groundwater from pollution associated with stormwater. Ecology's UIC guidelines, as found in Guidance for UIC Wells that Manage Stormwater (Ecology 2006), provide design information that must be followed for UIC installation. These regulations have requirements for minimum depth to groundwater (5 feet), as well as location and installation requirements. They also list development activities that are prohibited from using UICs.

Where UIC regulations conflict with City code, the more stringent of the two regulations shall apply.

### B. Critical Aquifer Recharge Area (CARA)

Washougal Municipal Code 16.04.050, which is the city's Critical Aquifer Recharge Area (CARA) ordinance, specifies that Class V injection wells are not allowed in Category I CARAs, and a permit is required for their installation in Category II CARAs. Stormwater infiltration facilities are classified as Class V injection wells.

### C. Depth to Groundwater

Ecology criteria on UICs list a minimum depth to groundwater (5 feet). For facilities that are not considered UICs, the base of all infiltration basins or trench systems shall be greater than 5 feet above the seasonal high-water mark, bedrock (or hardpan), or other low permeability layer. A separation down to 3 feet may be considered if the City judges the groundwater mounding analysis, volumetric receptor capacity, and design of the overflow and/or bypass structures to be adequate to prevent overtopping and meet the site suitability criteria specified in the WWM.

### D. Infiltration Testing Frequency

As part of the design of the infiltration facilities, the ground beneath the proposed infiltration facility must be tested for the infiltration rate of the soil, and the depth to groundwater must be determined. Locations for performing infiltration tests shall be as follows:

1. A minimum of one infiltration test shall be conducted for each proposed infiltration facility location.
2. At least one infiltration test shall be conducted for each location where the soil characteristics significantly vary within the vicinity of the proposed infiltration facility.
3. One infiltration test shall be conducted for each proposed drywell location.

The geotechnical engineer/geologist shall determine the actual number of tests based on the variability of subsurface soil and groundwater conditions and the degree of certainty related to the future location of the infiltration system(s).

Ideally, tests should be conducted at the proposed depth and location of the final system; however, future system locations are often not known or accessible during the field testing. Therefore, at a minimum, the tests shall be conducted in the general vicinity of the future system and in soil conditions similar to those into which the infiltration system will discharge.

#### E. Testing Methods

The single-ring falling head infiltration test and the pilot infiltration test (PIT) are the acceptable methods for determining infiltration rates on a site. Note that the USDA Soil Textural Classification and the ASTM Gradation Testing methods discussed in Volume III, Section 3.3.6 of the WWM are not allowed in the City of Washougal to determine infiltration rates for stormwater infiltration facilities.

#### F. Infiltration BMPs on Industrial and Commercial Sites

1. Infiltration of stormwater runoff shall not be allowed on commercial/industrial sites that, due to location or the proposed use, pose a significant threat of contamination to groundwater.
2. Approval for use of infiltration BMPs (RI.05-30 in the Puget Sound Manual) on industrial and commercial sites, including gas stations, shall be conditioned on all the following criteria, unless found inappropriate by the Director:
  - a. Analysis of the potential for groundwater contamination from the site. This analysis shall include a soils and groundwater evaluation, if deemed appropriate by the Director;
  - b. Demonstration that no other feasible alternative exists for disposing of stormwater from the site; and
  - c. A "state waste discharge permit," as described in WAC 173-216, is obtained from the state of Washington Department of Ecology, where required by the state, as well as any other state permits and approvals as appropriate.
3. The requirements of this subsection shall not apply to runoff from portions of a site where the risk of groundwater contamination is no greater than single-family residential sites. Examples of these areas include rooftop drainage, runoff from undeveloped portions of a site, and drainage from portions of parking lots where the risk of illegal dumping is minimal.
4. In cases where infiltration is allowed on commercial and industrial sites and a significant risk of groundwater contamination exists, the Director may require groundwater monitoring to insure against groundwater contamination. The Director may also require an agreement from the applicant for full mitigation in the event of groundwater contamination.
5. The provisions of this subsection do not apply to nonindustrial and noncommercial sites that are defined under the NPDES permit system as industrial, due to temporary construction activity.

#### **4.10 Offsite Analysis and Mitigation**

- A. A project is exempt from performing an offsite analysis if any of the following three conditions apply:
1. Based on the information in the final technical information report (TIR), the City determines that there is sufficient evidence to conclude that the project will not have a significant adverse impact on the downstream and/or upstream drainage system.
  2. The project:
    - a. Adds less than 2,000 square feet of new impervious surface in the urban area or adds less than 5% of the site as new impervious surface in the rural area; and
    - b. Adds less than 35,000 square feet of new pervious surface; and
    - c. Does not construct or modify a drainage pipe/ditch that is 12 inches or more in size/depth or that receives runoff from a drainage pipe/ditch that is 12 inches or more in size/depth; and
    - d. Does not contain or lie adjacent to a landslide, steep slope, or erosion hazard area.
  3. The project does not change the rate, volume, duration, or location of discharges to and from the project site (e.g., where existing impervious surface is replaced with other impervious surface having similar runoff-generating characteristics or where pipe/ditch modifications do not change existing discharge characteristics).
- B. The offsite analysis shall extend downstream for the entire flow path, from the development site to the receiving water or up to 1 mile, whichever is less. If the receiving water is within a mile, the analysis shall extend within the receiving water to a mile from the development site. The analysis shall extend upstream to a point where any backwater effects created by the project cease. The applicant shall use best efforts to obtain these data, while respecting private property.
- C. The existing conditions and potential impacts to be evaluated shall include, at a minimum, but not be limited to:
- 1 Excessive sedimentation.
  - 2 Upland erosion impacts, including landslide hazards.
  - 3 Stream channel erosion at the outfall location.
  4. Streambank erosion.
  5. Conveyance system capacity.
  6. Localized flooding.
  7. Violations of surface water quality standards as identified in a basin plan or a total maximum daily load (TMDL); or violations of groundwater standards in a wellhead protection area.
  8. Spills and discharges of priority pollutants, as defined by the federal Clean Water

Act.

- D. Existing offsite impacts that are not affected by the project site do not require mitigation. However, in cases where the project site was the cause of the existing impact, it is the responsibility of the applicant to mitigate for those impacts.

## **QUALITATIVE ANALYSIS**

The following subsections describe components (or tasks) of the qualitative analysis.

### **Task 1: Map of the Study Area**

A site map shall be submitted showing property lines, topography (at a minimum, a USGS 1:24000 quadrangle topographic map), site boundaries, study area boundaries, downstream flow path, and potential/existing problems.

### **Task 2: Review of All Available Information on the Study Area**

This task shall include all available basin plans, groundwater management area plans, drainage studies, floodplain/floodway FEMA maps, wetlands inventory maps, critical areas maps, stream habitat reports, salmon distribution reports, and other applicable studies.

### **Task 3: Field Inspection of the Study Area**

The design engineer shall physically inspect the existing onsite and offsite drainage systems of the study area for each discharge location for existing or potential problems and drainage features. An initial inspection and investigation shall include the following:

1. Investigate problems reported or observed during the review of available information.
2. Locate existing/potential constrictions or capacity deficiencies in the drainage system.
3. Identify existing/potential flooding problems.
4. Identify existing/potential overtopping, scouring, bank sloughing, or sedimentation.
5. Identify significant destruction of aquatic habitat (e.g., siltation, stream incision).
6. Collect qualitative data on features such as land use, impervious surface, topography, soils, presence of streams, and wetlands.
7. Collect information on pipe sizes, channel characteristics, and drainage structures.
8. Verify tributary drainage areas identified in task 1.
9. Contact Clark County Public Works, neighboring property owners, and residents about drainage problems.
10. Note date and weather at time of inspection.

#### **Task 4: Description of the Drainage System and Its Existing and Predicted Problems**

For each drainage system component (e.g., pipes, culverts, bridges, outfalls, ponds, vaults), the analysis shall include the location, physical description, problems, and field observations.

All existing or potential problems (e.g., ponding water, erosion) identified in tasks 2 and 3 shall be described. The descriptions shall be used to determine whether adequate mitigation can be identified or whether more detailed quantitative analysis is necessary. The following information shall be provided for each existing or potential problem:

1. Magnitude of or damage caused by the problem.
2. General frequency and duration.
3. Return frequency of storm or flow when the problem occurs (may require quantitative analysis).
4. Water elevation when the problem occurs.
5. Names and concerns of the parties involved.
6. Current mitigation of the problem.
7. Possible cause of the problem.
8. Whether the project is likely to aggravate the problem or create a new one.

#### **QUANTITATIVE ANALYSIS**

Upon review of the qualitative analysis, Clark County may require a quantitative analysis, depending on the presence of existing or predicted flooding, erosion, or water quality problems and on the proposed design of the onsite drainage facilities. The analysis shall repeat tasks 3 and 4 above, using quantitative field data, including profiles and cross-sections.

The quantitative analysis shall provide information on the severity and frequency of an existing problem or the likelihood of creating a new problem. It shall evaluate proposed mitigation intended to avoid aggravation of the existing problem and creation of a new problem.

#### **D. Mitigation**

Depending on the results of the above analyses. Mitigation measures shall take the form of acceptable BMPs for downstream erosion control. The publication entitled *Integrated Streambank Protection Guidelines* (WDFW et al. 2003) shall be used to guide design and installation of streambank erosion BMPs within and adjacent to streams. Where the offsite analysis reveals impacts other than the types listed in task 4 above, the county may require mitigation of a type to be determined by the responsible official.

### **4.11 Acceptance of New Stormwater Facilities**

For stormwater facilities that will be owned by the City, the City will provisionally accept ownership upon approval of the record drawings, approval of a facilities inspection, and receipt of a workmanship and materials bond as previously described in these standards. Provisional acceptance of the facilities does not relieve the applicant from any obligation to undertake any remedial measures to correct deficiencies in the design, construction, maintenance, or operation of the facilities.

No sooner than 18 months after the provisional acceptance of the facilities, the applicant shall notify the Director that the facilities are eligible for final acceptance. The applicant shall continue to maintain the facilities until the City inspects and subsequently accepts the facilities.

The City may accept new stormwater facilities constructed under an accepted site development permit that meets all of the following conditions:

1. Improvements in residential plats where at least 80 percent of the lots have been completed, unless waived by the City.
2. All stormwater facilities have been tested, inspected, signed off by the design engineer, and accepted by the City. In addition, said drainage facilities have been in satisfactory operation for at least 2 years.
3. All stormwater facilities reconstructed during the maintenance period have been accepted by the City.
4. The stormwater facility, as designed and constructed, conforms to the provisions of this manual.
5. All easements and tracts required under this manual, entitling the City to properly operate and maintain the subject stormwater facilities, have been conveyed to the City and have been recorded with the Clark County Auditor.
6. An operations and maintenance manual, including a maintenance schedule, has been submitted to and accepted by the City.
7. A complete and accurate set of reproducible Mylar as-built (record) drawings has been provided to the City.
8. A complete and accurate set of the as-built (record) drawings has been provided to the City on computer disk in one of the following approved file formats: Portable Document Format (.pdf), AutoCAD (.dwg, .dxf), or MicroStation (.dgn).

# Chapter 5

## Water

City of Washougal Engineering Standards for Public Works Construction

February 2010

Director of Public Works: Trevor Evers

# Chapter 5

## Water

City of Washougal Engineering Standards for Public Works Construction  
February 2010

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# Chapter 5

## Water

City of Washougal Engineering Standards for Public Works Construction  
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## **CHAPTER 5 - WATER**

### **5.00 Developer Extension Agreements**

- A. When extension of the existing water system is required for service, the Owner/Developer shall submit an application to the City as described within the Washougal Municipal Code.
- B. Upon completion of the design and approval by the City, the Owner/Developer will be notified of requirements to be completed prior to construction. Upon completion of the pre-construction requirements and 48-hours notice, a pre-construction meeting will be held with the City, at which time construction inspection will be scheduled. No water main construction work shall commence prior to the pre-construction meeting. After completion of construction, testing, and submittal of required documents and fees, final acceptance will be given by the City, at which time service will be available by application following payment of fees for water meters.
- C. Prior to commencing construction of any component of the public water system, the Developer shall submit to the City an approved performance bond in accordance with the requirements of Section 1.08 of these Standards.
- D. Developer Extension projects shall be deeded to the City for maintenance and operation by letter after the system has been found to meet City standards.

### **5.01 Utility Tracts**

All public utilities (storm, water, and sewer) shall be in public utility tracts. The tract shall be a minimum twenty (20) feet wide with a twelve (12) feet wide all weather surface. No obstructions are to be located within the public utility tracts.

### **5.02 General Design Considerations**

- A. In all residential and commercial developments water main extensions are required to assure orderly development of the water utility system. Where applicable, water main extensions shall conform to the requirements of the City's latest approved Water System Plan. Where the proposed extension is not addressed in the Water System Plan, the Developer shall pay the cost for any Water System Plan amendments required by the Washington State Department of Health, or Director. All proposed water main extensions must comply with the City's requirements for development, water quality, pressure zones, and fire protection requirements of the City.
- B. Design and construction of water mains, including but not limited to, mainlines, valving, fire hydrants, fire sprinkler connections with backflow devices, domestic and irrigation services, pump stations, pressure reducing stations, telemetry and other appurtenances shall be in compliance with the City ordinances, special requirements of the City, these Standards, and the Standard Details.
- C. The applicant is responsible for designing the Developer Extension Water system(s). The system(s) must be designed by a licensed engineer and approved by the City.

- D. Water mains shall be extended through and to the extremes of the property being developed for gridding or future development, as determined by the City.
- E. Dead end water main extensions shall be avoided. Unless specifically approved by the Director, all water main extensions shall be looped to other water mains within the pressure zone of that water main extension. Generally, looping of water main extensions is required for all extensions serving twenty (20) or more equivalent residential units.
- F. Water main extensions for service to pressure zones different from the pressure zone from which the extension is made shall be avoided. Unless specifically approved by the Director, booster pump stations or pressure reducing valve stations shall not be permitted.

### **5.03 Sizing and Pressure Requirements**

- A. In areas where gridding or fire flow is a requirement, 8-inch diameter pipe is required. Nothing shall preclude the City from requiring the installation of a larger sized main if the City determines a larger size is needed to meet fire protection requirements or for future service. The Developer shall be required to pay the cost of all oversizing. Reimbursement for oversizing will be in accordance with the WMC.
- B. Minimum size mains shall be 6-inch on runs less than three hundred (300) feet, when there will not be more than eight (8) 1-inch services, where no more than one (1) fire hydrant is required, and when there is no possibility of future extensions.
- C. Dead end mains shall be avoided. If they are permitted, a blow off assembly will be required at the end of the pipeline. In the event that the "dead end" finishes where there is risk of a vacuum being created due to water shut down, then a Combination Air and Vacuum Release Valve shall be installed in accordance with the Standard Drawings.
- D. All water system installation shall be designed to provide a pressure range at the residence of thirty (30) psi to ninety (90) psi at all times, including during peak demand, unless specifically approved.
- E. An approved screen shall be located in the pressure reducing valve vault at a location upstream of the pressure-reducing valve. Pressure reducing valves may be required at the discretion of the City on individual services. Such valves will be installed after the meter and will be the responsibility of the homeowner to install and maintain.
- F. Water service size shall be evaluated by the Developer's engineer. The requirements of this section shall be met and shall be no smaller than 1-inch. Booster pumps shall not be allowed on meter service lines in order to meet this requirement, unless specifically approved by the Director. The meter size shall be no smaller than the service line size unless approved by the Director, except that a ¾-inch meter shall have a 1-inch service line.
- G. Where requested by the Director, the Developer's engineer shall provide a "pressure available" chart on the water system plan sheet of the construction plans. This sheet shall indicate the calculated pressures theoretically available to each lot during static and peak demand periods. In such cases it shall be the Developer's engineer's responsibility to determine pressures based upon an analysis of the system. All work associated with the

analysis shall be paid for by the Developer.

#### 5.04 Shut-off Valves

- A. Valves shall be located, whenever possible, at intersections (one (1) valve per each line radiating from the intersection). In general, sufficient valves should be provided to permit shutting down any section of the line, not exceeding five-hundred (500) feet, with valve operations in not more than three (3) locations.
- B. Valves shall be installed in clusters at pipeline intersections.
- C. Valves 8-inches and smaller shall be resilient seat gate valves.
- D. Valves 10-inches and greater shall be butterfly valves.

#### 5.05 Air-release Valves

At high points in the water system, combination air and vacuum release valves (CARV) shall be installed as required by the Director. All Air-Vac, Air Evacuation, and Vacuum Prevention Valves of sizes 2-inches and larger shall vent to the outside of the vault. If construction of the valve does not permit the venting of leakage to the outside of the vault, a screened drain to daylight of at least the supply line size must be provided at a level that will prevent cross connection and/or backflow problems. This decision will be made by the Director prior to the plan approval.

#### 5.06 Hydrants

- A. The number and locations of fire hydrants, fire flow requirements, and fire sprinkler components will be determined by the City Fire Department. Following are general requirements for fire hydrant locations:
  - 1. **Commercial Buildings:** Fire hydrants shall be located so that no part of a commercial building is more than two-hundred and fifty (250) feet from a fire hydrant measured along a route accessible to fire department vehicles. When a fire department connection (FDC) is installed in conjunction with an automatic sprinkler system, it is required to have a fire hydrant located within seventy (70) feet of the FDC.
  - 2. **Non-Commercial Buildings:** Fire hydrants shall be placed at a minimum at each street intersection. The Fire Marshall may request additional hydrants per Fire Code requirements.
    - a. Intermediate hydrants are required when the distances to any part of non-commercial buildings exceeds five-hundred (500) feet measured along a route accessible to fire department vehicles.
- B. Fire hydrants shall not be connected to mains less than 8-inches, or 6-inches in diameter where the length of 6-inch main is less than two-hundred (200) feet. As per the UFC, fire hydrants shall be located to allow a 5-foot clear space surrounding the hydrant. For example, street lights, sign posts, protective posts, or retaining walls shall be no closer than five (5) feet from the nearest portion of a hydrant. There shall also be no

obstructions directly in line with any of the ports of the hydrant.

- C. Fire hydrants shall have Storz fittings (or approved equal).
- D. Fire hydrants subject to possible vehicular damage shall be adequately protected with guard posts in accordance with Uniform Fire Code Section 8001.11.3. For marking, see Section 901.4.3. For obstruction, see Section 1001.7.

### **5.07 Water Meters**

- A. Water meters sized 1-inch shall be furnished and set by the City. The owner is required to make application and pay meter fees prior to the installation. The City will install meters and lock off meter setters and turn on as requested by the owner after acceptance by the City. Water meters will be set only after curb stop and box are at proper finished grade.
- B. Meters 1 ½ -inch and larger shall be compatible with the City's MVRS and AMR system, installed by the owner as part of the construction project, and will be locked off by the City. The 1 ½ -inch and larger meters will be turned on by the City by request from the owner after acceptance by the City.
- C. Meters shall be located outside of the sidewalk and/or drivepath within public right-of-way or as otherwise approved by the Director.
- D. In plat and short plats, water meter applications will be processed for meter sets and water turned on after acceptance of the water mainline facility by the City.
- E. All irrigation systems require plumbing permits and the installation of state approved backflow preventers.  
  
All irrigation meters will be set and turned on after acceptance of the water system by the City. The City will not accept a water system until all the requirements of the Extension Agreement have been completed and all the fees have been paid.
- F. Adjustments, repairs, or replacement of the service line, meter box, or setter shall be the responsibility of the property owner.
- G. Water services are to be single runs from the main line to each meter. Manifolds with multiple meters shall be allowed in multi-family units with a single property owner.

### **5.08 Fees and Charges**

All fees and charges related to development shall be in accordance with the latest requirements of the WMC.

### **5.09 Cross Connection Control**

- A. All water system connections to serve buildings or properties with domestic water, fire sprinkler systems, or irrigation systems shall comply with the minimum backflow requirements as established by the Department of Health (DOH), WAC 246-290-490, and the City. See the Washougal Cross Connection Control Program for information on City requirements.
- B. A permit is required for the installation of all backflow preventers to protect the existing water system and users from possible contamination. These backflow preventers shall be installed in accordance with the requirements of the "Accepted Procedure and Practice in Cross Connection Control" manual, the Uniform Plumbing Code, Chapter 6 Washington State Amendments 603.0.

#### **5.10 Contract for Reimbursement (Latecomer Agreements)**

Should the Developer deem that the utility extension is an undue hardship and will significantly benefit other property owners, the Developer may request a latecomer agreement, in accordance with the WMC.

#### **5.11 Water Quality**

The quality, taste, and odor of water drawn from new construction water mains shall be the same as the water in the existing facility classed as acceptable for use by the City. Should the water not be acceptable for use because of taste, required steps as approved by the City shall be accomplished to attain water quality acceptable for use. Sampling for such water quality testing shall be performed by the use of a Kupferle (model #88 Eclipse) sampling station installed permanently and specifically for such testing. A sampling station shall be required for every fifty (50) EDU's or as determined by the Director. The location for said sampling stations will be determined by the Director.

#### **5.12 Plans and Specifications**

- A. All extensions to the water system shall conform to the most recent edition of the Standard Specifications for Road, Bridge, and Municipal Construction. The system shall be capable of future expansion and be constructed of permanent materials.
- B. The installation of water extensions shall be in accordance with construction plans and specifications prepared by the Developer's engineer and reviewed and approved by the City. Where conflicts exist the more stringent specification shall apply as approved by the City.

#### **5.13 Connections to Existing Pipelines**

- A. Cut-ins shall be made in existing pipes. The work shall be conducted at such a time and in such a manner as to minimize the interruption of service. Cut-in time must be approved by the City. Necessary pipe, fittings, and gate valves shall be swabbed with chlorine and assembled at the site ready for installation prior to the shutting-off of water in the existing main. Once the water has been shut off, the work shall be performed vigorously, to minimize the interruption, and shall not be halted until the line is restored to service.

When approved by the Director, connections may be made to existing pipes under pressure with a tapping machine by determining the size and type of pipe and installing tapping sleeve to fit complete with tapping gate valve.

Operation of all water main line valves shall be by the City.

The City shall witness all wet taps and cut-in connections and requires 48-hours notice and approval by the City.

- B. The Contractor shall have the responsibility of giving written notice to the City at least four (4) days and to affected customers at least 48-hours prior to disruption of service. Written notice to affected customers shall consist of, at a minimum, door hangers, as well as signs posted at the entrance to the customers streets.
- C. Pipes to be abandoned shall be removed or capped watertight with mechanical couplings, as determined by the Director.

#### **5.14 Roadway and Railway Crossing**

The owner shall be responsible for obtaining all permits required when constructing within right-of-way outside of the City's jurisdiction. The design shall be acceptable to the City and the government or private agency having control of the right-of-way.

#### **5.15 Trench Excavation**

- A. Clearing and grubbing where required shall be performed within the easement or public right-of-way and as permitted by the property owner and/or governing agencies. Debris resulting from the clearing and grubbing shall be disposed of by the Developer.
- B. Trenching for water mains shall be completed in accordance with the Standard Specifications.
- C. Trenching and shoring operations shall not proceed more than one-hundred (100) feet in advance of pipe laying without written approval of the City.
- D. Where a utility crosses under an existing asbestos cement water main or where a trench alters the bedding of an existing asbestos cement water main, the existing A.C. pipe shall be cut three (3) feet minimum from each side of the trench wall and replaced with a corresponding size ductile iron pipe Class 52. The ductile iron pipe shall be connected to A.C. pipe with transition couplings.
- E. Contractor shall furnish a watertight plug of the appropriate size which shall be installed in the end of water main when work is delayed or stopped at the end of the work shift.

#### **5.16 Pipe in Filled Areas**

Where pipe is to be installed in filled areas, special treatment may be required at the discretion of the City. This treatment may consist of compacting the backfill in 6-inch layers, careful choice of backfill materials, use of Mechanical Joint Ductile Iron Pipe in short lengths, or such other reasonable method or combinations as may be necessary or as required by the City.

### 5.17 Pipe Installation for Water Mains

The work necessary to excavate, bed, and backfill water pipelines shall conform to the requirements of the Standard Specifications and the Standard Drawings.

#### A. Pipe and Fittings

1. Use only Class 52 ductile iron pipe and fittings in accordance with the Standard Specifications.

#### B. Permissible Deflection of Joints

1. Wherever it is necessary to deflect pipe from a straight line either in a vertical or horizontal plane, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the values in the following Table 5.1.

**Table 5.1**  
**Maximum Deflection Permitted\***  
**18-Foot Length Pipe**

Dia. Inches	Mechanical Joint**		Push-on Joint	
	Angle Degrees and Minutes	Deflection Inches	Angle Degrees	Deflection Inches
4	8-18	31	5	18
6	7-07	27	5	18
8	5-21	20	5	18
10	5-21	20	5	18
12	5-21	20	5	18

\* The maximum deflection shall be whichever is less; the table or that recommended by the pipe manufacturer.

\*\* Safe deflection for one hundred and fifty pounds (150 lbs.) pressure. For higher pressure, reduce tabulated deflection proportionally ten percent (10%) for each one hundred and fifty pounds (150 lbs.) added pressure.

### 5.18 Bedding and Backfill

Use imported bedding for all water main pipe installed under pavement, curbs, sidewalks, or usable shoulder. Bed and backfill pipe and appurtenances in accordance with the Standard Specifications.

### **5.19 Hydrostatic Tests**

The Contractor shall make pressure and leakage tests on all newly laid pipe. Test to be made at one hundred and fifty (150) psi or one and one-half times the normal working pressure, whichever is greater, for 1-hour with no loss. Test at higher pressures may be required depending upon installation. The Contractor shall furnish all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The City shall witness the test; if the test does not pass inspection for any reason, additional trips required to witness the test shall be at the owner's expense.

#### **A. Correction of Excessive Leakage**

Should any test of pipe laid disclose leakage greater than that allowed, the Contractor shall locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

#### **B. Isolation of Existing Systems Prior to Testing**

Existing water pipelines shall be protected from contamination during the testing process for new construction. Use of special "blind flanges" will be necessary if the line being tested cannot be adequately separated from existing systems. The Developer's engineer shall submit shop drawings and proposed procedures to the City prior to installing any special testing device.

### **5.20 Sterilization and Flushing of Water Mains**

Pipelines intended to carry potable water shall be sterilized before placing in service. Sterilizing procedures shall conform to the standard specifications as hereinafter modified or expanded.

#### **A. Disposal of Sterilizing Water**

Sterilizing water shall be disposed of in an approved manner. Sterilizing water shall not be allowed into a waterway without adequate dilution or other satisfactory method of reducing chlorine to a safe level. Dechlorination procedures are to be submitted in writing and approved by the Director prior to flushing system.

### **5.21 Cross Connection Control and Backflow Assemblies**

- A. An approved backflow prevention assembly, as listed in "Backflow Prevention Assemblies for Installation in Washington State" (DOH PUB 331-137), is required on all fireline systems, domestic water service larger than 2-inches, and/or building in excess of thirty (30) feet above the water main. The assembly shall be installed at the location normally established for water meters, usually at the property line. A water service shall not be turned on until all required backflow prevention assemblies are installed, inspected, tested, approved, and registered with the City of Washougal. Costs of all installations, including all costs of inspection and testing fees, shall be the responsibility of the customer. The backflow prevention assembly will remain the property of the customer. The customer will be responsible for all maintenance and

testing of the assembly and vault.

- B. When required, backflow prevention assemblies for protection of the public water system shall meet the requirements set forth in the current Washington State Department of Health regulations, Uniform Plumbing Code, and City ordinances. All installation shall meet AWWA Cross Connection Control Manual, May 1990, requirement.
- C. There are two (2) types of backflow prevention assemblies, which the City will allow as protection of the public water system; reduced pressure backflow assemblies and double check (or double detector check) assemblies. The Washington State Department of Health provides a list of approved assemblies that meet these criteria.

The type of backflow prevention assembly required is determined by the aforementioned rules and codes, based on the type of premises to which water service is being provided, hydraulic condition, complexity of piping and determined by the State certified Cross Connection Control Specialist. The approved types of assemblies are listed below with some of the types of premises that must be protected by each type of assembly. However, these lists are not complete, they are only intended to provide some basic guidelines.

#### 1. Reduced Pressure Backflow Assembly

- a. An approved Reduced Pressure Backflow Assembly shall be installed on the service connection above ground to the following:
- b. Any parcel or building that has an auxiliary water supply on or available to it. This will include any above or below ground water source. (The most commonly encountered type of auxiliary water supply is a private well);
- c. Buildings which are located within an industrial zone;
- d. Hospitals, medical centers, and clinics;
- e. Mortuaries and nursing homes;
- f. Gas stations;
- g. Car washes;
- h. Sewage pump and lift stations;
- i. Dry cleaners and commercial laundries;
- j. Any water system which has a pump to supplement pressure; and
- k. Irrigation systems, which are designed to use chemical injection.

#### 2. Double Check Assembly or Double Detector Check Assembly

An approved double check assembly or an approved double detector check assembly shall be required (provided that all internal plumbing is installed and maintained in accordance with the Uniform Plumbing Code), on the service connection to premises where there is:

- a. Any fire system or water line to a private fire hydrant;
- b. Multi-story buildings which are in excess of thirty (30) feet above the water main at the service connection;
- c. Shopping centers or large retail stores; and
- d. Restaurants or fast food establishments.

C. Installation and Testing

1. Backflow prevention assemblies shall be installed at the water service connection on the customer side of the meter. Backflow assemblies 3-inch diameter and larger shall be installed in a vault in accordance with these standards. Backflow prevention assemblies 1-inch and smaller shall be installed in a Carson Industries Box, series 1324 or an approved equal. 1 ½-inch and 2-inch assemblies shall be installed in a series 1730 box, or equal.
2. After installation, all backflow prevention assemblies that are installed must be tested upon installation by a State of Washington certified tester. The results of the testing shall be received by the City prior to issuance of "final occupancy."
3. Backflow prevention device assembly vaults shall be constructed in accordance with the standard drawings and requirements of this section. Backflow vaults shall be on private property and located outside of public easements.

**5.22 Requirements for Water System Vault Installations**

To ensure proper operation and accessibility of all assemblies, the following requirements shall apply to installation of these assemblies, unless otherwise approved by the City. Vaults shall be constructed per the Standard Details.

- A. The vault shall be sealed with an asphalt base foundation coating on the outside of the vault. Vault penetrations shall be sealed with non-shrink grout from the outside. Apply waterproof coating over grout. Backfill around vault per manufacturer's specifications.
- B. Access to be through an H-20 rated standard Bilco door, or approved alternate.
- C. Provide approved ladder if the vault or chamber depth is 5'0" or greater and entry is through the vault or chamber roof. Ladders shall include a Model 1 Bilco LadderUP safety post or approved equal.
- D. Adequate drainage for the vault or chamber shall be provided. (Drainage to piped storm systems allowed with check valve).
- E. Vault must be equipped with a moisture proof light fixture if adequate lighting is not available.
- F. Vault is to have no other use, except for use described by these Standards.
- G. Vault shall be installed on undisturbed base or compacted 3/4"-0" gravel base.
- H. No piping shall be installed in excess of three (3) feet above the vault floor.

- I. Assembly is to be adequately supported from the floor, and suitably restrained from movement. Supports shall consist of steel supports or approved equal; no wood supports shall be used.
- J. All electrical wiring shall be inspected by a Washington State Electrical Inspector (Permit is required).
- K. The assembly shall be readily accessible with adequate room for maintenance.

All new services are to be pressure tested and disinfected by the contractor and proven to be bacteriologically safe from the existing main to the vault.

### **5.23 Fire Services and Domestic Services**

- A. No part of the backflow prevention assembly shall be submerged in water or installed in a location subject to flooding. In a vault or chamber, adequate drainage shall be provided; and test cocks shall be plugged. The plugs shall not be of dissimilar metals.
- B. The backflow assembly shall be protected from freezing and other severe weather conditions.
- C. All backflow assemblies shall have a minimum 12-inch clearance on the backside, 24-inch clearance on the test-cock side and 12-inches below the assembly.
- D. Adequate clearance (6-inches minimum) must be maintained above gate-valve stem at full extension. Headroom of 6'0" is required in vaults without a full opening top. Access to the device and to any vault or chamber shall remain clear at all times.

### **5.24 Special for Fire Service Only**

- A. Fire Service backflow prevention assemblies shall be installed at the property line or edge of the public water line easement. The fire service from the public main to the backflow assembly shall be privately owned and meet all City's Standard Drawings.
- B. Only approved resilient seat indicating valves are allowed on fireline assemblies.
- C. Only approved Double Detector Check Valve Assemblies are to be used for system containment on fire line services in the City. The meter on the bypass detector shall read in cubic feet.
- D. Fire Line Flow and Tamper Switches installed, as required by UBC sec. 3803, must be connected to a monitored Fire Detection System approved by the Fire Marshal. The tamper switches are required on the rising stem gate valves in the vault, as well as any other indicating control valves on the fire protection system. Electrical inspection and permit is required.
- E. The remote reader (if allowed) shall be rigidly mounted on an exterior building wall (near the domestic meter), enclosed in a metal box with a slot opening which allows reading the remote without opening the box, and at an elevation of five (5) feet above the

ground level.

The remote reader shall have the same number configuration as the metering device itself, and read in cubic feet. All wires to the remote reader shall be enclosed in a heavy plastic or rigid metal conduit. All wiring shall be in conformance with appropriate sections of the National Electric Code.

#### **5.25 Water Meter Vaults**

The vault is to be provided and installed by the Contractor, per Standard Drawings.

#### **5.26 Pressure Reducing Valve Vaults**

PRV vaults are unique to each situation. The engineer shall detail the vault on the plans and submit for review. The City will review the vault for size and compliance with the general requirements listed under this section.

#### **5.27 Appurtenances**

Air and Vacuum Release Valves

- A. Air and vacuum release valves shall be APCO - Valve and Primer Corporation, "Heavy-Duty," combination air release valve, or equal.
- B. Installation shall be as shown on the Standard Details.
- C. Piping and fittings shall be copper or brass. Location of the air release valves as shown on the plans will be approximate. The installation shall be set at the high point of the line. Water line must be constructed so the air release valve may be installed in a convenient location.

# Chapter 6

## Sanitary Sewer

City of Washougal Engineering Standards for Public Works Construction

February 2010

Director of Public Works: Trevor Evers

**Chapter 6**  
**Sanitary Sewer**

City of Washougal Engineering Standards for Public Works Construction  
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## CHAPTER 6 - WASTEWATER

### 6.00 Extension of the Sewer System and Service

#### A. General

In residential and commercial development, sewer main extensions are required to assure orderly and adequate extension of the sewer utility system. These extensions are to be in accordance with requirements of development and service availability as established by the City and the Washington State Department of Ecology.

#### B. Main Line Extensions

1. Design and construction of sewer mains and facilities, including but not limited to: sewer lift stations, telemetering facilities, and appurtenances shall be in compliance with the latest edition of the City's ordinances, these Standards, the Standard Details and the latest issue or revision of "Criteria for Sewage Works Design" published by the Washington State Department of Ecology.
2. In residential and commercial areas the minimum size sewer main to be installed shall be 8-inches. Larger sewer mains will be required where it is determined by the City that an 8-inch sewer is inadequate to handle the capacity of the users in the new or downstream facility, or for future service needs.
3. Minimum slopes of main lines shall be designed to provide a minimum velocity of two (2) feet per second, with all side sewer stubs having a minimum slope of two percent (2%). All dead end sewer mainline runs shall have a minimum of one percent (1%) with manholes having two tenths (2/10) of a foot slope from inflow to outflow unless otherwise approved by the City. Manholes shall be set at points of alignment or grade change or at a maximum of four-hundred (400) feet, line and grade.
4. Sewers shall be located within public right-of-way whenever possible. All sewer mains designed on public utility tracts shall have a minimum of one percent (1%) slope and shall be offset from the property line with manhole accesses located on offsets ten (10) feet from property line and property corners.
5. Sewer mains shall be extended through and to the extremes of the property being developed, to provide connection points for future development of unserved property as determined by the City. The depth of the main shall be determined by the applicants' Engineer and approved by the City. This shall be done by evaluating the feasible drainage basin that could contribute to that mainline and design the depth accordingly.
6. All manholes and cleanouts shall be constructed to finished grade. Any re-adjustment of finish grade by the Developer or lot owner shall require that party to adjust the manhole and/or cleanout fixtures to the new finished grade. A 3-foot diameter concrete pad is required around all cleanouts.
7. All manholes in unimproved surfaces shall be two (2) feet higher than surrounding

grade. All cleanouts in unimproved surfaces shall be constructed to finished grade. Further, a 3-foot diameter concrete pad is required around all cleanouts.

#### C. Developer Extension Agreements

1. When extension of the existing sanitary sewer system for service is required, the Developer shall submit an application to the City, as described within the Washougal Municipal Code.
2. To initiate the Developer extension process, two (2) signed copies of the aforementioned application, together with property legal description, site and improvement plans, sewer design plans and design review, and administration fees are submitted by the Owner or his agent to the City. Upon completion and approval by the City, plans and a pre-construction letter of requirements will be sent to the Owner. Requirements to be completed prior to construction will be noted in the pre-construction letter.

Upon completion of the pre-construction requirements and 48-hours notice, a pre-construction meeting shall be held with the Public Works Department at which time construction inspection will be scheduled. No sewer main construction shall commence prior to the pre-construction meeting. After completion of construction, testing in accordance with the Standard Specifications, and submittal of required documents and fees, final acceptance will be given by the City at which time service will be available by permit and side sewer connection.

3. Prior to commencing construction of any component of the public sewer system, the Developer shall submit to the City an approved performance bond in accordance with the requirements of Chapter 1 of these Standards.
4. Public utility tracts for main line sanitary sewer system shall be a minimum of twenty (20) feet wide or wider, unless otherwise approved by the Director, than twenty (20) feet for mains ten (10) feet deep or deeper. A 12-foot all weather roadway shall be provided with access to all manholes. No obstructions are to be located within the tracts. The tract shall be prepared by a surveyor or engineer licensed to practice in the State of Washington. The tract shall be reviewed and approved by the City prior to acceptance.
5. Developer extension projects will be deeded to the City for maintenance and operation by letter after the system has been found to meet City standards.
6. The Developer shall provide final as-built elevations of manhole inverts and tops. All elevations shall be from Clark County datum.

#### D. Side Sewers

1. Side sewer permits for commercial and multifamily projects will be issued to owners as an extension agreement pre-construction requirement and shall be installed by a bonded contractor. The Owner is required to make application and pay all necessary fees to obtain a permit. The side sewer can be installed as part of the mainline extension and put in use only after acceptance of the mainline system by the City.
2. Side sewer permits for plats will be issued for installation only after main line

extensions are accepted by the City. The lot owner or his bonded contractor is required to make application and pay all necessary fees, obtain a side sewer permit and connect the side sewer from the mainline lateral to the house plumbing.

3. Pipe material for side sewers shall be the same as the pipe material used on the mainline in that area, unless otherwise approved by the Director.

E. Fees and Charges

All fees and charges related to development shall be in accordance with the latest requirements of the WMC.

F. Latecomer Agreements

Should the Developer deem that the utility extension as an undue hardship and will benefit other property owners, the Developer may request for a latecomer agreement, in accordance with the WMC.

## 6.01 Plans and Specifications

- A. All extensions to the sewer system shall conform to the most recent design standards and other requirements of the City. All work and materials shall be in accordance with this document and the Standard Specifications. Where conflicts exist, the more stringent specification shall apply. The system must be capable of future expansion and be constructed of permanent materials.
- B. The installation of sewer extensions shall be in accordance with construction plans and specifications prepared by the Developer's engineer and reviewed and approved by the City.

## 6.02 Connection to Existing Systems

- A. Connection of new pipe lines to existing manholes shall be core drilled for connection using a core and seal boot w/ non-shrink grout and link seal.
- B. Connection of a pipe line to a system where a manhole is not available shall be accomplished by pouring a concrete base and setting manhole sections. The existing pipe shall not be cut into until approval is received from the City.
- C. Connections to manholes using inside or outside drop structures shall be as approved by the City. Inside drops are prohibited unless specifically approved by the Director. Inside drops, if allowed, must be constructed with pipe and installed in a 60-inch or larger diameter manhole.
- D. Connection of new service laterals to existing mains shall be a minimum of 6-inches and shall be accomplished by tapping the main where the lateral is to be installed using "insert-a-tee" or approved equal. All taps shall be accomplished in the presence of a City inspector at the Owner's expense. The new service lateral shall be constructed of the same material as the main.
- E. Connections where the new service lateral is the same size as the existing main shall be accomplished by cut-in of a wye using a mechanical coupling as approved by the City.

Wye cut-ins on cast iron or ductile iron will require installation of a wye made of the same material as the main.

- F. Connection to an existing manhole requires the installation of ¼ -inch mesh screen in the downstream line while making connection to eliminate debris from entering the existing system. After the connection has been completed the new incoming pipe shall be plugged. Where a heavy flow exists in the connection manhole and when unable to use the ¼-inch mesh screen, due care shall be used to keep debris out of the downstream line.

### **6.03 Roadway and Railway Crossing**

The owner shall be responsible for obtaining all permits required when constructing within right-of-way outside of the City's jurisdiction. The design shall be acceptable to the City and the government or private agency having control of the right-of-way.

### **6.04 Trench Excavation**

- A. Trench excavation shall be completed in accordance with the Standard Specifications.
- B. Trenching operations shall not proceed more than one-hundred (100) feet in advance of pipe laying except with written approval of the City.
- C. When trenching operations involve cutting through concrete pavement, the pavement shall be removed to width of 18-inches greater than the top width of the trench. The concrete shall be cut on a straight line and shall be beveled so that the cut will be approximately 1-inch wider at the top than at the bottom.
- D. Where a sewer main crosses under an A.C. water main the Contractor shall replace the existing A.C. main over the excavation with Ductile Iron Pipe Class 52 to a point of bearing soil a minimum of three (3) feet each side of the excavation.

### **6.05 Pipe Laying**

Pipe laying shall be in accordance with the Standard Specifications.

### **6.06 Pipe Bedding**

Imported bedding will be required of all sewer pipes and service pipe, located under pavement, curb, sidewalk, or usable shoulder. Bedding shall be compacted and tested every five-hundred (500) feet per the standard specifications prior to placement of the next layer.

### **6.07 Pipe in Filled Areas**

Where pipe is to be installed in filled areas, special treatment may be required at the discretion of the City. This treatment may consist of compacting the backfill in 6-inch layers, careful choice of backfill materials, use of Mechanical Joint Ductile Iron Pipe in short lengths, or such other reasonable method or combinations as may be necessary or as required by the City.

### **6.08 Cleaning and Flushing**

All sewers shall be cleaned and flushed per the Standard Specifications.

#### **6.09 Testing of Gravity Sewers**

All sewers shall be tested per the Standard Specifications.

#### **6.10 Television Inspection**

- A. Sanitary sewers shall be inspected by the use of a television camera before acceptance. The costs incurred in making the inspection shall be borne by the Developer.
- B. Films shall be submitted to the City on DVD.
- C. The Developer shall bear all costs incurred in correcting any deficiencies found during television inspection including the cost of any additional television inspection that may be required by the City to verify the correction of said deficiency.
- D. Test films will become the property of the City.

#### **6.11 Testing of Pressure Sewer Mains**

The Contractor shall make pressure and leakage tests on all newly laid pipe. Test to be made at one hundred and fifty (150) psi or one and one-half times the normal working pressure, whichever is greater, for 1-hour with no loss. Test at higher pressures may be required depending upon installation. The Contractor shall furnish all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The City shall witness the test; if the test does not pass inspection for any reason, additional trips required to witness the test shall be at the owner's expense.

#### **6.12 Manholes**

The Contractor is to grout and channel one manhole to prove proficiency in concrete work to City inspectors. Work may continue on remaining manholes (in an as good or better standard) after acceptance.

- A. Materials and construction shall be per the Standard Specifications.
- B. Manhole sizing
  - 1. 48-inch Manhole
    - a. Two (2) connecting pipes, 8-inch to 12-inch diam.
    - b. Three (3) connecting pipes, 8-inch to 10-inch diam., perpendicular.
    - c. Four (4) connecting pipes, 8-inch diam.
  - 2. 54-inch Manhole
    - a. Two (2) connecting pipes, 8-inch to 12-inch with more than forty-five degree

(45°) deflection, 15-inch to 18-inch diam. with forty-five degree (45°) or more deflection.

- b. Three (3) connecting pipes, 10-inch to 12-inch diam., perpendicular.
  - c. Four (4) connecting pipes, 10-inch to 12-inch diam., perpendicular.
3. 72-inch Manhole
- a. Two (2) connecting pipes, 15-inch to 18-inch diam. with less than forty-five degree (45°) deflection.
  - b. Three (3) connecting pipes, 15-inch diam., perpendicular.
  - c. Four (4) connecting pipes, 15-inch diam., perpendicular.
4. In the above criteria "deflection" refers to the angle between any two (2) pipe channels in the manhole. Channels shall be centered in manhole with ladder rungs placed on side with larger shelf.

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

The above configurations will provide adequate shelves and room for maintenance and performing T.V. inspections.

- C. Provide locking manhole covers in areas outside of public right-of-way.
- D. At all manhole connections where the groundwater level is above the invert of the connecting sewer or sewers, the Contractor shall install a Wrapid Seal on each connection in accordance with the written instructions of the seal manufacturer.

### **6.13 Side Sewers**

#### **A. General**

Owners of properties located within the sanitary sewer services area with conventional service available shall be required to extend from the structure plumbing system to the main line side sewer connection.

#### **B. Application for Side Sewer Permit**

Before construction and connection of a side sewer on public or private property, the Owner is required to apply for and have a permit issued by the City.

#### **C. Installation**

Installation of side sewers is to conform to the requirements of the Uniform Plumbing Code, latest edition, the Standard Details, and the Standard Specifications.

### **6.14 Pump Stations**

- A. Pump stations shall only serve those properties which cannot otherwise be served by conventional gravity sewers, as determined by the Director.

- B. Unless otherwise authorized by the Director, all pump stations shall be designed in

accordance with the requirements of the latest edition of the City of Vancouver “General Requirements and Details for Sanitary Pump and Lift Stations,” with the following amendments:

1. In all cases, the design shall conform to the requirements of the Washington State Department of Ecology;
2. The installations of Romtech (or approved equal) prefabricated lift stations shall be installed unless otherwise approved by the Director;
3. Pumps shall be four-hundred and sixty (460) volt, three (3) phase Flygt pumps or approved equal;
4. All check valves shall be Flygt ball check or approved equal;
5. A yard hydrant shall be provided at the end of the potable water service;
6. Multi-trode transducers shall be used in place of floats unless otherwise approved by the Director;
7. Telemetry shall be Mission RTU with US filter controller;
8. Exterior lighting shall be installed;
9. An approved lift station sign shall be installed;
10. All pump stations shall be furnished with fixed on-site generation supplied with natural gas;
11. City of Washougal Standard Details shall be used on the installation of water service, backflow preventer, and combination air valve with odor control;
12. An air discharge permit, naming the City of Washougal as the owner, shall be obtained from the Southwest Washington Clean Air Agency prior to the start of construction.