

# Design Standards Manual



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## **1.0 Authority and Purpose**

The purpose of these Design Standards is to provide a consistent policy under which certain physical aspects of public facility design will be implemented. Most of the elements contained in this document are Public Works oriented and it is intended that they apply to both public improvements under City contract and public improvements under private contract designated herein.

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

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

## **1.1 Engineering Policy**

### **General:**

It shall be the policy of the City of Newberg to require compliance with Oregon Revised Statute 672 for professional engineers.

All engineering plans, reports, or documents shall be prepared by a registered professional engineer, or by a subordinate employee under the engineer's direction, and shall be signed by the engineer and wet stamped with the engineer's seal to indicate the engineer's responsibility for them. It shall be the engineer's responsibility to review with the City any proposed public facility extension, modification, or other change prior to any proposed design work to determine any special requirements or to determine whether the proposal is permissible. A "Preliminary Review" and/or a "Plans Approved for Construction" stamp of the City on the plans for any job does not in any way relieve the engineer of responsibility to meet all requirements of the City or obligation to protect life, health, and property of the public. The plan for any project shall be revised or supplemented at any time it is determined that the full requirements of the City have not been met.

Public works permit application(s) for public street, storm drainage, waterworks, and/ or wastewater improvements shall be approved/ issued by the City before commencement of any onsite building, grading, or construction activities.

### **Contractor Qualifications:**

All contractors performing work in the Public Right of Way and/ or on City owned infrastructure shall be pre-approved with the City of Newberg, and shall apply and possess a current City Business License. Upon the City Engineer's request, contractors shall provide supporting

documents of work history showing experience in the scope of work intended to be performed. Each contractor shall submit an approved Oregon Department of Transportation (ODOT) contractor prequalification application with its ODOT Approval Letter to the City for consideration to become an approved contractor with the City of Newberg. Contractors shall submit the pre-approval documents for the City's consideration at least 10 calendar days prior to any proposed construction.

### **Fees:**

Reference the Engineering Services Department Fee Schedule, for the most current and updated rates. A two percent plan review fee is due upon the initial plan submittal/ review process. Applicant may incur additional plan review fees for plans/ submittals and/ or length review periods considered unacceptable by the City. A three percent inspection fee is due upon completion of the plan review process. Additional inspection fees may be incurred due to failed inspections e.g. unprepared at the time of City arrival.

## **1.2 Standard Specifications and Standard Drawings**

Except as otherwise provided by these Design Standards all construction design detail, workmanship and materials shall be in accordance with the current edition of the City of Newberg Standard Specifications and Standard Drawings.

## **1.3 Revisions to Design Standards**

It is anticipated that revisions to these Design Standards will be made from time to time. The date appearing on the title page is the date of the latest revision. Users shall apply the latest edition to the work contemplated, and it shall be each user's responsibility to maintain his/her copy of these Design Standards with the latest changes.

## **1.4 Definitions**

**Alley** - A public way not over 30 feet wide providing a secondary means of access for vehicular or service access to properties otherwise abutting on a street.

**Applicant**- The owner or authorized agent acting on behalf of the owner.

**Approved Backflow Prevention Device** - A device that has been investigated and approved by the City and the Oregon State Health Division for preventing backflow.

**Arterial Street** - A major facility for moving intra-area traffic and for moving traffic to and from the freeway/expressway system.

**As-built Plans** - Plans signed, dated, and stamped by the project engineer indicating that the plans have been reviewed and revised, if necessary, to accurately show all as-built construction details.

**Backflow** - The reverse of flow from its normal or intended direction of flow. Backflow can be caused by back-pressure or back-siphonage.

**Backflow Preventer** - An approved device or means to prevent backflow into the potable water system.

**Back-siphonage** - Backflow that results from negative or reduced pressure (partial vacuum) in the supply piping system.

**Bike Lanes** - A designated travel-way for bicyclists that is established within the roadway directly adjacent to the outside vehicular lane or on the shoulder.

**Bike Path** - A designated travel-way for bicyclists which is completely separated from the vehicular travel lanes and is within independent rights-of-way.

**Bike Route** - A designated travel-way for bicyclists that is shared with vehicular traffic. The roadway is designated with signs for bicycling (no pavement markings for the bike route or delineation of parking spaces used).

**Building Service Lateral** - A public wastewater or stormwater sewer beginning at the property line or public easement line and extending to the wastewater sewer main.

**Building Sewer** - A private wastewater sewer beginning five (5) feet outside the building and extending to the property line or public easement line connecting to the building service lateral.

**Building Supply** - The pipe carrying potable water from the water meter or other source of water supply to a building or other point of use or distribution on the lot. Building supply shall also mean customer line.

**Channel Morphology**- The stream channel type and the physical characteristics of the streambed.

**City** - The City of Newberg, Oregon.

**City Engineer** - The individual designated by the City Manager to have the authority for review and approval on all projects subject to these design standards. The Assistant City Manager or Public Works Director may act in this role when the City Engineer position is not filled.

**Collection Systems** - Facilities maintained by the City of Newberg for the collecting, pumping, conveying, and controlling of wastewater.

**Collector Sewer** - The portion of the public wastewater conveyance system which is primarily installed to receive wastewater directly from individual residences and other individual public or private structures.

**Collector Street** - A facility that allows traffic within an area or neighborhood to connect to the arterial system.

**Common Development Plan-** All lands included within the boundary of a certified survey map or subdivision plat created for the purpose of development or sale of property where integrated, multiple, separate and distinct land developing activity may take place at different times by future owners.

**Core** - To cut and remove a portion of pipe, manhole, or pavement with a circular hollow drill.

**Cross Connection** - Any actual or potential physical connection between a potable waterline and any pipe or vessel containing a non-potable or potable (i.e., well) fluid (suspended solid or gas) so that it is possible to introduce the non-potable fluid into the potable fluid by backflow.

**Cul-de-sac** - A dead-end street that has a vehicular turnaround area at the end.

**Cut Sheets** - Sheets of tabulated data, indicating stationing, structures, fittings, angle points, beginning of curve, points on curve, end of curves, storm drain slope, staking offset, various elevations, offset cuts, and storm drain depths for streets, waterlines, wastewater sewers, and storm drains.

**Datum** - The vertical elevation control for the City of Newberg is "The North American Vertical Datum of 1988."

**Dead-end Street** - A street or series of streets which can be accessed from only one point. Dead-end streets can be either temporary (intended for future extension as part of a future street plan) or permanent. New construction of permanent dead-end streets (including cul-de-sacs) must provide adequate turnaround capability, and be publicly maintained.

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

**Demolition-** Any act or process of wrecking or destroying a building, improvement, or structure.

**DEQ-** Oregon Department of Environmental Quality

**Designated Arterial or Collector Street** - A street designated as an arterial or collector in the Comprehensive Plan or the Newberg Transportation System Plan.

**Design Standards Manual-** The current version of the City of Newberg design standards manual and specifications.

**Design Storm-** A hypothetical discrete rainstorm characterized by a specific duration, temporal distribution, rainfall intensity, return frequency and total depth of rainfall.

**Detention** – Area used to temporarily contain stormwater and reduce the peak velocity and volume of runoff to provide additional system capacity and to reduce erosion in surface conveyance facilities.

**Director** –The City of Newberg’s director of public works or their authorized representative.

**Development**- Residential, commercial, industrial or institutional construction, alteration, or other improvement which alters the hydrologic characteristics of a property or properties.

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

**Double Check Valve Assembly** - An assembly composed of two single, independently acting, approved check valves, including tightly closing shut-off valves located at each end of the assembly and fitted with properly located test cocks.

**Double Detector Check Valve Assembly** - A line-sized, approved, double check valve assembly with a parallel meter and meter-sized, approved, double check valve assembly. The purpose of this assembly is to prevent backflow contamination to the distribution system and, at the same time, provide a metering of the fire system showing any system leakage or unauthorized use of water.

**Drainage Facilities** - Pipes, ditches, detention basins, creeks, culvert bridges, etc., used singularly or in combination with each other for the purpose of conveying or storing storm water runoff.

**Driveway** - A vehicular connection between on-site parking and the public right-of way.

**Driveway Apron** - A portion of the driveway connecting a street to the right-of-way; also known as driveway approach or driveway ramp.

**Easement** - Areas located outside of dedicated right-of-way, which are granted to the City for special uses. Easements may also be granted to non-City entities such as franchise utility companies for their uses.

**Engineer** - The engineer, including the City's engineer, licensed by the State of Oregon as a Professional Engineer under whose direction plans, profiles, and details for the work are prepared and submitted to the City for review and approval, or who is in charge of and responsible for construction of the improvement.

**Expansion Joint** - A joint to control cracking in the concrete surface structure. Felt or fabric type expansion joint is not allowed.

**Fill**- A deposit of soil or other earth material placed by artificial means.

**Fire Hydrant Assembly** – The fire hydrant, with restraint devices, spool and attached auxiliary valve in valve box. See 300 series detail. Mechanical joint restraint shall be made using Field Lok® Gaskets and/or Megalugs® (no thrust blocks in new construction.)

**Fire Protection Service** - A backflow protected connection to the public water main intended only for the extinguishment of fires and the flushing necessary for its proper maintenance. All fire services shall have a detector check.

**Grade** - The degree of inclination of a street or slope.

**Grading**- Any act by which soil is cleared, stripped, stockpiled, excavated, scarified, filled, or any combination thereof.

**Half-street** - Means a minimum 50 percent portion of the ultimate width of the street (but not less than 22 feet with no parking on either side, or 28 feet with parking on one side.) Usually along the edge of a subdivision where the remaining portion of the street shall be provided when adjacent property is developed.

**Hydrant Spool** - The waterline connecting the fire hydrant to the auxiliary valve on the City distribution main.

**Illicit Connections**- A situation that the director determines would cause harm to the public, environment, or downstream stormwater facilities before the situation can be alleviated or repaired.

**Illicit Discharge**- Any direct or indirect non-stormwater discharge to the stormwater system except discharges regulated under NPDES permit or exempted by this chapter.

**Immediate Threat**- A situation that the director determines would cause harm to the public, environment, or downstream stormwater facilities before the situation can be alleviated or repaired.

**Impervious**- The hard surface area either prevents or greatly retards infiltration and causes water to runoff the surface in greater quantities or at an increased rate of flow from that present in undeveloped conditions. Surfaces which would ordinarily be considered pervious are considered impervious if they do not allow natural infiltration of stormwater.

**Industrial Waste** - Solid, liquid, or gaseous waste resulting from any industrial, manufacturing, trade, or business processes; or development, recovery, or processing of natural resources.

**Infiltration**- The passage or movement of water into the soil subsurface.

**Interceptor Sewer** - The primary public wastewater sewer line which conveys wastewater directly into the Wastewater Treatment Plant.

**Irrigation Service** - A metered connection intended for seasonal use and delivering water which is not discharged to the wastewater collection and treatment system.

**Lateral Sewer** - A building sewer service line.

**Local or Residential Street** - A facility designated to serve primarily direct access to abutting land and offers the lowest level of traffic mobility. Through traffic movement is deliberately discouraged.

**Longitudinal Joint** - A joint that follows a course approximately parallel to the centerline of the roadway.

**Low Impact Development Approaches (LIDA)** - A stormwater management approach that mimics pre-development hydrology through design techniques that infiltrate, filter, store, evaporate, or detain runoff close to its source.

**Maintenance Agreement**- An agreement between the City and a maintenance organization for private stormwater facilities detailing the operation and maintenance requirements of the facilities.

**Maintenance Organization**- The person(s), company, or nonprofit organization(s) responsible for long-term operation and maintenance of stormwater facilities recorded in the maintenance agreement.

**Major Trees** – Trees within the right-of-way which have a 12” caliper or larger. Street improvement plans should identify major trees by location, caliper, and species.

Major tree species are those that contribute to the landscape character of the area to include: e.g. Douglas fir, cedar, redwood, sequoia, oak, ash, birch, walnut, maple. The identification of major trees should distinguish species generally suitable for retention adjacent to streets and those species with growth habits that create nuisances, unusual maintenance problems, or hazards to the public. Major trees exist in clusters, groves, or rows within the right-of-way. Check with City’s Planning Department for a list of approved tree planting species.

**Manager** - The City Manager (or designee) of the City of Newberg acting either directly or through authorized representatives.

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

**Natural Grade** - The grade of the land in an undisturbed state.

**Net Impervious Area**- The increase in impervious area on a property after a project is completed.

**Non-Stormwater Discharge**- Any discharge to the stormwater system that is not composed entirely of stormwater.

**Owner** - The owner of record of real property as shown on the latest tax rolls or deed records of Yamhill County, and includes a person who purchases a parcel of property and furnishes evidence of the purchase under a written recorded land sale contract.

**Partition** - To divide an area or tract of land into two or three parcels within a calendar year when such area or tract of land exists as a unit or contiguous units of land under a single ownership at the beginning of such year. Partition does not include divisions of land resulting from the creation of cemetery lots; and partition does not include any adjustment of a lot line by the relocation of a common boundary where an additional parcel is not created and where the existing parcel reduced in size by the adjustment is not reduced below the minimum lot size established by any applicable code. Partition does not include the sale of a lot in a

recorded subdivision, even though the lot may have been acquired with other contiguous lots or property by a single owner.

**Peak Run-off** - The maximum stormwater runoff rate (in cubic feet per second) as determined for the design storm.

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

**Plans** - Construction plans, including any applicable system plans, sewer plans, profiles, cross sections, elevations, project specific detailed drawings, standard details, etc., or reproductions thereof, signed by the Engineer of Record, approved or to be approved by the City Engineer, which show the location, character, dimensions, and details of the work to be performed, and which constitute part of the construction contract documents for privately financed development projects or publicly financed infrastructure improvement projects.

**Potable Water** - Water which is satisfactory for drinking, culinary, and domestic purposes and meets the requirements of the health authority having jurisdiction over it.

**Private Wastewater Collection System** - A privately owned and maintained lateral wastewater conveyance system installed to serve multi-unit structures on single ownership properties which cannot legally be further divided.

**Private Storm Drain** - A storm drain located on private property or serving private parking lot catch basins.

**Project**- An activity that creates impervious area.

**Project Summary**- A narrative that includes the project description, location, emergency contacts, and other information determined by the public works director such that the project can be located and a determination made regarding methods of stormwater management.

**Public Wastewater System** - Any sewer in public right-of-way or easement operated and maintained by the City for carrying wastewater and industrial wastes.

**Public Storm Drain** - Any storm sewer in public right-of-way or easement operated and maintained by the City.

**Reclaimed Water** – Wastewater that is treated sufficiently for reuse but not for drinking purpose.

**Record Survey Monument** – any physical marker, such as an iron rod with a plastic, brass, or aluminum cap, set in place by a professional land surveyor to indicate the location of a land boundary, street centerline, elevation, or other legal or physical land features as noted on a survey recorded in the County Surveyor's Office.

**Regional Water Quality Facility**- A water quality facility that treats more than 15,000 square feet of impervious area runoff.

**Release Rate** - The controlled rate of release of drainage, storm, and runoff water from property, storage pond, runoff detention pond, or other facility during and following a storm event.

**Responsible Party**- A person or entity holding fee title to the property, tenant, lessee, or a person or entity who is acting as an owner's representative including any person, company, nonprofit organization or other entity performing services that are contracted, subcontracted, or obligated by other agreement to meet the requirements of this code.

**Right-of-Way** - All land or interest therein which (by deed, conveyance, agreement, easement, dedication, usage, or process of law) is reserved for or dedicated to the use of the public for sidewalk, utility, and/or roadway purposes.

**Roadway** - That portion of the right-of-way used or to be used for vehicular traffic, which exists typically between curbs, proposed curb lines or ditches.

**Sediment** – Soil or other surficial materials held in suspension in surface water or stormwater.

**Sedimentation** – The process or action of sediment being deposited as a result of decreased surface water or stormwater velocity.

**Sidewalk** - A walk or raised path along the side of a street for pedestrians. A right-of-way deeded, dedicated, and designated for the use of non-motorized vehicles (as allowed) and pedestrians.

**Silt** - Fine clay and silt textured soil particles, including clay that is easily erodible and remains in suspension even at low stream velocities.

**Site**- Any property or combination of properties where a project is being proposed or completed.

**Slope**- The change in elevation of a ground surface expressed as a ratio of horizontal distance to vertical distance, e.g. 3H:1V.

**Standard Drawings** - The detailed drawings of structures and/ or details or devices commonly used on public improvements and referred to on construction plans.

**Stop Work Order**- An order issued by the director which requires all project activity, except those specifically stated in the stop work order, to cease on the site.

**Stormwater**- Water that originates as precipitation on a particular site, basin, or watershed and flows over land or impervious surfaces without percolating into the ground.

**Stormwater Facility**- A location to filter, retain, or detain stormwater for the purpose of water quality or quantity management. The facility may be structural or non-structural, has been designed and constructed according to city design standards, and has been required by the city to control post-construction stormwater.

**Stormwater Facility Operations and Maintenance Plan-** The required steps to be undertaken by an owner or maintenance organization to ensure proper functioning of a stormwater facility.

**Stormwater Management-** Techniques or structures intentionally used to temporarily or permanently reduce or minimize the adverse effects of stormwater velocities, volumes, and water quality on receiving watercourses. A series of techniques or structures constitute a stormwater system or treatment train.

**Stormwater System-** The combination of both artificial and natural system of drains, ditches, canals, culverts, detention ponds, retention ponds, dams, and other water control facilities used for collecting and transporting stormwater.

**Stormdrain-** Inlets, outlets, manholes, catch basins, pipes, and other structures used to convey stormwater to its ultimate discharge point.

**Stormwater-** Water that originates as precipitation on a particular site, basin, or watershed and flows over land or impervious surfaces without percolating into the ground.

**Streets or Roads** - Any public highway, road, street, avenue, boulevard, lane, alley, way, easement, or right-of-way used or to be used for vehicle movement.

**Structures** – Anything constructed or built, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

**Subdivision** - To divide an area or tract of land into four or more lots within a calendar year when such area or tract of land existed as a unit or contiguous units of land under a single ownership at the beginning of such year.

**Super elevation** - The tilting of the pavement that helps vehicles travel around a horizontal curve is measured as a vertical distance between the heights of the inner and outer edges of pavement surface. Design of super elevation shall follow the latest AASHTO (American Association of State Highway and Transportation Officials) design guide

**Three-Quarter Street:** - Means a minimum 75 percent portion of the ultimate width of the street (but not less than 24 feet with no parking on either side, 28 feet with parking on one side.) Usually along the edge of a subdivision where the remaining portion of the street shall be provided when adjacent property is developed (per Newberg Development Code 10.44.315(2).)

**TMDL-** Total Maximum Daily Load

**Transverse Joint** - A joint which follows a course approximately perpendicular to the centerline of the roadway.

**Traveled Way** - That portion of the roadway for the movement of vehicles, exclusive of shoulder and auxiliary lanes.

**Trunk Sewer** - A wastewater sewer which is primarily intended to receive wastewater from a collector sewer, another trunk sewer, an existing major discharge of raw or inadequately treated wastewater, or water pollution control facility.

**Turnaround Area** - A paved area of sufficient size and configuration that a motor vehicle may maneuver so as to travel in the opposite direction. The City Fire Marshall may require the turnaround to be sized to accommodate turning movements of their specified design vehicle.

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

**Wastewater** - The total fluid flow in the conveyance and treatment system which includes industrial waste, water-carried wastes from residences, business buildings, institutions, and industrial establishments, or any other waste (including that which may be combined with any ground water, surface water, or stormwater) that may be discharged into the conveyance and treatment system.

**Water Distribution System** - Water distribution pipelines, pumping stations, reservoirs, valves, and ancillary equipment used to transmit potable water from the supply source to the service line.

**Water Main** - The water supply pipe for public or community use.

**Water Service Line** - The pipe connection from the City water main to the users' water meter, hydrant, backflow prevention device, or fire sprinkler double check valve.

**Watercourse** – Any natural or artificial stream, river, creek, ditch, channel, canal, conduit, culvert, drain, gully, ravine, swale, wetlands, or wash in which water flows either continuously or intermittently. The width of the watercourse includes any adjacent area that is subject to inundation from overflow or floodwaters from the design storm

**Wetlands** – Transitional lands where the water table is usually at or near the land surface or the land is covered by shallow water. Wetlands have one or more of the following attributes: 1) support, at least periodically, plants that thrive in saturated conditions, 2) contains predominately undrained hydric soil, or 3) the area is saturated or covered with shallow water at some time during the growing season of each year.

## 1.5 Construction Plans

Construction plans shall follow the outline of plan submittal checklist. Prior to any construction work and plan approval, complete construction plans, specifications and all other necessary submittals shall be submitted to the City Engineer for review.

### 1.5.1 Plan Preparation

Construction plans and specifications shall be prepared as by a professional engineer licensed in the State of Oregon.

All construction plans shall be based on the current vertical datum for the City of Newberg, NAVD 88. City benchmark locations are available from the City Engineering department.

### 1.5.2 Sheet Size

All construction plans shall be clearly and legibly drawn in ink on sheets measuring 22 x 34 inches (11x17", half-size reduction). Sheets shall have a 1½ inch clear margin on the left edge and a ½ inch margin on all other edges.

### 1.5.3 Scale of Plans

When plans are prepared for developer financed projects, the following scale of full-sized drawings is suggested.

Plan/Scale	Horizontal	Vertical
Street	1" = 20'*	1" = 2'
Wastewater	1" = 40'	1" = 4'
Storm	1" = 40'	1" = 4'
Water	1" = 20' or 40'***	1" = 4'
Demolition	1" = 40'	n/a
Erosion Control	1" = 40'	n/a
Grading	1" = 40'	n/a
Landscape	1" = 40'	n/a
Signing & Striping	1" = 40'	n/a
Street Lighting	1" = 40'	n/a
Topographic Survey	1" = 40'	n/a

\*Subdivision street plans, when combined with other proposed facilities listed above, may be drawn at 1" = 40' scale.

\*\*When a scale is used which is smaller than 1" = 20' (i.e., 1" = 40') intersection details showing fittings and valves shall be provided at a larger scale.

A horizontal scale of 1" = 20' (or 1" = 30') for all drawings is recommended when half-sized drawings are utilized for bid solicitation or for field reference.

Architectural scales (e.g., 1/4" = 1'0") are not permitted.

#### **1.5.4 Required Plans**

Construction plan submittals shall contain the following minimum sheets: title sheet (unless not required by the City Engineer), plan and profile sheet(s) for street, storm sewer, water, and wastewater sewer, overall utility plan (existing and proposed), proposed grading, temporary and permanent erosion control, and detail sheet(s) plus any other relevant construction details.

##### **Title Sheet**

All subdivision projects and multiple sheet improvement projects shall have a title sheet as the first page of the construction plans. This sheet shall contain the following minimum information:

- a. Site plan of entire project with street right-of-way and/or subdivision layout at a 1" = 100' scale. A 1" = 200' scale may be used if project size is too large. The site plan shall also be a composite utility plan showing all properties served by proposed sewer, water, and storm facilities, in addition to the proposed facility.
- b. Vicinity map at a 1" = 1000' scale or greater.
- c. Index of sheets.
- d. Complete legend of symbols used.
- e. General and construction notes pertinent to project, including one-call locate note.
- f. Temporary and/or permanent benchmarks used along with their descriptions, elevations of benchmark, and datum. (When topographic survey is presented separately, show this information on that sheet.)
- g. Engineer's name, address, phone number including emergency contact information, fax number, email, and seal.
- h. Developer/owner's name, address and phone number including emergency contact information.
- i. Statement referencing City of Newberg Standard Specifications.
- j. Provide contact phone number for all affected utility companies including the City.
- k. Show tax lot numbers or lot and block designations, land use designations, gross site area, and site address.
- l. Date of last plan revision (large/bold).
- m. Land Use Planning case file number(s).

##### **Plan Sheet**

The plan view of each sheet shall be drawn at the appropriate scale showing the following minimum information:

- a. Adjacent street curbs, property lines, right-of-way lines, utility easements referenced to property lines, street centerlines, and intersections. Show property corner and curb elevations to determine water service level, serviceability of lot/property for wastewater sewer, points of disposal for building storm drains, and how new curbs will join to existing curbs.
- b. Location of all underground utilities within 100 feet of project (if they are affected by the project), existing power/telephone poles and guy anchors, valves, manholes, catch basins, fire hydrants, meter boxes and vaults,

- signs, etc. location of nearest street light(s) and fire hydrant(s) (distance could be greater than 100').
- c. Location of all water courses, railroad crossings, culverts, bridges, large water transmission pipes and gravity sewers, and/or storm drains within 200 feet of proposed gravity sewer and storm drain extensions if they affect the design of the project. All water courses shall show the 100-year flood plain as indicated on the U.S. Army Corps of Engineers and Federal Emergency Management Agency (FEMA) maps and any current or proposed wetlands.
  - d. On sewer and storm drain plans, each manhole, catch basin, and cleanout shall be numbered and stationed. Stationing shall tie to existing street monuments, property corners, or manholes. Stationing for each line shall increase from left to right on the plan sheet. This should result in north pointing to the top or to the left of the sheet. Each separate line shall be separately designated (e.g., sewer line 'A', storm line 'A', etc.).
  - e. On street plans, horizontal stationing shall show points of tangency and curvature for centerline; curve data shall show tangent length, radius distance, centerline curve length, and delta angle. Centerline intersection stationing, in both directions, shall be shown. Provide  $\frac{1}{4}$  point elevations for curb returns.
  - f. Where streets are being widened, edge of pavement elevations shall be shown to determine pavement cross-slope to new curb or pavement edge.
  - g. On water plans, all fittings and valves shall be shown and identified by type (i.e., MJ x MJ, FLG x MJ, etc.); fire hydrants shown; intersection details for valves and fittings are required when scale of plans is smaller than  $1" = 20'$  (i.e.,  $1" = 40'$ ).

### **Profile Sheet**

Profiles for construction plans shall be the same horizontal scale as the plan sheet. Profiles are drawn on the same sheet as the plan view and shall be immediately below the plan view. Stationing shall increase from left to right with lower stations to the left. The following minimum information shall be shown:

- a. For sewers and storm drains, show locations of manholes, catch basins, and cleanouts, with each numbered and stationed.
- b. Existing profile at centerline of proposed utility or street.
- c. Proposed profile grade, as appropriate, for all sewers, storm drains, and waterlines, giving pipe size, length between structures or fittings, slope, backfill and pipe material, sewer inverts, rim elevations, etc.
- d. Existing underground utility that crosses the alignment of the proposed facility.
- e. Beginning of all vertical curves, points of vertical intersection, end of vertical curve, low point of sag curve, and length of vertical curve. Profiles of existing centerline grade shall extend a minimum of 250 feet beyond the end of the improvement.
- f. Clearly show all potential conflicts with existing public and private utilities (i.e., pipes, conduits, vaults, cathodic protection systems, etc.) that impact proposed design.

**SPECIAL NOTE:** City of Newberg as-built records are only to be used as an aid to the engineer. The engineer shall field locate, or cause to be located, and verify the alignment, depth, and inverts of all existing facilities shown on the plans that will be crossed by the proposed facility.

### **Erosion Control Plans**

The erosion control plan shall address the measures as required by the Department of Environmental Quality (DEQ) erosion control standards and policies and the Willamette Total Maximum Daily Load (TMDL) Implementation Plan. Construction activity is assumed as "active" until all permanent vegetation and/or erosion protection is established.

Refer to the City of Newberg Erosion & Sedimentation Control Manual for additional information.

### **Detail Sheets**

Detailed drawings shall be included with all construction plans where City of Newberg Standard Specifications and Standard Drawings do not exist. If a Standard Drawing, such as sewer manholes, must be modified to fit existing or unique conditions, the modified drawing shall be shown on the plans. When appropriate, due to required detail complexity, a separate detail sheet shall be drawn. When City Standard Drawing appurtenances or construction installations are to be used, a reference to the specific Standard Drawing number shall be made on the relevant sheet.

## **1.5.5 Supporting Information**

The engineer shall submit sufficient supporting information to justify the proposed design. Such information shall include, but not be limited to, the following:

- a. Design calculations.
- b. Storm drainage report with all hydrology and hydraulic calculations, storm water quantity and quality calculations, basin maps and downstream analysis as required in **Section 4**, Storm Drainage.
- c. Alternate materials specifications including manufacturer's design application recommendation.
- d. Intersection sight distance certification as outlined in **Section 5**, Streets.
- e. Grading plan support information to include as appropriate:
  - (1) Soils engineering report
  - (2) Hydrology report
  - (3) Engineering geology report
  - (4) Arborist report
- f. Water model calculations and fire flow calculations for waterline systems.
- g. Documentation of proper protection and/or replacement of Record Survey Monuments. If, in the course of construction of the proposed development, a record survey monument shall be removed, disturbed, or destroyed, the Engineer shall cause a registered professional land surveyor to reference and replace the monument within 90 days in accordance with ORS 209.

## **1.6 Plan Submittal**

Construction plans for all privately financed public works facility improvements shall be submitted to the City Engineer or the designee. The City Engineer will coordinate the plan

review and approval of all construction plans which will include review for compliance with all Newberg Standard Specifications, the Newberg Development Code, and other City Codes and Ordinances.

All plan submittals shall include information required in these Design Standards along with all other information requested by the City Engineer. This information is to include, but not be limited to, construction cost estimates, intersection sight distance certifications, easement documents, right-of-way dedications, executed agreements, and a plan check and inspection fee. All submittals will be reviewed for completeness and the engineer notified if required information is missing. Submittals should be made in a timely manner as lack of information to the City may impede the review process.

## 1.7 As-built Plan Requirements

For all public works facility improvements the engineer shall submit a record drawing of as-built drawings for all plans that were approved for construction. As-built drawings shall meet the requirements of these Design Standards and shall be of archival quality.

The engineer shall submit, along with the as-built drawings, a statement certifying that all work for which plans were approved has been completed in accordance with the Newberg Design Standards and Specifications. No disclaimer to the accuracy of the as-built records is allowed.

At the time of the final as-built plan approval submittal, the applicant shall provide the City with as-built drawings of the public improvements as follows:

- 1) 3 mil mylar of the complete construction plan set(s).
- 2) A disk of the as-builts in "DWG" format, if available; otherwise "DXF" will be acceptable
- 3) The complete set of as-builts in printed Adobe Acrobat PDF format.
- 4) The as -built drawings shall be tied to the City's GPS network. The applicant's engineer shall provide the City with an electronic file with points for each structure (manholes, catch basins, water valves, hydrants and other water system features) in the development, and their respective X and Y State Plane Coordinates, referenced to NAD 83 (CORS 96). Points must be translated and rotated to match City co-ordinate system.
- 5) As-built drawings must show actual design numbers, "~~crossed out~~", and updated with actual as-built numbers.

The words "As-built Drawing" shall appear as the last entry in the revision block of the plans, along with the month, day, and year the as-built drawing was prepared.

**NOTE:** Actual location and depth from finish grade of any other utilities encountered during construction shall be shown and noted on both plan and profile of the as-built plans.

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

### 1.7.1 Street

- a. Change in horizontal alignment, curve data, and stationing of primary control points (e.g., PC, PI, PT, PRC, and PCC).
- b. Vertical curve or grade changes; change in location of low point in sag vertical curve.

- c. Change to approved thickness for street structural section components. Show station limits where changes in structural section have occurred including subgrade stabilization rock section.
- d. Change to driveway locations or widths, or construction materials.
- e. Other change(s) altering the approved plans.

#### **1.7.2 Storm Drains**

- a. Station of wye or tee connection into main line; tie end of branch line to nearest property corner at right-of-way line and distance back from the face of curb.
- b. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a manhole.
- c. Other change(s) altering the approved plans.
- d. Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

#### **1.7.3 Wastewater**

- a. Station of wye or tee into main line. Tie end of service lateral to nearest property corner at right-of-way line and distance back from the face of curb.
- b. Depth at the end of service lateral measured from existing ground to invert of pipe. When required by the City Engineer, invert elevations shall be noted.
- c. Length of service lateral measured from centerline of sewer main to end of pipe.
- d. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a manhole.
- e. Other change altering the approved plans.
- f. Type of pipe, backfill material and location.
- g. Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

#### **1.7.4 Water Main**

- a. Station and/or property line/corner to valves (not at standard location), all fittings, blow-offs, and dead-ended lines.
- b. All changes from standard 36-inch depth cover. Limits shall be shown on plan with annotated reason for change. Actual pipe elevation shall be specified at regular intervals by engineer of record.
- c. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a valve.
- d. Provide manufacturer of all valves and hydrants; identify types of fittings (i.e., MJ x MJ, FLG x MJ, etc.).
- e. Other change altering the approved plans.
- f. Provide design calculations and complete pressure/leak test results to the City Engineer.

Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

## 1.8 Approval of Alternate Materials, Methods, or Design

Any substitute material or alternate method not explicitly approved herein will be considered for approval as set forth in this section. Persons seeking such approvals shall make application in writing. Approval of any major deviation from these Design Standards will be in written form. Approval of minor matters will be made in writing if requested.

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

The written application for an alternate approval is to include, but is not limited to, the manufacturer's specifications and testing results, design standards, design drawings, calculations, and other pertinent information.

### 1. General

The City Engineer may approve a design exception request so long as it does not conflict with the City Development and/or Municipal Codes, the County or City Land Development Permit Decision, or any other relevant approvals, except as expressly provided herein. If the requested exception involves public safety, the City will rule in the direction of safety.

### 2. Submittal

All requests shall state the applicable standard, the desired exception, the reason for the request and a comparison between the applicable specification or standard and the exception as to function, performance and safety. If an exception is requested due to economic hardship, the request shall contain a statement on the impact to project cost with and without the exception. The request for exception shall be prepared by an Engineer and shall be stamped and signed by the Engineer. Multiple design exception requests shall be separated, individually prepared, and submitted to the City as separate requests.

Any approved exception to these Standards shall be documented and should reference nationally accepted guidelines, specifications, or standards. The approval of an exception shall not compromise public safety or the intent of these standards. An exception shall be approved only if the City Engineer finds that the alternative proposed by the Engineer meets the criteria addressed in this section and will provide equivalent or better function, performance, and safety.

Each exception shall be reviewed on a case-by-case basis and approved or denied by the City Engineer. All exception requests granted are considered unique to each request and project, do not set a precedent, and are not uniformly applicable.

When requested by the City, complete full size plans and design calculations shall be submitted for review with the request for approval.

### 3. Special Facility Designs

These standards are not intended to address the requirements for all possible public or private facilities. Facilities not addressed in these standards are considered unique and must be designed to meet site specific criteria. For these types of facilities, the design engineer must request a pre-design meeting to review the appropriate design, operating and maintenance criteria that will apply to the specific project prior to submittal any design reports or plans. The following are examples of facilities that will require special review and approval:

- Sewer Force Mains
- Water Distribution Pump Stations
- Relining of Existing Sewers
- Relining of Existing Water Mains
- Internal Sealing of Existing Sewers
- Water Pressure Regulating Devices
- Wastewater Regulatory Devices
- Energy Dissipaters
- Wastewater Pump Stations
- Water Reservoirs
- Sewer Siphons
- Water Treatment Plants
- Wastewater Treatment Plants
- Water Flow Measurement/Monitoring/Telemetry Devices
- Wastewater Flow Measurement/Monitoring Devices

#### 4. Review

The request for design exception will be reviewed by the City Engineer who will make one of the following decisions within fourteen days:

- Approve as requested;
- Approve with changes; or
- Deny with an explanation

Approval of a request in one project shall not constitute a precedent for other projects

#### 5. Appeal

The Applicant may appeal the City Engineer's decision to deny an exception to the Director. The appeal shall be submitted in writing within fourteen (14) days of the City Engineer's decision.

The appeal shall be in writing, state the relevant facts, applicable provisions of these Standards, specific grounds for appeal, the relief sought, and shall include all information on which the applicant relies. The applicant shall have the burden of proving that an error was committed, or that the requested exception meets the criteria and equals or exceeds the applicable standard as to function, performance, and safety.

The Director shall review all the information submitted with an appeal. The Director may request additional information from the Engineer, the City

Engineer, or both, and may meet with the parties. The Director shall render a decision in writing. The Director's decision shall be final.

6. Responsibility for Exceptions

The Engineer shall be responsible for requesting, in writing, any anticipated exceptions to these standards at the time of submittal of plans. Only those exceptions so noted and expressly approved by the City Engineer, shall be lawful and permitted, notwithstanding approval of the overall "red-line" or "as-builts".

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## SECTION 2 WASTEWATER

### 2.0 General Design Requirements

**Performance Standards** - Wastewater system design shall meet the policies and guidelines of the current "City of Newberg Wastewater Master Plan Update 2007" and the Oregon Department of Environmental Quality wastewater design guidelines and shall be designed with a 75 year life expectancy.

Public wastewater systems within the public right of way shall be designed to provide gravity service to all areas of development.

Wastewater system capacity shall be designed for ultimate development density of the tributary area. The system shall allow for future system extension and for future development.

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

Unpolluted or non-contact cooling waters shall not be discharged into wastewater systems. The overflow drains and filter backwash lines of swimming pools and "hot tubs" shall drain into a wastewater sewer.

All, waste systems shall be designed to allow for future loads and for ultimate development of the specific drainage area or basin concerned.

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

All waste lines shall be located within the public right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to provide required replacement and/or repair. Exceptions may be made on a case by case basis as approved by the City Engineer.

### 2.1 Pipe Materials and Size

All public wastewater sewers shall be constructed with PVC pipe as specified in the appropriate section of the Newberg Standard Specifications. Where required for added strength, Class 50 Ductile Iron pipe or C900 will be used. PVC pipe and fittings shall conform to ASTM D-3034, SDR 35 (no ductile iron if line has lateral connections).

All wastewater main lines shall be a minimum diameter of eight inches (8"). Private wastewater lines shall meet the appropriate sections of the Uniform Plumbing Code with Oregon amendments.

## 2.2 Minimum Design Criteria

**Velocity** - All wastewater lines shall be designed on a grade which produces a mean velocity, when flowing half full or full, of no less than two feet (2') per second.

**Manning Equation** - When calculating minimum pipe slopes and velocities, the engineer shall use the Manning pipe friction formula.

**Pipe Coefficient** - The minimum pipe roughness coefficient for wastewater sewers shall be 0.013.

**Inflow and Infiltration** – An allowance of 1,000 gallons/acre/day shall be added for all land area in the basin being served.

## 2.3 Alignment and Cover

### 2.3.1 Right-of-Way Location

Wastewater lines shall be located north and west from the right-of-way centerline as defined in **Standard Drawing No. 103**. All changes in direction of pipe shall be made at a manhole.

Sewers shall be located in the street right-of-way. If streets have curved alignments, the center of the manhole shall not be less than six feet (6') from the curb face on the outside of the curve, or the wastewater centerline less than six feet (6') from the curb face on the inside of the curve.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat per ORS 92.044 (7).

Curved alignments in wastewater lines are not permitted.

### 2.3.2 Minimum Cover

In new residential hillside subdivisions, mainline and lateral sewers shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street.

Wastewater sewers in residential areas shall be placed in the street with the following minimum cover, **Standard Details No. 211 & 212**:

Building Service Lateral - Six feet (6')  
Trunk and Collector Sewer  
In the roadway - Eight feet (8')  
In easements - Eight feet (8')

Where the topography is relatively flat and existing sewers are shallow alterations to the coverage may be approved by the City Engineer.

### 2.3.3 Easements

Public Sanitary Sewer easements shall conform to the dimension specified in **Standard Drawing No. 109**.

### 2.3.4 Relation to Watercourses

Generally, the top of all wastewater sewers entering, crossing or adjacent to streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. One foot (1') of cover is required where the sewer is in rock; three feet (3') of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least six inches (6") below finish grade of the bottom of the channel, except as provided above.

Sewers located along streams shall be located outside of the stream bed and sufficiently removed there from to provide for future, possible stream channel widening. All manhole covers shall be watertight at or below the 100-year flood elevation.

Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible, and shall be free from change of grade. The minimum cover shall be thirty-six inches (36") from the bottom of the stream bed or drainage channel.

Pipe material shall be Class 52 ductile iron or ASTM C-900 PVC with a 20-foot length of pipe centered on the stream or drainage channel centerline. The pipe shall extend to a point where a one-to-one slope begins at the top of the bank and slopes down from the bank away from the channel centerline and intersects the top of the pipe. (No tees are allowed in DI runs.)

Concrete encasement will be required when the above cover requirements cannot be met. Each deviation from the above requirements will be reviewed on a case-by-case basis, subject to the approval of the City Engineer.

## 2.4 Manholes

Manholes shall conform to ASTM C-478.

Manholes shall be located at all changes in slope, alignment, pipe size, pipe material, and at all pipe junctions with present or future wastewater sewers. The number of manholes in designs should be minimized, as the goal of the City is to reduce the number of structures possible, in order to reduce inflow and infiltration into City systems.

Manhole spacing shall not be greater than 500 feet.

Designs for manholes are shown in the Newberg Standard Specifications and **Standard Details No.204-208**. They are suitable for most conditions. New designs or revisions should not be shown on the construction drawings unless the standard designs are not suitable. New or revised designs may be necessary if;

- a. One or more of the sewers to be connected to the manhole is over 36 inches in diameter (smaller diameters may require a special design if the manhole is at an alignment change.)
- b. Several sewers will be connected to the manhole.
- c. There is less than 90° between the incoming and outgoing sewer.

- d. The manhole will be subject to unusual structural loads.
- e. Diversion or other flow control measures are required.

Where one or more of conditions a, b, or c is encountered, a drawing of the manhole base should be made to determine if it is feasible to use designs shown in the Standard Drawings. It may be necessary to restrict the options to a specific Standard Drawing specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show the details on the construction drawings and to provide structural calculations as needed.

### **Alternate Manhole Features**

Some alternate manhole features are shown in the Standard Drawings. Where these features are required, they must be specified by a note on the construction drawings. Some examples are;

- a. Short cones must be used in lieu of standard cones where there will be less than five (5) feet between the lowest pipe invert elevation and the top of the manhole lid. Flat top manholes may not be used on a case by case basis if a standard frame can be used. Pre-approval required.
- b. Watertight manhole frames and covers are to be used if flood waters are expected to cover the manhole top. Such conditions should be avoided wherever feasible. For manhole joint seal, apply wrap-around heat-shrink protection sleeves as approved by City Engineer.
- c. Tamperproof manhole frames (7" depth) and covers are required in all areas outside the paved public right-of-way.

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

- a. The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer.
- b. If the incoming and outgoing sewers are of equal size and are passing straight through the manhole, there shall be 0.20 ft difference in elevation.
- c. If sewers intersect or the alignment changes at the manhole, the invert elevation difference shall be at least 0.20 feet for 0°-45° of horizontal deflection angle, and at least 0.20 feet for over 45° of horizontal deflection angle. Horizontal deflection angles greater than 90° are not allowed.
- d. The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole.
- e. Drop connections are required when the vertical distance between flow-lines exceeds two (2) feet. The diameter of the drop connection must be specified on the

construction drawings. Smooth flow-lines with vertical distances of less than one foot must be provided wherever feasible.

- f. All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes.
- g. Channels shall be installed in the base of all manholes to maintain minimum velocity of no less than 2 feet per second. Channels shall also allow for insertion of televised sewer inspection equipment into the pipe from outside of the manhole. All connections shall be made with an approved Rubber Boot. Where conditions make compliance with these rules impractical, exceptions will be permitted. It will be necessary, however, for the designer to provide a complete analysis of the need for such designs.

## 2.5 Cleanouts

Cleanouts will not be approved as substitutes for manholes on public sewer lines. Cleanouts are permitted at the upper end of a sewer that will be extended during a future construction phase. If future extension requires a change in sewer alignment or grade, a manhole will be required at the cleanout location. A manhole or clean out is required between public and private property.

Cleanouts are only permitted at the end of a non-extendable wastewater line that does not exceed 250 feet in length and does not serve more than eight (8) dwelling units.

## 2.6 Service Lateral

Service laterals are those public wastewater lines to which a private building sewer connects. **See Detail No. 211.**

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

The minimum inside diameter of a wastewater service lateral shall be four inches (4") and shall be equal to or greater than the building sewer diameter. Service laterals shall be built to the same construction standards and of the same materials as the wastewater mainline. Laterals must be green colored pipes. Service laterals in general shall be placed at 90 degrees to the main wastewater line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90 degrees (45 degrees minimum) may be approved for special conditions such as cul-de-sac lots. Service line connections may be made at manholes if such placement would not interfere with other present or future connections to the manhole.

The minimum slope of wastewater service lines shall be 2.00 percent (1/4 inch per foot). Except that for unusual conditions, a slope of 1.00 percent (1/8 inch per foot) may be approved. It will be necessary, however, for the designer to provide a complete analysis of the need for any wastewater service lateral slope less than 2.00 percent. The maximum slope shall be 100.00 percent (45 degrees or one foot per foot).

Tees for service laterals, with a slope greater than 100 percent, shall have 1/16<sup>th</sup> or 1/8<sup>th</sup> bend to provide proper grade for service laterals. Service laterals shall be installed to the street right-of-way line or easement line. A water tight plug shall be installed in end of the lateral with a 2" x 4" standard wood marker placed from pipe invert to 12 inches above finish grade. The 2" x 4" top to be painted green and marked with the depth of the lateral measured from ground to invert of pipe. Curb line and concrete gutter surface shall have an "S" branded into the face (top) of curb at lateral crossing.

## 2.7 Connection to Existing Sewers

Connections to, and extensions of, existing sewers will occur to facilitate new development. Certain requirements will be placed on the design engineer as to the permitted methods and/or locations.

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

All manhole wall holes and base channels shall be cored; approved Rubber Boots shall be used.

- a. Where the invert of the connecting pipe is two feet (2') or less above the invert out elevation, an inside drop (beaver slide) will be constructed utilizing Portland Cement concrete. The wastewater entering the manhole will follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into main channel. Wastewater will not be allowed to fall freely to the manhole base.
- b. Where the invert of the connecting pipe is more than two feet above the manhole shelf, the contractor will be required to construct an inside drop per **Standard Drawing No. 206** with the inlet pipe invert being located at the manhole shelf. The wastewater entering the manhole will follow a smooth concrete channel transition from the inlet pipe into the main channel. Plastic pipe inserted thru manhole needs to have a proper collar to insure concrete adhesion and prevent infiltration.
- c. Where the invert is required to enter below the shelf of the manhole, the inlet pipe will not enter below a point where the crown of the new inlet pipe is below the crown of the outlet pipe. The base of the manhole shall be rebuilt if damaged in this process. The wastewater will enter the main flow in a smooth channel transitioning from the inlet pipe to the main channel.
- d. No pipe will enter an existing manhole where the angle between the incoming flow and the outgoing flow is greater than 90°.

When sewers are extended from cleanouts, the entire cleanout assembly, including the wye, shall be removed.

New building service laterals will be made at existing tees where possible.

When tees do not exist on the Public Wastewater Conveyance System, the new lateral sewer will enter the collection system through a "cored" opening with an approved connector saddle tap, or 'cut in' tee. This connection shall be done in conformance with City standards.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## SECTION 3 WATER SYSTEMS

### 3.0 General Design Requirements

**Performance Standards** - Water distribution systems shall be designed to meet Oregon Administrative Rules Chapter 333 and Oregon Revised Statutes 448, AWWA Standards, and guidelines of the current Newberg Water System Master Plans.

Water system design shall provide adequate flow for fire protection and ultimate water system demand. Required water system demands shall be met by maintaining the minimum operating pressures required by the City. For single family residential areas the minimum pressure shall be 40 PSI measured at the meter, and the minimum fire flow shall be 1,000 GPM with a 20 psi residual. For all other developments, the required fire flow shall be as determined by the Fire Marshall.

Water system design shall meet distribution needs for ultimate water system demand within a given service area. New water systems shall allow for future extensions beyond present development that are consistent with the Master Plan.

All waterlines shall be located within the public right-of-way or as directed by the City Engineer. Waterlines are placed within the public right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to permit required replacement and/or repair. The City Engineer, under special conditions, may allow a public waterline to be located within a public water easement as referenced in **Section 3.2.7**.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

### 3.1 Pipe Materials and Size

#### 3.1.1 Materials

All public water distribution systems shall be constructed with ductile iron pipe, minimum thickness Class 52. All such pipe shall be cement mortar lined pipe with push-on or mechanical type joints polyethylene encased with an 8 mil tubing meeting manufacturer and AWWA standards.

#### 3.1.2 Minimum Pipe Size

Water distribution main sizes shall generally conform to the following:

- a. **4-inch** - May only be used with approval of the City Engineer in residential zones on dead end streets less than a center line distance of 250 feet measured from the center of the intersection street to the radius point of the cul-de-sac of a dead end street with service to not more than 12 residences; and shall be connected to a looped minimum six inch main. Fire hydrants are not permitted on four inch lines. All four inch lines shall terminate with a standard blow off **Standard Drawing No. 311**.

- b. **6-inch** - Minimum size residential subdivision distribution water main for the grid (looped) system, not to exceed an unsupported length of 600 feet and shall not be permanently dead ended. Looping of the distribution grid shall be at least every 600 feet.
- c. **8-inch** - Minimum size for permanently dead ended mains supplying fire hydrants with a fire flow less than 1,500 GPM and for primary feeder mains in residential subdivisions.
- d. **10-inch and larger** - As required for distribution mains and primary feeder lines in larger subdivisions, industrial areas, and commercial areas. (Trench dam shall be provided for the 24" diameter water transmission pipeline **Standard Drawing No. 319**).

Velocity in distribution mains shall be designed not to exceed five feet (5') per second. Velocity in service lines shall not exceed ten feet (10') per second. Standard trench section **Standard Drawing No. 301** will be utilized for all water pipe installed.

## 3.2 Alignment and Cover

### 3.2.1 Grid System

The distribution system mains shall be looped at all possible locations. All developments will be required to extend mains across existing or proposed streets for future extensions of other developments by the City. All terminations shall be planned and located such that new or existing pavement will not have to be cut in the future when the main is extended. The installation of permanent dead end mains greater than 250 feet, upon which fire protection depends and the dependence of relatively large areas on single mains, will not be permitted.

### 3.2.2 Dead End Mains

Dead end mains, which will be extended in the future, shall be provided with end of line gate valve and a properly sized blow-off (see **Standard Drawing No. 311**) assembly.

Permanent dead end mains shall terminate with a standard blow-off assembly see **Standard Drawing No. 311**.

### 3.2.3 Right-of-way Location

Water systems shall be located north and west from the right-of-way centerline as defined in **Standard Drawing No. 103**. All waterlines shall be located in the public right-of-way, unless otherwise approved by the City Engineer. All abrupt changes in vertical or horizontal alignment shall be made with a fitting and secured with Megalugs and/or Field Lok Gaskets. No concrete thrust blocks are allowed unless approved in unique circumstances.

### 3.2.4 Curved Alignments

Curved alignment for waterlines or mains is permitted and shall follow the street centerline when practical. The minimum allowed radius shall be based on allowable

pipe deflection for the pipe diameter and the pipe laying length, but not to exceed 3° joint deflection.

### **3.2.5 Minimum Cover**

The standard minimum cover over buried water mains within the street right-of-way shall be thirty six inches (36") from finish grade.

The minimum cover for mains in easements across private property shall be thirty six inches (36") from finish grade.

Finish grade shall normally mean the existing or proposed pavement elevation. Where the main is located in the cut or fill side slope or where mains are located in easements, finish grade shall mean final ground elevation at the water main alignment.

Deviation from the above standards will be considered on a case by case basis. When there is underlying rock strata that prohibits placement of the water main thirty six inches (36") below finish grade, a written request must be submitted to the City Engineer for consideration, together with submission of a soils report, with a plan and profile certifying that bed rock exists less than three feet (3') below the undisturbed ground surface.

### **3.2.6 Separation with Wastewater and Other Utilities**

Water mains shall be installed a minimum clear distance of ten feet (10') horizontally from wastewater sewers and shall be installed to go over the top of such sewers with a minimum of 18 inches of clearance at intersections of these pipes (in accordance with the requirements of OAR Chapter 333, Public Water Systems). Exceptions shall first be approved by the City Engineer. In all instances the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting wastewater sewers, shall be three feet (3') horizontally when the standard utility location cannot be maintained.

Where water mains are being designed for installation parallel with other water mains, utility pipe, or conduit lines, the vertical location shall be twelve inches (12") below (or in such a manner which will permit future side connections of mains, hydrants, or services) and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the above mentioned main, hydrant, or service. Where crossing of utilities are required, the minimum vertical clearance shall be six inches (6"). Check all crossings to avoid conflicts.

### **3.2.7 Easements**

Mains placed in easements along a property line, shall have a minimum easement width of ten feet (10') on the side of the property line where the main is placed (the remaining required easement width may be on the adjacent property) and the main shall be offset 36 inches from the property line. Mains placed in easements along a right-of-way line shall be offset a minimum 3 feet from the right-of-way line and within a minimum 15 foot wide easement. For mains placed in easements located other than along a property or right-of-way line, the main shall be placed in the center of the easement. Easements, when required, shall be exclusive and a minimum of twenty five feet (25') in width. The conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted use for

water main purposes. Under no circumstances shall a building or structure be placed over a water main or water main easement. This includes overhanging structures with footings located outside the easement.

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

Any water main placed within a water main easement will be permanently marked with steel posts and metal signs at all angle points, and no less than every 100 feet. In addition, such posts and signs shall be placed where the waterline intersects the public right of way at the easement location. A monument cap set in the pavement of parking lots shall be an acceptable alternative to the sign. The City shall provide wording for the sign/monument.

All easements must be furnished to the City for review and approval prior to recording.

### **3.2.8 Relation to Watercourses**

New water mains may cross over or under existing streams, ponds, rivers, or other bodies of water as follows:

a. Above Water Crossings

The pipe shall be engineered to provide support, anchorage, and protection from freezing and damage, yet shall remain accessible for repair and maintenance. All above water crossings will require review and approval by the City Engineer.

b. Underwater Crossings

- 1) Mains crossing stream or drainage channels shall be designed to cross as nearly perpendicular to the channel as possible.
- 2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing and repair. The valves shall be easily accessible and not subject to flooding. The valve nearest to the supply source shall be in a manhole. Permanent taps shall be made on each side of the valve within the manhole to allow insertion of a small meter for testing, to determine leakage, and for sampling.
- 3) The following surface water crossings will be treated on a case-by-case basis:
  - a. Stream or drainage channel crossing for pipes twelve inches (12") inside diameter and greater.
  - b. River or creek crossings requiring special approval from the Division of State Lands.
- 4) The minimum cover from the bottom of the stream bed or drainage channel to the top of pipe shall be thirty-six inches (36") except as noted below in (5).
- 5) A scour pad centered on the waterline will be required for mains less than twelve inches (12") inside diameter when the cover from the top of the pipe to the bottom of the stream bed or drainage channel is thirty inches (30") or less. The scour pad shall be concrete, six inches (6") thick and ten feet (10') wide; reinforced with number four bars twelve

inches (12") on center both ways; and shall extend to a point where a one-to-one slope begins at the top of the bank and slopes down from the bank away from channel centerline and intersects the top of the pipe. The upstream edge of the scour pad shall be thickened or protected with rip rap to a depth below the scour depth of bank full velocities.

### **3.3 Appurtenances**

#### **3.3.1 Valves**

In general, valves shall be the same size as the mains in which they are installed. Valve types and materials shall conform to the City of Newberg Standard Specifications.

Distribution system valves shall be located at the tee or cross fitting. There shall be a sufficient number of valves so located that not more than four (4), and preferably three (3) valves, must be operated to affect any one particular shutdown. The spacing of valves shall be such that the length of any one shutdown in commercial or industrial areas shall not exceed 500 feet or 800 feet in other areas.

In general, a tee intersection shall be valved in two branches and a cross intersection shall be valved in three branches. Transmission water mains shall have valves at not more than 800-foot spacing's. Hazardous crossings such as creeks, railroad and freeway crossings, shall be valved on each side.

Valve Boxes: Shall be model 910 or equal (lug less) and placed at finished grade, centering vertically over operating wheel (2") or nut.

Distribution tees and crosses for future branch lines on transmission mains may be required at the direction of the City Engineer.

#### **3.2.2 Fire Hydrants**

The public fire hydrant system shall be designed to provide up to a maximum of 3,500 GPM. The distribution system shall be designed in commercial/industrial areas to accommodate fire flows up to 4,500 GPM. Minimum fire flow in single-family residential areas shall be 1,000 GPM with a 20 psi residual pressure.

The distribution of hydrants shall be based upon the required average fire flow for the area served. Design coverage shall result in hydrant spacing of approximately 500 feet in residential areas, approximately 250 feet in commercial or industrial subdivisions, or as approved by the Fire Chief and City Engineer. In addition, sufficient hydrants shall be available within 1,000 feet of a building in commercial/industrial areas to provide its required fire flow.

Residential hydrants shall be located as nearly as possible to the corner of street intersections and not more than 600 feet from any cul-de-sac radius point.

No fire hydrant shall be installed on a main of less than eight inches (8") inside diameter unless it is in a looped system of six inch (6") mains. The hydrant lead shall be a minimum six inch (6") inside diameter.

All fire hydrants will be located behind the existing or proposed sidewalk or in the planter strip. If any public hydrant encroaches on private property, an easement will be provided as directed by the City Engineer.

No hydrant shall be installed within five feet (5') of any existing aboveground utility nor shall any utility install facilities closer than five feet (5') from an existing hydrant.

Hydrant installation shall conform to **Standard Drawing No. 312**. Full depth hydrants will be required in all installations. Installation of hydrant extensions will not be allowed in new construction, unless approved by the City Engineer.

Each fire hydrant shall have an auxiliary valve and valve box which will permit repair of the hydrant without shutting down the main supplying to the hydrant. Such auxiliary valves shall be resilient seat gate valves. The auxiliary valve shall have mechanical flange joint ends as referenced in the **Standard Drawing No. 313**. The valve shall be connected directly to the water main using a flange joint tee, restrained spool full length using mega lugs and/or field loc gaskets.

Hydrants shall not be located within twenty feet (20') of any building, nor will they be blocked by parking. The large hydrant port shall face the road or fire lane.

Guard posts, a minimum of three feet (3') high, shall be required for protection from vehicles when necessary. Such protection shall consist of four inch (4") diameter steel pipes, six feet (6') long, filled with concrete, and buried a minimum of three (3') feet deep in concrete, and located at the corners of a six (6') foot square with the hydrant located in the center. Use of posts other than at the four corners may be approved by the City Engineer.

### **3.2.3 Air Release Valves and Combination Air/Vacuum Release Valves**

When designated by the City Engineer, air release valves shall be installed. Such valves will be required on large diameter lines at all high points in grade.

### **3.2.4. Restrained Joints**

Provide joint restraint (locked joints) to prevent movement of the pipe or fitting at all bends tees, crosses, plugs, and hydrants. All MJ fittings shall also be restrained.

- a. Mechanical Joint Restraint - Mechanical joint restraint where incorporated into the design of the follower gland shall consist of individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be made of grade 60-42-10 to ductile iron conforming to ASTM A-536-84. The wedges shall be ductile iron heat-treated to a minimum hardness of 370 BHN. Dimensions shall be appropriate to match pipe materials being utilized. Torque limiting twist-off nuts shall be used to insure proper actuation of the restraining wedges.

The system shall be rated for working pressures of at least 350 psi for pipes 16 inches and smaller diameter and 250 psi for larger sizes. The devices shall be UL listed up through 24 inch diameters and FM approved through 12 inch

diameters. The restraint systems and devices shall be Series 1100 Megalug restraint, as produced by EBAA Iron Sales, Inc., or approved equal. Contractor shall perform visual inspection of the restraint devices for flaws before installation. Faulty restraint devices shall not be used at all. Contractor shall bear all cost of repairing and subsequent retesting to correct the defect.

- b. Gasket Joint Restraint - All pipes shall be Tyton joint gasket. Contractor shall use Tyton joint gasket Field-LOK, or approved equal, for pipe-to-pipe gasket joint restraint. Contractor shall perform visual inspection of the restraint devices for flaws before installation. Faulty restraint devices shall not be used at all. Contractor shall bear all cost of repairing and subsequent retesting to correct the defect.

### 3.3 Railroad or Highway Crossings

All such crossings defined above, or as determined by the City to be of a hazardous nature, shall be valved on both sides of the crossing. Casing of railroad or highway crossings, if required, shall be as noted in the permit from the respective agency.

### 3.4 Water Service Lines

The sizes of water service lines that may be used are 3/4", 1", 2", 4", 6", 8", 10", and 12". Water service lines will be reviewed for effects on the distribution system and shall not be greater in size than the distribution main. Meter box lids shall accommodate installation of touch read pad.

For two inch (2") and greater services, a design drawing must be submitted showing the vault and fitting requirements with the expected flow (normal and maximum day flow) requirements and proposed usage.

Domestic service lines 3/4" through 2" shall normally extend from the main to behind the curb, with a meter curb stop and meter box located at the termination of the service connection **Standard Drawing No. 307, 308 & 309**. Meter must be purchased from and installed by City. Meter boxes are to be provided by the developer. In general, individual service connections shall terminate in front of the property to be served and shall be located 18-inches each side of a common side property line.

When a corrosive potential condition is encountered and the copper service passes over or under an active cathodic protection system, the service will be installed in a Schedule 40 PVC conduit for a distance of 10 feet on each side of the active system. All conduit placements must be provided with as-built records.

### 3.5 Fire Service

The water fire service line shall normally extend from the main to the property line and end with a vault and an approved backflow prevention device.

A vault will be required when a development provides fire sprinklers. The vault drawing will be included on construction drawings submitted to the City. The vault shall contain all valves,

fittings, meters, and appurtenances required for fire service to the development and be located on private property adjacent to the to the public right-of-way.

### **3.6 Backflow Prevention**

Backflow prevention devices shall be required on all 1-1/2" and larger water services, irrigation services, and fire sprinkler system services.

### **3.7 System Testing**

All new water systems (lines, valves, hydrants, and services) shall be individually pressure tested, chlorinated, and tested for bacteria. All testing shall be performed in accordance with the Newberg Standard Specifications and in the presence of a City inspector. The contractor is to provide all equipment and materials to conduct the test. Water samples for bacteria testing will be taken and delivered to the lab by a City representative, the contractor shall pay for the testing.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

## **4.0 General Design Requirements**

**Performance Standards** - All storm drain system designs shall make adequate provisions for collecting, treating, detaining and conveying all storm water runoff. The system shall accommodate all runoff from upstream tributary areas whether or not such areas are within the proposed development. The amount of runoff to be accommodated shall be based upon ultimate development of all upstream tributary areas.

New or modified existing storm drain systems shall not adversely impact any inadequate downstream system.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

Storm drainage design shall comply with the required ESC Measures (see City of Newberg **Erosion and Sediment Control Manual**). The development area must include provisions to adequately control runoff from all public and private streets and the roof, footing, and area drains of residential, multi-family, commercial, or industrial buildings. The design must ensure future extension of the drainage system to the entire drainage basin in conformance with the adopted Storm Drainage Master Plans and these Design Standards. These provisions include:

- a. Surface and/or subsurface drainage, caused or affected by the alteration of the natural grade, removal of natural ground cover/vegetation, or placement of impervious surfaces, shall not be allowed to flow over adjacent public or private property in a volume, velocity or location materially different from that which existed before development occurred. Surface and/or subsurface drainage shall be managed, treated, and infiltrated or collected, and conveyed in an approved manner, to an approved point of discharge.
- b. Surface water entering the subject property shall be received at the naturally occurring locations and surface water exiting the subject property shall be discharged at the natural locations with adequate flow control and energy dissipation, to prevent adverse impacts from flooding, erosion, or sedimentation.
- c. Approved points of discharge for storm water may include but not be limited to a storm drain, existing open channel, creek, low impact development approach facility, detention pond, or retention pond, as approved by the City Engineer. Acceptance of suggested facilities will depend upon the prevailing site conditions, capacity of existing downstream facilities, and feasibility of alternate designs. Curb weephole drainage systems shall only be utilized for single home developments.
- d. A drainage report with the required analysis of downstream system conditions is required with all plan submittals. Planning applications shall include a draft preliminary report.
- e. When private property must be crossed in order to reach an approved point of disposal, it shall be the developer's responsibility to acquire a recorded public drainage easement on city form prior to commencement of construction. The drainage facility

installed must be a closed conduit system. Temporary drainage ditch facilities, when approved, must be engineered to contain the storm water without causing erosion or other adverse effects to the public and/ or private property.

- f. Drainage from roofs, footings, and downspouts may drain directly to a street through the curb under the following circumstances:
  - 1) The building pad ground elevation is at least 12 inches above the existing street curb.
  - 2) The existing street is adequately crowned to avoid sheet flow across the street.
  - 3) Storm water quantity and quality facility provisions have been satisfactorily addressed.
  - 4) Springs/ sump pumps shall connect to a piping system, unless approved by the City Engineer.

## **4.1 Pipe Materials and Size**

### **4.1.1 Pipe Materials**

All public storm drains shall be constructed with PVC 3034 SDR 35.. Where required, for added strength, C900 or Class 50/ Class 51 Ductile Iron pipe will be used. When approved by the City Engineer, concrete pipe may be used and the pipe strength shall meet the applicable sections of ASTM C-14 or ASTM C-76.

### **4.1.2 Minimum Diameter**

All public stormwater conveyance pipes, mainlines, and leads shall be a minimum of (12") inches in diameter. Laterals shall be 4 inches in diameter minimum, large diameter laterals are considered on a case by case basis and shall connect to the mainline at a structure. In all instances, a cleanout is required to be installed at the lateral connection between public and private systems as shown in **Standard Drawing No. 211**.

### **4.1.3 Private Storm Drains**

Properties that slope and drain away from the public storm drain systems may need to provide a private drainage system in private easements. This system shall be for collection of roof drains, footing drains, and surface runoff. This system shall be designed to meet the Uniform Plumbing Code requirements. For multifamily, commercial and industrial laterals, a manhole is required at the connection between private and public storm systems.

Mainlines crossing multiple lots may be required to be public, such as rear lot drain lines as approved by the City Engineer on a case by case basis. A clean-out shall be installed at the lateral connection between private and public storm system. When required by the City Engineer, a backflow preventer shall be installed on the private side at the lateral connection between private and public storm systems.

Site designers shall consider potential drainage from sump pumps and/ or flow from perennial flowing wall/ building footing drains. Such drainage systems shall not connect to curb weep holes and will be connected to a storm drain piping system.

## 4.2 Alignment, Location and Cover

### 4.2.1 Alignment

All pipes shall run in straight lines, with a constant slope, material and diameter from manhole to manhole.

### 4.2.2 Right-of-Way Location

Public storm lines shall be located within the public right-of-way as directed by the City Engineer. These lines are placed in the public right-of-way for ease of maintenance and access, control and operation of the facility, and to facilitate replacement and/or repair. Please reference **Standard Drawing No. 103**.

### 4.2.3 Public Easements

For public storm sewer easement reference **Standard Drawing No. 109**.

### 4.2.4 Cover

For stormwater cover requirements reference **Standard Drawing No. 110**.

## 4.3 Structures

### 4.3.1 Manholes

The City preference is for the use of inlet manholes **Standard Drawings No. 407, 409, & 410**, behind the curb piping systems. Manholes and inlet manholes shall be located at all changes in slope, alignment, pipe size, and at all pipe junctions with existing or future storm drain connections.

Manhole spacing shall not exceed 500 feet and spacing for manholes used as inlets, shall not exceed 400 feet.

Standard manholes are required when rim to lowest pipe invert elevation exceeds five feet (5') at pipe junctions. Short cone manholes shall be used when rim to lowest pipe invert elevation is less than five feet (5'). Flat tops with a standard frame may be approved on a case by case basis.

When the downstream pipe size increases, the crown of all upstream pipes shall not be lower than the crown of the larger downstream pipe.

All manholes shall be designed with a minimum drop of 0.2 feet from the inlet and outlet invert elevations.

### 4.3.2 Inlet Manholes and Catch Basins

All structures shall be located in streets at the curb line to receive storm water runoff and convey it to the main storm drain.

Structures shall be located at the following locations, but in no case be spaced further than 400 feet:

- a. At curb returns on the upstream side of an intersection.
- b. At the end of all dead-end streets with a descending grade.
- c. At intermediate locations so that storm flows at the curb line do not exceed three feet (3') in width (measured from the curb face) or three inches (3") in depth (measured at the curb face), whichever is less, refer to figure 4-1 for design storm.
- d. An oversized inlet manhole at low point (sag) of all vertical curves. Street and or vertical curves with flat slopes may require installation of additional inlets.
- e. All structures shall be capable of intercepting completely the design storm flow at the curb.

#### **4.3.3 Culverts**

Culverts at road crossings in natural, perennial channels shall be designed to pass the peak discharge for the specified design storm such that the headwater:

- a. Does not exceed 1.5 times the culvert diameter; or
- b. Remains at least 1 foot below the roadway subgrade, whichever is less.
- c. Bottomless or fish friendly culverts shall be installed in wetland and/or water quality sensitive areas. Final designs shall be permitted by applicable regulatory agencies. Approved permits shall be submitted to the City.
- d. Culvert material shall have a minimum design life of 75 years.

#### **4.3.4 Bridges**

New and replacement bridges over natural, perennial channels shall be designed to pass the 100 year peak discharge from the tributary area assuming full development. Vertical clearance between the design water surface and the bottom of any part of the bridge shall be a minimum of two feet.

#### **4.3.5 Walls**

When sizing walls, the designer will consider the surcharge caused by vehicles, soil and/ or future building construction on facility walls. All walls in public facilities shall be cast in place reinforced concrete, with a decorative surface finish, designed by a registered professional engineer.

### **4.4 Drainage Report**

A final drainage report containing the information listed below shall be submitted at the time of initial construction plan review by the City. An abbreviated preliminary drainage report shall be prepared and submitted during the land use approval process that is an outline/draft form of the final report requirements listed below. The City may waive some or all of these report requirements for single-family residential partition projects and projects where post-development impervious surfaces constitute less than 25% of the parcel. In order to apply for a waiver, the applicant must submit a written request to the City and the applicant or applicant's Engineer must participate in a pre-design meeting to discuss the proposed project and its stormwater impacts prior to the land use approval process submittal.

1. Narrative, with tables where appropriate, describing:
  - a. Areas and flows used for design calculations per this design manual.
  - b. Results of downstream analysis.

- c. How water quality and quantity requirements of these rules are met by the project.
2. Maps showing the following information:
    - a. Upstream basin flowing through the site with contours.
    - b. Downstream basin to the point where analysis is required in the downstream analysis, with contours.
    - c. Site plan showing development layout with contours.
    - d. Existing stormwater facilities on and adjacent to the site.
    - e. Stormwater facilities proposed to be constructed by the project.
  3. Calculations for:
    - a. Hydrological calculations for both existing and post development conditions.
    - b. Conveyance system sizing, including calculations showing portions of existing conveyance system that are not proposed to be altered have adequate capacity according to the criteria in these rules.
    - c. Sizing of water quality and quantity facilities.
  4. Downstream Analysis:
    - a. A certificate of investigation stating that the design engineer has taken downstream impacts into consideration is required for each development constructing, collecting or discharging more than 500 square feet of new impervious area.
    - b. Projects that receive approval for a fee in lieu of construction and/or install partial or no storm water quantity facilities, the analysis shall extend downstream to a point in the drainage system where the additional flow from the proposed development site constitutes 10 percent or less of the total tributary drainage flow.
    - c. When the downstream analysis does not continue for at least one-quarter (1/4) mile, the design engineer shall provide a stamped certification of investigation that states the design Engineer has visually investigated the downstream system for at least one-quarter (1/4) mile downstream and is aware of no observable downstream impacts to the conveyance system.
  5. For privately maintained water quantity or quality facilities or conveyance systems, a maintenance plan that clearly identifies maintenance activities and frequency in a form that can be easily provided to and understood by the people responsible for maintenance.

The maintenance plan is to be included with the City standard private facility maintenance agreement form and submitted to the City for review. Upon approval of the maintenance agreement by the City, the applicant shall record the agreement with Yamhill County and return one fully executed original to the City Recorders office.

## **4.5 Flow Determination**

### **4.5.1 Design Event/Storm Frequency**

All public storm drain systems shall be designed for the design storm recurrence interval and 24 hour rainfall depths as in the following **Figures 4-1 & 4-2**:

**Figure 4-1: DRAINAGE SYSTEM DESIGN REQUIREMENTS**

<b>Drainage System Design Requirements</b>	
<b>Drainage System Element</b>	<b>Design Storm Recurrence Interval (years)</b>
<b>Facilities:</b> Water Quantity & Quality Control	See <b>Sections 4.7.8 &amp; 4.7.9</b>
<b>Minor:</b> Minor Collector Streets, Local Streets, Curbs, Gutters, Inlets, Inlet Manholes and Mainlines up to 250 Tributary Acres	25
<b>Major:</b> Major Collector, Arterial Streets, the Drainage System in or under Arterial Streets, and anything greater than 250 Tributary Acres	50
<b>Watercourses:</b> Without FEMA Designated Floodplain	50
<b>Watercourses:</b> FEMA Designated Floodplain	100
<b>Bridges:</b>	100

**Figure 4-2: Rainfall Depths**

<b>24 Hour Rainfall Depths Newberg, Oregon</b>	
<b>Recurrence Interval (years)</b>	<b>Total Precipitation Depth (inches)</b>
2	2.5
5	3.0
10	3.5
25	4.0
50	4.2
100	4.5

### **4.5.3 Computational Methods for Runoff Calculations**

Design of conveyance systems shall be based on full build-out of the upstream basin based upon the most recent approved City comprehensive Land Use Plan and realistic estimates of development densities in areas included in recent additions to the Urban Growth Boundary.

Unless an alternative method is approved by the City in writing, calculation of storm runoff used for conveyance design shall be based on one of the following methods with the limitations on use of each listed. A maximum overland distance for sheet flow used in calculations shall be 100 feet.

#### **Rational Method**

The rational method is allowed with the following limitations:

- a. Drainage subbasin area cannot exceed 1 acre for a single calculation without approval from the City.
- b. The time of concentration shall be a minimum of five minutes.
- c. The calculation methodology shall conform to the procedures outlined in Chapter 7 and Appendix A & F of the 2011 Oregon Department of Transportation (ODOT) Hydraulics Manual. The City of Newberg Intensity, Duration, and Frequency (IDF) recurrence interval curves to be used in the calculations shall be ODOT Zone 7.

#### **Santa Barbara Urban Hydrograph (SBUH)**

SBUH methods shall be based on the following information:

- a. The rainfall distribution to be used within the City is the design storm of 24-hour duration based on the standard NRCS Type 1A rainfall distribution using the chart included herein.
- b. Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)-Urban Hydrology for Small Watersheds.
- c. Soil types shall be derived from the NRCS Soil Survey for Yamhill County.

#### **TR-55**

- a. The TR-55 method developed by NRCS when used for runoff calculations shall be based on the following information:
- b. A standard NRCS Type 1A storm shall be assumed.
- c. Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)-Urban Hydrology for Small Watersheds.
- d. Soil types shall be derived from the NRCS Soil Survey for Yamhill County.

#### **Stormwater Management Model (SWMM)**

- a. The SWMM method developed by EPA may be used on medium to large projects for computing runoff volumes for conveyance.

**Figure 4-3: 24-Hour NRCS Type 1a Rainfall Distribution**

Time From Start of Storm, Minutes	Cumulative % Rainfall	Cumulative % Rainfall									
0 - 10	0.40	0.40	360 - 370	0.95	22.57	720 - 730	0.72	67.40	1080 - 1090	0.40	86.00
10 - 20	0.40	0.80	370 - 380	0.95	23.52	730 - 740	0.72	68.12	1090 - 1100	0.40	86.40
20 - 30	0.40	1.20	380 - 390	0.95	24.47	740 - 750	0.72	68.84	1100 - 1110	0.40	86.80
30 - 40	0.40	1.60	390 - 400	0.95	25.42	750 - 760	0.72	69.56	1110 - 1120	0.40	87.20
40 - 50	0.40	2.00	400 - 410	1.34	26.76	760 - 770	0.57	70.13	1120 - 1130	0.40	87.60
50 - 60	0.40	2.40	410 - 420	1.34	28.10	770 - 780	0.57	70.70	1130 - 1140	0.40	88.00
60 - 70	0.40	2.80	420 - 430	1.34	29.44	780 - 790	0.57	71.27	1140 - 1150	0.40	88.40
70 - 80	0.40	3.20	430 - 440	1.80	31.24	790 - 800	0.57	71.84	1150 - 1160	0.40	88.80
80 - 90	0.40	3.60	440 - 450	1.80	33.04	800 - 810	0.57	72.41	1160 - 1170	0.40	89.20
90 - 100	0.40	4.00	450 - 460	3.40	36.44	810 - 820	0.57	72.98	1170 - 1180	0.40	89.60
100 - 110	0.50	4.50	460 - 470	5.40	41.84	820 - 830	0.57	73.55	1180 - 1190	0.40	90.00
110 - 120	0.50	5.00	470 - 480	2.70	44.54	830 - 840	0.57	74.12	1190 - 1200	0.40	90.40
120 - 130	0.50	5.50	480 - 490	1.80	46.34	840 - 850	0.57	74.69	1200 - 1210	0.40	90.80
130 - 140	0.50	6.00	490 - 500	1.34	47.68	850 - 860	0.57	75.26	1210 - 1220	0.40	91.20
140 - 150	0.50	6.50	500 - 510	1.34	49.02	860 - 870	0.57	75.83	1220 - 1230	0.40	91.60
150 - 160	0.50	7.00	510 - 520	1.34	50.36	870 - 880	0.57	76.40	1230 - 1240	0.40	92.00
160 - 170	0.60	7.60	520 - 530	0.88	51.24	880 - 890	0.50	76.90	1240 - 1250	0.40	92.40
170 - 180	0.60	8.20	530 - 540	0.88	52.12	890 - 900	0.50	77.40	1250 - 1260	0.40	92.80
180 - 190	0.60	8.80	540 - 550	0.88	53.00	900 - 910	0.50	77.90	1260 - 1270	0.40	93.20
190 - 200	0.60	9.40	550 - 560	0.88	53.88	910 - 920	0.50	78.40	1270 - 1280	0.40	93.60
200 - 210	0.60	10.00	560 - 570	0.88	54.76	920 - 930	0.50	78.90	1280 - 1290	0.40	94.00
210 - 220	0.60	10.60	570 - 580	0.88	55.64	930 - 940	0.50	79.40	1290 - 1300	0.40	94.40
220 - 230	0.70	11.30	580 - 590	0.88	56.52	940 - 950	0.50	79.90	1300 - 1310	0.40	94.80
230 - 240	0.70	12.00	590 - 600	0.88	57.40	950 - 960	0.50	80.40	1310 - 1320	0.40	95.20
240 - 250	0.70	12.70	600 - 610	0.88	58.28	960 - 970	0.50	80.90	1320 - 1330	0.40	95.60
250 - 260	0.70	13.40	610 - 620	0.88	59.16	970 - 980	0.50	81.40	1330 - 1340	0.40	96.00
260 - 270	0.70	14.10	620 - 630	0.88	60.04	980 - 990	0.50	81.90	1340 - 1350	0.40	96.40
270 - 280	0.70	14.80	630 - 640	0.88	60.92	990 - 1000	0.50	82.40	1350 - 1360	0.40	96.80
280 - 290	0.82	15.62	640 - 650	0.72	61.64	1000 - 1010	0.40	82.80	1360 - 1370	0.40	97.20
290 - 300	0.82	16.44	650 - 660	0.72	62.36	1010 - 1020	0.40	83.20	1370 - 1380	0.40	97.60
300 - 310	0.82	17.26	660 - 670	0.72	63.08	1020 - 1030	0.40	83.60	1380 - 1390	0.40	98.00
310 - 320	0.82	18.08	670 - 680	0.72	63.80	1030 - 1040	0.40	84.00	1390 - 1400	0.40	98.40
320 - 330	0.82	18.90	680 - 690	0.72	64.52	1040 - 1050	0.40	84.40	1400 - 1410	0.40	98.80
330 - 340	0.82	19.72	690 - 700	0.72	65.24	1050 - 1060	0.40	84.80	1410 - 1420	0.40	99.20
340 - 350	0.95	20.67	700 - 710	0.72	65.96	1060 - 1070	0.40	85.20	1420 - 1430	0.40	99.60
350 - 360	0.95	21.62	710 - 720	0.72	66.68	1070 - 1080	0.40	85.60	1430 - 1440	0.40	100.00

## **4.6 Conveyance Design**

### **4.6.1 Design for Full Build Out**

Storm drainage and conveyance facilities shall be designed and constructed to accommodate all future full build-out flows generated from the upstream drainage basin. Conveyance system adequacy shall be demonstrated by performing a backwater analysis. The calculated hydraulic grade line shall in all cases be lower than a 2 foot minimum from finished grade at all structure locations. The hydraulic grade line for shallow conveyance systems shall be determined by the City Engineer on a case by case basis.

### **4.6.2 Velocity and Slope**

All storm drains shall be on a grade that produces a mean velocity, when flowing full, of at least three feet (3') per second.

### **4.6.3 Pipe Roughness Coefficient**

The manning's roughness coefficient to be used in conveyance calculations shall be a minimum of 0.013.

### **4.6.4 Open Channels**

Open channel systems shall be designed for minimum 1 foot freeboard from bank full provided no structures are impacted by the design water surface elevation.

#### **a. Natural Channels**

Control of discharge from developed areas to natural channels shall be such that the average velocity resulting from all design storms less than or equal to the 10-year event remains below the erosive velocity of the channel.

#### **b. Manmade Channels (Ditches)**

Ditches are only allowed as temporary facilities; rock lining is required when flows are in excess of 3 ft/s. Manmade channels shall be designed for a 10 year storm with a maximum depth of 2 feet and 3:1 side slopes. Water Quality Facilities are not considered ditches.

### **4.6.5 Overflow Analysis**

Overland/Overflow analysis shall be performed for all conveyance, water quality & water quantity systems that demonstrate that the 100-year event will not impact or inundate any buildings. Designer shall submit documentation indicating the overland/ overflow path during the permitting process to the City.

### **4.6.6 Upstream Impacts**

Modifications to the existing on-site storm drainage facilities shall not restrict flows thereby creating backwater onto off-site property to levels greater than the existing situation, unless approved by the impacted off-site Property Owners and the City. When approved, the off-site Property Owner(s) shall agree to and sign a permanent easement legally describing the location of the backwater storage and authorizing the use of their property for stormwater drainage and detention purposes. The easement shall be in a form approved by the City.

#### **4.6.7 Downstream Impacts**

Downstream restrictions that create backwater during the 25-year design storm in the current or post-development condition may be required to be removed by the developer, at the discretion of the City. The engineer of record shall evaluate downstream impacts per **Section 4.4**.

Removal of downstream obstructions shall not be allowed if the removal will cause, contribute, or exacerbate flooding and/or erosion damages to existing buildings, dwellings or properties in the 100-year design storm.

When downstream restrictions are not removed, an on-site detention facility shall be required.

#### **4.6.8 Cross-Lot Drainage**

Developments shall accommodate existing off-site drainage entering the site so as to not impact upstream property owners or negatively impact the new development.

#### **4.6.9 Outlet Protection/Dissipation of Runoff**

Runoff exiting a development site shall be discharged with adequate energy dissipation to prevent downstream damage. Storm drain lines shall enter a creek or drainage channel at 90° or less to the direction of flow. The outlet shall have a head wall and appropriate scour protection to prevent erosion of the existing bank or channel bottom.

The size of pipe or channel being entered will govern which protective measures are required. All protective measures must conform to the erosion control requirements of these Design Standards and the City's Erosion and Sediment Control Manual.

#### **4.6.10 Subsurface Drains**

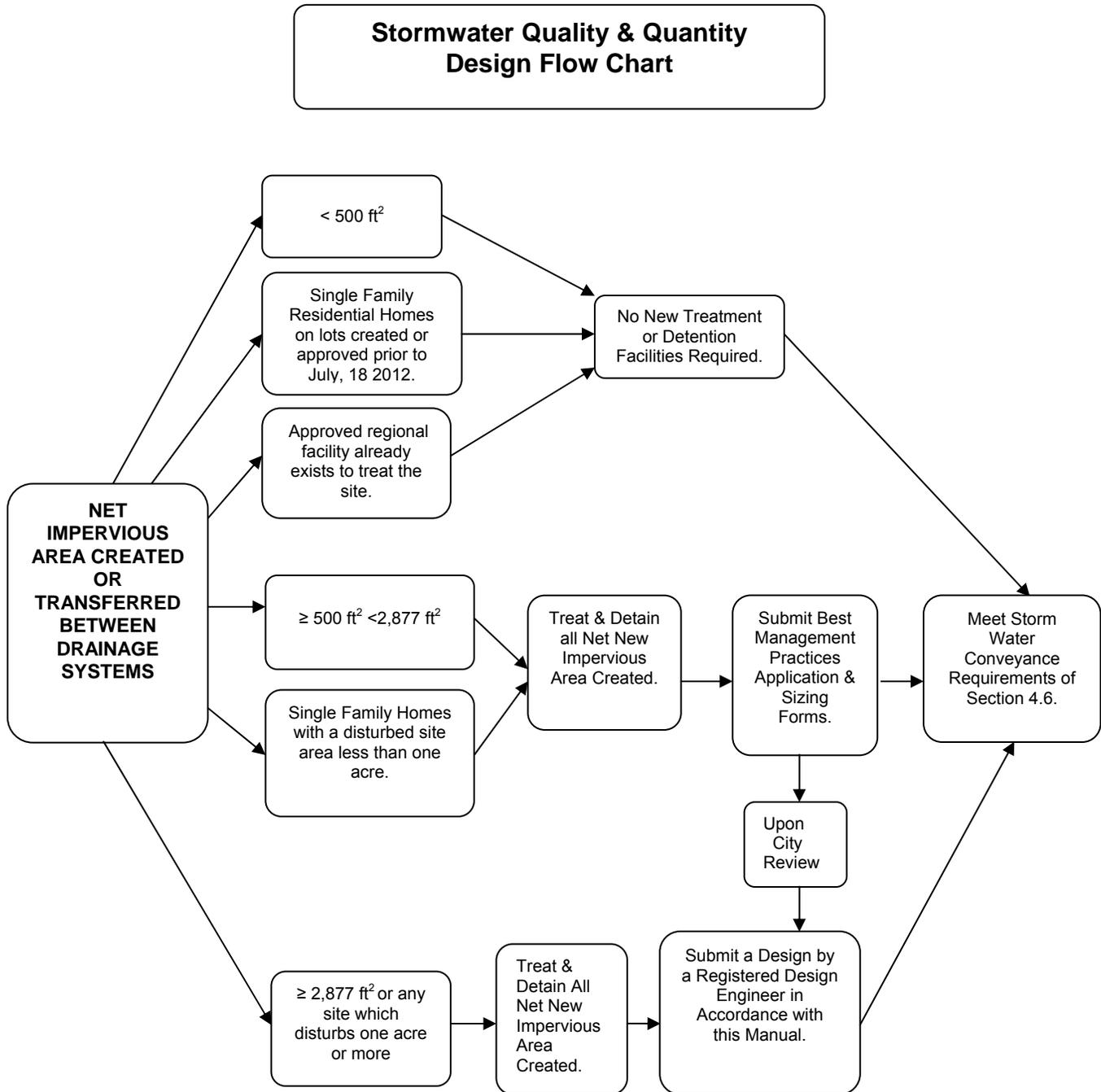
Subsurface drains (under drains) shall be provided at the following locations:

- a. For all existing springs and field tile intercepted during construction activity for other facilities; i.e., wastewater, water, mains, street excavations, foundations, etc.
- b. Where high ground water exists or when it is necessary to reduce the piezometric surface to an acceptable level to prevent land slippage or under floor flooding of buildings.
- c. Subsurface drainage shall not discharge into a street or a street gutter.

## 4.7 Water Quantity and Quality Facilities

### 4.7.1 General Requirements

Figure 4-4:



### **Impervious Surface Area:**

- a. For all sites, the threshold and approach for the design of water quality and quantity facilities shall be based on **Figure 4-4** (above).
- b. For single family and duplex residential subdivisions, stormwater quality facilities shall be sized for all net impervious area created by the subdivision. This includes all existing and proposed residences on individual lots at the rate of 2877-square feet of impervious surface area per dwelling unit. Private LIDA facilities on individual lots shall utilize actual impervious area. For the purpose of design calculations, the actual impervious surface can be utilized as an alternative to 2877 square feet per dwelling unit when the average lot size on a single-family residential project is less than 3000 sq.ft.
- c. Except as noted in **Section (a.) above**, for all developments other than single family and duplex, including row houses and condominiums, the sizing of stormwater quality facilities shall be based on the net impervious area created by the development, including structures, roads, and other impervious areas. Impervious areas shall be determined based upon building permits, construction plans, or other appropriate methods of measurement deemed reliable by the City.

### **Erosion Protection**

- a. Inlets to water quality and quantity facilities shall be protected from erosive flows through the use of an energy dissipater or rip rap stilling basin of appropriate size based on flow velocities. Flow shall be evenly distributed across the treatment area.
- b. All exposed areas of water quality and quantity facilities shall be protected using coconut or jute matting. Coconut matting or high density jute matting (Geojute Plus or approved equal) shall be used in the treatment area of swales and below the water quality volume levels of ponds. Low density jute matting (Econo jute or approved equal) may be used on all other zones.

### **Planting/Vegetation**

Planting/vegetation shall be in accordance with Appendix A: Planting Requirements. No invasive species shall be planted or permitted to remain within a facility which may affect its function, including, but not limited to the following:

1. Himalayan blackberry (*Rubus discolor*)
2. Reed canarygrass (*Phalaris arundinacea*)
3. Teasel (*Dipsacus fullonum*)
4. English Ivy (*Hedra helix*)
5. Nightshade (*Solanum sp.*)
6. Clematis (*Clematis ligusticifolia* and *C. vitifolia*)
7. Cattail (*Typhus latifolia*)
8. Thistle (*Cirsium arvense* and *C. vulgare*)
9. Scotch Broom (*Cytisus scoparius*)

## **Fencing**

Any facility with the potential of storing (18) inches or more at any time shall require delineation fencing around facilities and/or tracts containing facilities. The fence shall be 4-foot high, black or brown vinyl-clad chain link fence in conformance with the **City Standard Drawing No.419**.

- a. When a facility is fenced, the fence shall include a 12-foot wide lockable gate for maintenance access conforming to the City **Standard Drawing No. 419**.
- b. If a facility is located adjacent to a riparian corridor, wildlife friendly fencing shall be utilized, as approved by the City Engineer and Planning Division.

## **Access**

Access roads shall be provided for maintenance of all water quality and quantity facilities. The following criteria are considered to be the minimum required for facilities maintained by the City. If the design Engineer anticipates that any of the requirements will not be met due to the configuration of the proposed development, the design Engineer is advised to meet with the City Engineer to gain approval for the deviation prior to submittal.

### **Standard Road Design**

1. The road section shall be designed according to **Standard Drawing No. 513**; the subgrade shall be compacted to 95-percent AASHTO T-99; or, the design Engineer may submit an alternate design certified as capable of supporting a 30-ton maintenance vehicle in all weather conditions.
2. Strengthened sidewalk and driveway sections according to **Standard Drawing No. 510**.
3. Maximum grade shall be 10-percent with a maximum 3-percent cross-slope.
4. Minimum width shall be 12 feet on straight runs and 15 feet on curves. Minimum gravel shoulder width shall be 1-foot, matching the cross slope of the access road.
5. Curves shall have a minimum 40-foot interior radius.
6. Access shall extend to within 10-feet of the center of all structures unless otherwise approved by the City.
7. The City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.
8. The side slope for road embankments shall be 2H:1V or flatter, as approved by the Geotechnical Engineer for the project.
9. A vehicle turnaround shall be provided when the access road exceeds 150' in length, reference **Standard Drawing No. 529**.

## 4.7.2 Maintenance Responsibilities

### Public Facilities

- a. Unless otherwise approved by the City Engineer, newly constructed water quality or quantity facilities serving public roads shall be publicly maintained to City Standards.
- b. The developer, or other legally bound party, shall be responsible for Public facility bonding and maintenance, two years from the date of the acceptance of the public facility improvements. The maintenance period may extend beyond the two year period if facility plant die off is greater than 20-percent at the end of the two year period.
- c. Publicly maintained water quality or quantity facilities shall be contained within a tract with an approved access road provided and encumbered by a surface/ stormwater management easement dedicated to the City. The City will retain ownership of the tract.

### Private Facilities

Private facilities shall be maintained by the owner. The owner or responsible party shall complete the City standard private maintenance agreement forms and submit to the City for review/approval. The maintenance agreement shall be approved by the City and recorded with Yamhill County before the issuance of building occupancy permits.

A maintenance plan is required for all privately maintained stormwater facilities, it shall:

- a. Be composed of an agreement to be signed by the owner of the stormwater facilities and the City and a detailed explanation of the operation, maintenance, and preservation of the stormwater facility including a schedule of required maintenance activities. The maintenance plan will be appended to the property deed. Educational material will be given to all present and subsequent owners of the facility that describes the stormwater facility, maintenance procedures including methods of waste disposal, maintenance schedule, and the location of the installation and maintenance records of previous years.
- b. Components –
  1. Inspection schedule including storm- related inspections
  2. Description of facility components, the observable trigger for maintenance, and the method of maintenance including appropriate waste disposal method
  3. Type of maintenance for plants and other landscaping material required for proper functioning of the stormwater facility and to maintain a 75% vegetative cover
- c. Contain the location for stormwater installation records. The installation records will be kept until the facility is dismantled and no longer discharges to the City's stormwater system. They include at a minimum, the design calculations and assumptions and the construction drawings that show the individual components and the entire system.
- d. Provide requirements for maintenance records. Annual reports will be submitted to the City by the owners of the stormwater facility attesting to the proper maintenance, safety, and functioning of the stormwater facility. The maintenance records will be kept with the facility installation records and be

available for inspection by the City for at least five (5) years. Installation records will be kept until the stormwater facility is dismantled and no longer discharges to the City's stormwater system.

#### 4.7.3 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

<b><i>Detention Facilities</i></b>	<b><i>Water Quality Facilities</i></b>
1. LIDA Facilities	1. LIDA Facilities
2. Surface Pond	2. Regional LIDA Swale
3. Underground Tanks	3. Proprietary Treatment Systems
4. Fee in lieu of construction payment	4. Fee in lieu of construction payment

#### 4.7.4 Private and Public Proprietary Treatment Systems

Proprietary treatment systems shall meet the removal efficiency requirements of the City's Willamette TMDL implementation plan. Proprietary treatment systems shall be allowed in situations meeting one of the following criteria:

##### **Private**

- a. Treatment of runoff from a single parcel.
- b. Treatment of runoff from an adjoining commercial, industrial, or multi-family, or condominium parcels which share a common parking lot.
- c. Treatment of runoff from high-density zoning classifications where the development is primarily single family residential and the average lot size is 3000 or less square feet.
- d. Proprietary treatment systems shall be maintained by private parties, except for systems that are approved by the City Engineer on a case by case basis, to treat runoff from a public street.
- e. Proprietary systems require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This maintenance plan shall be submitted and approved with the drainage report for the project.
- f. All proprietary treatment systems shall be subject to maintenance responsibilities as stated under 4.7.2.

##### **Public**

Treatment of runoff from new and expanded collector and arterial roadways where no other opportunities exist for treatment without necessitation of the removal of homes or businesses.

All public and private water quality proprietary treatment systems shall be in conformance with Contech Stormwater Management StormFilter system or approved equivalent.

#### **4.7.5 Small Developments**

Two and three parcel single family home partitions that can demonstrate (storm report required) adequate downstream conveyance capacity are eligible for a fee in lieu of construction of stormwater quality/quantity facility payment. Large parcel single family home partitions with the potential for additional dwelling units and/or future subdividing/partitioning are not considered small developments.

#### **4.7.6 Fee in Lieu of Construction Payment**

Refer to the Engineering Services Department fee schedule for the fee in lieu of construction payment schedule. The payment shall be made to the City before recordation of the final partition or subdivision plat for single family home construction, or the issuance of building permits for all other projects.

Fee in lieu of construction payments for water quantity and quality facilities will be collected by the City and used to fund the enhancement/upsizing of existing facilities and development of regional facilities when feasible

## 4.7.8 Water Quantity Facility Design & Control Standards

### General Requirements

- a. Each new development shall incorporate techniques for mitigating its impacts on the public stormwater system in accordance with the City of Newberg Ordinance No. 2012-2754, having an effective date of July 18, 2012, by the construction of permanent on-site stormwater quantity detention facilities designed in accordance with this chapter.
- b. All water quantity facilities shall be designed in accordance with City guidance documents and be consistent with this Chapter.
- c. When required, stormwater quantity on-site detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from the ½ of the 2-year return storm to the 25-year return storm. Specifically, the ½ of the 2, 2, 10, and 25-year post-development runoff rates will not exceed their respective ½ of the 2, 2, 10, and 25-year pre-development runoff rates; unless other criteria are identified in an adopted watershed management plan or storm drainage basin master plan.
- d. Applicable low impact development approaches, designed in accordance with this Chapter, can be utilized to meet all or part of any detention requirements on a site.
- e. For all sites, the threshold and approach for the design of water quantity facilities shall be based on **Figure 4-4**.

### Hydraulic Design Criteria

- a. Detention design shall be assessed by dynamic flow routing through all the conveyance components within the basin. Documentation of the proposed design shall be included in the drainage report. Acceptable analysis programs include those listed below, as well as others using the SBUH or TR-55 methodology.
  1. HEC-1
  2. HEC-HMS
  3. SWMM
  4. HYDRA
  5. Others as approved by the City Engineer
- b. A pond overflow system shall provide for discharge of the design storm event without overtopping the pond embankment or exceeding the capacity of the emergency spillway.
- c. Provide an emergency spillway sized to pass the 100-year storm event or an approved hydraulic equivalent. Emergency spillway shall be located in existing soils when feasible and armored with riprap or other approved

erosion protection extending to the toe of the embankment. The emergency spillway shall direct flows away from proposed or existing structures.

#### **Facility Design Criteria**

- a. The facility can be a combined water quality and quantity facility provided it meets all relevant criteria.
- b. Provide an approved outlet structure for all flows and an approved secondary flow route/path if the primary outlet and or conveyance system fails.
- c. Certain situations require use of multiple orifice plates to achieve desired outflow rates.
- d. All water quality/ quantity facilities shall have a maximum depth of 5 feet unless approved by the City Engineer.

#### **Walls in Water Quantity Facilities**

- a. Retaining walls may serve as pond walls if the design is prepared and stamped by a registered professional engineer and a fence is provided along the top of the wall. At least 25% of the pond perimeter shall be vegetated with a side slope of 3H:1V or flatter allowing for maintenance access. All retaining walls in publicly maintained facilities, shall be cast in place concrete with a decorative surface finish, unless otherwise approved by the City Engineer.
- b. Walls that are 4 feet or higher that are surcharged and/ or are periodically inundated shall meet all of the following criteria:
  1. Permitted through the City Building Division.
  2. The City shall not have maintenance responsibility for the wall. The party responsible for maintenance of the walls within the water quantity tract or easement area shall be clearly documented on the final plat, or in alternate form, both with review and approval by the City Attorney and City Engineer.

### **4.7.9 Water Quality Facility Design and Treatment Standards**

#### **Water Quality Treatment Requirements**

Owners of new development and other activities which create new impervious surfaces or increase the amount of stormwater runoff or pollution leaving the site are required to construct permanent water quality facilities per the City of Newberg Ordinance No. 2012-2754, having an effective date of July 18, 2012, to reduce contaminants entering the storm and surface water system.

#### **Required Treatment Design Efficiency**

The following approaches are available for meeting the treatment design efficiency standards of the pre-development vs. post development reduction of wind/ rain deposited organic & inorganic sediments, automotive wastes, bacteria, mercury, and temperature control, as follows:

- a. Pretreatment as specified in the following sections in combination with a facility listed in b & c below:
- b. Low impact development approaches and regional water quality/ detention facilities that can be demonstrated, to the satisfaction of the City, to meet treatment efficiency standards.

- c. Proprietary treatment systems meeting the requirements of **Section 4.7.4**.

### **Design Considerations**

- a. If an onsite water quality facility cannot be constructed to treat the runoff from the development's impervious surface, then with City Engineer approval, an off-site water quality facility may be designed to treat runoff from an equivalent area of adjacent untreated impervious surfaces.
- b. Facilities shall be designed such that flow from the development is treated off-line from the storm conveyance system and reconnected to upstream flows following treatment.
- c. Discharges to riparian and/or wetland sensitive areas shall maintain the flows of pre-development site conditions to the extent necessary to protect the characteristic functions of the sensitive area. Conversely, discharge of flows that may be damaging to downstream water quality sensitive areas into other catchments will not be permitted.

### **Water Quality Volumes and Flows**

Water quality volumes and flow rates are calculated using section 4.5.3 computational methods for runoff calculations.

- a. **Water Quality Storm**

The water quality storm is the storm required by regulations to be treated. The storm defines both the volume and rate of runoff. The stormwater quality only facilities shall be designed for a dry weather storm event totaling 1.0 inches of precipitation falling in 24 hours with an average storm return period of 96 hours using Figure 4-3, rainfall distribution.

### **Water Quality Pretreatment**

Incoming flows to a regional water quality facility shall be pretreated using a water quality manhole or other pre-treatment methods such as forebays, water quality manholes, or other methods, as approved by the City.

### **Water Quality Manholes**

- a. Hydraulic Criteria:
  - 1. Minimum Design Flow: Water Quality Flow
  - 2. Upstream flow splitter may be used to bypass conveyance flows in excess of the Water Quality flow.
  
- b. Design Criteria:
  - 1. Shall conform to City Standard Drawings
  - 2. Minimum Manhole Diameter: 60-inch
  - 3. Maximum size of incoming pipe: 18-inch (high flow flow splitter may be required.)
  - 4. Sump Depth: No deeper than 5 feet from invert out to bottom of sump
  - 5. Volume of sump: 20 cubic feet/ 1.0 cfs of flow into the water quality manhole, up to the 25-year flow. Flow calculations shall include the effect of an upstream flow splitter.

6. Maintain a 3-foot clear access zone between the inside structure.
7. Orient access to structure in a clear zone.

## **4.8 Low Impact Development Approaches (LIDA)**

### **Introduction**

The City's Design Standards define the requirements for development to treat and detain stormwater runoff. Stormwater is the runoff from impervious surfaces such as streets, roofs and parking lots that flows to storm drains, ditches and culverts, and then to the nearest river, stream or wetland. When it rains, stormwater runoff may pick up oil, sediment, bacteria, grease and chemicals that can pollute local waterways.

LIDAs offer options to comply with stormwater management requirements, and complement the water quality facilities that have been established as part of this manual. The five objectives of LIDA are to:

1. Conserve Existing Resources
2. Minimize Disturbance
3. Minimize Soil Compaction
4. Minimize Imperviousness
5. Direct Runoff from Impervious Areas onto Pervious Areas

### **LIDA Design Considerations**

- a. LIDA may be used in combination or with standard water quantity and quality facilities to meet the requirements of this Chapter.
- b. The applicant shall provide an analysis in the drainage report of the ability of any proposed LIDA to meet the water quantity and quality requirements for a project.
- c. The applicant shall provide a report from a registered design professional detailing infiltration rates of existing soils for LIDA facilities that are proposed to fully discharge into existing soils.
- d. Maintenance access shall be provided for all LIDA facilities adjacent to collector or arterial roadways as approved by the City Engineer.
- e. Approval of use of a LIDA by the City does not eliminate the need for the applicant to secure approval from other appropriate agencies for use of LIDA on their project. A potential example maybe DEQ's underground injection control (UIC) permit.
- f. LIDA facility planting shall follow the guidelines as detailed in Appedndix A of this Design Manual.

## LIDA Approvable by the City:

- a. **Figure 4-5** identifies acceptable LIDA facilities to meet the requirements of this chapter. The table identifies LIDA facilities to be used for publicly maintained systems and whether LIDA can be designed to meet the quality or quantity requirements of the Chapter. Designers are also encouraged to consult the City of Portland's stormwater management manual, Clean Water Services LIDA Handbook, and/or Oregon State University Extension Service LID facility design details for additional specific designs and other considerations.
- b. LIDA facilities not included in **Figure 4-5** may be approved by the City Engineer if the applicant can demonstrate that the LIDA can meet the requirements of this Chapter.
- c. LIDA facilities require a long-term recorded maintenance plan identifying maintenance techniques, schedule, and responsible parties. This requirement shall be noted in a maintenance plan and the City private maintenance agreement template shall be completed and approved with the drainage report for a project, before building permit and or site development permit is finalized for a project.
- d. All private LIDA Facilities shall be designed and constructed in locations that are approved by the building department.
- e. Reference **Standard Drawing No. 451**, LIDA Sizing form.

**Figure 4-5  
APPROVABLE LOW IMPACT DEVELOPMENT APPROACHES**

Application	Green Roof	Porous Pavement/ Pavers	Flow-through Planter	Infiltration Planter <sup>1</sup> / Rain Garden	Vegetated Filter Strip	LIDA Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate <sup>2</sup>	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

1. Water proofing maybe required for the building, foundation or a crawlspace.

2. Infiltration testing is required to determine rate.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

### 5.0 General Design Requirements

**Performance Standards** - All street designs shall provide for the safe and efficient travel to the motoring public. Streets shall be designed to carry the recommended traffic volumes identified for each street classification. Street classifications are set forth in the City of Newberg Transportation System Plan (2005) and the Newberg Development Code.

Streets shall be designed to meet or exceed the minimum guidelines set forth in the "AASHTO Policy on Geometric Design of Highways and Streets" (latest edition). Traffic Control Devices shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways," Federal Highway Administration, with Oregon Supplements, Oregon Department of Transportation (latest edition).

All vertical and horizontal curves shall meet the guidelines of the AASHTO Policy and the design speed for each street classification.

#### 5.0.1 Right-of-way and Pavement Width

Please refer to City of Newberg Development Code chapter 15.505.060.

#### 5.0.2 Access

Please refer to City of Newberg Development Code 15.505.200.

### 5.1 Traffic Analysis

The City Engineer will require a traffic analysis report as determined by the type of development and its potential impact to existing street systems. A traffic analysis will generally be required for a development:

- a. When it will generate in excess of 40 trips per p.m. peak hour, or
- b. When a development's location, proposed site plan, and traffic characteristics could affect traffic safety, access management, street capacity, or known traffic problems or deficiencies in a development's study area.

The report shall be prepared by a licensed traffic engineer in the State of Oregon. At a minimum, the report shall contain the following:

#### 1. Purpose of Report and Study Objectives

A discussion of key traffic issues to be addressed and the transportation system and development objectives related to a specific development.

General transportation system objectives are:

- a. To provide safe and effective transfer of vehicle traffic between the site and the street system;
- b. To maintain easy and safe traffic flow on surrounding street system;
- c. To provide convenient, safe and efficient on-site and off-site movement of vehicles, pedestrians, transit, service and delivery vehicles, and bicycles;

- d. To effectively mitigate adverse site generated traffic impacts on affected streets and intersections. Site specific objectives may be established by the City for each study.

## **2. Executive Summary**

A concise summary of the study purpose/objectives, site location and study area, development description, key assumptions, findings, conclusions and recommendations.

## **3. Description of Site and Study Area Roadways**

Anticipated nearby development and committed roadway improvements, which would affect future traffic in the study area.

The study area will be defined by:

All roads, ramps, and intersections through which peak hour site traffic composes at least 5% of the existing capacity of an intersection approach, or roadway sections on which accident character or residential traffic character is expected to be significantly impacted.

## **4. On-site Traffic Evaluation**

An evaluation of the proposed (and alternative) site access locations, the adequacy of access drive depth, driveway lanes, and queuing storage, the safety and efficiency of proposed vehicular circulation, parking layout, pedestrian and service vehicle routes/facilities, together with recommendations for on-site traffic markings and controls.

## **5. Technical Appendix**

A technical appendix including worksheets, charts, and drawings to support findings described in the body of the report.

## **6. Recommendations for Public Improvements**

Recommendations should be made for external roadway improvements, such as additional through lanes and turn lanes, and traffic control devices necessitated as a result of the development. Recommended improvements to transit facilities, and pedestrian and bike circulation should also be reported.

The recommendations should specify the time period within which improvements should be made, particularly if improvements are associated with a phased development, the estimated cost of improvements, and any monitoring of operating conditions and improvements that may be needed. If needed street improvements unrelated to the development are identified during the analysis, such improvements should be reported.

## **7. Access Management**

On sites with arterial and major collector street frontages, the report shall evaluate and recommend the use of access management plans or techniques:

- a. To separate basic conflict areas (reduce number of driveways or increase spacing between driveways and intersections).

- b. To remove turning vehicles or queues from the through lanes (reduce both the frequency and severity of conflicts by providing separate paths and storage area for turning vehicles and queues).

These techniques may include turn restrictions, striping, medians, frontage roads, channelization of lanes or driveways, shared driveways and access between similar uses, access consolidation, lanes for left or right turns, and other transportation system management (TSM) actions.

## **8. Off-site Traffic Evaluation**

Offsite traffic should include:

- a. Existing daily and P.M. peak hour counts by traffic movements at intersections effected by generated traffic from the development (use traffic flow diagrams).
- b. Projected daily and P.M. peak hour volumes for these same intersections and proposed access points when the development is in full service. (Use traffic flow diagrams)
- c. A determination of the existing levels of service and projected levels of service at each intersection and access points studied.
- d. A discussion of the need for traffic signals. This should include a traffic warrant computation based on the latest edition of National Manual on Uniform Traffic Control Devices.
- e. The recommendations made in the report should be specific, and should be based on a minimum level of service "D" with maximum volume to capacity (v/c) ratio of 0.90 when the development is in full service. As an example, if a traffic signal is recommended, the recommendation should include the type of traffic signal control and what movements should be signalized. If a storage lane for right turns or left turns is needed, the recommendation should include the amount of storage needed. If several intersections are involved for signalization and an interconnect system is considered, specific analysis should be made concerning progression of traffic between intersections.
- f. The report should include a discussion of bike and pedestrian usage, safe route to schools, and the availability of mass transit to serve the development.

## **5.2 Intersections**

Connecting street intersections shall be located to provide for traffic flow, safety, and turning movements, as conditions warrant. Where signalized, design shall provide for optimal signal phasing. Consideration for arterial street progression, protected/permitted and permitted left turn phasing shall occur. New signal proposals in remote locations shall first include an evaluation of alternate applications such as roundabouts.

**Arterial Intersections:** Exclusive left and right turn lanes will be provided; bus turnouts will be provided if traffic flow and safety conditions warrant; designated crosswalks will be provided at controlled locations; street alignments across intersections shall be continuous.

**Minor Collector and Local Street Intersections:** Street and intersection alignments should facilitate local circulation but avoid alignments that encourage non-local, through traffic.

Streets shall be aligned so as to intersect at right angles (90°). Angles of less than 75° will not be permitted. Intersection of more than two streets at one point will not be permitted.

New streets shall intersect with existing street intersections so that center lines are not offset, except as provided below. Where existing streets adjacent to a proposed development do not align properly, conditions may be required of the development to provide for proper alignment.

For intersections which are not directly aligned with street center lines, the centerline spacing must meet the following minimum separation distance:

<u>Street Class</u>	<u>Intersection Spacing (Ft.) *</u>
3 Lane Major/Minor Arterial	300
Major Collector	200
Minor Collector	150
Local/Cul-de-sac	100

\*The City Engineer may permit a lesser spacing when comprehensive findings are made to establish that:

- a. Without the change, there could be no public street access from the parcel(s) to the existing street, and
- b. All other provisions of the street design requirements can be met.

### **5.3 Half Street Construction**

Half street construction is generally not acceptable. Where such a street is justified, the City Engineer will approve the right-of-way and pavement width. In no case shall the pavement width required be less than that required to provide two lanes of traffic to pass at a safe distance. For a 34 foot local street, the half street pavement width will be 22 feet. Half streets will only be approved when the abutting or opposite frontage property is undeveloped and the full improvement will be provided with development of the abutting or opposite (upon right-of-way dedication) frontage property. Half street shall be signed “No Parking” until the full width of the street is improved. A clear 20 feet for travel shall be maintained at all times.

A development on an unimproved street shall be responsible for constructing a continuous, City standard street to a connection with the nearest standard (publicly maintained) street.

### **5.4 Street Classification**

All streets within the City shall be classified as listed in Newberg Transportation System Plan. The classification for any street not listed shall be that determined by the City Engineer.

## 5.5 Design Speed

Design speeds for classified streets shall be as follows\*:

3 Lane Major/Minor Arterial	35 - 45 mph
Major Collector	25 - 35 mph
Minor Collector	25 - 35 mph
Local	25 mph
Cul-de-sac	25 mph

\* Where existing traffic conditions identify speeds in excess of design speeds listed, then the higher speed will be used for design purposes.

## 5.6 Horizontal/Vertical Curves and Grades

### 5.6.1 Horizontal Curves

Horizontal curve radius (on centerline) for each street classification shall be designed according to the roadway design speed. The radius shall not be less than the following:

Design Speed (MPH)	Radius (Feet)
25	180'
30	300'
35	450'
40	670'

All horizontal curves shall be designed to the current version of the American Association of State Highway and Transportation Officials (AASHTO) Manual.

### 5.6.2 Vertical Curves

Vertical curve length shall be based on the design criteria which include:

- Design speed
- Crest vertical curve
- Sag vertical curve - stopping sight distance for crest and sag vertical curves shall be based on sight distance and headlight sight distance, respectively.

All vertical curves shall be parabolic and the length shall be computed for each location and shall be designed to the current version of the American Association of State Highway and Transportation Officials (AASHTO) Manual.

### 5.6.3 Grades

Maximum grades for each street classification shall be as follows:

Arterial	0.060 ft./ft.	(6%)
Major Collector	0.080 ft./ft.	(8%)
Minor Collector	0.100 ft./ft.	(10%)
Local/Cul-de-sac	0.120 ft./ft.	(12%)

Local and cul-de-sac streets may exceed 12%, but in no case permitted to exceed 15%. The City Engineer may approve a grade greater than 12% when all of the following conditions exist:

- 1) Topographic constraints do not allow the development to be served by a street with a maximum grade of 12% without causing destabilization of soils by excessive cuts and fills.
- 2) There is no access to the property being developed through adjacent properties at a maximum 12% grade.
- 3) The section of local street will not exceed a combination of length, horizontal alignment, and/or grades exceeding 12% which will create hazardous traffic conditions.
- 4) In no case shall the maximum street grade exceed 15%.

Minimum grade for all streets shall be 0.0050 feet per foot (0.50%) however, in all cases street grades shall allow for proper and adequate drainage. Cul-de-sac "bulbs" shall have a minimum slope of 0.0060 feet per foot (0.60%).

Street cross slopes shall be as shown in street typical section **Standard Drawing No. 513**.

## 5.7 Pavement Design

In general, all streets shall be constructed with asphaltic concrete; however, Portland Cement Concrete (PCC) streets are permitted as approved by the City Engineer.

Typical flexible pavement thicknesses will be as shown in **Standard Drawing No. 513**. This will apply only to local streets and lower classifications.

The Design Engineer will provide a street structural design section for all roadways classified as "Minor Collector" and higher, and for local streets in industrial zones. Minimum standards for roads classified as "Minor Collector" and higher shall be as shown in **Standard Drawing No. 527**.

## 5.8 Concrete Curb

All development projects will be required to construct street improvements with concrete curbs. Monolithic curb and gutter, as shown in the Standard Drawings, shall be used on all streets. Curb exposure for monolithic curb and gutter shall be six inches (6") and eight inches (8") at catch basins. Joint spacing in curbs shall be 15-foot maximum for contraction joints and 45-foot maximum for expansion joints. In addition, expansion joints shall be located at all curb return points and at driveway curb-drop transition points.

A minimum of two drainage block outs to accommodate 3" drain pipe shall be provided for each lot. Typically these block outs are located five feet (5') from each side of property line.

### 5.8.1 Curb Return Radius

Please refer to City of Newberg Development Code Chapter 15.505.090.

## 5.9 Parking

<u>Street Class</u>	<u>Parking Lanes</u>	<u>Parking Required</u>
3 Lane Major/Minor Arterial	None	Not Allowed
Major Collector	None	Variable (1) (2)
Minor Collector	2	Yes
Local	2	Yes (3) (4)
Cul-de-sac	2	Yes (3) (4)

- 1) Where bike lanes exist, parking may be prohibited.
- 2) No parking within 45' of curb return.
- 3) No parking within 30' of curb return.
- 4) Local Streets and Cul-de-sacs in areas of steeper topography, which are approved for reduced 32 feet pavement width, will be required to have one parking lane; to assure that on street parking is adequate for adjacent uses, a reduced street design will consider clustered parking bays adjacent to the street, if needed. Parking will not be allowed in reduced radius cul-de-sacs.

For streets designated as “Major Collector” and below, the City Engineer may consider design modifications to conserve major trees in the public right-of-way. Subject to approval by the City Engineer, parking lanes may be removed on one or on both sides of a street.

## 5.10 Sidewalks

In general, new sidewalks are required for all development requiring a development permit. Where planter strips are required, sidewalks shall be one (1) foot off the right-of-way line (except cul-de-sacs). Where no planter strips are required, sidewalks shall abut curbs. Minimum sidewalk width is five feet.

For streets designated as “Major Collector” and below, the City Engineer may modify design of sidewalk to conserve major trees in the public right-of-way. Include handrails or fences to protect pedestrians when there is a vertical drop of 30-inches or greater adjacent to sidewalk.

### 5.10.1 Sidewalk Ramps

All new street intersections shall provide sidewalk ramps (for access) that meet the requirement of the Americans with Disabilities Act (ADA). In residential areas the ramp will be located at the midpoint of the curb return. On streets classified above local or cul-de-sac, ramps may be required at different locations within the curb return. It may also be required to construct two (2) ramps at a curb return when a different location is required. Retrofit of existing ramps within the project limit may be required.

Locations of sidewalk ramps shall be designed with regard to storm water flows, street grades, and pole locations. Other factors may also dictate sidewalk ramp location.

See **Standard Drawing No. 505** for standard locations.

## 5.11 Bikeways

The City has adopted the "Newberg Bicycle/Pedestrian Plan." This plan summarizes the City's policy and implementation strategies for bikeways within the City. Follow AASHTO and ODOT standards and criteria as the minimum guidelines for bikeway design, construction, and control.

Use the following guidelines for bikeway improvements:

- 1) ODOT, "Oregon Bicycle & Pedestrian Plan" (latest edition.)
- 2) AASHTO, "Guide to Development of Bicycle Facilities" (latest edition.)
- 3) Manual on Uniform Traffic Control Devices with Oregon supplements by Oregon Transportation Commission (latest edition.)

### 5.11.1 Bikeway Location, Width

<u>Bikeway Location</u>	<u>Width</u>	<u>Comments</u>
Public Street (designated bike lane)	5'**	Each direction of travel at shoulder/curb
** Six foot is recommended for "Arterial" classification.		

### 5.11.2 Design Criteria

In general, bikeway design shall meet the adopted standards referred to in **Section 5.11**.

All bikeways shall have a minimum cross slope of two percent (2%) and a maximum cross slope of five percent (5%). On curved alignments, the cross slope shall be to the inside of the curve.

Bikeway curvature will be based on a minimum design speed of 20 MPH.

Bikeway grades shall be limited to a maximum of five percent (5%). Where topography dictates, grades over five percent (5%) are acceptable when a higher design speed is used and additional width is provided.

## 5.12 Driveways

Access to private property shall be permitted with the use of driveway curb cuts. The access points with the street shall be the minimum necessary to provide access while not inhibiting the safe circulation and carrying capacity of the street.

On Major Collector streets and above, one driveway per site frontage will be the normal maximum number. Double frontage lots and corner lots on these streets may be limited to access from a single street, usually the lower classification street. If additional driveways on a frontage are approved by the City Engineer, a finding shall be made that no eminent traffic hazard would result and impacts on through traffic would be minimal; restrictions may be imposed on additional driveways, such as limited turn movements, shared access between

uses, closure of existing driveways, or other access management actions. Please refer to City of Newberg Development Code Chapter 15.505.200.

Driveway approach types shall generally be limited to those shown in the Standard Drawings for residential driveways, and commercial/industrial driveways. Residential driveways shall conform to **Standard Drawing No. 508 & 509**; commercial/industrial driveways shall conform to **Standard Drawing No. 510 & 511**. Curb return driveway approaches must be approved by the City Engineer.

**TABLE 5-1**

**Driveway Widths (Minimum/Maximum in Feet)**

Street Classification	Res.	Comm.	Ind.
3 Lane Major/Minor Arterial:	NA (1)	NA (1)	NA (1)
Major Collector:	12/24 (2)	12/36(5)	12/36(5)
Minor Collector:	12/24 (2)	12/36(3)	12/36(3)
Local:	12/24 (2)	12/36	(4)
Cul-de-sac:	12/24 (2)	12/36	12/36

Res. = Residential Zone  
 Comm. = Commercial Zone  
 Ind. = Industrial Zone

- Notes: (1) Special conditions may warrant access.  
 (2) 28' maximum with 3-car garage (measured at low curb cut)  
 (3) Frontage greater than 130/ft. permitted one additional curb cut.  
 (4) Build to Minor Collector standard.  
 (5) Certain businesses may warrant one additional curb cut for service driveway.

For classification of Major Collector and above, driveways adjacent to street intersections shall be located beyond the required queue length for traffic movements at the intersection. If this requirement prohibits access to the site, a driveway with restricted turn movements may be allowed.

Within commercial, industrial, and multi-family areas, shared driveways and internal access between similar uses are encouraged to reduce the access points to the higher classified roadways; to improve internal site circulation; and to reduce local trips or movements on the street system. Shared driveways or internal access between uses will be established by means of common access easements at the time of development.

Driveway grades shall not exceed twelve percent (12%) from the curb line to the front edge of setback (Type "A") sidewalk.

## 5.13 Street Lighting, Trees, Names and Signage

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

### 5.13.1 Street Lighting

#### General Design

- a. All street lighting shall be designed using the Illuminating Engineering Society of North America and Washington County Standards for Roadway Illumination, as amended.
- b. All electrical components shall be UL approved and testing lab approved from labs accepted by the State of Oregon.
- c. All street light plans shall include pole, conduit, junction box, photo cell, and transformer/controller locations, and photometrics (or P.E. Certification), along with any other pertinent information.
- d. The Contractor shall be responsible to provide all required traffic control during system installation.
- e. The Contractor shall be responsible for making arrangements with PGE for installation and connecting the street lighting system to the local distribution system.
- f. For installation of new street lighting on an existing street lighting system, contact the City Engineer.
- g. For installation of a new street lighting system associated with a residential subdivision, contact the PGE Engineering Division. Engineer shall submit to PGE electronic file of the survey base and site development base files including all underground public utilities.
- h. All street light poles should be located near property lines and at least 25 feet from any street trees, unless otherwise approved in writing by the City Engineer. The following codes and references shall be used in designing all street light systems: 1. National Electrical Code (NEC). 2. Portland General Electric (PGE).
- i. The Design Engineer shall submit a copy of the approved PGE lighting plan to the City before commencement of any onsite or offsite work.
- j. The Contractor shall submit a copy of the final electrical inspection to the City prior to City acceptance of the street light system.
- k. The City and the appropriate natural resource agencies shall determine whether or not lighting shall be provided for shared-use paths in designated natural resource and wildlife areas.
- l. All street lights shall be Option "A" as defined below unless otherwise approved in writing by the City Engineer. The Public Works Director will have to approve any alternative street illumination options (B or C) with PGE prior to approving site work construction plans.

**LIGHTING LEVELS  
AVERAGE MAINTAINED ILLUMINANCE ON THE HORIZONTAL**

**MINIMUM AVERAGE MAINTAINED FOOT CANDLES**

<b>Roadway Classification</b>	<b>High Pedestrian Conflict Area</b>	<b>Medium Pedestrian Conflict Area</b>	<b>Low Pedestrian Conflict Area</b>
Arterials	1.7	1.3	0.9
Collectors	1.2	0.9	0.6
Neighborhood	0.9	0.7	0.4
Local	0.9	0.7	0.4

**Option “A” Lighting**

Under this PGE option, PGE will install, own, and maintain street lighting system.

**Poles and Street Lighting Fixtures**

Light standards (poles), luminaries, and lamps shall be on the approved PGE list, be approved by the City Engineer, and have the most energy efficient and maintenance-free PGE approved lamp.

**Street Lighting Controls**

- a. A single phase, 3 wire, 240 volt, dedicated unmetered service shall be provided by the developer for street lighting.
- b. All street light circuits shall be controlled by a single photocell installed on the street light fixture closest to the controller cabinet.
- c. In systems with lights on both sides of the street, the circuitry shall be designed such that the lights on one side of the street can be “de-energized” without affecting the operation of the lights *on the opposite side of the street*.
- d. All conduit runs, pole boxes shall be designed and installed per PGE Standards.

**5.13.2 Street Trees**

Please refer to City of Newberg Development Code Chapter 15.420.020.

**5.13.3 Street Names and Traffic Control Signage**

Signs will conform to current City Sign Standards.

The City’s planning division, prior to recording of any maps or plats will approve street names for all new development. The city planner shall refer proposed street names to the Newberg Fire Department for their consideration.

Street names and building numbers shall conform to the established grid system(s) in the City and metropolitan area. No new street name shall be used which will duplicate or be confused with the name of existing streets within the Newberg Fire District.

**5.14 Permanent Dead-end Streets**

A standard cul-de-sac turnaround shall be provided at the end of a permanent dead end street that does not provide looped circulation. Permanent dead end streets shall be limited to serving no more than twenty five dwellings and shall not exceed four hundred feet in length from the point of the nearest centerline/centerline intersection.

A permanent dead end street is measured from the right-of-way line at the nearest intersecting street which has at least two points of access, to the right of way line at the furthest end of the dead end street. Exceptions to the dead end street standard must comply with the Newberg Development Code.

An existing dead end street system which is more than 600 feet long or which serves more than 25 dwelling units may be terminated in a cul-de-sac if no Future Street Plan has been adopted and the following criteria are met:

- a. Alternative emergency vehicle access or fire protection is provided satisfactory to the Manager; and,
- b. Neighborhood traffic circulation needs are not adversely impacted by the proposed cul-de-sac termination of the street.

## **5.15 Alleyways and Private Residential Streets/Access ways**

### **5.15.1 Alleyways**

Alleyways may be provided in commercial and industrial developments with approval by the City Engineer. When approved, alleyways shall be dedicated to the City. The right-of-way width shall be 20 feet with a 20 foot pavement width.

Design for alleyways shall meet the same criteria as other public streets. The exception to those criteria may be centerline radius and design speed. Generally, alleyways shall be designed for one way operation.

### **5.15.2 Private Streets**

Private streets are not allowed, refer to Newberg Municipal Code 15.505.180.

### **5.15.3 Limited Residential Streets**

Design for limited residential streets shall meet the same criteria as other public streets including structural section and materials.

The conditions for usage as set forth in the Newberg Development Code Section 15.505.060 specify factors that will be reviewed by the governing body in determining feasibility.

## **5.16 Local Street Design for Adverse Topography**

Local streets shall have a minimum cross section slope of 2.5% ("crown") in accordance with **Standard Drawing No. 513**, except in situations of adverse topography. The Design Engineer may utilize an "offset" or unequal crown section when the existing ground slope exceeds 8.00% across the roadway section.

The offset crown design shall meet the following conditions:

1. Minimum distance from "crown" to (one) face of curb is 10 feet.
2. Maximum cross slope of pavement is 5.00%.

3. Maximum differential in top of curb elevation from one side to the other is 1 foot.

The existing ground "side-slope" criteria are based on the relationship of the slope of the ground to the transverse slope of the roadway profile. This relationship shall be met for the entire length of the roadway alignment utilizing an offset.

### **5.17 Five Year Moratorium Street Cut Replacement Guidelines**

The City of Newberg has enacted a five-year moratorium on all new pavement surfaces. This will include overlays, inlays, reconstruction, and new construction of at least a half street or greater.

Anyone applying to open cut a moratorium street for utility connections, upgrading/repair of subsurface facilities or new street connection shall apply for the appropriate permit through the City of Newberg Public Works Department, Engineering Division.

If the permit is approved, the applicant shall adhere to strict reconstruction guidelines to achieve the following goals:

- Minimize pavement degradation
- Maintain structural integrity of street
- Maintain a smooth riding surface
- Limit visual impact and perceptions

### **5.18 Trench Restoration Requirement**

The actual trench cut shall be repaired as per standard drawing number 517. Asphaltic concrete shall be replaced in a minimum of 2 lifts and be at least 92% of rice theoretical maximum density as determined in conformance with AASHTO T-209 as modified by OSHD.

After performing trench cut restoration, a 2" grind/inlay for a distance of 1' per posted mile per hour (mph) each direction from the cut is required. The extent of surface grind/inlay width will be as follows:

- A single lane that is impacted will have full restoration for the width of the lane
- If multiple lanes, the full width of those lanes shall be restored
- If impact extends past the centerline, all lanes curb to curb shall be restored
- All inlayed asphaltic concrete shall be placed with a self-propelled slip form paver. Drag boxes shall not be used
- All tie-in joints to existing asphaltic concrete surfaces shall be sealed with rubberized asphalt emulsion (hot or cold)
- All striping removed by grinding shall be replaced with thermoplastic. All symbols, emblems, arrows, letters and bars shall be preformed thermoplastic

#### **5.18.1 Striping Restoration**

- All striping removed by grinding shall be replaced with thermoplastic. All symbols, emblems, arrows, letters and bars shall be performed thermoplastic

### **5.19 Intersection Sight Distance**

It is the policy of the City to have the applicant's Project Engineer evaluate safe intersection sight distance using the principles and methods recommended by the current edition of AASHTO. This policy shall apply to the design of new streets and driveways, and to the placement of any object in the public right-of-way, including landscaping features. Unless superseded by the current version of AASHTO, the following minimum standards shall apply:

**Intersection (and Driveway) Sight Distance:** The following table is for intersection and driveway sight distances:

<b>INTERSECTION SIGHT DISTANCE DESIGN SPEED (MPH)</b>	<b>MINIMUM INTERSECTION SIGHT DISTANCE (FEET)</b>
15	145
20	195
25	240
30	290
35	335
40	385
45	430

Source: American Association of State Highway and Transportation Officials, *A Policy of Geometric Design of Highways and Streets 2001*, Fourth Edition, (based on AASHTO Case B2 and B3).

Sight distance shall be determined for each street approach to an intersection. A driver on the approach street should be able to see each vehicle on the intersecting street from the time that the vehicle is the sight distance from the intersection until the time that the vehicle reaches the intersection. Poles, trees, and similar obstructions will be allowed within the sight distance area only if it can be shown that such obstructions do not prevent the continuous view of the vehicle approaching on the intersecting street.

For purposes of this calculation, the driver's eye is assumed to be 15 feet from the near edge of the nearest lane of the intersecting street, and at a height range of 3.5 feet to 7.6 feet above the approach street pavement. The sight distance criteria should be met throughout the range of driver's eye heights. The top of the vehicle on the intersecting street is assumed to be 3.5 feet above the cross-street pavement.

The traffic speed used in the calculation shall be the highest of the following: (1) the design speed of the intersecting street; (2) the posted speed of the intersecting street; or (3) the measured 85th percentile speed of the intersecting street. Where the intersecting street is controlled by a stop sign or yield sign, a design speed of zero may be assumed. Where traffic signal control exists at an intersection or where a traffic signal is likely to be installed in the future, adequate sight distance shall be provided for potential right turns on red. In some locations, maintenance of the required sight distance may require restrictions to potential development outside the public right-of-way. The Project Engineer shall demonstrate that adequate restrictions are in place (and enforceable by the City such as sight distance easements) to assure that the required sight distance can be maintained in the future.

At the time of construction plan submittal, the project engineer shall submit a stamped intersectional sight distance report for each new or modified intersection by a development

which generally includes a sketch, calculations, narrative, and photographs, for review by the City.

No modifications or exceptions to these standards shall be allowed unless approved by the City Engineer.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***

# Appendix A

## PLANTING REQUIREMENTS

### A1.0 INTRODUCTION

#### A1.1 General

The City recognizes the need to improve water quality and preserve aquatic species. To meet the intent of both the federal Clean Water and the Endangered Species Acts, the City developed requirements for planting Stormwater Facilities.

Successful vegetation of Stormwater Facilities is key for the benefit of water quality and quantity management, and aquatic species preservation. This Appendix aids professionals, the development community, and field crews in planning, designing and implementing successful vegetation projects. This document guides design decisions to promote successful planting efforts, while allowing flexibility to address opportunities and constraints at each site.

#### A1.2 Jurisdiction

Most Sensitive Areas are regulated by the Division of State Lands (DSL) and/or the U.S. Army Corps of Engineers (Corps). Where the Corps and/or DSL permit mitigation, planting plans for these areas shall follow DSL and Corps guidelines and approved plans. Stormwater Facilities are regulated by the City and the plans and management strategies for these areas shall follow the steps outlined in this document. Alternative plans and management strategies may be approved by the City

#### A1.3 Professional Assistance

Vegetation in Stormwater Facilities should facilitate succession toward low-maintenance plant communities. Consultation with a professional landscape architect, ecologist, or horticulturist knowledgeable in native plants is highly recommended when preparing plans. Satisfying the landscaping requirements may require the services of a registered landscape architect. See ORS 671.310 through 671.459.

Non-native, invasive plant management and wildlife damage management strategies may need to be developed. Especially challenging management situations may require assistance from a landscape maintenance contractor or a wildlife biologist.

### A2.0 PLANTING PLAN METHODS

Planting plans shall be required for development projects with Stormwater Facilities. When a planting plan is required, four major components shall be addressed: hydrology, soils, plant materials, and maintenance. When developing planting plans, the following steps should be used:

#### A2.1 Step 1: Assess Hydrologic and Hydraulic Conditions

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- a. Determine the frequency and duration of water inundation, including appropriate elevations of the vegetation area. In some cases, current site conditions (i.e. wetland presence) will suffice. For Stormwater Facilities, the models used to design and size the facility shall be used to determine frequency, duration and surface water elevations within the facility.
- b. Assign appropriate hydrologic zones to the vegetation area and apply them to the plan. Most project sites include one or more of the following planting zones with respect to hydrology during the growing season:
  1. Wet - standing or flowing water/nearly constant saturation; anaerobic soils
  2. Moist - periodically saturated; anaerobic and/or aerobic soils
  3. Dry - infrequent inundation/saturation, if any; aerobic soils

## **A2.2 Step 2: Assess Soil Conditions and Assign Appropriate Preparation**

### Specifications to Plans

- a. Determine the organic content and non-native, invasive seed bank likely in the soil. For most Stormwater Facilities, the soil is often high in clay, gravel, or minerals devoid of topsoil and organic material, and/or high in non-native, invasive weed content. The conditions in Sensitive Areas and adjacent areas can vary greatly.
- b. For upland sites with at least one foot of native topsoil, but containing a non-native, invasive seed bank or plants, add notes to the plan to remove the undesirable plants, roots, and seeds prior to planting.
- c. For upland sites with either disturbed and compacted soils or less than one foot of topsoil and invasive, non-native seed bank or plants that have become established, the following notes shall be added to the plan:
  1. Remove the undesirable plants, roots, and seeds prior to adding topsoil.
  2. Till the sub-grade in these areas to a depth of at least four inches and add at least 12 inches of clean compost-amended topsoil. The compost-amended topsoil shall have the following characteristics to ensure a good growing medium:
    - A) Texture – material passes through one-inch screen
    - B) Fertility – 35% organic matter
    - C) In lieu amending onsite soils, the contractor can import a certified amended soil in the treatment area which is composed of equal parts of organic compost, gravelly sand and topsoil. Compost is weed-free, decomposed, non-woody plant material; animal waste is not allowed. Check with the City of Newberg or Clean Water Services for Seal of Testing Approval Program (STA) Compost provider.
  3. In the event of floodplain grading, over-excavate the sub grade to ensure 12 inches of topsoil can be applied without impacting surface water elevations.

- a. For wet areas in Sensitive Areas and Stormwater Facilities, the soil conditions shall be hydric or graded to hold sufficient water to promote hydric soil formation. The addition of organic muck soil will improve plant establishment for some bulbs and tubers.
- b. Where appropriate and necessary for erosion control or to enhance organic matter, leaf compost may be placed uniformly on topsoil. (Refer the Erosion and Sediment Control Manual). Other amendments, conditioners, and bio-amendments may be added as needed to support the specified plants or adjust the soil pH. Traditional fertilization techniques (applying N-P-K) are not necessary for native plants.

### **A2.3 Step 3: Identify Plants to be Preserved**

Select Re-vegetation Plant Materials, Quantities, Placement, and Assign Planting Zones and Specifications to Plans

- a. Preservation: Every effort shall be made to protect a site's existing native vegetation. Native vegetation along Sensitive Areas and adjacent areas shall be retained to the maximum extent practicable.
- b. Selection: Plant selection shall be from a native species palette and shall consider site soil types, hydrologic conditions, and shade requirements. Containerized or bare root plants may be used. A list of common native plant community types appropriate for planting Sensitive Areas, Vegetated Corridors and Stormwater Facilities are provided in Planting Tables. Upon approval from the City, limited use of non-invasive non-native plants may be permitted in highly urbanized and other unique settings such as regional town centers. Unless approved by the City Engineer, planting restrictions are limited to the following:
  - 1. Deep rooting trees and shrubs (e.g. willow) shall not be planted on top of concrete pipes, or within 10 feet of retaining walls, inlet/outlet structures or other culverts; and
  - 2. Large trees or shrubs shall not be planted on berms over four feet tall that impound water. Small trees or shrubs with fibrous root systems may be installed on berms that impound water and are less than four feet tall.
- c. Quantities:
  - 1. Vegetated Corridors and Sensitive Areas  
Trees and shrubs shall be planted using the following equations to achieve the specified densities:
    - A) Total number of trees: 1 tree per every 200 square feet of area.
    - B) Total number of shrubs: 1 shrub per every 100 square feet of area.
    - C) Groundcover: plants and seeds to achieve 100% areal coverage
  - 2. Stormwater Facilities

- A) Stormwater Facilities in tracts or easements less than 30 feet wide shall be planted using the following equations to achieve the specified densities on a per acre basis:
  - i. Total number of shrubs: 1 shrub per every 100 square feet of area.
  - ii. Groundcover: plant and seed to achieve 100% areal coverage
- B) Stormwater Facilities in tracts or easements 30 feet wide or more shall be planted using the following equations to achieve the specified densities on a per acre basis:
  - i. Total number of trees: 1 tree per every 200 square feet of area.
  - ii. Total number of shrubs: 1 shrub per every 100 square feet of area.
  - iii. Groundcover: plant and seed to achieve 100% areal coverage
- d. Size: Potted plants shall follow size requirements outlined in (Planting Tables). Bare root plants shall be 12 to 16 inches long.
- e. Placement: Plant placement shall be consistent with naturally occurring plant communities. Trees and shrubs shall be placed in singles or clusters of the same species to provide a natural planting scheme. This arrangement may follow curved rows to facilitate maintenance. Distribution and relative abundance shall be dependent on the plant species and on the size of the re-vegetation area. The Vegetated Corridor re-vegetation area shall be over seeded with native seed mixes appropriate to the plant community and hydrologic zone of the site (see Planting Tables): Plant Communities for Re-vegetation). Plant placement and seeding shall promote maximum vegetative cover to minimize weed establishment.

#### **A2.4 Step 4: Determine Plant Installation Requirements and Assign Specifications to Plans**

- a. Timing  
Containerized stock shall be installed only from February 1 through May 1 and October 1 through November 15. Bare root stock shall be installed only from December 15 through April 15. Plantings outside these times may require additional measures to ensure survival which shall be specified on the plans.
- b. Erosion Control  
Grading, soil preparation, and seeding shall be performed during optimal weather conditions and at low flow levels to minimize sediment impacts. Site disturbance shall be minimized and desirable vegetation retained, where possible. Slopes shall be graded to support the establishment of vegetation. Where seeding is used for erosion control, an appropriate native grass, Regreen (or its equivalent), or sterile wheat shall be used to stabilize slopes until permanent vegetation is established. Biodegradable fabrics (coir, coconut or approved jute matting (minimum 1/4" square holes) may be used to stabilize slopes and channels. Fabrics such as burlap may be used to secure plant plugs in place and to discourage floating upon inundation. No plastic mesh that can entangle wildlife is permitted. Refer to the Erosion and Sediment Control Manual for additional information.
- c. Mulching

Trees, shrubs, and groundcovers planted in upland areas shall be mulched a minimum of three inches in depth and 18 inches in diameter, to retain moisture and discourage weed growth around newly installed plant material. Appropriate mulches are made from composted bark or leaves that have not been chemically treated. The use of mulch in frequently inundated areas shall be limited, to avoid any possible water quality impacts including the leaching of tannins and nutrients, and the migration of mulch into waterways.

- d. **Plant Protection from Wildlife**  
Depending on site conditions, appropriate measures shall be taken to limit wildlife-related damage.
- e. **Irrigation**  
Appropriate plant selection, along with adequate site preparation and maintenance, reduces the need for irrigation. However, unless site hydrology is currently adequate, a City approved irrigation system or equivalent (i.e., polymer, plus watering) shall be used during the two-year plant establishment period. Watering shall be at a minimum rate of at least one inch per week from June 15 through October 15. Other irrigation techniques, such as deep watering, may be allowed with prior approval by the City Engineer.
- f. **Access**  
Maintenance access for plant maintenance shall be provided for Sensitive Areas and Vegetated Corridors via a five-foot easement or shared boundary with Stormwater Facilities. Stormwater Facility access requirements are provided in the Storm Drainage Chapter.

#### **A2.5 Step 5: Determine Plant Monitoring and Maintenance Requirements**

- a. **Monitoring**  
Site visits are necessary throughout the growing season to assess the status of the plantings, irrigation, mulching, etc. and ensure successful re-vegetation.
- b. **Weed Control**  
The removal of non-native, invasive weeds shall be necessary throughout the maintenance period, or until a healthy stand of desirable vegetation is established.
- c. **Plant Replacement and Preservation**  
Installed plants that fail to meet site review inspections by the City Engineer shall be replaced during the maintenance period. Prior to replacement, the cause of loss (wildlife damage, poor plant stock, etc.) shall be documented by a landscape, arboriculture, and/or wildlife specialist with a description of the corrective actions taken.

#### **A2.6 Step 6: Prepare Construction Documents and Specifications**

The construction documents and specifications shall include:

- a. Sensitive Area and Vegetated Corridor boundaries that include limits of approved, temporary construction encroachment. Orange construction fencing

shall be noted at Vegetated Corridor boundaries as well as at encroachment limits during construction. Note permanent type fencing and signage between the development and the Vegetated Corridor for project completion is required.

- b. Site Preparation plan and specifications, including limits of clearing, existing plants and trees to be preserved, and methods for removal and control of invasive, non-native species, and location and depth of topsoil and or compost to be added to re-vegetation area.
- c. Planting plan and specifications, including all of the following:
  - 1. Planting table that documents the common name, scientific name, distribution (zone and spacing), condition and size of plantings
  - 2. Installation methods for plant materials
  - 3. Mulching
  - 4. Plant tagging for identification
  - 5. Plant protection
  - 6. Seeding mix, methods, rates, and areas
- d. Irrigation plan and specifications, including identification of water source, watering timing and frequency, and maintenance of the system.
- e. Maintenance schedule; including responsible party and contact information, dates of inspection (minimum three per growing season and one prior to onset of growing season) and estimated maintenance schedule (as necessary) over the two-year monitoring period.
- f. Easement descriptions for all Vegetated Corridor and Sensitive Areas that are required as part of the development.
- g. Good rated corridor notes i.e. invasive species removal resulting in cleared areas exceeding 25 square feet shall be replanted with native vegetation.
- h. Access points for installation and maintenance including vehicle access if available.
- i. Standard drawing details (north arrow, scale bar, property boundaries, project name, drawing date, name of designer and Property Owner).

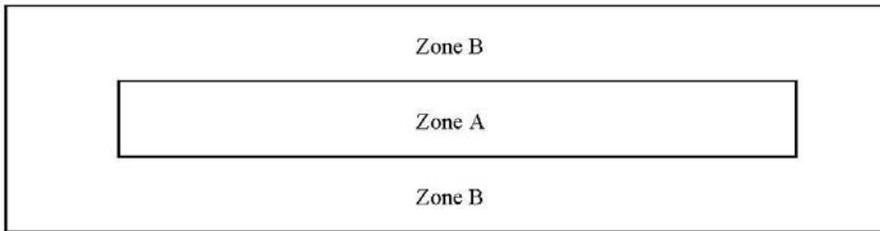
Facility Planting Shedule					
Facility Type	Number of Plants	Vegetation Type	Per Square Feet	Size	Spacing Density (on center)
Planters, Zone A, Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Planters, Zone A, Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	2 ft
Vegetated Filter Strip:	100 Percent cover by native grasses, native wildflower blends, native ground covers, or any combination thereof.				
Private Swales, Zone A-Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Private Swales, Zone A-Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	3 ft
Private Swales, Zone B, Option 1:	1	Evergreen Tree or (Deciduous Tree)	200	6 ft Min., (1 1/2" at 6" above base)	na
	3	Large Shrubs	100	3 gallons or equivalent	4 ft
	4	Medium to Small Shrubs	100	1 gallon or equivalent	2 ft
	70	Groundcover	100	1 gallon or equivalent	1 ft
Public Swales, Zone A, Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Public Swales, Zone A, Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	2 ft
Public Swales, Zone B, Option 1:	12	Small Shrubs	100	1 gallon or equivalent	2 ft
	70	Groundcover	100	1 gallon or equivalent	1 ft

## PLANTING TEMPLATES AND PLANT LISTS

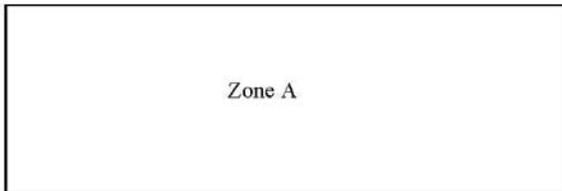
**Zone A:** Area of the facility defined as the bottom of the facility to the designed high water mark. This area has moist to wet soils and plants located here shall be tolerant of mild inundation.

**Zone B:** Area of the facility defined as the side slopes from the designed high water line up to the edge of the facility. This area typically has dryer to moist soils, with the moist soils being located further down the side slopes. Plants here should be drought tolerant and help stabilize the slopes.

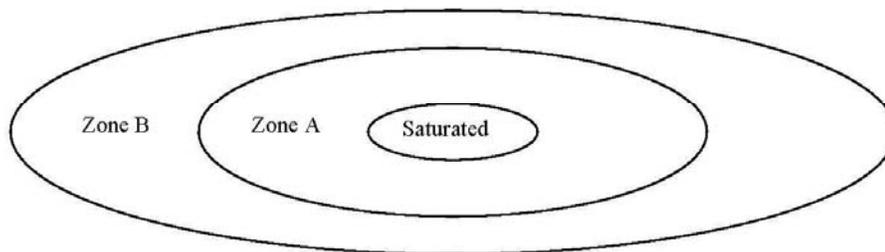
### Swale Planting Zones



### Planter Planting Zones



### Basin Planting Zones



## Public Streets Planting List

Plant Name	Facility Type			Characteristics					
	Zone	Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
<i>Botanic name, Common Name</i>									

### Herbaceous Plants

<i>Carex densa</i> , Dense Sedge	A	X	X	X	Y	Y	24"	12"	
<i>Carex morrowii</i> , Ice Dance	A	X	X	X	N	Y	24"	12"	
<i>Carex obnupta</i> , Slough Sedge	A	X	X	X	Y	Y	48"	12"	
<i>Deschampsia cespitosa</i> , Tufted Hair Grass	A/B	X	X	X	Y	N	48"	12"	
<i>Helictotrichon sempervirens</i> , Blue Oat Grass	B	X	X		N	Y	24"	12"	
<i>Juncus patens</i> , Spreading Rush	A	X	X	X	N	Y	36"	12"	

### Shrubs

<i>Cornus sericea "Kelseyii"</i> , Kelsey Dogwood	A/B	X	X	X	N	N	24"	24"	
<i>Euonymus japonicus</i> 'Microphyllus' Boxleaf Evergreen	B	X	X		N	Y	24"	24"	
<i>Mahonia nervosa</i> , Dull Oregon Grape	B	X	X		Y	Y	24"	24"	
<i>Spiraea betulifolia</i> , Birchleaf Spiraea	A/B	X	X	X	Y	N	24"	24"	
<i>Spiraea densiflora</i> , Sub-alpine Spiraea	A/B	X	X	X	Y	N	24"	24"	
<i>Spiraea japonica</i> , Japanese spirea cultivars: Dart's Red, Goldflame, Goldmound, Little Princess, Magic Carpet	A/B	X	X	X	N	N	24"- 36"	24"	

### Groundcovers

<i>Arctostaphylos uva-ursi</i> , Kinnickinnick	B	X	X		Y	Y	6"	12"	
<i>Fragaria chiloensis</i> , Coastal Strawberry	B	X	X		Y	Y	6"	12"	

## Public Streets Planting

Plant Name	Zone	Facility Type			Characteristics				
		Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
<i>Botanic name, Common Name</i>									
<i>Mahonia repens</i> , Creeping Oregon Grape	B	X	X		Y	Y	12"	12"	
<i>Rubus calycynoides</i> & <i>pentalobus</i> , Creeping Bramble	A	X	X		N	Y	6"	12"	

## Public Streets Planting

Plant Name	Zone	Facility Type			Characteristics				
		Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
<i>Botanic name, Common Name</i>									

### Accent Plants

<i>Camassia leichtlinii</i> , Great Camas	A/B	X	X	X	Y	N	24"	12"	
<i>Camassia quamash</i> , Common Camas	A/B	X	X	X	Y	N	24"	12"	
<i>Iris douglasiana</i> , Douglas Iris	B	X	X		Y	N	18"	12"	
<i>Iris tenax</i> , Oregon Iris	B	X	X		Y	N	18"	12"	

### Street Trees

<i>Acer campestre</i> 'Evelyn', Queen Elizabeth Hedge Maple	A/B	X	X	X	N	N	30'		N
<i>Betula jacquemontii</i> , Jacquemontii Birch	A/B	X	X	X	N	N	60'		N
<i>Celtis occidentalis</i> , Hackberry	A/B	X	X	X	N	N	50'		N
<i>Koeleruteria paniculata</i> , Goldenrain Tree	A/B	X	X	X	N	N	30'		Y
<i>Nyssa sylvatica</i> , Black Tupelo	A	X	X	X	N	N	50'		N
<i>Prunus virginiana</i> 'Canada Red', Canada Red Chokecherry	A/B	X	X	X	N	N	25'		Y
<i>Quercus shumardii</i> , Shumard Oak	A/B	X	X	X	N	N	70'		N
<i>Rhamnus purshiana</i> , Cascara	A/B	X	X	X	Y	N	30'		Y

## Facility Plant List

Plant Name  Botanic name, Common Name	Zone	Proposed Facility Type			Basin	Characteristics				
		Private Swale Planter Basin	Public Basin	NW Native		Evergreen	Potential Hgt.	O.C. Spacing		
<b>Herbaceous Plants</b>										
<i>Aster suspicatus</i> , Douglas' Aster	B	X		X			Y	N	36"	12"
<i>Athyrium felix-femina</i> , Lady Fern	B	X		X		X	Y	N	36"	24"
<i>Blechnum spicant</i> , Deer Fern	B	X		X		X	Y	N	24"	24"
<i>Bromus carinatus</i> , California Brome Grass	A			X		X	Y	Y	18"	12"
<i>Bromus sitchensis</i> , Alaska Brome	A			X		X	Y	Y	18"	12"
<i>Bromus vulgaris</i> , Columbia Brome	A			X		X	Y	Y	18"	12"
<i>Camassia leichtlinii</i> , Camas Lily	A	X	X	X			Y	N	24"	12"
<i>Camassia quamash</i> , Common Camas	A/B	X	X	X		X	Y	N	24"	12"
<i>Carex deweyana</i> , Dewey Sedge	A	X	X	X		X	Y	Y	36"	12"
<i>Carex densa</i> , Dense Sedge	A	X	X	X		X	Y	Y	24"	12"
<i>Carex obnupta</i> , Slough Sedge	A	X	X	X		X	Y	Y	4'	12"
<i>Carex rupestris</i> , Curly Sedge	A	X	X	X			N	Y	14"	12"
<i>Carex stipata</i> , Sawbeak Sedge	A	X	X	X			N	N	20"	12"
<i>Carex testacea</i> , New Zealand Orange Sedge	A	X	X	X		X	N	Y	24"	12"
<i>Carex vesicaria</i> , Inflated Sedge	A	X	X	X		X	Y	N	36"	12"
<i>Deschampsia cespitosa</i> , Tufted Hair Grass	A/B	X	X	X		X	Y	N	36"	12"
<i>Eleocharis acicularis</i> , Needle Spike Rush	A	X	X	X		X	Y	Y	30"	12"
<i>Eleocharis ovata</i> , Ovate Spike Rush	A	X	X	X		X	Y	Y	30"	12"
<i>Eleocharis palustris</i> , Creeping Spike Rush	A			X		X	Y	Y	30"	12"
<i>Elymus glaucus</i> , Blue Wild Rye	B	X		X		X	Y	Y	24"	12"

## Facility Plant List

Plant Name	Proposed Facility Type				Characteristics			
	Zone	Private Swale Planter Basin	Public Basin	NW Native	Evergreen	Potential Hgt.	O. C. Spacing	
<b>Herbaceous Plants (continued)</b>								
<i>Festuca occidentalis</i> , Western Fescue Grass	A	X	X		X	Y	N	24" 12"
<i>Festuca rubra</i> , Red Fescue	B	X	X		X	Y	Y	24" 12"
<i>Glyceria occidentalis</i> , Western Manna Grass	A		X		X	Y	Y	18" 12"
<i>Hebe 'Autumn Glory'</i> , Hebe	B	X	X			N	Y	14" 12"
<i>Iris douglasiana</i> , Douglas Iris	B	X	X		X	Y	N	18" 12"
<i>Iris sibirica</i> , Siberian Iris	A	X	X	X		N	N	36" 12"
<i>Iris tenax</i> , Oregon Iris	B	X	X		X	Y	N	18" 12"
<i>Juncus balticus</i> , Baltic Rush	A	X	X	X		N	N	20" 12"
<i>Juncus effusus</i> var. <i>pacificus</i> , Soft rush	A	X	X	X	X	Y	Y	36" 12"
<i>Juncus ensifolius</i> , Dagger- leaf Rush	A	X	X	X	X	N	N	10" 12"
<i>Juncus patens</i> , Spreading Rush	A	X	X	X	X	N	Y	36" 12"
<i>Juncus tenuis</i> , Slender Rush	A	X	X	X	X	Y	Y	36" 12"
<i>Lupinus micranthus</i> , Small Flowered Lupine	B	X	X		X	Y	N	18" 12"
<i>Lupinus polyphyllus</i> , Large- leaved Lupine	A/B	X	X			Y	N	36" 12"
<i>Polypodium glycyrrhiza</i> , Licorice Fern	A	X	X	X		Y	Y	12" 12"
<i>Polystichum munitum</i> , Sword Fern	A/B	X	X		X	Y	Y	24" 24"
<i>Pteridium aquilinum</i> , Bracken Fern	B	X	X			Y	Y	5' 12"
<i>Scirpus acutus</i> , Hardstem Bulrush	A	X	X	X		N	N	10" 12"
<i>Scirpus americanus</i> , American Bulrush	A	X	X	X	X	Y	Y	30" 12"
<i>Scirpus microcarpus</i> , Small Fruited Bulrush	A		X		X	Y	Y	24" 12"
<i>Scirpus validus</i> , Softstem Bulrush	A	X	X	X		N	N	5' 12"

## Facility Plant List

Plant Name  <i>Botanic name, Common Name</i>	Zone	Proposed Facility Type				Basin	Characteristics			
		Private Swale	Planter	Basin			Public Basin	NW Native	Evergreen	Potential Hgt.
<b>Herbaceous Plants (continued)</b>										
<i>Sedum oregonum</i> , Oregon Stonecrop	B	X					Y	Y	4"	12"
<i>Sisyrinchium californicum</i> , Yellow-eyed Grass	A/B	X	X	X			N	Y	6"	12"
<i>Veronica liwanensis</i> , Speedwell	A	X		X			N	N	2"	12"
<b>Large Shrubs and Small Trees</b>										
<i>Acer circinatum</i> , Vine Maple	A/B	X	X	X		X	Y	N	15'	10'
<i>Amelanchier alnifolia</i> , Western Serviceberry	B	X		X		X	Y	N	20'	10'
<i>Ceanothus sanguineus</i> , Oregon Redstem Ceanothus	B	X		X		X	Y	Y	7'	4'
<i>Holodiscus discolor</i> , Oceanspray	B	X		X		X	Y	N	6'	4'
<i>Lonicera involucrata</i> , Black Twinberry	B	X		X		X	Y	N	5'	4'
<i>Oemleria cerasiformis</i> , Indian Plum	B	X		X		X	Y	N	6'	4'
<i>Philadelphu lewisii</i> , Wild Mock Orange	B	X		X		X	Y	N	6'	4'
<i>Ribes sanguineum</i> , Red-Flowering Current	B	X		X		X	Y	N	8'	4'
<i>Rubus parviflorus</i> , Thimbleberry	B	X		X		X	Y	N	8'	4'
<i>Rubus spectabilis</i> , Salmonberry	A	X	X	X		X	Y	N	10'	4'
<i>Salix fluviatilis</i> , Columbia Willow	A/B	X	X	X		X	N	N	13'	6'
<i>Salix lucida</i> var. 'Lasiandra', Pacific Willow	A	X	X	X		X	Y	N	13'	6'
<i>Salix purpurea nana</i> , Blue Arctic Willow	B	X		X			N	N	8'	6'
<i>Salix stichensis</i> , Sitka Willow	A	X	X	X		X	Y	N	20'	6'

## Facility Plant List

Plant Name  <i>Botanic name, Common Name</i>	Zone	Proposed Facility Type				Characteristics				
		Private Swale Planter Basin	Public Basin	NW Native	Evergreen	Potential Hgt.	O. C. Spacing			
<b>Large Shrubs and Small Trees (continued)</b>										
<i>Sambucus cerulea</i> , Blue Elderberry	B	X		X		X	Y	N	10'	10'
<i>Sambucus racemosa</i> , Red Elderberry	B	X		X		X	Y	N	10'	10'
<i>Spiraea douglasii</i> , Douglas Spiraea	A/B	X	X	X		X	Y	N	7'	4'
<i>Viburnum edule</i> , Highbush Cranberry	A/B	X	X	X		X	Y	N	6'	4'
<b>Shrubs</b>										
<i>Ceanothus velutinus</i> , Snowbrush	B	X		X		X	Y	Y	4'	3'
<i>Cornus sericea</i> , Red-twig Dogwood	A	X	X	X		X	Y	N	6'	4'
<i>Cornus sericea 'Kelseyii'</i> , Kelsey Dogwood	B	X		X		X	N	N	24"	24"
<i>Gaultheria shallon</i> , Salal	B	X		X		X	Y	Y	24"	24"
<i>Mahonia aquifolium</i> , Oregon Grape	B	X		X		X	Y	Y	5'	3'
<i>Mahonia nervosa</i> , Dull Oregon Grape	B	X		X		X	Y	Y	24"	24"
<i>Physocarpus capitatus</i> , Pacific Ninebark	A/B	X	X	X			Y	N	10'	3'
<i>Rosa gymnocarpa</i> , Baldhip Rose	B	X		X		X	Y	N	3'	3'
<i>Rosa nutkana</i> , Nootka Rose	B	X		X		X	Y	N	8'	3'
<i>Rosa pisocarpa</i> , Swamp Rose	A/B	X	X	X		X	Y	N	8'	3'
<i>Symphoricarpos alba</i> , Common Snowberry	B	X		X		X	Y	N	6'	3'
<b>Groundcovers</b>										
<i>Arctostaphylos uva-ursi</i> , Kinnickinnick	B	X		X			Y	Y	6"	12"
<i>Fragaria chiloensis</i> , Coastal Strawberry	B	X		X			Y	Y	6"	12"

## Facility Plant List

Plant Name  <i>Botanic name, Common Name</i>	Zone	Proposed Facility Type				Characteristics				
		Swale	Planter	Basin	Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	
<b>Groundcovers (continued)</b>										
<i>Fragaria vesca</i> , Woodland Strawberry	B	X		X			N	Y	10"	12"
<i>Fragaria virginiana</i> , Wild Strawberry	B	X		X			N	Y	10"	12"
<i>Helictotrichon sempervirens</i> , Blue Oat Grass	B	X		X			N	Y	24"	12"
<i>Mahonia repens</i> Creeping Oregon Grape	B	X		X			Y	Y	12"	12"
<b>Trees</b>										
<i>Abies grandis</i> , Grand Fir	B			X		X	Y	Y	150'	
<i>Acer griseum</i> , Paperbark Maple	B	X		X			N	N	30'	
<i>Acer macrophyllum</i> , Big Leaf Maple	B	X		X		X	Y	Y	60'	
<i>Alnus rubra</i> , Red Alder	A	X		X		X	Y	N	80'	
<i>Arbutus menziesii</i> , Madrone	B			X		X	Y	N	35'	
<i>Crataegus douglasii</i> , Black Hawthorn	A	X		X		X	Y	N	40'	10'
<i>Fraxinus latifolia</i> , Oregon Ash	A/B	X		X		X	Y	N	30'	
<i>Malus fusca</i> , Pacific Crabapple	A	X	X	X		X	Y	N	30'	10'
<i>Metasequoia glyptostroboides</i> , Dawn Redwood	B			X		X	N	N	80'	
<i>Populus tremuloides</i> , Quaking Aspen	A			X		X	Y	N	40'	
<i>Prunus emarginata</i> var. <i>mollis</i> , Bitter Cherry	A/B	X	X	X		X	Y	N	50'	
<i>Pseudotsuga menziesii</i> , Douglas Fir	B	X		X		X	Y	Y	200'	
<i>Quercus garryana</i> , Oregon White Oak	B	X		X		X	Y	N	100'	

## Facility Plant List

Plant Name  <i>Botanic name, Common Name</i>	Zone	Proposed Facility Type				Characteristics			
		Swale	Planter	Basin	Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
<b>Trees (continued)</b>									
<i>Rhamnus purshiana</i> , Cascara	A/B	X	X	X		X	Y	N	30'
<i>Salix hookeriana</i> , Hooker's Willow	A/B	X	X	X		X	Y	N	15'
<i>Salix scouleriana</i> , Scouler's Willow	A/B	X	X	X		X	Y	N	15'
<i>Thuja plicata</i> , Western Red Cedar	A			X		X	Y	Y	150'
<i>Tsuga heterophylla</i> , Western Hemlock	A	X		X		X	Y	Y	125'
<i>Tsuga mertensiana</i> , Mountain Hemlock	B	X		X		X	Y	Y	125'

**Pond Plant List**

Plant Name	Planting Zone			Characteristics			
	Wet to Saturated	Moist to Dry	Dry/Up land	NW Native	Evergreen	Potential Hgt.	O. C. Spacing
<i>Botanic name, Common Name</i>							
<b>Herbaceous Plants</b>							
<i>Alisma plantago-aquatica</i> , Water Plantain	X			Y	N	24"	12"
<i>Alopecurus geniculatus</i> , Water Foxtail		X		Y	Y	18"	12"
<i>Aster suspicatus</i> , Douglas' Aster	X	X		Y	N	36"	12"
<i>Bidens cernua</i> , Nodding Beggerticks		X		Y	N	24"	12"
<i>Blechnum spicant</i> , Deer Fern	X	X		Y	N	24"	24"
<i>Bromus sitchensis</i> , Alaska Brome		X	X	Y	Y	18"	12"
<i>Camassia quamash</i> , Common Camas		X		Y	N	24"	12"
<i>Carex deweyanna</i> , Dewey Sedge	X	X		Y	Y	36"	12"
<i>Carex obnupta</i> , Slough Sedge	X			Y	Y	4'	12"
<i>Deschampsia cespitosa</i> , Tufted Hair Grass		X		Y	N	36"	12"
<i>Eleocharis ovata</i> , Ovate Spike Rush	X			Y	Y	30"	12"
<i>Eleocharis palustris</i> , Creeping Spike Rush	X			Y	Y	30"	12"
<i>Elymus glaucus</i> , Blue Wild Rye		X		Y	Y	24"	12"
<i>Glycera occidentalis</i> , Western Manna Grass	X	X		Y	Y	18"	12"
<i>Lemna minor</i> , Common Lesser Duckweed	X						
<i>Juncus effusus var. pacificus</i> , Soft rush	X	X		Y	Y	36"	12"
<i>Juncus ensifolius</i> , Dagger-leaf Rush	X	X		Y	Y	24"	12"

**Pond Plant List**

Plant Name	Planting Zone			Characteristics			
	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
<i>Botanic name, Common Name</i>							
<b>Herbaceous Plants (continued)</b>							
<i>Juncus oxymeris</i> , Pointed Rush	X	X		Y	Y	24"	12"
<i>Juncus patens</i> , Spreading Rush	X	X		N	Y	36"	12"
<i>Juncus tenuis</i> , Slender Rush	X	X		Y	Y	36"	12"
<i>Lupinus polyphyllus</i> , Large-leaved Lupine		X		Y	N	36"	12"
<i>Myosotis laxa</i> , Small-flowered Forget-Me-Not	X			Y	N	18"	12"
<i>Polystichum munitum</i> , Sword Fern	X	X		Y	Y	24"	24"
<i>Sagittaria latifolia</i> , Wapato	X			Y	N	24"	12"
<i>Potamogeton natans</i> , Floating leafed Pondweed	X			Y	Y	18"	12"
<i>Scirpus acutus</i> , Hardstem Bulrush	X			N	N	10"	12"
<i>Scirpus microcarpus</i> , Small Fruited Bulrush		X		Y	Y	24"	12"
<i>Sisyrinchium idahoense</i> Blue-eyed Grass		X		N	Y	6"	12"
<i>Sparganium emersum</i> , Narrowleaf Bur-reed	X			Y	N	24"	12"
<i>Veronica liwanensis</i> , Speedwell	X	X		N	N	2"	12"
<i>Viola palustris</i> , Marsh Violet	X	X		Y	N	6"	6"
<b>Large Shrubs and Small Trees</b>							
<i>Acer circinatum</i> , Vine Maple	X	X		Y	N	15'	10'
<i>Amelanchier alnifolia</i> , Western Serviceberry			X	Y	N	20'	10'
<i>Holodiscus discolor</i> , Oceanspray			X	Y	N	6'	4'
<i>Lonicera involucrata</i> , Black Twinberry			X	Y	N	5'	4'

**Pond Plant List**

Plant Name	Planting Zone			Characteristics			
	Wet to Saturated	Moist to Dry	Dry/Up and	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
<i>Botanic name, Common Name</i>							

**Large Shrubs and Small Trees (continued)**

<i>Oemleria cerasiformis</i> , Indian Plum		X	X	Y	N	6'	4'
<i>Philadelphu lewisii</i> , Wild Mock Orange			X	Y	N	6'	4'
<i>Ribes sanguineum</i> , Red-Flowering Current			X	Y	N	8'	4'
<i>Rubus parviflorus</i> , Thimbleberry		X		Y	N	8'	4'
<i>Rubus spectabilis</i> , Salmonberry	X	X		Y	N	10'	4'
<i>Salix fluviatilis</i> , Columbia Willow	X	X		N	N	13'	6'
<i>Salix lucida</i> var. 'Lasiandra', Pacific Willow	X	X		Y	N	13'	6'
<i>Salix stichensis</i> , Sitka Willow	X	X		Y	N	20'	6'
<i>Sambucus racemosa</i> , Red Elderberry		X		Y	N	10'	10'
<i>Spiraea douglasii</i> , Douglas Spiraea		X		Y	N	7'	4'
<i>Viburnum edule</i> , Highbush Cranberry		X		Y	N	6'	4'

**Shrubs**

<i>Cornus sericea</i> , Red-twig Dogwood	X	X		Y	N	6'	4'
<i>Fragaria vesca</i> , Woodland Strawberry		X	X	N	Y	10"	12"
<i>Fragaria virginiana</i> , Wild Strawberry		X	X	N	Y	10"	12"
<i>Mahonia aquifolium</i> , Oregon Grape		X	X	Y	Y	5'	3'
<i>Mahonia nervosa</i> , Dull Oregon Grape		X		Y	Y	24"	24"

**Pond Plant List**

Plant Name	Planting Zone			Characteristics			
	Wet to Saturated	Moist to Dry	Dry/Up and	NW Native	Evergreen	Potential Hgt.	O. C. Spacing
<i>Botanic name, Common Name</i>							
<b>Shrubs (continued)</b>							
<i>Physocarpus capitatus</i> , Pacific Ninebark	X			Y	N	6'	3'
<i>Rosa gymnocarpa</i> , Baldhip Rose	X			Y	N	3'	3'
<i>Rosa nutkana</i> , Nootka Rose		X		Y	N	8'	3'
<i>Rosa pisocarpa</i> , Swamp Rose	X			Y	N	8'	3'
<i>Spiraea betulifolia</i> , Birchleaf Spiraea		X		Y	N	24"	24"
<i>Symphoricarpos alba</i> , Snowberry		X		Y	N	3'	3'
<b>Trees</b>							
<i>Abies grandis</i> , Grand Fir		X		Y	Y	150'	
<i>Acer macrophyllum</i> , Big Leaf Maple		X		Y	Y	60'	
<i>Alnus rubra</i> , Red Alder	X	X		Y	N	80'	
<i>Arbutus menziesii</i> , Madrone			X	Y	N	35'	
<i>Cornus nuttallii</i> , Western flowering Dogwood		X	X	Y	N	20'	
<i>Crataegus douglasii</i> , Black Hawthorn	X			Y	N	40'	
<i>Fraxinus latifolia</i> , Oregon Ash	X	X		Y	N	30'	
<i>Malus fusca</i> , Pacific Crabapple	X	X		Y	N	30'	
<i>Pinus ponderosa</i> , Ponderosa Pine			X	Y	Y	70'	
<i>Pinus monticola</i> , Western White Pine		X	X	Y	Y	90'	
<i>Prunus emarginata</i> var. <i>mollis</i> , Bitter Cherry	X			Y	N	50'	
<i>Pseudotsuga menziesii</i> , Douglas Fir		X		Y	Y	200'	

**Pond Plant List**

Plant Name	Planting Zone			Characteristics			
	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
<i>Botanic name, Common Name</i>							

**Trees (continued)**

<i>Quercus garryana</i> , Oregon White Oak		X		Y	N	100'	
<i>Rhamnus purshiana</i> , Cascara	X			Y	N	30'	
<i>Salix hookeriana</i> , Hooker's Willow	X	X		Y	N	15'	
<i>Salix scouleriana</i> , Scouler's Willow	X	X		Y	N	15'	
<i>Thuja plicata</i> , Western Red Cedar	X	X		Y	Y	150'	