Storm Drainage Report

Final

520 Trail Grade Separation at NE 40th Street
Redmond, Washington

RMDX-0062
November 2018
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<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMPs</td>
<td>Best Management Practice(s)</td>
</tr>
<tr>
<td>DOE</td>
<td>Washington State Department of Ecology</td>
</tr>
<tr>
<td>LID</td>
<td>Low Impact Development</td>
</tr>
<tr>
<td>NRCS</td>
<td>National Resource Conservation Service</td>
</tr>
<tr>
<td>PGHS</td>
<td>Pollution Generating Hard Surface</td>
</tr>
<tr>
<td>RMC</td>
<td>Redmond Municipal Code</td>
</tr>
<tr>
<td>SWMMWW</td>
<td>Stormwater Management Manual for Western Washington</td>
</tr>
<tr>
<td>SWPPP</td>
<td>Stormwater Pollution Prevention Plan</td>
</tr>
<tr>
<td>SR</td>
<td>State Route</td>
</tr>
<tr>
<td>TDA</td>
<td>Threshold Discharge Area</td>
</tr>
</tbody>
</table>
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1 Project Overview

The City of Redmond is improving about 800 feet of trail access along State Route (SR) 520 by installing a grade separated trail under NE 40th Street. The existing SR 520 Trail through the City of Redmond includes an at-grade crossing of NE 40th Street, which requires pedestrians and bicyclists to cross eight lanes of traffic. The improvements will provide pedestrians and bicyclists a safe continuous pedestrian and bike path for the SR 520 Regional Shared Use Path. This will include placing a tunnel under NE 40th Street.

This storm drainage report provides stormwater requirements and design calculations for the proposed site.

The project site is located within both Section 14, Township 25 North, Range 5 East, Willamette Meridian and Section 23, Township 25 North, Range 5 East, Willamette Meridian. Figure 1 illustrates the location of the site relative to the surrounding area. The site is bordered by commercial properties to the west and SR 520 to the east.

Figure 1. Vicinity Map
1.1 Existing Conditions

The entire project is comprised of one Threshold Discharge Area (TDA). Figure 2 illustrates the project’s TDA boundary delineation. A detailed description of the downstream analysis is provided in Section 3.

The project site is surrounded by commercial properties to the west and SR 520 to the east. In general, the SR 520 trail slopes from the north to the south. Runoff from the trail is collected by a series of catch basins which connect to the adjacent storm drain systems along the SR 520 westbound off- and on-ramps. NE 40th Street is crowned where runoff from the north portion sheet flows north towards the SR 520 westbound off-ramp storm drain system. Similarly, the south portion of NE 40th Street slopes southerly towards the SR 520 westbound on-ramp storm drain system. Runoff from both on- and off-ramps eventually combine within a ¼ mile.

1.2 Proposed Conditions

The project will provide a continuous 14-foot wide multiuse trail at the west leg of the NE 40th Street and SR 520 Westbound ramp terminal intersection. The multiuse trail will go under NE 40th Street while still providing at grade sidewalk access to NE 40th Street. A storm drain system will be placed along the proposed multiuse trail and connect to the existing system along the SR 520 westbound on-ramp. The catch basins will collect all of the runoff from the new trail.
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2 Conditions and Requirements Summary

The stormwater requirements for this project will be evaluated and designed in accordance with the following standards and manuals.

- Redmond Municipal Code (RMC) Chapter 15.24

The proposed project is classified as a “Large Project” per Section 3.5 of the Stormwater Notebook. This project is classified as a Large Project since it will exceed 5,000 square feet of new impervious area. Therefore Minimum Requirements #1-9 will be triggered. Based on the flowchart, Minimum Requirements will apply to only the new hard surfaces and converted vegetation areas since the project does not add 50% or more of the existing hard surface. The Minimum Requirements Flowchart is shown in Figure 3 on the following page.
Figure 3. Minimum Requirements Flow Chart
2.1 Minimum Requirements

Minimum Requirement #1:

Preparation of Stormwater Site Plans: Separate Civil Plans and Storm Drainage Report herein have been prepared for the subject project. The proposed project is classified as a “Large Project” per Section 3.5 of the Stormwater Notebook.

Minimum Requirement #2:

Construction Stormwater Pollution Prevention Plan (SWPPP): All redevelopment for this project shall comply with the Construction SWPPP Element #1 through Element #13 listed in the 2012 DOE Stormwater Manual. The project disturbs more than 2,000 square feet of land and will require a Construction SWPPP. An NPDES permit is not required as the total site disturbance is less than one acre.

The Construction SWPPP for the project shall include a narrative and drawings. The Contractor will be responsible for developing the Construction SWPPP, including modifying the engineering plans and narrative as necessary, prior to any construction activity. The following provides a brief explanation of temporary erosion control and construction stormwater pollution prevention best management practices (BMPs) selected during the design phase. The final Construction SWPPP shall include the 13 required elements unless site conditions render the element unnecessary. The Construction SWPPP shall include a spill prevention plan and emergency/incident response plan for the construction period.

2.1.1 Element 1: Preserve Vegetation/Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed during construction, the limits of construction shall be clearly marked with high visibility fence before land-disturbing activities begin. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible. The BMPs relevant to marking the clearing limits that will be applied to this project include:

- BMP C101: Preserving Natural Vegetation
- BMP C103: High Visibility Plastic or Metal Fence

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads. Street sweeping and street cleaning shall be employed to prevent sediment from entering state waters. There will be no washing of pavements and streets. Pavement shall be swept or vacuumed.
2.1.3 Element 3: Control Flow Rates

Controlling of flow rates from stormwater runoff is not anticipated to be necessary for the project area during construction. Stormwater runoff shall be properly discharged during construction to avoid downstream erosion due to increases in velocity and peak flow rate from the project site.

2.1.4 Element 4: Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility. The specific BMPs to be used for controlling sediment on this project include:

- BMP C220: Storm Drain Inlet Protection
- BMP C233: Silt Fence
- BMP C235: Wattles

Inlet protection shall be installed on all existing and new grate inlets and any inlets within 200 feet downstream of the work limits. Silt fence or wattles shall be installed in all areas (including construction staging areas) where the hydraulic gradient will otherwise allow the flow of sediment laden water to adjacent properties or to undisturbed areas of the site. Wattles to be held in place with spring expandable mesh units. Contractor to contact City staff for additional approved BMPs.

2.1.5 Element 5: Stabilize Soils

For areas outside of the roadway, the final surfacing such as topsoil, mulch, and seeding or planting shall be installed as soon as is practical with temporary cover methods being implemented only if necessary. The Contractor shall follow the City’s requirements for wet and dry season work. The following BMPs are to be used for soil stabilization:

- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP C123: Plastic Covering

2.1.6 Element 6: Protect Slopes

Temporary cover methods described in Element 5 shall be used at a minimum to stabilize soils on slopes.
2.1.7 Element 7: Protect Drain Inlets

Inlet protection shall be installed on all existing catch basins within the project limits and 200 feet downstream prior to the beginning of any ground breaking activity. Inlet protection shall also be installed on new catch basins after they have been set in place.

- BMP C220: Storm Drain Inlet Protection

2.1.8 Element 8: Stabilize Channels and Outlets

This project does not involve temporary channels and outlets needing stabilization. Permanent outfalls shall be stabilized as quickly as practical during construction in order to prevent downstream erosion.

2.1.9 Element 9: Control Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater, soils or groundwater. Good housekeeping and preventative measures shall be taken to ensure that the site will be kept clean, well-organized, and free of debris. BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. The following specific BMPs will be used to control pollutants for this project:

- BMP C151: Concrete Handling
- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C153: Material Delivery, Storage and Containment
- BMP C154: Concrete Washout Area
- Dechlorination

2.1.10 Element 10: Control De-Watering

All dewatering water from open cut excavation, tunneling, foundation work, trench, or underground vaults shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Channels will be stabilized, per Element #8. Clean, non-turbid dewatering water will not be routed through stormwater sediment ponds, and will be discharged to systems tributary to the receiving waters of the State in a manner that does not cause erosion, flooding, or a violation of State water quality standards in the receiving water. Highly turbid dewatering water from soils known or suspected to be contaminated, or from the use of construction equipment, will require additional monitoring and treatment as required for the specific pollutants based on the receiving waters into which the discharge is occurring. Such monitoring is the responsibility of the contractor.

However, the dewatering of soils known to be free of contamination will trigger BMPs to trap sediment and reduce turbidity. At a minimum, geotextile fabric socks/bags/cells will be used to filter this material. Other BMPs to be used for sediment trapping and turbidity reduction include the following:

- Concrete Handling (BMP C151)
• Construction Stormwater Chemical Treatment (BMP C250)
• Construction Stormwater Filtration (BMP C251)
• Use of a sedimentation bag, with outfall to a ditch or swale for small volumes of localized dewatering
• Dechlorination
• Alternative BMPs not included in the SWMMWW (2014) or SWMMEW (2004)

2.1.11 Element 11: Maintain BMPs

All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMPs specifications. Visual monitoring of the BMPs will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive, and is temporarily stabilized, the inspection frequency will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

2.1.12 Element 12: Manage the Project

Inspection and Monitoring

All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. This person has the necessary skills to:

• Assess the site conditions and construction activities that could impact the quality of stormwater, and
• Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

A Certified Erosion and Sediment Control Lead shall be onsite or on-call at all times. Whenever inspection and/or monitoring reveals that the BMPs identified in this SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.
Maintaining an Updated Construction SWPPP

The SWPPP shall be retained onsite or within reasonable access to the site. The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

2.1.13 Element 13: Protect Low Impact Development BMPs

For this project there are no existing or proposed Low Impact Development BMPs.

Minimum Requirement #3:

Source Control of Pollution: Source control BMPs for construction are addressed in the Construction SWPPP (MR #2). Operational and structural source control BMPs shall be implemented as applicable.

Minimum Requirement #4:

Preservation of Natural Drainage Systems and Outfalls: Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. Discharge from the site is to the existing natural discharge location. See Section 3 of this report for the downstream analysis and discussion of the natural discharge location. The stormwater runoff for the project site will be conveyed to the existing tight line pipe system located along the SR 520 westbound on-ramp.

Minimum Requirement #5:

On-Site Stormwater Management: Per the Technical Notebook Appendix B Minimum Requirement 5 Map, the site falls within the Standard Low Impact Development (LID) zone. Projects are required to implement On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing flooding or erosion impacts.

Project proponents shall use DOE’s 2012 Stormwater Management Manual for Western Washington: Volume I of Section 2.5.5, Chapter 3 of Volume III, and Chapter 5 of Volume V to determine which on-site stormwater management BMPs shall be employed on a particular site, and document the determination in the Stormwater Site Plan (Drainage report).
This project directly discharges to Lake Sammamish where Lake Sammamish is a flow exempt water body. Per Figure 2.5.1 (Figure 4) this project shall implement specific On-site Stormwater Management BMPs where feasible.
Figure 4. On-Site Stormwater Management

Figure I-2.5.1
Flow Chart for Determining LID MR #5
Requirements

*Recommended by Ecology for projects triggering MRs #1 - #5.

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storm Drainage Report
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Redmond, Washington
Per the flow chart the following BMPs were considered for the site:

Lawn and Landscaped areas:

- Post construction Soil Quality and Depth in accordance with BMP T5.13: Post-Construction Soil Quality and Depth

  **Response:** Amended soils will be used in proposed landscaped areas where feasible according to BMP T5.13 of the DOE Manual.

Roofs:

- BMP T5.10A: Downspout Full Infiltration.
- Downspout Dispersion Systems in accordance with BMP T5.10B: Downspout Dispersion Systems.
- Perforated Stub-out Connections in accordance with BMP T5.10C: Perforated Stub-out Connections.

  **Response:** N/A – This project does not contain roofs.

Other Hard Surfaces:

- Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11: Concentrated Flow Dispersion.

  **Response:** Sheet flow dispersion is not feasible for this project due to the nature of developed urban areas containing relatively small amounts of pervious land cover. The minimum vegetated flow path for sheet flow dispersion cannot be met.
Minimum Requirement #6:

Runoff Treatment: Runoff treatment for this project is not required because the pollution generating hard surface (PGHS) is less than the 5,000 square feet threshold. This project is a trail project where all new hard surface will be non-pollution generating. The project will not add new PGHS.

Minimum Requirement #7:

Flow Control: Flow control for this project is not required because the project discharges directly to Lake Sammamish through a conveyance system. Lake Sammamish is listed as a flow control exempt waterbody.

Minimum Requirement #8:

Wetlands Protection: This requirement applies only to projects whose stormwater discharges into a wetland, either directly or indirectly through a conveyance system. There are no wetlands located on site or off site in proximity to the project. No additional protection measures are required.

Minimum Requirement #9:

Operation and Maintenance: The project will add a new storm drain system along the multiuse trail. This system will be maintained by WSDOT. As a reference, typical operation and maintenance information is provided in Section 6 of this report.
3 Off-Site Analysis

An off-site analysis has been completed by conducting a site visit and using county maps, City GIS maps, project survey information, and King County iMAP services. The site is bordered by commercial properties on both the west side and SR 520 to the east. This analysis follows the proposed site discharge for approximately ¼ mile downstream from the site location. There were no observed drainage problems in the ¼ mile downstream analysis.

The project site is located within City of Redmond Watershed No. 260, which is part of the Sammamish River Drainage Basin and WRIA No. 8 (Cedar-Sammamish). The project location is identified on City of Redmond’s Watershed Map in Figure 5.

Figure 5. City of Redmond Watershed Map

The downstream analysis shows that the project is comprised of one TDA. See Figure 6 for the downstream flow path and discharge locations.
Figure 6. Downstream Analysis
Within the project limits, the existing bike trail generally slopes from the north towards the south. Runoff is collected by a storm drain system along the trail, which then connects to the adjacent SR 520 on and off-ramp systems. The two areas, north and south of NE 40th Street, are considered a single TDA due to the downstream drainage paths combining within ¼ mile.

For the trail portion north of NE 40th Street (Image 1), runoff enters a 12-inch enclosed storm drain system along the trail (Image 2) which connects to the SR 520 westbound off-ramp where the system continues northerly down the off-ramp towards SR 520 (Image 3). Based on City GIS and WSDOT as-built plans, from that point the system crosses under SR 520 through an 18-inch concrete culvert towards the eastbound shoulder where the system then travels southerly along the SR 520 eastbound shoulder towards the Sound Transit Overlake Transit Center property located on the east of SR 520. This property is located near the intersection of NE 40th Street and 156th Avenue NE.

Similarly south of NE 40th Street, the SR 520 bike trail slopes to the south (Image 4). Runoff enters the adjacent 12-inch storm drain system along the trail (Image 5), which connects to the SR 520 eastbound on-ramp system. The storm drain system conveys runoff southerly down the on-ramp (Image 6). Based on City GIS and WSDOT as-built, from that point the system crosses under SR 520 through a 30-inch concrete pipe towards the SR 520 eastbound shoulder where the system then travels north towards the Sound Transit property.

Based on as-built drawings, the Sound Transit property contains a detention vault. The vault discharges to an existing 48-inch diameter storm drain system along NE 40th Street which eventually outfalls to Lake Sammamish. This vault has since been removed due to the recent Sound Transit East Link project where the area now directly discharges to Lake Sammamish.
Image 1: SR 520 Trail - North of NE 40th Street
(photo taken at north end of project, facing south)
Image 2: SR 520 Trail - North of NE 40th Street
(photo taken at NE 40th Street, facing north)
Image 3: SR 520 WB Off-Ramp
(photo taken at NE 40th Street, facing north)
Image 4: SR 520 Trail - South of NE 40th Street
(photo taken at NE 40th Street, facing south)
Image 5: SR 520 Trail - South of NE 40th Street
(photo taken at south end of project, facing north)
Image 6: SR 520 WB On-Ramp
(photo taken at south end of project, facing south)
4  Basin Analysis & Design

4.1  Soil Information

Soil information for the project was obtained from the Web Soil Survey website (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx) published by the United States Department of Agriculture Natural Resources Conservation Service (NRCS) as a soil report. The primary soil type which exists within the project area described by the NRCS is Alderwood gravelly sandy loam, 0 to 8 percent slopes in Hydrologic Group B. The NRCS Soil Map is located in Appendix B. The DOE’s 2012 Stormwater Management Manual for Western Washington, as amended in 2014 (SWMMWW), classifies the soil as till, Hydrologic Group Type C.

4.2  Pre-Development Condition

The project is located in a highly developed area surrounded by commercial properties. The majority of the project site is impervious with landscaped areas along the existing trail.

Existing site conditions are described under Section 1. Pre-Developed areas are shown on Figure 3. The downstream flow paths are described in Section 3.

The quantities of existing impervious and pervious surfaces are listed in Table 1.

<table>
<thead>
<tr>
<th>Pre-Developed Area</th>
<th>Square Feet</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Pollution Generating Hard Surface</td>
<td>48,480</td>
<td>1.11</td>
</tr>
<tr>
<td>Existing Non-Pollution Generating Hard Surface</td>
<td>15,510</td>
<td>0.35</td>
</tr>
<tr>
<td>Existing Pervious Surface</td>
<td>11,480</td>
<td>0.26</td>
</tr>
<tr>
<td>Total Site Area</td>
<td>75,470</td>
<td>1.73</td>
</tr>
</tbody>
</table>

Percent Existing Hard Surface 85%
4.3 Post-Development Condition

The developed site results in approximately 6,880 square feet of new non-pollution generating hard surface. There is also approximately 11,490 square feet of replaced hard surface for restoring NE 40th Street. A breakdown of surface areas is shown in Table 2 and shown in Figure 7.

Table 2. Developed Areas

<table>
<thead>
<tr>
<th>Developed Area</th>
<th>Square Feet</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replaced Hard Surface</td>
<td>11,490</td>
<td>0.26</td>
</tr>
<tr>
<td>New Pollution Generating Hard Surface</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>New Non-Pollution Generating Hard Surface</td>
<td>6,880</td>
<td>0.16</td>
</tr>
</tbody>
</table>

4.4 Performance Standards

Flow Control & Water Quality Performance Standards: The project is exempt from flow control and water quality.

Conveyance System Capacity Standards: The new conveyance system has been designed with sufficient capacity to convey and contain the 50-year peak flow.
5 Conveyance System Analysis and Design

Conveyance System Capacity Standards: The project will require a new 12-inch storm drain system along the multiuse trail.

For basic conveyance system design, the WSDOT Hydraulics Manual was used for analyzing the pipe size.

The "Storm Drain Design" Microsoft Excel spreadsheet based on the WSDOT Hydraulics Manual was used. For calculating the Index to Rainfall Coefficient, m and n values for the 50-year event were used.

Information from WSDOT as-built plans were used in analyzing the downstream storm drain capacity to the existing Sound Transit Vault.

Inlet Spacing: For the new 12-inch storm drain system, gutter and inlet spacing design used the “Inlet Spacing with Side Flow” Microsoft Excel spreadsheet based on the WSDOT Hydraulics Manual.

The flow along the trail edge was also checked where there are walls preventing sheet flow off the trail. The inlet spacing generates a maximum flow spread of 2.5 feet in a 10-year storm event. This 2.5 feet includes the 2-foot shoulder and 0.5 feet of the 10-foot lane. This flow spread is less than half of the lane width, which is reasonable.

Calculations for inlet spacing can be found in Appendix C.
6 Maintenance and Operations Manual

Facilities on the trail will be maintained by WSDOT. The elements of the installed system requiring maintenance are listed below.

- Catch Basins – Standard maintenance per current maintenance practices.
- Pipes and Ditches – Standard maintenance per current maintenance practices.

WSDOT will continue to maintain the replaced catch basins on the westbound SR 520 on-ramp.
### NO. 5 – CATCH BASINS AND MANHOLES

<table>
<thead>
<tr>
<th>Maintenance Component</th>
<th>Defect or Problem</th>
<th>Condition When Maintenance is Needed</th>
<th>Results Expected When Maintenance is Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Sediment</td>
<td>Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.</td>
<td>Sump of catch basin contains no sediment.</td>
</tr>
<tr>
<td></td>
<td>Trash and debris</td>
<td>Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.</td>
<td>No Trash or debris blocking or potentially blocking entrance to catch basin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trash or debris in the catch basin that exceeds ½ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.</td>
<td>No trash or debris in the catch basin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).</td>
<td>No dead animals or vegetation present within catch basin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deposits of garbage exceeding 1 cubic foot in volume.</td>
<td>No condition present which would attract or support the breeding of insects or rodents.</td>
</tr>
<tr>
<td></td>
<td>Damage to frame and/or top slab</td>
<td>Corner of frame extends more than ¼ inch past curb face into the street (if applicable).</td>
<td>Frame is even with curb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.</td>
<td>Top slab is free of holes and cracks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frame not sitting flush on top slab, i.e., separation of more than ¼ inch of the frame from the top slab.</td>
<td>Frame is sitting flush on top slab.</td>
</tr>
<tr>
<td></td>
<td>Cracks in walls or bottom</td>
<td>Cracks wider than ¼ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.</td>
<td>Catch basin is sealed and is structurally sound.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cracks wider than ¼ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.</td>
<td>No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.</td>
</tr>
<tr>
<td></td>
<td>Settlement/ misalignment</td>
<td>Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.</td>
<td>Basin replaced or repaired to design standards.</td>
</tr>
<tr>
<td></td>
<td>Damaged pipe joints</td>
<td>Cracks wider than ¼-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.</td>
<td>No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.</td>
</tr>
<tr>
<td></td>
<td>Contaminants and pollution</td>
<td>Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.</td>
<td>Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.</td>
</tr>
<tr>
<td></td>
<td>Inlet/Outlet Pipe</td>
<td>Sediment accumulation</td>
<td>Sediment filling 20% or more of the pipe.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trash and debris</td>
<td>Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Damaged</td>
<td>Cracks wider than ¼-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.</td>
</tr>
<tr>
<td>Maintenance Component</td>
<td>Defect or Problem</td>
<td>Condition When Maintenance is Needed</td>
<td>Results Expected When Maintenance is Performed</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Metal Grates (Catch Basins)</td>
<td>Unsafe grate opening</td>
<td>Grate with opening wider than 7/8 inch.</td>
<td>Grate opening meets design standards.</td>
</tr>
<tr>
<td></td>
<td>Trash and debris</td>
<td>Trash and debris that is blocking more than 20% of grate surface.</td>
<td>Grate free of trash and debris. Footnote to guidelines for disposal</td>
</tr>
<tr>
<td></td>
<td>Damaged or missing</td>
<td>Grate missing or broken member(s) of the grate. Any open structure requires urgent maintenance.</td>
<td>Grate is in place and meets design standards.</td>
</tr>
<tr>
<td>Manhole Cover/Lid</td>
<td>Cover/lid not in place</td>
<td>Cover/lid is missing or only partially in place. Any open structure requires urgent maintenance.</td>
<td>Cover/lid protects opening to structure.</td>
</tr>
<tr>
<td></td>
<td>Locking mechanism Not Working</td>
<td>Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.</td>
<td>Mechanism opens with proper tools.</td>
</tr>
<tr>
<td></td>
<td>Cover/lid difficult to Remove</td>
<td>One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.</td>
<td>Cover/lid can be removed and reinstalled by one maintenance person.</td>
</tr>
</tbody>
</table>
# NO. 6 – CONVEYANCE PIPES AND DITCHES

<table>
<thead>
<tr>
<th>Maintenance Component</th>
<th>Defect or Problem</th>
<th>Conditions When Maintenance is Needed</th>
<th>Results Expected When Maintenance is Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>Sediment &amp; debris accumulation</td>
<td>Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.</td>
<td>Water flows freely through pipes.</td>
</tr>
<tr>
<td></td>
<td>Vegetation/roots</td>
<td>Vegetation/roots that reduce free movement of water through pipes.</td>
<td>Water flows freely through pipes.</td>
</tr>
<tr>
<td></td>
<td>Contaminants and pollution</td>
<td>Any evidence of contaminants or pollution such as oil, gasoline, concrete stains or paint.</td>
<td>Materials removed and disposed according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.</td>
</tr>
<tr>
<td></td>
<td>Damage to protective coating or corrosion</td>
<td>Protective coating is damaged: rust or corrosion is weakening the structural integrity of any part of pipe.</td>
<td>Pipe repaired or replaced.</td>
</tr>
<tr>
<td></td>
<td>Damaged</td>
<td>Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.</td>
<td>Pipe repaired or replaced.</td>
</tr>
<tr>
<td>Ditches</td>
<td>Trash and debris</td>
<td>Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.</td>
<td>Trash and debris cleared from ditches.</td>
</tr>
<tr>
<td></td>
<td>Sediment accumulation</td>
<td>Accumulated sediment that exceeds 20% of the design depth.</td>
<td>Ditch cleaned/flushed of all sediment and debris so that it matches design.</td>
</tr>
<tr>
<td></td>
<td>Noxious weeds</td>
<td>Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.</td>
<td>Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.</td>
</tr>
<tr>
<td></td>
<td>Contaminants and pollution</td>
<td>Any evidence of contaminants or pollution such as oil, gasoline, concrete stains or paint.</td>
<td>Materials removed and disposed according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.</td>
</tr>
<tr>
<td></td>
<td>Vegetation</td>
<td>Vegetation that reduces free movement of water through ditches.</td>
<td>Water flows freely through ditches.</td>
</tr>
<tr>
<td></td>
<td>Erosion damage to slopes</td>
<td>Any erosion observed on a ditch slope.</td>
<td>Slopes are not eroding.</td>
</tr>
<tr>
<td></td>
<td>Rock lining out of place or missing (If Applicable)</td>
<td>One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.</td>
<td>Replace rocks to design standards.</td>
</tr>
</tbody>
</table>
APPENDIX A:
TEMPORARY EROSION AND SEDIMENT CONTROL (TESC), ROADWAY AND DRAINAGE PLANS
PAVING NOTES

1. New Main Pavement Area
2. Trail Pavement Area
3. Terrace Pavement Area
4. Permeable Concrete Ramp Per AASHTO Standard F-10-01-03 Type A
5. Install Concrete Curb and Gutter per C.o.R. Detail Number 304
6. Install Concrete Extruded Curb per C.o.R. Std. Detail 304A
7. Pedestrian Rail See Wall Plans
8. Chain Link Fence Type 3 Per AASHTO Standard L-2010-03
9. Retaining Wall / Fence See Wall Plans

DRAINAGE NOTES

1. Provide and Install Catch Basin Type 1 with a Rectangular Frame Drain per AASHTO Plans 5-00-10-02 and 5-00-11-03.
2. Provide and Install Catch Basin Type 2 - 47" Drain with a Rectangular Frame Drain per AASHTO Plans 5-00-10-02 and 5-00-11-03.
3. Provide and Schedule a Storm Sewer Pipe 12-inch drain with special provisions 1.5m for city approved schedule a pipe material, pipe zone bedding and backfill per AASHTO Plans 5-00-10-02.
5. Connect Proposed Pipe to Existing Structure.
6. Provide Existing Catch Basin During Construction. Catch Basin to Remain
7. Remove Existing Drainage Pipe
8. Remove Existing Drainage Structure
9. Remove Catch Basin Per Detal. Section
10. Provide and Schedule a Storm Sewer Pipe 6-inch drain with special provisions 1.5m for city approved schedule a pipe material, pipe zone bedding and backfill per AASHTO Plans 5-00-10-02.
11. Provide and Install Stormwater Cleanout for city of Redmond Standard Details 012.
12. Provide and Install Five Storm Pipe 8-inch drain with special provisions 1.5m for city approved schedule a pipe material pipe zone bedding and backfill per AASHTO Plans 5-00-10-02.
13. Connect Wall Undersides to Proposed Structure.
14. Provide and Install Manhole 47" drain with a Rectangular Frame Drain per AASHTO Plans 5-00-10-02 and 5-00-11-03.

GENERAL NOTES

1. See sheet 2 for legend and abbreviations.
2. Preserve and protect any existing facilities to remain.
3. Payment Delay Section Shall Match the Profile of the Existing Grade.
4. For Storm Drainage Locations See Sheets 492-00-00 to 492-99-00.
5. Adjust all surface utilities and monuments within the Paving Area to Grade After Construction.
6. All Loop Lead-in Storm-Outs Shall Be Replaced After Grading.
7. Pedestrian Stairs and Handrail Per Detail Sheets 600-00/900-000

Call 48 Hours Before Dig
1-800-424-5555

City of Redmond

520 Trail Grade Separation
At NE 40th Street

90% Submittal

Plan and Profile

City of Redmond
GENERAL NOTES

1. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL COMPLETE EXISTING STRUCTURAL UTILITY/STRUCTURAL UTILITY PRIOR TO CONSTRUCTION.

2. THE CONTRACTOR SHALL RETRIEVE ALL POTENTIAL CONFLICTS WITH UTILITY TO VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES. WHERE THE VERTICAL DISTANCE BETWEEN UTILITIES IS LESS THAN 6 INCHES, THE CONTRACTOR SHALL PROVIDE AN (0.000001) X 0.0001 BUR STABILIZATION PIPES PRIOR TO THE SPECIAL PROVISIONS 7-08.03.01

3. ALL DRAINAGE STRUCTURES ARE LOCATED BY STATION AND OFFSET OF CENTERLINE OF UTILITY TO ASSEMBLE STRUCTURE TO NEW STRUCTURE.

4. ALL DRAINAGE PIPE SHALL BE SCHEDULE A. SEE SPECIAL PROVISIONS 7-04 FOR CITY APPROVED SCHEDULE A PIPE MATERIAL.

5. ALL GRADES SHALL BE ADA COMPLIANT. DURABLE, DURABLE, DURABLE GRADES PER THE STANDARDS.

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

DRAINAGE PROFILE 1

DRAINAGE PROFILE 2

520 TRAIL GRADE SEPARATION
AT NE 40TH STREET

SOP02
APPENDIX B:

NRCS SOIL INFORMATION
Soil Map—King County Area, Washington

Natural Resources Conservation Service
Web Soil Survey National Cooperative Soil Survey

7/2/2018 Page 1 of 3
The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 13, Sep 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
## Map Unit Legend

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AgB</td>
<td>Alderwood gravelly sandy loam, 0 to 8 percent slopes</td>
<td>0.9</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Totals for Area of Interest  
0.9  
100.0%
King County Area, Washington

AgB—Alderwood gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t625
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)

Hydric soil rating: No

Minor Components

Mckenna
Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Everett
Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Shalcar
Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma
Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 13, Sep 7, 2017
over 4,000 soil types into these four soil groups. Table III-2.3.1 Hydrologic Soil Series for Selected Soils in Washington State (p.439) shows the hydrologic soil group of most soils in the state of Washington and provides a brief description of the four groups. For details on other soil types refer to the NRCS publication mentioned above (TR-55, 1986).

### Table III-2.3.1 Hydrologic Soil Series for Selected Soils in Washington State

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnew</td>
<td>C</td>
<td>Hoogdal</td>
<td>C</td>
<td>Raught</td>
<td>B</td>
</tr>
<tr>
<td>Ahl</td>
<td>B</td>
<td>Hoypus</td>
<td>A</td>
<td>Reed</td>
<td>D</td>
</tr>
<tr>
<td>Aits</td>
<td>C</td>
<td>Huel</td>
<td>A</td>
<td>Reed, Drained or Protected</td>
<td>C</td>
</tr>
<tr>
<td>Alderwood</td>
<td>C</td>
<td>Indianoloa</td>
<td>A</td>
<td>Renton</td>
<td>D</td>
</tr>
<tr>
<td>Arents, Alderwood</td>
<td>B</td>
<td>Jonas</td>
<td>B</td>
<td>Republic</td>
<td>B</td>
</tr>
<tr>
<td>Arents, Everett</td>
<td>B</td>
<td>Jumpe</td>
<td>B</td>
<td>Riverwash</td>
<td>variable</td>
</tr>
<tr>
<td>Ashoe</td>
<td>B</td>
<td>Kalaloch</td>
<td>C</td>
<td>Rober</td>
<td>C</td>
</tr>
<tr>
<td>Baldhill</td>
<td>B</td>
<td>Kapowsin</td>
<td>C/D</td>
<td>Salal</td>
<td>C</td>
</tr>
<tr>
<td>Bameston</td>
<td>C</td>
<td>Kilchis</td>
<td>C</td>
<td>Salkum</td>
<td>B</td>
</tr>
<tr>
<td>Baungard</td>
<td>B</td>
<td>Kitsap</td>
<td>C</td>
<td>Sammamish</td>
<td>D</td>
</tr>
<tr>
<td>Beausite</td>
<td>B</td>
<td>Klaus</td>
<td>C</td>
<td>San Juan</td>
<td>A</td>
</tr>
<tr>
<td>Belfast</td>
<td>C</td>
<td>Klone</td>
<td>B</td>
<td>Scamman</td>
<td>D</td>
</tr>
<tr>
<td>Bellingham</td>
<td>D</td>
<td>Lates</td>
<td>C</td>
<td>Schneider</td>
<td>B</td>
</tr>
<tr>
<td>Bellingham variant</td>
<td>C</td>
<td>Lebam</td>
<td>B</td>
<td>Seattle</td>
<td>D</td>
</tr>
<tr>
<td>Boistfort</td>
<td>B</td>
<td>Lummi</td>
<td>D</td>
<td>Sekiu</td>
<td>D</td>
</tr>
<tr>
<td>Bow</td>
<td>D</td>
<td>Lynwood</td>
<td>A</td>
<td>Semiahmoo</td>
<td>D</td>
</tr>
<tr>
<td>Bristcot</td>
<td>D</td>
<td>Lystair</td>
<td>B</td>
<td>Shalcar</td>
<td>D</td>
</tr>
<tr>
<td>Buckley</td>
<td>C</td>
<td>Mal</td>
<td>C</td>
<td>Shano</td>
<td>B</td>
</tr>
<tr>
<td>Bunker</td>
<td>B</td>
<td>Manley</td>
<td>B</td>
<td>Shelton</td>
<td>C</td>
</tr>
<tr>
<td>Cagey</td>
<td>C</td>
<td>Meshel</td>
<td>B</td>
<td>Si</td>
<td>C</td>
</tr>
<tr>
<td>Carlsborg</td>
<td>A</td>
<td>Maytown</td>
<td>C</td>
<td>Sinclair</td>
<td>C</td>
</tr>
<tr>
<td>Casey</td>
<td>D</td>
<td>McKenna</td>
<td>D</td>
<td>Skipopa</td>
<td>D</td>
</tr>
<tr>
<td>Cassolary</td>
<td>C</td>
<td>McMurray</td>
<td>D</td>
<td>Skykomish</td>
<td>B</td>
</tr>
<tr>
<td>Cathcard</td>
<td>B</td>
<td>Melbourne</td>
<td>B</td>
<td>Snohipish</td>
<td>B</td>
</tr>
<tr>
<td>Centralia</td>
<td>B</td>
<td>Menzel</td>
<td>B</td>
<td>Snohomish</td>
<td>D</td>
</tr>
</tbody>
</table>
### Table III-2.3.1 Hydrologic Soil Series for Selected Soils in Washington State (continued)

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chehalis</td>
<td>B</td>
<td>Mized Alluvial</td>
<td>variable</td>
<td>Solduc</td>
<td>B</td>
</tr>
<tr>
<td>Chesaw</td>
<td>A</td>
<td>Molson</td>
<td>B</td>
<td>Solleks</td>
<td>C</td>
</tr>
<tr>
<td>Cinebar</td>
<td>B</td>
<td>Mukilteo</td>
<td>C/D</td>
<td>Spana</td>
<td>D</td>
</tr>
<tr>
<td>Calallam</td>
<td>C</td>
<td>Naff</td>
<td>B</td>
<td>Spanaway</td>
<td>A/B</td>
</tr>
<tr>
<td>Clayton</td>
<td>B</td>
<td>Nargar</td>
<td>A</td>
<td>Springdale</td>
<td>B</td>
</tr>
<tr>
<td>Coastal beaches</td>
<td>variable</td>
<td>National</td>
<td>B</td>
<td>Sulavar</td>
<td>B</td>
</tr>
<tr>
<td>Colter</td>
<td>C</td>
<td>Neilton</td>
<td>A</td>
<td>Sultan</td>
<td>C</td>
</tr>
<tr>
<td>Custer</td>
<td>D</td>
<td>Newberg</td>
<td>B</td>
<td>Sultan variant</td>
<td>B</td>
</tr>
<tr>
<td>Custer, Drained</td>
<td>C</td>
<td>Nisqually</td>
<td>B</td>
<td>Sumas</td>
<td>C</td>
</tr>
<tr>
<td>Dabob</td>
<td>C</td>
<td>Nooksak</td>
<td>C</td>
<td>Swantown</td>
<td>D</td>
</tr>
<tr>
<td>Datula</td>
<td>C</td>
<td>Norma</td>
<td>C/D</td>
<td>Tacoma</td>
<td>D</td>
</tr>
<tr>
<td>Delphi</td>
<td>D</td>
<td>Ogarty</td>
<td>C</td>
<td>Tanwax</td>
<td>D</td>
</tr>
<tr>
<td>Dick</td>
<td>A</td>
<td>Olete</td>
<td>C</td>
<td>Tanwax, Drained</td>
<td>C</td>
</tr>
<tr>
<td>Dimal</td>
<td>D</td>
<td>Olomount</td>
<td>C</td>
<td>Tealwhit</td>
<td>D</td>
</tr>
<tr>
<td>Dupont</td>
<td>D</td>
<td>Olympic</td>
<td>B</td>
<td>Tenino</td>
<td>C</td>
</tr>
<tr>
<td>Earlmont</td>
<td>C</td>
<td>Orcas</td>
<td>D</td>
<td>Tisch</td>
<td>D</td>
</tr>
<tr>
<td>Edgewick</td>
<td>C</td>
<td>Orida</td>
<td>D</td>
<td>Tokul</td>
<td>C</td>
</tr>
<tr>
<td>Eld</td>
<td>B</td>
<td>Orting</td>
<td>D</td>
<td>Townsend</td>
<td>C</td>
</tr>
<tr>
<td>Elwell</td>
<td>B</td>
<td>Oso</td>
<td>C</td>
<td>Trition</td>
<td>D</td>
</tr>
<tr>
<td>Esquatzel</td>
<td>B</td>
<td>Ovall</td>
<td>C</td>
<td>Tukwila</td>
<td>D</td>
</tr>
<tr>
<td>Everett</td>
<td>A</td>
<td>Pastik</td>
<td>C</td>
<td>Tukey</td>
<td>C</td>
</tr>
<tr>
<td>Everson</td>
<td>D</td>
<td>Pheeney</td>
<td>C</td>
<td>Urbana</td>
<td>C</td>
</tr>
<tr>
<td>Galvin</td>
<td>D</td>
<td>Phelan</td>
<td>D</td>
<td>Vailton</td>
<td>B</td>
</tr>
<tr>
<td>Getchell</td>
<td>A</td>
<td>Pilchuck</td>
<td>C</td>
<td>Verlot</td>
<td>C</td>
</tr>
<tr>
<td>Giles</td>
<td>B</td>
<td>Potchub</td>
<td>C</td>
<td>Wapato</td>
<td>D</td>
</tr>
<tr>
<td>Godfrey</td>
<td>D</td>
<td>Poulisbo</td>
<td>C</td>
<td>Warden</td>
<td>B</td>
</tr>
<tr>
<td>Greenwater</td>
<td>A</td>
<td>Prather</td>
<td>C</td>
<td>Whidbey</td>
<td>C</td>
</tr>
<tr>
<td>Grove</td>
<td>C</td>
<td>Puget</td>
<td>D</td>
<td>Wilkeson</td>
<td>B</td>
</tr>
<tr>
<td>Harstine</td>
<td>C</td>
<td>Puyallup</td>
<td>B</td>
<td>Winston</td>
<td>A</td>
</tr>
<tr>
<td>Harntit</td>
<td>C</td>
<td>Queets</td>
<td>B</td>
<td>Woodinville</td>
<td>B</td>
</tr>
<tr>
<td>Hoh</td>
<td>B</td>
<td>Quilcene</td>
<td>C</td>
<td>Yelm</td>
<td>C</td>
</tr>
</tbody>
</table>
Table III-2.3.1 Hydrologic Soil Series for Selected Soils in Washington State (continued)

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
<th>Soil Type</th>
<th>Hydrologic Soil Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holo</td>
<td>C</td>
<td>Ragnar</td>
<td>B</td>
<td>Zynbar</td>
<td>B</td>
</tr>
<tr>
<td>Hoodspoor</td>
<td>C</td>
<td>Rainier</td>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

Hydrologic Soil Group Classifications, as defined by the Soil Conservation Service:

A= (Low runoff potential). Soils having low runoff potential and high infiltration rates, even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 0.30 in/hr.).

B = (Moderately low runoff potential). Soils having moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.3 in/hr.).

C = (Moderately high runoff potential). Soils having low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine textures. These soils have a low rate of water transmission (0.05-0.15 in/hr.).

D = (High runoff potential). Soils having high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a hardpan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr.).


Additional Note: Where field infiltration tests indicate a measured (initial) infiltration rate less than 0.30 in/hr, the WWHM user may model the site as a C soil.

Table III-2.3.2 Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas (p.443) shows the CNs, by land use description, for the four hydrologic soil groups. These numbers are for a 24-hour duration storm and typical antecedent soil moisture condition preceding 24 hour storms.

The following are important criteria/considerations for selection of CN values:

Many factors may affect the CN value for a given land use. For example, the movement of heavy equipment over bare ground may compact the soil so that it has a lesser infiltr-
APPENDIX C:

CONVEYANCE AND INLET SPACING
### STORM SEWER DESIGN (English Units)

This spreadsheet incorporates a rational method using the rational method. Enter the data in the non-shaded areas only.

#### Project Name: 520 Trail Grade Separation at NE 40th Street

**Designed By:** WSDOT

**Project Office:** Bellevue

<table>
<thead>
<tr>
<th>No.</th>
<th>STA</th>
<th>Design Storm Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>506+09</td>
<td>11/8/2018</td>
</tr>
</tbody>
</table>

#### Design Storm Event =

- **Project Name:** 520 Trail Grade Separation at NE 40th Street
- **Designed By:** WSDOT
- **Project Office:** Bellevue

#### Pipe Thickness (inches) =

- **Pavement thickness (ft):**


#### Notes:
- Column 12 represents inflow from a storm sewer line, branch, or offsite source that flows into the trunk line being analyzed.
- The conservative assumption is that the flow enters the storm sewer line at the upstream end of the run being analyzed.

#### For pipe cover calculation, Pipe cover = Depth = Pavement thickness - (top of pipe thickness) - (pipe diameter) - (pavement thickness) - (top of pipe thickness) - (pipe diameter) - (pavement thickness).

#### The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2.

#### Please specify the largest pipe thickness of the storm sewer run being analyzed.

#### If analyzing complicated storm sewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to model the conveyance system.

#### Please contact your regional Hydraulic Contact.

#### WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN.

Please report any problems to the WSDOT Hydraulics Office.
STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge Drain</th>
<th>Design Drain Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drain Located On</th>
<th>From Sta.</th>
<th>To Sta.</th>
<th>Source of Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>A (acre)</th>
<th>Runoff Coeff. C</th>
<th>CA (acre)</th>
<th>Sum CA (acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc Across Area</th>
<th>(minutes)</th>
<th>Total Tc = Col. 8a + Tc across pipe length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rainfall Intensity (in/hr)</th>
<th>Runoff (cfs) Contrib. Inflow</th>
<th>Total Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>Manning roughness coefficient</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Slope</th>
<th>Velocity Of Flow</th>
<th>Pipe Capacity</th>
<th>Pipe Velocity Check</th>
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</thead>
<tbody>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Capacity Check (Column 13 vs. Column 17)</th>
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</thead>
<tbody>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
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</tr>
</tbody>
</table>


Notes: Column 12 represents inflow from a storm sewer line, branch, or offsite source that flows into the trunk line being analyzed.

The conservative assumption is that the flow enters the storm sewer system at the upstream end of the run being analyzed.

For pipe size calculations, pipe size = Drainage Area / (Rainfall Intensity - Runoff Coeff. C) (Actual Discharge = Flow / Pipe size; slope calculation = Pipe size / Upstream - Downstream)

The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2. Please specify the largest pipe thickness of the storm sewer run being analyzed.

To calculate the conveyance system, please contact your region Hydraulic Contact.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Office.

Design Storm Event =

Project Name: 520 Trail Grade Separation at NE 40th Street Designed By: 
Project Office: 
Pipe Thickness (inches) = Pavement thickness (ft) =
### Storm Sewer Design (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.

- **Project Name**: 520 Trail Grade Separation at NE 40th Street
- **Designed By**: IHI
- **Project Office**: Bellevue

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge</th>
<th>Drain</th>
<th>Design Drain</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Remarks

- **Drain Located On**: From Sta. To Sta.
- **Source of Drainage**: Drainage Area, A (acre)
- **Runoff Coeff. C**: CA (acre)
- **Sum CA (acre)**
- **Tc Across Area (minutes)**
- **Total Tc = Col. 8a + Tc across pipe length (minutes)**
- **Rainfall Intensity (in/hr)**
- **Runoff (cfs) Contrib. Inflow (cfs)**
- **Total Flow (cfs)**
- **Pipe Dia. (in)**
- **Manning roughness coefficient “n”**
- **Pipe Slope (ft/ft)**
- **Velocity Of Flow (ft/s)**
- **Pipe Capacity (cfs)**
- **Pipe Capacity Check (Column 13 vs. Column 17)**
- **Pipe Length*** (ft)
- **Elevation Change (ft)**
- **Upstr. Invert Elev. (ft)**
- **Downstr. Invert Elev. (ft)**
- **Upstr. Ground Elev. (ft)**
- **Downstr. Ground Elev. (ft)**
- **Upstr. Pipe Cover (ft)**
- **Downstr. Pipe Cover (ft)**
- **Upstr. Pipe Cover Check (ft)**
- **Downstr. Pipe Cover Check (ft)**

**Notes:**
- Column 12 represents inflow from a storm sewer line, branch, or offsite source that flows into the trunk line being analyzed.
- The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.
- For pipe cover calculation, Pipe cover is based on the elevation of the ground or rim elevation - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
- Please specify the largest pipe thickness of the storm sewer run being analyzed.

See WSDOT hydraulic manual 6-5 for explanation of columns: [http://www.wsdot.wa.gov/eesc/design/hydraulics/](http://www.wsdot.wa.gov/eesc/design/hydraulics/)

**WARNING:** START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN.
### STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes storm sewer design using the rational method. Enter the data in the non-shaded areas only.

*Project Name: 520 Trail Grade Separation at NE 40th Street*

#### Remarks
- Project Office: Bellevue
- Designed by: WSH

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge</th>
<th>Drain</th>
<th>Design Drain</th>
<th>Profile</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

#### Drain Located On
- From Sta. 0 + 00 to Sta. 5 + 00

#### Source of Drainage
- Drainage Area: A
- Runoff Coeff. C
- CA (acre)

#### Runoff Inflow
- Runoff (cfs) Contrib.

#### Total Flow
- Total Flow (cfs)

#### Pipe Dia.
- Manning roughness coefficient
- Pipe Slope (ft/ft)

#### Velocity of Flow
- Pipe Capacity (cfs)

#### Pipe Capacity Check
- Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec)

#### Pipe Length
- Elevation Change (ft)
- Upstr. Invert Elev. (ft)
- Downstr. Invert Elev. (ft)
- Upstr. Ground Elev. (ft)
- Downstr. Ground Elev. (ft)

#### Pipe Cover
- Upstr. Pipe Cover (ft)
- Downstr. Pipe Cover (ft)

#### Pipe Cover Check
- Upstr. Pipe Cover Check (ft)
- Downstr. Pipe Cover Check (ft)

---


**Notes:**
- Column 12 represents inflow from a storm sewer line, branch, or offsite source that flows into the trunk line being analyzed.
- The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.
- For pipe cover calculations, please refer to the WSDOT Manual Concrete for Shallow Pipe Cover Installation Fill Height Table 8-11.2
- Please specify the largest pipe thickness of the storm sewer run being analyzed.
- The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
- If analyzing multiple laterals, please provide an example lateral so that you can reference this example lateral in your calculations.
- For more information on hydraulic calculations, please contact your region Hydraulic Contact.

---

**WARNING:** START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN.
STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge</th>
<th>Drain</th>
<th>Design</th>
<th>Drain Profile</th>
<th>Remarks</th>
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</tbody>
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Notes:
- Column 12 represents inflow from a storm sewer line, branch, or offsite source that flows into the trunk line being analyzed.
- The conservative assumption is that the flow enters the storm sewer at the upstream end of the run being analyzed.
- For pipe under calculation, Pipe cover = Drainage - Pipe Slope - Pipe Dia. (see WSDOT Manual Concrete for Shallow Pipe Cover Installations fill Height Table 8-11.2)
- Please specify the largest pipe thickness of the storm sewer run being analyzed.
- The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations fill Height Table 8-11.2
- Please report any problems to the WSDOT HQ Hydraulics Office.
# Inlet Spacing - Curb and Gutter Spreadsheet (English Units)

<table>
<thead>
<tr>
<th>Station</th>
<th>Distance</th>
<th>Width</th>
<th>T-Y</th>
<th>Slope L</th>
<th>Super T</th>
<th>G.W.</th>
<th>G.L.</th>
<th>D</th>
<th>Q</th>
<th>Qbp</th>
<th>Check</th>
<th>Velocity Check</th>
<th>Qbp Check</th>
<th>Comments (L/R)</th>
</tr>
</thead>
<tbody>
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<td>18</td>
<td>14.00</td>
<td>0.01</td>
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<tr>
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<td>14.00</td>
<td>0.06</td>
<td>0.06</td>
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<td>2.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.54</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**For last grate on run of gutter, if spreadsheet shows a value for Vside, check Vside and Qbp (Column S) for compliance. Otherwise, check Vcontinuous and Qbp (Column L) for compliance.**

Please report any problems to WSDOT HQ Hydraulics Office. Spreadsheet is protected but does not require a password to unprotect.
### INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

**Project Name:** 520 Trail Grade Separation at NE 40th Street  
**Project #:** RMDX0062  
**Designed By:** NKW  
**Date:** 7/5/2018  
**Updated:**

<table>
<thead>
<tr>
<th>Station</th>
<th>Distance</th>
<th>Width</th>
<th>T/P</th>
<th>Slope L</th>
<th>Super T</th>
<th>G.W.</th>
<th>G.L.</th>
<th>D</th>
<th>Q</th>
<th>Qbp*</th>
<th>Continuous</th>
<th>Yield**</th>
<th>E</th>
<th>E</th>
<th>Qb</th>
<th>Zd</th>
<th>Zd Check</th>
<th>Velocity Check</th>
<th>Qbp Check</th>
<th>Comments (L/R)</th>
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</tbody>
</table>

Zd ALLOWABLE > Zd DESIGN VELOCITY < 5 FT/SEC

**FOR LAST GRADE ON RUN OF GUTTER, IF SPREADSHEET SHOWS A VALUE FOR Vside, CHECK Vside AND Qbp (COLUMN S) FOR COMPLIANCE. OTHERWISE, CHECK Vcontinuous AND Qbp (COLUMN L) FOR COMPLIANCE.**

PLEASE REPORT ANY PROBLEMS TO WSDOT HQ HYDRAULICS OFFICE. SPREADSHEET IS PROTECTED BUT DOES NOT REQUIRE A PASSWORD TO UNPROTECT.
APPENDIX D:

AS-BUILT
APPENDIX E:

RESOURCE MAPS