OVERLAKE VILLAGE SOUTH SUBAREA STORMWATER INFRASTRUCTURE PLANNING, REDMOND, WASHINGTON

Prepared for
City of Redmond

Prepared by
Herrera Environmental Consultants, Inc.

In conjunction with
HDR Engineering, Inc.

August 4, 2016

HERRERA

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

OVERLAKE VILLAGE SOUTH SUBAREA STORMWATER INFRASTRUCTURE PLANNING, REDMOND, WASHINGTON

Prepared for
City of Redmond
15670 Northeast 85th Street
Redmond, Washington 98052

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206-441-9080

In conjunction with
HDR Engineering, Inc.
500 108th Avenue Northeast, #1200
Bellevue, Washington 98004

August 4, 2016

CONTENTS

1. Introduction 1
2. Background Research 3
   2.1. Project Location 3
   2.2. Soils and Infiltration Rate 3
   2.3. Groundwater 5
      2.3.1. Groundwater Depth 5
      2.3.2. Groundwater Protection 6
      2.3.3. Groundwater Contamination 6
   2.4. Environmentally Critical Areas 6
   2.5. Drainage Complaints 7
   2.6. Regional Infiltration Facility 7
3. Stormwater Analysis and Design 9
   3.1. Opportunities and Constraints 9
   3.2. Stormwater Modeling Approach and Inputs 9
   3.3. Bioretention Design 9
   3.4. Bioretention Modeling and Results 10
      3.4.1. Preliminary Modeling Results 11
      3.4.2. Final Modeling Results 11
   3.5. Assessment of Bioretention Details 12
   3.6. Bioretention Costs 12
   3.7. Developer Toolbox 13
   3.8. Storm Drainage Improvements 13
   3.9. Permeable Pavement 13
   3.10. Public Open House 14
4. Limitations 15
5. References 17

APPENDICES

Appendix A Geotechnical Investigations
Appendix B Opportunities and Constraints Map
Appendix C Bioretention Sizing Graphs
Appendix D Comments on Bioretention Standard Details
Appendix E Developer Toolkit
Appendix F Open House Presentation Board

TABLES

Table 1. MGS Flood Project Location Design Inputs. 9
Table 2. Bioretention Typical Configuration. 10

FIGURES

Figure 1. Overlake Village South Subarea. 4
Figure 2. Typical Bioretention Section. 10

1. INTRODUCTION

The City of Redmond (the City) is engaged in planning for the redevelopment of the Overlake Village South Subarea (subarea). Zoning regulations and goals for the subarea are designed to reward urban density, innovation and sustainability. Redevelopment within the subarea will consist of subdividing large parcels, enhancing the street network, building a shared used pedestrian and bicycle path, raising building height limits, and incorporating low impact development (LID) stormwater development strategies.

In preparation for the redevelopment of the subarea, the City has contracted HDR and Herrera Environmental Consultants (Herrera) to assist in two key objectives:

- Define requirements and options for integrating LID best management practices (BMPs) into the right-of-way.
- Develop a toolkit of LID solutions for developers to use on private parcels.

Herrera's key roles consisted of background research on the subarea as it pertains to stormwater, development of opportunities and constraints maps for stormwater infrastructure planning, initial selection and modeling of stormwater BMPs, Integration of LID BMPs into the proposed street sections for the subarea, providing input on the City's current bioretention standard details, developing a toolkit of BMPs for stormwater infrastructure on private parcels, and development of supporting material for public outreach and engagement.

2. BACKGROUND RESEARCH

Background research and a literature review was conducted by Herrera to identify key opportunities and constraints for stormwater management in the subarea. Information from the following sources was reviewed:

- City of Redmond website
- City of Redmond GIS Database
- King County Interactive Mapping Tool
- Washington Geological Survey – Subsurface Geology Information System
- Groundwater Well Logs
- Washington Department of Ecology – Water Quality Assessment for Washington
- Overlake Planning Documents received from the City of Redmond

Details from the above are discussed in this section of the report.

2.1. PROJECT LOCATION

The subarea is approximately 100 acres in size (approximately 2,000 feet by 1,600 feet) located in the southwest part of the city (see Figure 1). The subarea is bounded by 148th Avenue NE to the west, Bel-Red Road to the south and east, and NE 24th Street to the north.

2.2. SOILS AND INFILTRATION RATE

The subarea has variable soils conditions and infiltration rates. The Redmond-Overlake Basin Geological Mapping Project (Troost 2010) provides extensive discussion on soil mapping efforts carried out within the subarea and immediate vicinity. In general, the subarea consists of soils that include large areas of weathered and unweathered glacial till and recessional outwash deposits (Otak 2010).

Glacial till in its unweathered condition is very dense and relatively impermeable when considering stormwater infiltration. Infiltration rates into unweathered glacial till are generally less than 0.10 inches per hour (Otak 2010). Weathered glacial till is also dense and relatively impermeable when considering stormwater infiltration; however, it is slightly more permeable than the unweathered till. Infiltration rates into weathered glacial till may range from 0.20 to 0.50 inches per hour.

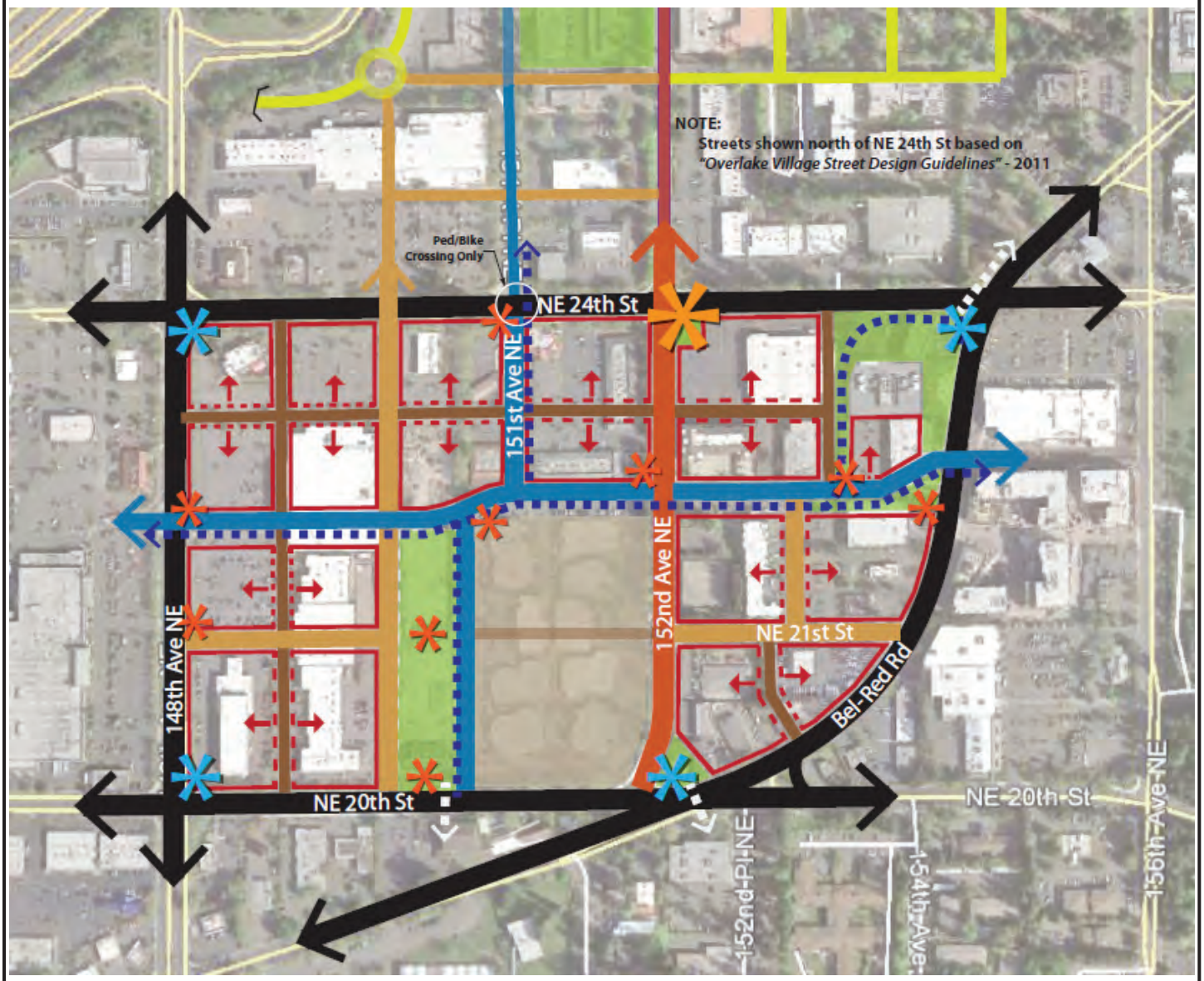


Figure 1.
OVERLAKE VILLAGE SOUTH SUBAREA.

N

0 XX XX XX

Approximate scale in feet

HERRERA

graphics-03-11-08/sm/HEC-R/06-03475-002-125-002/Sediment Transp Memo

Recessional outwash deposits consist of sand and gravel with areas of silty sand and silt. The sandy outwash deposits should be relatively permeable with infiltration rates of about 2 inches per hour. Infiltration rates into silty outwash deposits will be much lower (Troost 2010).

2.3. GROUNDWATER

Approximately one-third of the city's drinking water supply comes from a shallow groundwater aquifer located with the city limits. Designing stormwater infrastructure that accounts for groundwater conditions is instrumental in developing the subarea. A summary of groundwater depth, protection and contamination is provided in the subsequent sections.

2.3.1. Groundwater Depth

The Washington Department of Natural Resources Subsurface Geology Information System (DNR 2015) was accessed to obtain previously conducted subsurface exploration documents. Of the eight documents available for the subarea, two reports were the most comprehensive for the subarea, and therefore included in Appendix A. An additional investigation was obtained from the Overlake Village Stormwater and Park Facilities Conceptual Design (Otak 2000).

Based on six borings that encountered groundwater in three separate geotechnical investigations and reports, groundwater is typically found at a depth of 13 to 20 feet below surface grade within the subarea. A summary of each document is provided as follows:

- An investigation conducted in 2010 in the parking lot of Overlake Fashion Plaza. Groundwater was observed in this boring at a depth of 18.2 feet below existing ground surface (Otak 2012). Existing finished grade at time of boring is estimated at 301 feet above mean sea-level (amsl).

- An investigation conducted in October of 1992 in the southeast portion of the subarea. Five test boring were drilled, ranging in depth from 6 feet to 15 feet below grade. Groundwater seepage was encountered at 14 feet below existing ground surface (Appendix A). Existing surface grade elevation is at approximately 295 feet amsl, resulting in a groundwater elevation of approximately 281 feet.

- An investigation conducted in August of 1984 in the general vicinity of the area currently occupied by Marshalls and Sears, adjacent to the northeast of the intersection of 148th Avenue NE and NE 20th Street. Ten test borings were drilled, ranging in depth from 13 to 21 feet below grade. No groundwater was encountered in six of the borings. In four of the borings, groundwater was encountered at a depth 13, 17, and, on two occasions, 20 feet below existing ground surface (Appendix B). Existing surface grade elevation at time of boring is at estimated at 300 feet amsl, resulting in a groundwater elevation of approximately 287 to 280 feet amsl.

Groundwater depth typically fluctuates seasonally with higher groundwater elevations in the rainy reason (October through May) and lower groundwater elevations in the dry season (June through September).

Additional sources of groundwater data that were researched as part of this report:

- Per the Natural Resources Conversation Service report (NRCS 2015), depth to groundwater is listed as 0 to 37 inches for the four soil types in the study area. This appeared to be inconsistent with field-verifiable geotechnical findings; therefore, these data were not used in this analysis.
- A "depth to groundwater" GIS shape file was received from the City. The limits of data in this file are outside of the subarea limits.
- Per King County Water and Land Services, a groundwater well (Well ID R_473747122080601, owner unknown) is located in the east part of the subarea, north of NE 21st Street and immediately west of Bel-Red Road. The well extends to a depth of 65 feet, but no water level or water quality data are available from it.

2.3.2. Groundwater Protection

The City has designated four zones for wellhead protection: 1, 2, 3, and 4. The subarea falls entirely within wellhead protection zone 4. Per the City of Redmond Clearing, Grading, and Stormwater Management Technical Notebook (Redmond 2012), runoff from pollution generating impervious surfaces can be infiltrated without treatment provided the soil profile provides treatment per Chapter 3.3 of Volume III of the 2005 Ecology Manual. Infiltration of runoff from non-pollution generating impervious areas considered to be clean, including most roofs and sidewalks, is strongly encouraged where feasible.

2.3.3. Groundwater Contamination

No reference to groundwater contamination was discovered during the literature review.

2.4. Environmentally Critical Areas

Per King County iMap (King County 2015), no seismic hazards, landslide hazards, wetlands, or critical aquifer recharge areas are identified in the subarea. The subarea is outside of the FEMA 100-year and 500-year floodplain and is not listed as susceptible to groundwater contamination. Per the Washington Department of Ecology Water Quality Assessment for Washington map (DOE 2015), no water bodies within or immediately adjacent to the subarea area classified as impaired. The tributary area of the subarea, Kelsey Creek, is designated as a Chinook distribution stream.

2.5. Drainage Complaints

No drainage complaints from the City or area landowners were obtained as part of our investigation.

2.6. Regional Infiltration Facility

In 2011, the City adopted an implementation plan for stormwater and park facilities within the Overlake neighborhood. The plan consists of constructing regional infiltration facilities, regional detention facilities, conducting LID retrofits, and an urban pathway with LID facilities. This plan focused on the commercial and employment areas of the neighborhood that are zoned for the highest density of development. The proposed stormwater facilities and some new streets were further defined by the Overlake Village Street Design Guidelines, (Redmond 211).

The Overlake Village South Detention Vault (rendering below), the first large stormwater facility in the plan, was completed in 2015. This regional detention facility, located within the subarea, detains stormwater that has been treated locally within public rights-of-way and private development areas. Once surrounding property develops in the future, park facilities will be constructed on top of the stormwater vault. In the meantime, parking use will continue by the owner of the property.

Above: Rendering of the Overlake Village South Detention Vault.

3. STORMWATER ANALYSIS AND DESIGN

3.1. OPPORTUNITIES AND CONSTRAINTS

Results from the background research and a literature review were incorporated into opportunity and constraints maps (see Appendix B), to be used as guidance in determining where future stormwater facilities can potentially be located. The maps were developed based on findings from Section 2 of this report.

Key research elements incorporated into the opportunity and constraints maps consist of existing soil conditions, anticipated infiltration rates, depth to groundwater, and location of existing and proposed infrastructure.

3.2. STORMWATER MODELING APPROACH AND INPUTS

Stormwater modeling was performed based on requirements set forth in the Department of Ecology Stormwater Management Manual for Western Washington (Ecology 2014) and the Technical Manual (Redmond 2012). MGS Flood version 4.38, a Department of Ecology approved continuous model, was used for the preliminary sizing of stormwater facilities. A summary of MGS Flood inputs are detailed in Table 1.

Table 1. MGS Flood Project Location Design Inputs.

Climatic Region	Puget Sound East 40 Inches
Computational Timestep	15 Minutes
Pre-Developed Conditions	Till Forest

3.3. BIORETENTION DESIGN

Per correspondence with the City, preferred layout options and preferences for bioretention were discussed. To fit into the proposed urban character of the subarea, a vertical wall bioretention configuration was chosen. A typical section of this configuration is shown in Figure 2. A summary bioretention modeling configuration is detailed in Table 2.

Table 2. Bioretention Typical Configuration.	
Soil Media Thickness	18 Inches
Soil Porosity	35 to 40%
Storage Depth	12 Inches
Bioretention Soil Infiltration Rate	3 Inches/Hour[a]
Native Soil Infiltration Rate	Varies, depending on native soils
Cell Sideslope/Walls	Vertical (0:1)

[a] Selected based on Ecology recommended rate of 12 inches per hour and with a Factor of Safety of 4 applied.

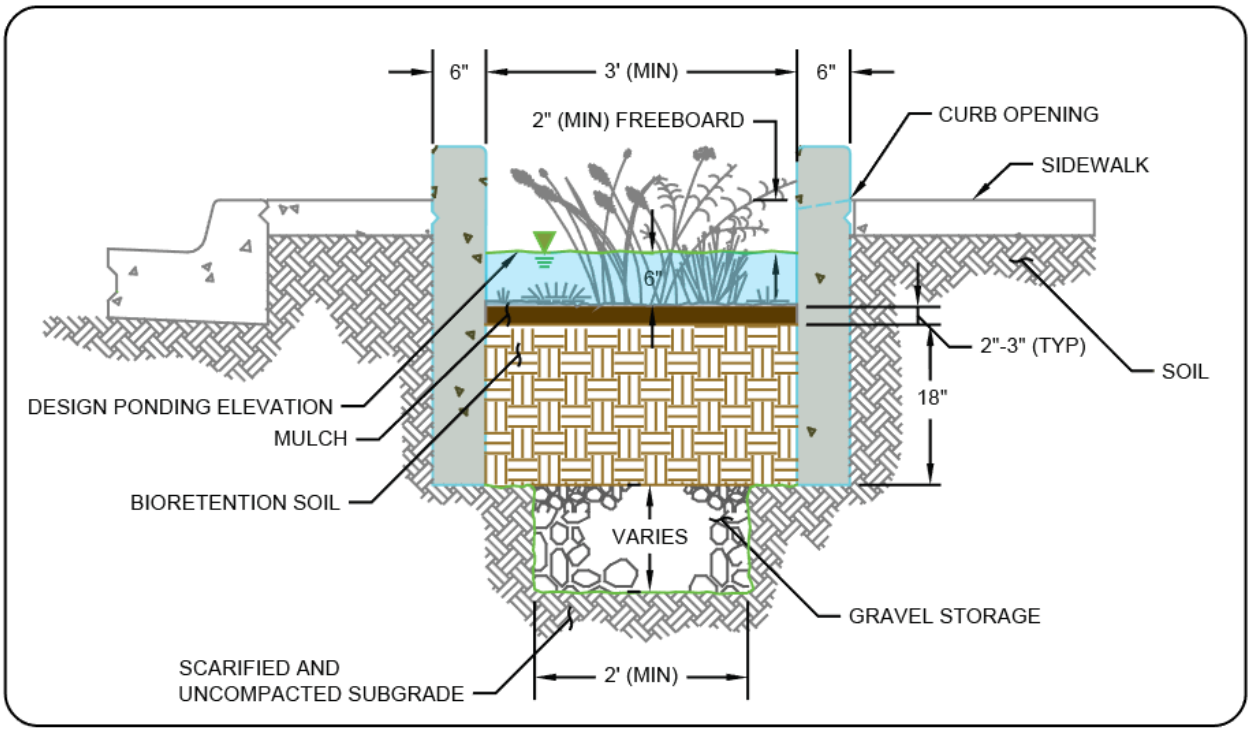


Figure 2. Typical Bioretention Section.

3.4. Bioretention Modeling and Results

Initial modeling efforts were conducted for the subarea to provide a basis of discussion with City staff. Based on these results, additional scenarios were run to develop guidelines for determining required bioretention areas based on a recommended configuration and native soil infiltration rates.

3.4.1. Preliminary Modeling Results

Initial modeling efforts consisted of running sixty modeling scenarios for the subarea, summarized in the sizing graph in Appendix C. The only variable between the scenarios was varying the native soil infiltration rate. Based off the literature review of previous geotechnical investigations, 0.25 to 1.00 inches per hour is a reasonable estimate for the long-term infiltration rate within the subarea. Three native soil infiltration rates were chosen in this range: 0.25, 0.75, and 1.00 inches per hour, and twenty scenarios per modeled for each.

In each scenario, a 40,000-square-foot block subbasin was selected and routed equally to six separate bioretention cells. Each cell was 5 feet wide, with a length ranging from 10 feet up through 200 feet. The total percentage of the subbasin dedicated to bioretention was incrementally increased from 0.75 percent up to 15 percent as the bioretention cells were increased in length.

As shown on the graph, the total percentage of stormwater that is infiltrated in the subbasin increases as the total percentage of bioretention in the subbasin increases. The greatest benefit is achieved early on, as with each increase in bioretention length, there is a diminishing gain in the quantity of stormwater being infiltrated.

Shading is shown in each figure to delineate what flow control performance standard is met. As the bioretention percentage in the subbasin increases, first 50 percent of the 2-year storm event is met, then 50 percent of the 2-year through the 2-year event, and ultimately the 2-year event through the 50-year event. Per the models output, there is a lag in which 100 percent of the modeled runoff is infiltrated and all three performance standards are met (50 percent of the 2-year through the 50-year).

The point where all three duration standards are met are shown on each figure as, after this point, increasing the size of bioretention does not provide any additional performance benefit as 100 percent of the stormwater is being infiltrated and all three performance standards are met.

3.4.2. Final Modeling Results

After preliminary modeling results were reviewed with the City, final modeling was completed to provide sizing guidelines for bioretention within the right-of-way. Bioretention sizing for private parcels is discussed separately in Section 3.7.

The following conclusions were drawn from final modeling:

- Based on guidance from the City, stormwater from major public and private streets should be infiltrated using bioretention systems in areas with outwash soils. Furthermore, these systems should be sized to treat and infiltrate the entire water quality storm. To achieve this goal, the modeling indicates at least 2.5 percent of bioretention area is

needed for every unit of land area infiltrated assuming a native infiltration rate of 1 inch per hour.

- In areas with till soils, the modeling showed bioretention systems would be impractical due to space limitations; therefore, Filterra systems were proposed instead based on guidance from the City. Because they do not infiltrate water in their standard configuration, the Filterra systems would need to be installed in combination with a shallow infiltration facility below the sidewalk to achieve the goal of infiltrating the entire water quality storm.

- Bioretention Configuration: Soil porosity was increased from 35 percent to 40 percent.

3.5. Assessment of Bioretention Details

As part of developing stormwater design recommendations for the subarea, a review of existing City-approved standard plans was conducted. The following 2014 standard plans were reviewed:

1. Standard Plan 655 – Bioretention Facility

1. Standard Plan 657 – Bioretention Plant Palette

2. Standard Plan 659 – Bioretention Curb Extension

3. Standard Plan 661 – Bioretention Check Dam

4. Standard Plan 663 – Bioretention In-line Curb Cut

5. Standard Plan 655 – Bioretention Side Curb Cut

6. Standard Plan 667 – Bioretention Outlet Structure

7. Standard Plan 669 – Bioretention Clean-Out

8. Standard Plan 671 – Bioretention Hydrant Access

Comments on these standard plans are included in Appendix D.

3.6. Bioretention Costs

At a planning level, we estimate bioretention to cost $100 per square foot in the public right of way and $50 per square foot on private parcels. This costs includes all design, materials and constructions costs, but excludes land acquisitions (private parcels only) or permitting. The higher costs in the public right of way are typically caused by utility conflicts and traffic control for construction.

3.7. Developer Toolbox

The developer toolbox is a set of stormwater best management practices that can be utilized on private parcel development in the Overlake South Subarea. The toolbox was developed based on research findings, planning-level modeling work and discussions with the City. The best management practices can be used in any combination to meet applicable Washington State and City of Redmond codes governing use of stormwater solutions.

Best management practices in the toolbox consist of the following:

1. Bioretention
2. Green Roof
3. Roof Infiltration to Drywell
4. On-Site Detention
5. Urban Pathway

Sizing information for each BMP is included in the toolkit. A sizing factor of 5 percent of parcel area being devoted to bioretention was based on guidance received from the City.

The developer toolbox is included in Appendix E.

3.8. Storm Drainage Improvements

The subarea has an underground storm drainage pipe network designed around the current parcel and roadway layout. As the subarea is redeveloped, we anticipate that most of this network will be demolished and a new storm drainage system will be installed around the reconfigured roadway and parcel layout.

As a safety mechanism in the event of overflow, clogging, or failure, all bioretention cells will need to be connected to the new storm drainage network. The outfall for this network is to be determined, but is anticipated to be either a regional infiltration facility or pipe conveyed out of the subarea.

3.9. Permeable Pavement

Permeable pavement is a method of paving that is able to support traffic loads with a durable surface while allowing stormwater to seep into the ground as it falls. This dispersed infiltration approach addresses water quality through filtration and adsorption of pollutants in the pavement matrix and in the soils below the facility and addresses water quantity through

storage in the pavement base and infiltration into the soils below the facility. Per City guidance, permeable pavement is not being considered in the public right of way at this point.

3.10. Public Open House

Preliminary findings and design options from the stormwater analysis effort were presented at a public open house for the subarea on December 17, 2015. The presentation board used at the open house is included in Appendix F.

4. LIMITATIONS

The summary of findings in this report are intended for planning-level decision making. Every best effort was taken in presenting an accurate overview of subarea conditions.

5. REFERENCES

DNR. 2015. Washington State Department of Natural Resources Subsurface Geology Information System. Accessed August 5, 2015. <https://fortress.wa.gov/dnr/geology/?Theme=subsurf>.

Ecology. 2014. Stormwater Management Manual for Western Washington as Amended in December 2014. Publication Number 14-10-055. Washington State Department of Ecology, Olympia, Washington. August 2012.

Ecology. 2015. Washington Department of Ecology Water Quality Assessment for Washington. Accessed August 5, 2015. <http://www.ecy.wa.gov/programs/Wq/303d/index.html>.

King County. 2015. King County iMap Interactive Mapping Tool. Accessed August 5, 2015. <http://www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx>.

NRCS. 2015. Natural Resources Conversation Service Web Soil Survey, Accessed July 30, 2015. <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.

Otak. 2010. Overlake Village Stormwater and Park Facilities Conceptual Design. Otak, Inc. and The Berger Partnership, Redmond, Washington. June 30, 2010.

Redmond. 2011. Overlake Village Street Design Guidelines. City of Redmond, Redmond, Washington. April 5, 2011.

Redmond. 2012. Clearing, Grading, and Stormwater Management Technical Notebook. City of Redmond, Redmond, Washington. February 23, 2012.

Redmond. 2015. GIS Data Download Center. Accessed July 22, 2015. <https://www.redmond.gov/Government/MapsGISservices/GISDataDownloadCenter>.

Troost. 2010. Summary Report: Redmond-Overlake Basin Geological Mapping Project. Troost Geological Consulting and GeoMapNW, Snohomish, Washington. April 27, 2010.

APPENDIX A

Geotechnical Investigations

APPENDIX A-1

(6392)

PERMIT # 1138-93

RECEIVED
MAY 07 1993
PERMIT
CITY OF

GEOTECHNICAL ENGINEERING STUDY
PROPOSED TACO BELL RESTAURANT #06
BELLEVUE, WASHINGTON

E-5980

November 17, 1992

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

PREPARED FOR
TACO BELL, CORP.

Kyle R. Campbell, P. E.
Manager of Geotechnical Services

Donald J. Bruno
Staff Geologist

KYLE R. CAMPBELL
STATE OF WASHINGTON
27674
REGISTERED
PROFESSIONAL ENGINEER
11/18/92
EXPIRES 11/18/94

GEOTECHNICAL ENGINEERING STUDY
PROPOSED TACO BELL RESTAURANT #06-611
BELLEVUE, WASHINGTON

E-5980

November 17, 1992

Earth Consultants, Inc.
1805 - 136th Place Northeast, Suite 101
Bellevue, Washington 98005
(206) 643-3780

222 East 26th Street, Suite 103
Tacoma, Washington 98411-9998
(206) 272-6608

SITE CONDITIONS

Surface

The site of the proposed facility is located southeast of the intersection of 148th Avenue Northeast and Northeast 20th Street in Bellevue,Washington.(see Plate 1, Vicinity Map). The near rectangular shaped parcel encompasses about seven-tenths of an acre and is bounded by Northeast 20th Street to the north, a one level restaurant to the south, a Bellevue Fire Station to the east, and 148th Avenue Northeast to the west. The property is relatively level and is presently occupied by a vacated petroleum service station, located at the central east side of the site. The remaining areas of the site are covered with asphalt pavement and three concrete pump islands, located at the northern half of the site. Extensive cracking of the asphalt pavements was observed during the time of our field exploration. As of the date of this report, it is our understanding that the on-site underground petroleum tanks have not been removed.

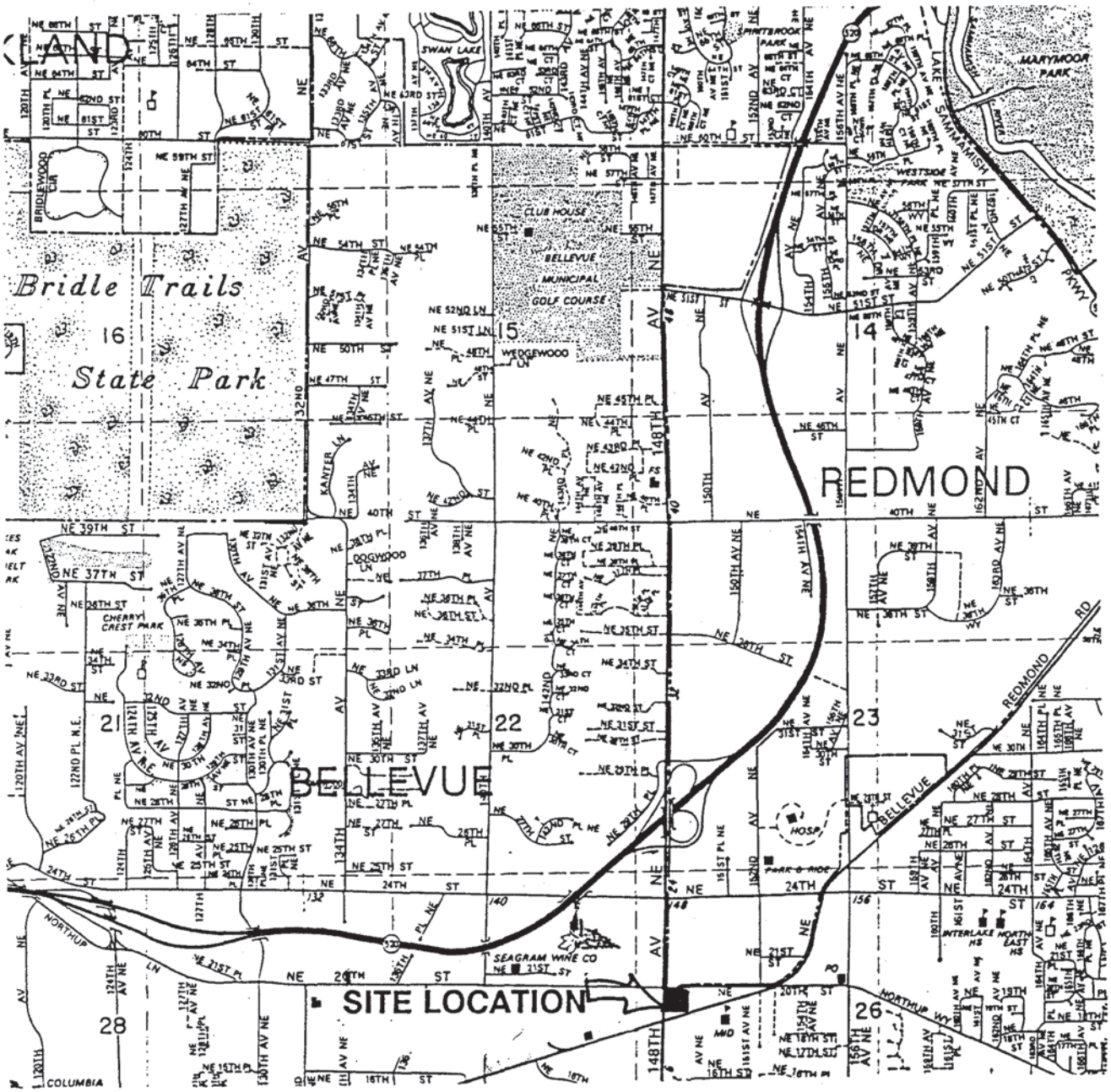
Subsurface

The site was explored by drilling five test borings at the approximate locations shown on Plate 2. Refer to the test boring logs, Plates A2 to A6, for a detailed description of the conditions encountered at each location explored. A description of the field exploration methods is included in Appendix A. Below is a generalized description of the subsurface conditions encountered.

During our site study, we encountered three inches of asphalt underlain by three inches of base course material composed of a silty sand with gravel (Unified Classification SM). Underlying the upper pavement section, two to six feet of fill soils, composed predominantly of soft to stiff lean clay and soft elastic silt, (CL and MH) were encountered. Beneath the fill soils, medium stiff to very stiff native lean clay (CL) was encountered to a depth of approximately nine feet below the existing ground surface. Underlying the native clay layer, a dense to very dense sand with silt (SP-SM) was encountered to the maximum exploration depth of fifteen (15) feet below the existing ground surface.

Groundwater

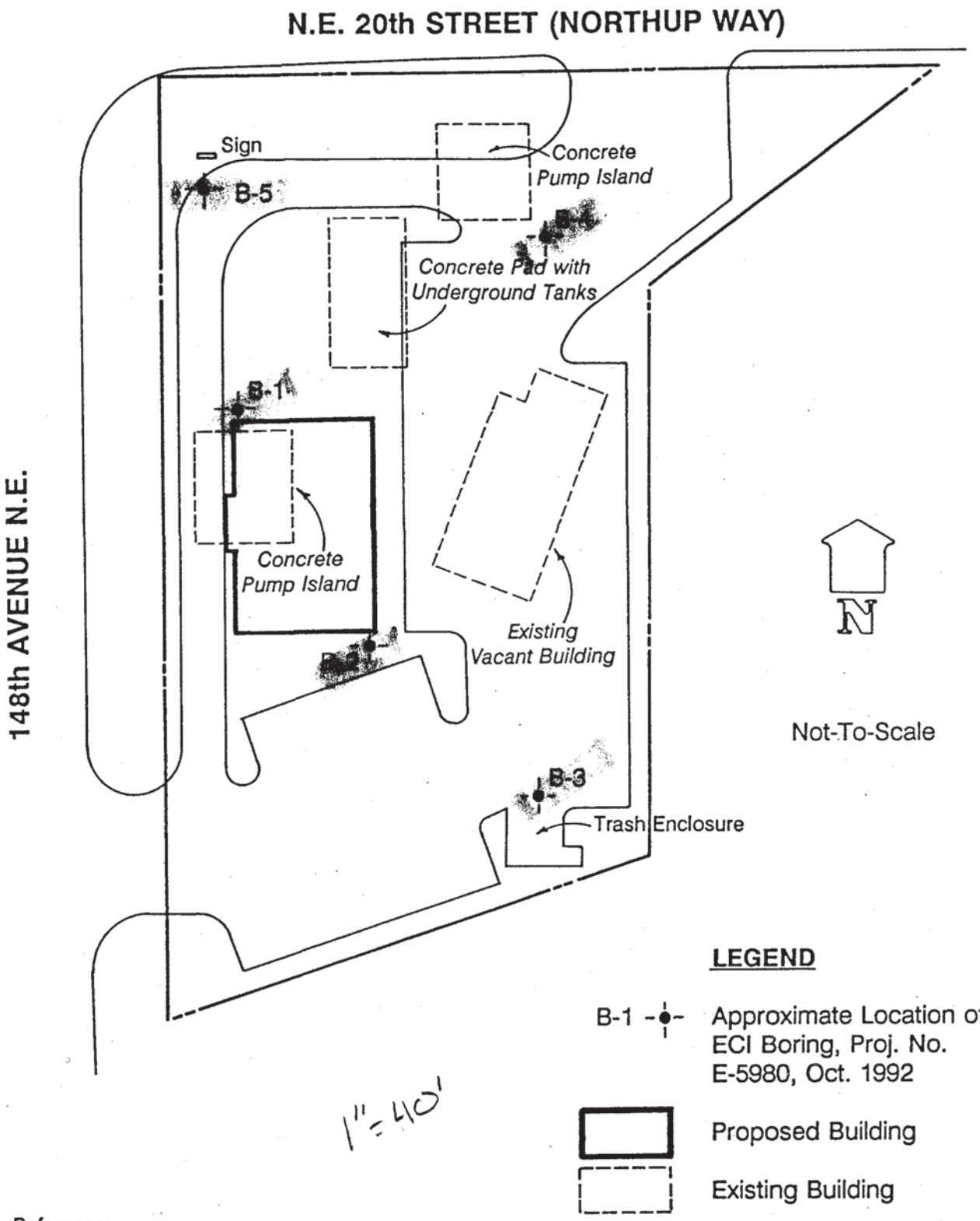
Groundwater seepage was encountered at fourteen (14) feet below the existing ground surface. It is important to note that groundwater seepage levels and volumes are not constant; thus, one may expect fluctuations in the level and volume depending on the season, amount of rainfall, surface water runoff, and other factors. Generally, the groundwater seepage flow is greater during the wetter winter months (typically October through May).



N

Reference:
King County / Map 16
By Thomas Brothers Maps
Dated 1990

Earth Consultants Inc. Geotechnical Engineers, Geologists & Environmental Scientists			Vicinity Map Proposed Taco Bell #06-0611 Bellevue, Washington			
Proj. No. 5980	**Drwn.** GLS	**Date** Oct. '92	**Checked** DB	**Date** 10/26/92	**Plate** 1	



LEGEND

B-1 Approximate Location of ECI Boring, Proj. No. E-5980, Oct. 1992

Proposed Building

Existing Building

Reference:
Site Sketch
By Brown Connally Rowan Arch.
Dated 8/6/92

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Location Plan
Proposed Taco Bell #06-0611
Bellevue, Washington

Proj. No. 5980	Drwn. GLS	Date Oct. '92	Checked DB	Date 10/26/92	Plate 2

Boring Log

Project Name:				Sheet 1 of 1
Proposed Taco Bell #06-0611				
Job No.: E-5980	Logged by: Don Bruno	Start Date: 10-21-92	Completion Date: 10-21-92	Boring No: **B—1**
Drilling Contractor: Associated Drilling		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☐ Abandoned, sealed with bentonite		

W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: 3" asphalt
						4" base course
19	11		1, 2, 3		cl	FILL: Gray lean CLAY, stiff, moist to wet
21	15		4, 5, 6		cl	Gray mottled brown lean CLAY, trace sand, stiff, moist to wet
9	32		7, 8, 9		sm/ sp	Gray fine to medium SAND with silt, dense to very dense, moist
8	45		10, 11, 12, 13, 14			-grades to very dense
11	46		15			
			16, 17, 18, 19			Boring terminated at 15.0 feet below existing grade. Groundwater seepage encountered at 14.0 feet during drilling. Boring backfilled with cuttings and bentonite, concrete plug.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
PROPOSED TACO BELL #06-0611
BELLEVUE, WASHINGTON

Proj. No. 5980	Dwn. GLS	Date Nov'92	Checked DB	Date 11-4-92	Plate A2

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use of interpretation by others of information presented on this log.

Boring Log

Project Name:				Sheet 1 of 1
Proposed Taco Bell #06-0611				
Job No.: E-5980	Logged by: Don Bruno	Start Date: 10-21-92	Completion Date: 10-21-92	Boring No: **B—2**
Drilling Contractor: Associated Drilling		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☐ Abandoned, sealed with bentonite		

W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: 3" asphalt, 4" base course
18	6		1, 2, 3, 4		cl	FILL: Gray and brown CLAY with sand, medium stiff, wet
35	6		5, 6, 7		cl	Gray lean CLAY, medium stiff, wet to saturated
14	22		8, 9			-with fine sand, grades to very stiff
7	41		10, 11, 12, 13		sp	Gray fine to medium SAND, trace silt and gravel, very dense, moist
	56		14			
			15, 16, 17, 18, 19			Boring terminated at 14.0 feet below existing grade. No groundwater seepage encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
PROPOSED TACO BELL #06-0611
BELLEVUE, WASHINGTON

Proj. No. 5980	Dwn. GLS	Date Nov'92	Checked DB	Date 11-4-92	Plate A3

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use of interpretation by others of information presented on this log.

Boring Log

Project Name: Proposed Taco Bell #06-0611				Sheet 1 of 1
Job No.: E-5980	Logged by: Don Bruno	Start Date: 10-21-92	Completion Date: 10-21-92	Boring No: **B—3**
Drilling Contractor: Associated Drilling		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☐ Abandoned, sealed with bentonite		

	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: 3" asphalt, 3" base course
	46	4		1, 2, 3, 4		mh	FILL: Dark brown elastic SILT, soft, saturated, trace organic rootlets -grades to gray
	30	7		5, 6, 7		cl	Gray lean CLAY, medium stiff, moist
	20	9		8, 9			-medium stiff to stiff, trace sand and gravel
				10, 11, 12, 13, 14, 15, 16, 17, 18, 19			Boring terminated at 9.0 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
PROPOSED TACO BELL #06-0611
BELLEVUE, WASHINGTON

Proj. No. 5980	Dwn. GLS	Date Nov'92	Checked DB	Date 11-4-92	Plate A4

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily

Boring Log

Project Name: Proposed Taco Bell #06-0611				Sheet 1 of 1
Job No.: E-5980	Logged by: Don Bruno	Start Date: 10-28-92	Completion Date: 10-28-92	Boring No: **B-4**
Drilling Contractor: Associated Drilling		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☐ Abandoned, sealed with bentonite		

	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: 3" asphalt, 3" base course
	24	5		1, 2, 3, 4		cl	FILL: Gray and brown lean CLAY, soft, wet
	39	4		5, 6		mh	FILL: Gray and brown clayey SILT, soft, wet to saturated -grades to gray
				7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19			Boring terminated at 6.0 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
PROPOSED TACO BELL #06-0611
BELLEVUE, WASHINGTON

Proj. No. 5980	Dwn. GLS	Date Nov'92	Checked DB	Date 11-4-92	Plate A5

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily

Boring Log

Project Name: Proposed Taco Bell #06-0611				Sheet 1 of 1
Job No.: E-5980	Logged by: Don Bruno	Start Date: 10-28-92	Completion Date: 10-28-92	Boring No: **B-5**
Drilling Contractor: Associated Drilling		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☐ Abandoned, sealed with bentonite		

W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: 3" asphalt, 4" base course
58			1, 2		mh	FILL: Brown elastic SILT, soft, wet, trace organics
33	8		3, 4		cl	Gray CLAY, medium stiff, wet
23	13		5, 6			-grades to stiff
8	62		7, 8		sm-sp	Gray fine to medium SAND with silt, very dense, moist
			9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19			Boring terminated at 8.5 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
PROPOSED TACO BELL #06-0611
BELLEVUE, WASHINGTON

Proj. No. 5980	Dwn. GLS	Date Nov'92	Checked DB	Date 11-4-92	Plate A6

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use of interpretation by others of information presented on this log.

APPENDIX A-2

Applied Geotechnology Inc.

6431

A Report Prepared for

G & D Centers, Inc.
18425 Burbank Boulevard, Suite 414
Tarzana, California 91356

REPORT
GEOTECHNICAL INVESTIGATION
OVERLAKE PLAZA
REDMOND, WASHINGTON

AGI Report No. 14,860.001/B

by

Glen Mann, P.E.
Principal Engineer

APPLIED GEOTECHNOLOGY INC.
300 120th Avenue NE, Building 4, Suite 215
Post Office Box 3885
Bellevue, Washington 98009
206/453-8383

September 17, 1984

RECEIVED
OCT 13 1985
BUSH, ROED & HITCHINGS INC.

I. INTRODUCTION

A. General

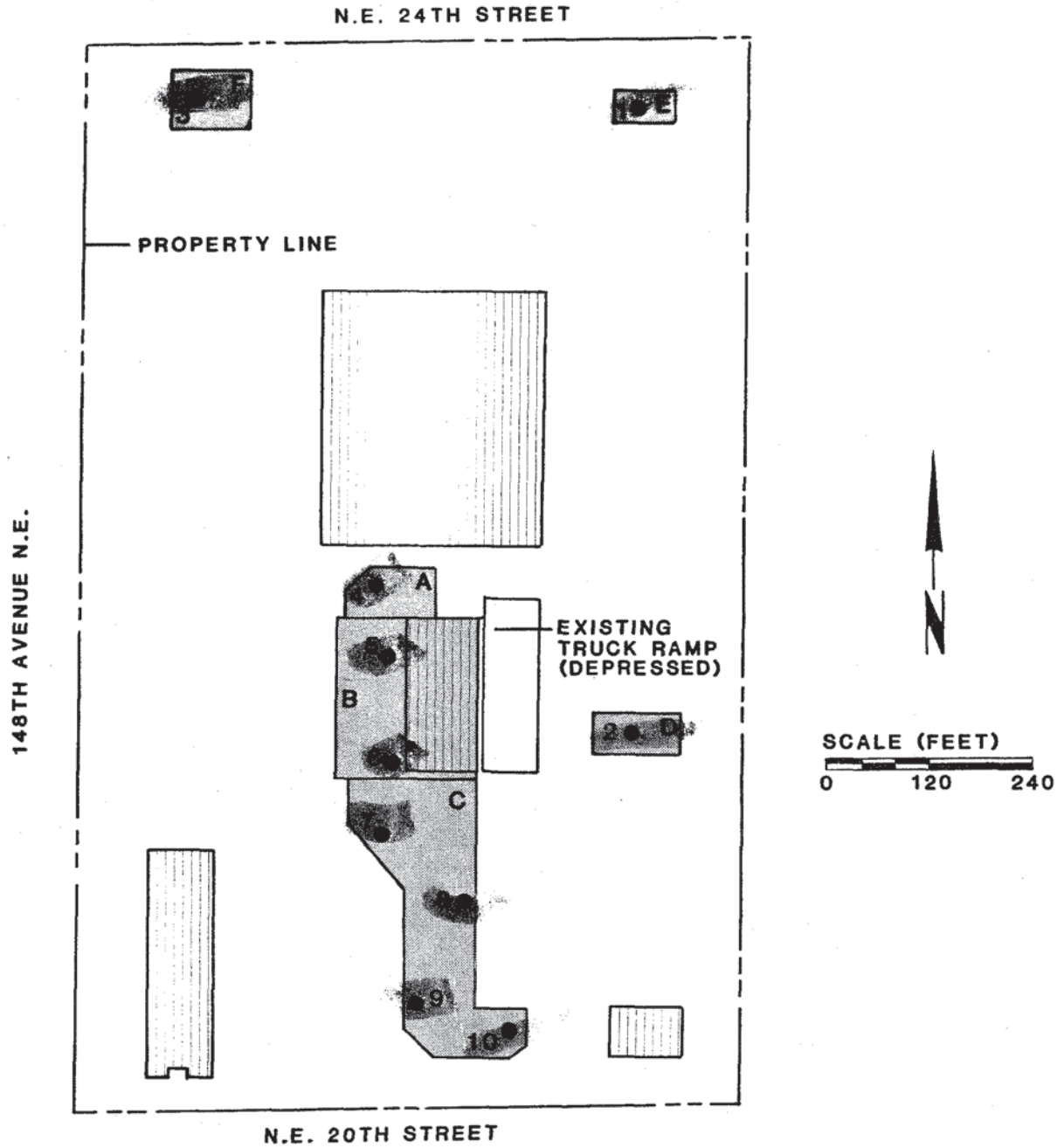
This report presents the results of our geotechnical investigation for design and construction of your proposed series of one-story retail buildings at Overlake Plaza in Redmond, Washington, located approximately as shown on Figure 1, Site Plan. Our scope of services was developed through conversations with Mr. Joseph Kurily, your structural engineer, and from the Soils Investigation Checklist he provided on July 13, 1984. It was submitted for your review and approval on July 18, 1984, and we received your written authorization to proceed on July 31, 1984.

B. Project Description

We understand that you propose to construct a series of one-story buildings with plan areas ranging from approximately 2,500 to 35,000 square feet. The buildings are to consist of masonry walls with wood framed or possibly light steel roof systems and concrete slab-on-grade floors at, or close to, existing site grades. Wall and column loads are estimated to be on the order of less than 2 kips per linear foot or 100 kips, respectively, for all dead and live loads. Floor loads are not expected to exceed 150 pounds per square foot.

No deep excavations or significant construction fills, buried basement walls, retaining walls, or rockeries are contemplated.

Paved access roads and parking areas around the completed new construction will be provided.



LEGEND

10● BORING NUMBER AND APPROXIMATE LOCATION

F PROPOSED BUILDING LOCATION AND DESIGNATION

EXISTING BUILDING LOCATION

REFERENCE: SITE PLAN, TITLED "OVERLAKE PLAZA, REDMOND, WASHINGTON", SHEET A, HERBERT NADEL AIA, AND PARTNERS, DATED 5/30/84. NO SURVEY DATA AVAILABLE.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

SITE PLAN
Overlake Plaza
Redmond, Washington

FIGURE **1**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT		9/12/86		

Equipment Mobile B-61

Elevation 304 feet * Date 8/3/84

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	
				0		Asphalt Concrete
						BROWN SILTY SAND (SM) loose, moist, with gravel (Fill)
	72	7.7	108.8			GRAY BROWN SILTY SAND (SM) very dense, moist with gravel and broken cobble (Weathered Glacial Till)
				5		
	60/6"					no recovery, driving on rocks
				10		driving on rocks.
	128/3"					hard drilling.
				15		Boring terminated at 13.0 foot depth on 8/3/84. No groundwater encountered.
				20		
				25		
				30		
				35		
				40		

*Elevations based on USC & GS Datum; As-built Paving Plan for Sears Roebuck & Co.; Sheet C-3 for Job No. 1733, by John Graham and Company, Architects, dated 6/23/70.

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

[redacted] 1
Overlake Plaza
Redmond, Washington

PLATE 2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT		9/7/84		

Laboratory Tests

Equipment Mobile B-61

Elevation 299 feet Date 8/3/84

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	
			0		Asphalt Concrete
20	11.2	118.6			BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
			5		becomes dense at 3 feet
15					GRAY SANDY SILT (ML) stiff, moist with some gravel, trace of clay (Weathered Glacial Till)
			10		
101					GRAY SILTY SAND (SM) very dense, wet with some occasional cobble (Glacial Till)
			15		Boring terminated at 13.5 foot depth on 8/3/84. No groundwater encountered.
			20		
			25		
			30		
			35		
			40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

[redacted] 2
Overlake Plaza
Redmond, Washington

PLATE 3

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT		9/12/84		

Laboratory Tests

Equipment Mobile B-61

Elevation 307 feet Date 8/3/84

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	
			0		Asphalt Concrete
30	14.3	115.3			BROWN/GRAY SILTY SAND (SM) dense, moist with gravel, note dark brown organic silt mixed in sample (Fill)
			5		
26					BROWN/GRAY SILTY SAND (SM) medium dense, moist with some gravel (Weathered Glacial Till)
			10		hard drilling becomes gray, very dense
121/6"					
			15		Boring terminated at 13.0 foot depth on 8/3/84. No groundwater encountered.
			20		
			25		
			30		
			35		
			40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Boring 3
Overlake Plaza
Redmond, Washington

PLATE 4

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Equipment Mobile B-61

Elevation 300.5 feet Date 8/3/84

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0	Asphalt Concrete
	50	4.8	106.5		BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
				5	becomes very dense at 3 feet
					LIGHT GRAY SANDY SILT (ML) very stiff, moist with some gravel, little clay (Weathered Glacial Till)
	21				
				10	decreasing sand, increasing clay content
					becomes medium stiff at 12½ feet
	10				
	19			15	becomes stiff at 15 feet
					LIGHT GRAY SILTY SAND (SM) dense, moist with gravel and cobble (Glacial Till)
	56			20	
					Boring terminated at 21.0 foot depth on 8/3/84.
				25	No groundwater encountered.
				30	
				35	
				40	

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

[redacted]
Overlake Plaza
Redmond, Washington

PLATE 5

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Laboratory Tests

Equipment Mobile B-61

Elevation 300.5 feet Date 8/3/84

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	Description
			0		Asphalt Concrete
41					BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
			5		BROWN GRAY SILTY SAND (SM) very dense, moist with gravel (Weathered Glacial Till)
9	41.3	79.8			GRAY CLAY (CH) stiff, wet with peat flecks (Lacustrine Deposit)
			10		
15					becomes sandy at 13 feet
			15		
91					GRAY SILTY SAND (SM) very dense, wet with some gravel (Glacial Till)
36			20		decreasing silt content, becomes medium dense
					Boring terminated at 21.0 foot depth on 8/3/84.
			25		NOTE: Sample at 20 foot depth saturated.
			30		
			35		
			40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Boring 5
Overlake Plaza
Redmond, Washington

PLATE 6

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Laboratory Tests

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	Description
			0		Asphalt Concrete
48					BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
			5		BROWN GRAVEL (GW) loose, moist (Fill)
15					BROWN GRAY SILTY SAND (SM) loose, moist with gravel, occasional cobble (Fill)
			10		GRAY SILTY SAND (SM) very dense, moist with gravel (Weathered Glacial Till)
12					becomes medium dense and wet at 8 feet
			15		GRAY CLAY (CL) stiff, moist with peat flecks and sand partings (Lacustrine Deposit)
91					hard drilling
			20		GRAY SILTY SAND (SM) very dense, wet with some gravel (Glacial Till)
85					2 feet of water in hole noted during drilling
			25		GRAY COARSE SAND (SP) very dense, saturated (Sand)
					Boring terminated at 23.5 foot depth on 8/2/84.
			30		Note: Water in hole during drilling at 20 foot depth.
			35		
			40		

Equipment Mobile B-61

Elevation 301 feet Date 8/2/84

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Boring 8
Overlake Plaza
Redmond, Washington

PLATE 7

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Equipment Mobile B-61

Elevation 299 feet Date 8/3/84

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	
				0		Asphalt Concrete
	135	7.6	96.7			BROWN SILTY SAND (SM) loose, moist with some gravel (Fill)
				5		GRAY SILTY SAND (SM) very dense, moist with gravel (Weathered Glacial Till)
	7			10		MOTTLED BROWN AND BLUE GRAY CLAY (CL) stiff, moist, with peat flecks (Lacustrine Deposit)
	35			15		GRAY SILTY SAND (SM) medium dense, moist with gravel and cobble (Glacial Till)
				20		Boring terminated at 13.5 foot depth on 8/3/84.
						No groundwater encountered.
				25		
				30		
				35		
				40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

[redacted]
Overlake Plaza
Redmond, Washington

PLATE 8

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Equipment Mobile B-61

Elevation 298 feet Date 8/3/84

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0	Asphalt Concrete
	69				BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
				5	GRAY SILTY SAND (SM) very dense, wet with gravel and cobble (Weathered Glacial Till)
	20	20.5	107.4		MOTTLED BROWN/BLUE GRAY SANDY SILT (ML) very stiff, moist with organics, occasional gravel (Lacustrine Deposit)
				10	GRAY SILTY SAND (SM) dense, saturated some gravel and cobbles (Glacial Till)
	57				
				15	Boring terminated at 13.5 foot depth on 8/3/84.
					No groundwater encountered.
				20	
				25	
				30	
				35	
				40	

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Boring 8
Overlake Plaza
Redmond, Washington

PLATE **9**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Equipment Mobile B-61

Elevation 297.5 feet Date 8/3/84

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	
				0		Asphalt Concrete
						BROWN SILTY SAND (SM) loose, moist with some gravel (Fill)
	74	7.0	118.1			
				5		GRAY/BROWN SILTY SAND (SM) very dense, moist with gravel and cobbles (Weathered Glacial Till)
	24					GRAY SANDY SILT (ML) hard, moist with some gravel, trace of clay (Glacial Till)
				10		no recovery, driving on rock
	75/4"			15		no recovery, driving on rock
	116					GRAY SAND (SP) very dense, saturated (sample dropped out of sampler) (Sand)
				20		Boring terminated at 18.0 foot depth on 8/3/84.
						Sample saturated at 17 foot depth.
				25		
				30		
				35		
				40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Log of Boring 9
Overlake Plaza
Redmond, Washington

PLATE **10**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT				

Laboratory Tests

Equipment Mobile B-61

Elevation 297.5 feet Date 8/3/84

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Sample	Description
			0		Asphalt Concrete
63	3.0	119.2			BROWN SILTY SAND (SM) loose, moist with gravel (Fill)
			5		DARK BROWN SILT (ML) hard, moist with organics (Old Topsoil)
72					BROWN/GRAY SILTY SAND (SM) very dense, with some gravel (Weathered Glacial Till)
			10		GRAY COARSE SAND (SP) medium dense, saturated with trace silt (Sand)
40					
			15		Boring terminated at 13.5 foot depth on 8/3/84.
					Sample saturated at 13 foot depth.
			20		
			25		
			30		
			35		
			40		

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

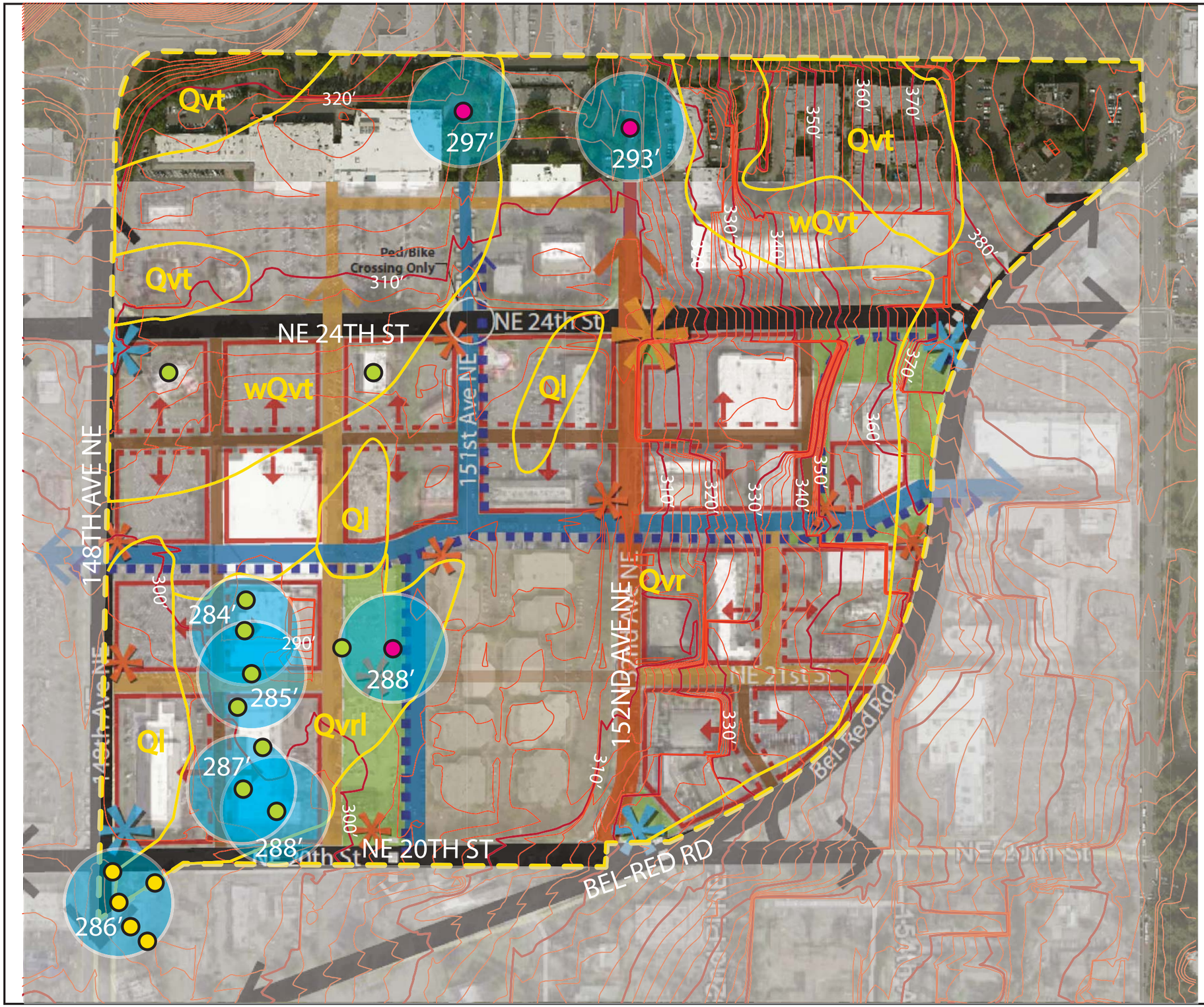
[redacted]
Overlake Plaza
Redmond, Washington

PLATE 11

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,860.001	BJT		9/17/84		

APPENDIX B

Opportunities and Constraints Map



APPENDIX B
OVERLAKE VILLAGE
SOUTH SUBAREA
Soils and Groundwater Depth

LEGEND

SUB-AREA LIMITS

SOIL TYPE

Ql: Lake Deposits
Qvr: Vashon Recessional Outwash Deposits
Qvrl: Vashon Recessional Lacustrine Deposits
Qvt: Vashon Subglacial Till
wQvt: Weathered Vashon Glacial Till

BORING/MONITORING WELL

- Park and Facilities Design (2010)
- Taco Bell (1992)
- Overlake Plaza (1984)

GROUNDWATER

XX' Observed Groundwater Elevation

N

0 125 250 500

Approximate scale in feet

APPENDIX B
OVERLAKE VILLAGE
SOUTH SUBAREA
Site Infiltration Potential

LEGEND

SUB-AREA LIMITS

SECTION CUT

REGIONAL STORMWATER FACILITY

SOILS

GLACIAL TILL

OUTWASH

ESTIMATED INFILTRATION RATE

NOTES:

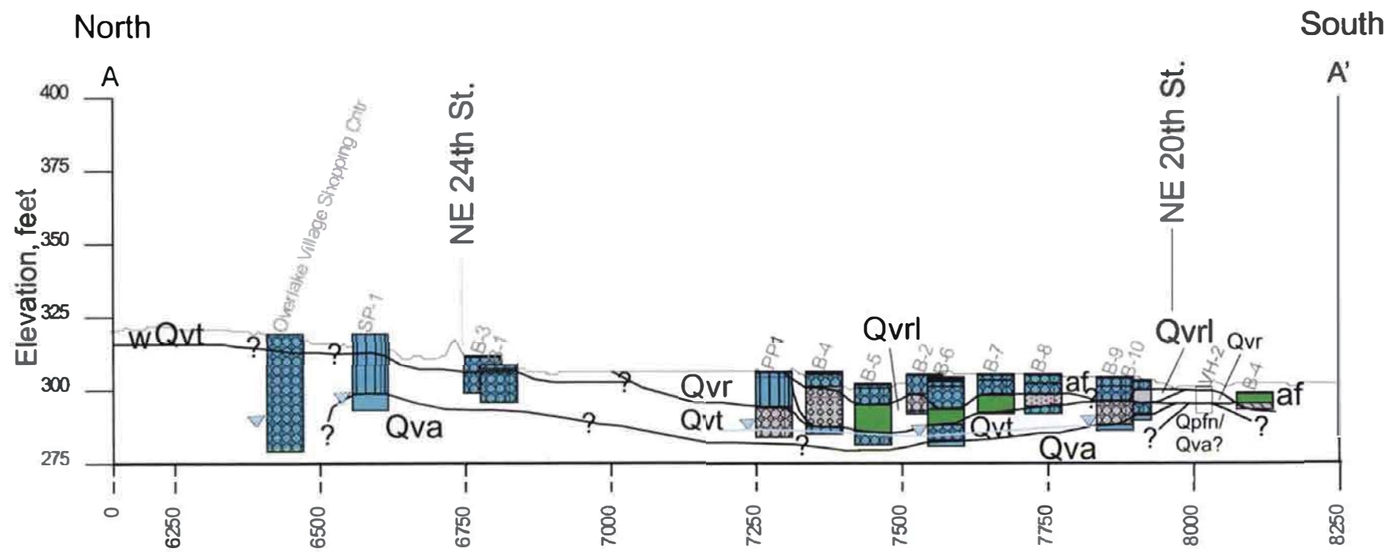
1. SECTION CUTS IN PROFILE EXTEND PAST SUB-AREA LIMITS.

2. SOILS INFORMATION IN SECTION CUTS PER REDMOND-OVERLAKE BASIN GEOLOGICAL MAPPING PROJECT (TROOST. 2010.)

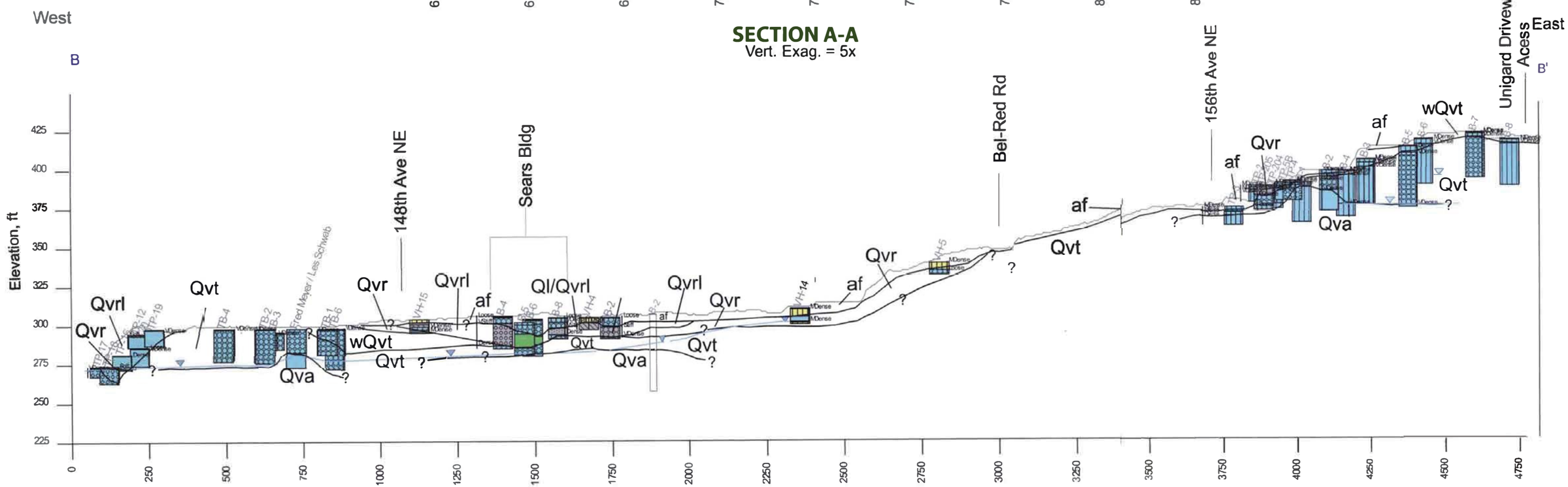
N

0 125 250 500

Approximate scale in feet



SECTION A-A
Vert. Exag. = 5x



SECTION B-B
Vert. Exag. = 5x

APPENDIX B
Groundwater Sections

Geologic Unit Key

af= fill
Qal= alluvial (river) deposits
Ql= lacustrine (lake) deposits
Qvr= recessional outwash (from rivers at waning of last glaciation)
Qvrl= recessional lacustrine deposits
Qvi= ice contact deposits
Qvt= Vashon till (at base of ice)
wQvt= weathered Vashon till (fractured, less compac than Qvt)
Qva= advance outwash (deposited when ice was advancing)
Qpfnl= pre-Fraser nonglacial deposits (on the landscape when Vashon glacier advanced)

Notes

1. Groundwater levels shown on cross sections (blue triangles and blue lines) based on measurements provided on boring logs and are from different times of the year. Fluctuations from that shown are expected.

2. This cross section depicts a geologic interpretation based on limited borehole information. Actual conditions will vary from those depicted.

3. The interpreted continuity of geologic units expressed on this cross section is based on standard geological practice and experience with Puget Lowland geologic conditions. Actual conditions will vary.

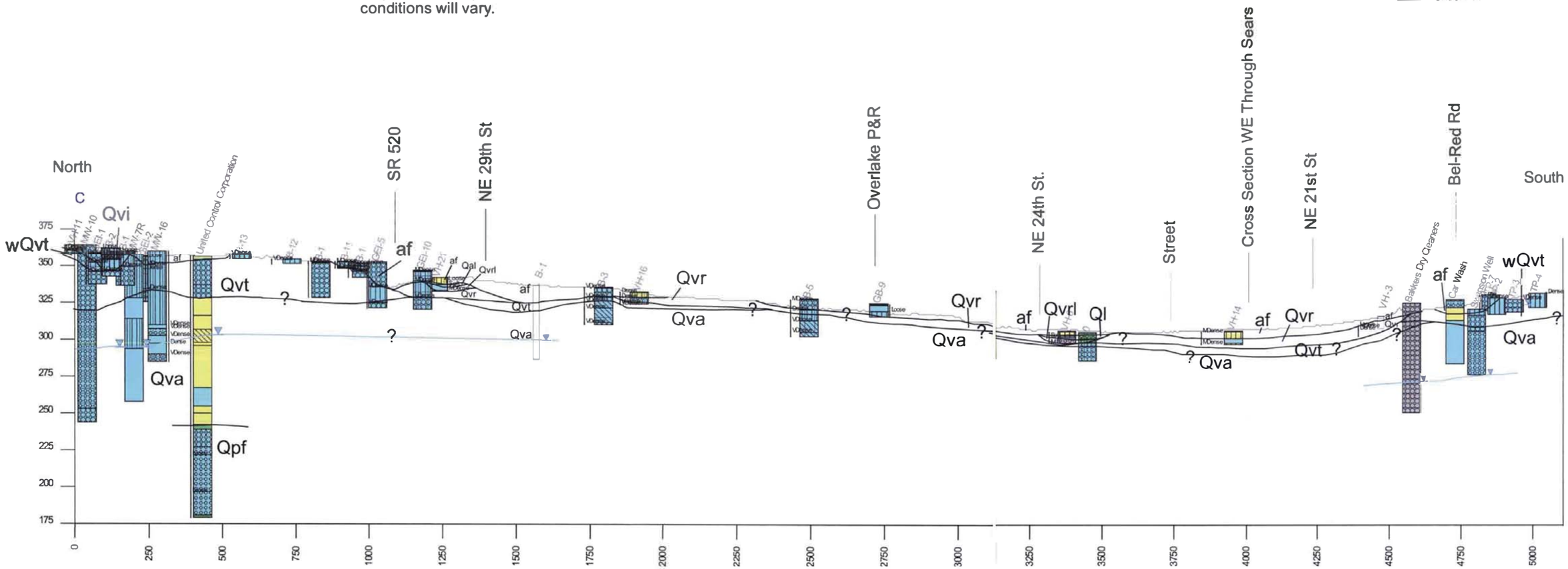
4. The interpretation shown on this cross section is based, in part, on the lithologies described on the boring logs. Although, the interpretations provided on the boring logs were not used ver batim.

5. Refer to the description of the geological materials, Table 4.

6. The cross section is intended for regional use only; site specific evaluations require geotechnical and geological investigations.

Borehole Lithology Key

- Asphalt/Concrete
- Fill
- Debris
- Topsoil/Vegetation
- Peat
- Volcanic Ash
- Cobbles
- Gravel
- Silty Gravel
- Clayey Gravel
- Sand
- Gravelly Sand
- Gravelly Silty Sand
- Silty Sand
- Gravelly Clayey Sand
- Clayey Sand
- Silt
- Gravelly Silt
- Gravelly Sandy Silt
- Sandy Silt
- Clayey Silt
- Sandy Clay/Silt
- Clay
- Gravelly Clay
- Gravelly Sandy Clay
- Sandy Clay
- Silty Clay
- Sedimentary Bedrock
- Volcanic Bedrock
- Plutonic/Metamorphic Bedrock
- Undifferentiated Rock
- No Info
- Undefined

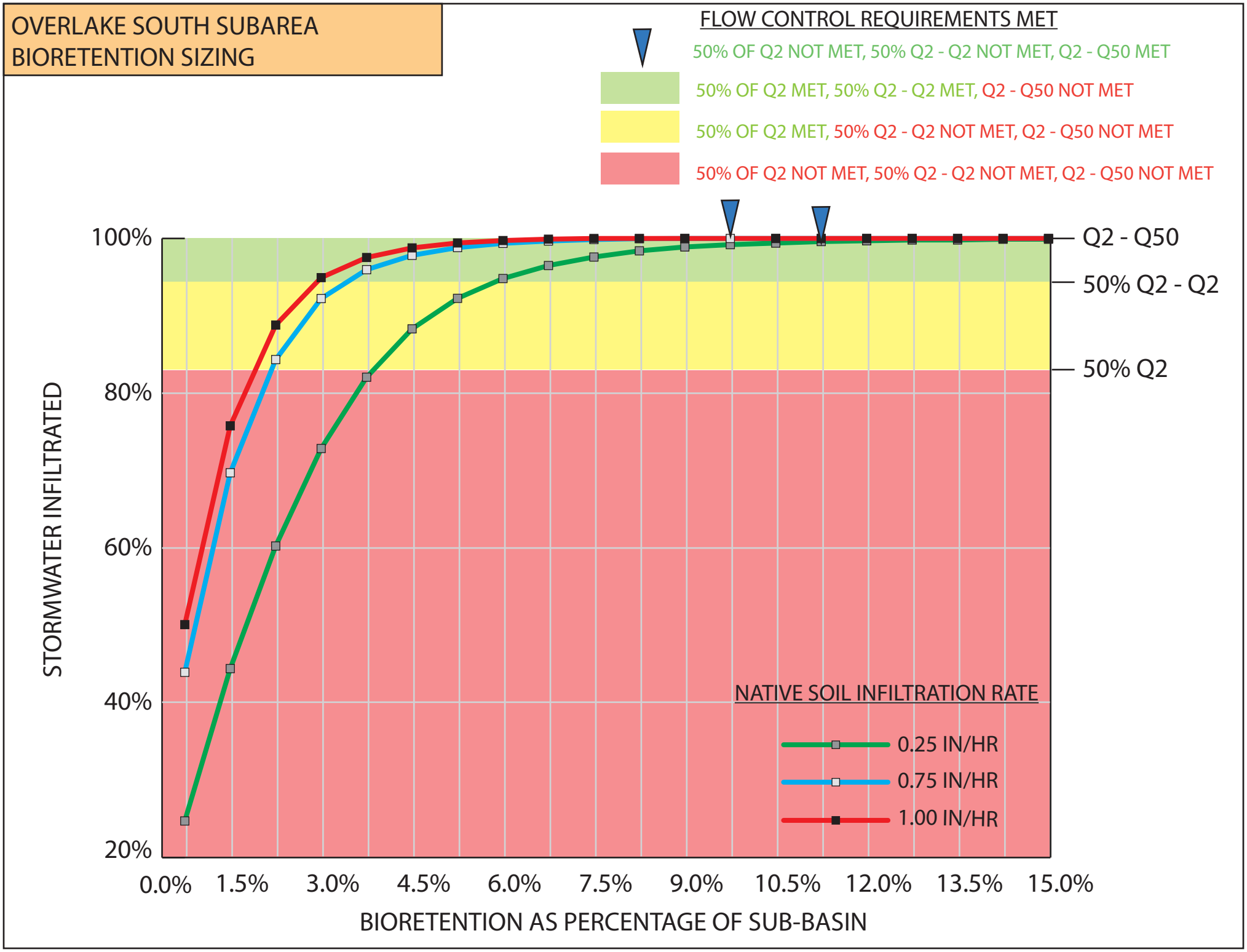


SECTION C-C
Vert. Exag. = 5x

APPENDIX B
Groundwater Sections

APPENDIX C

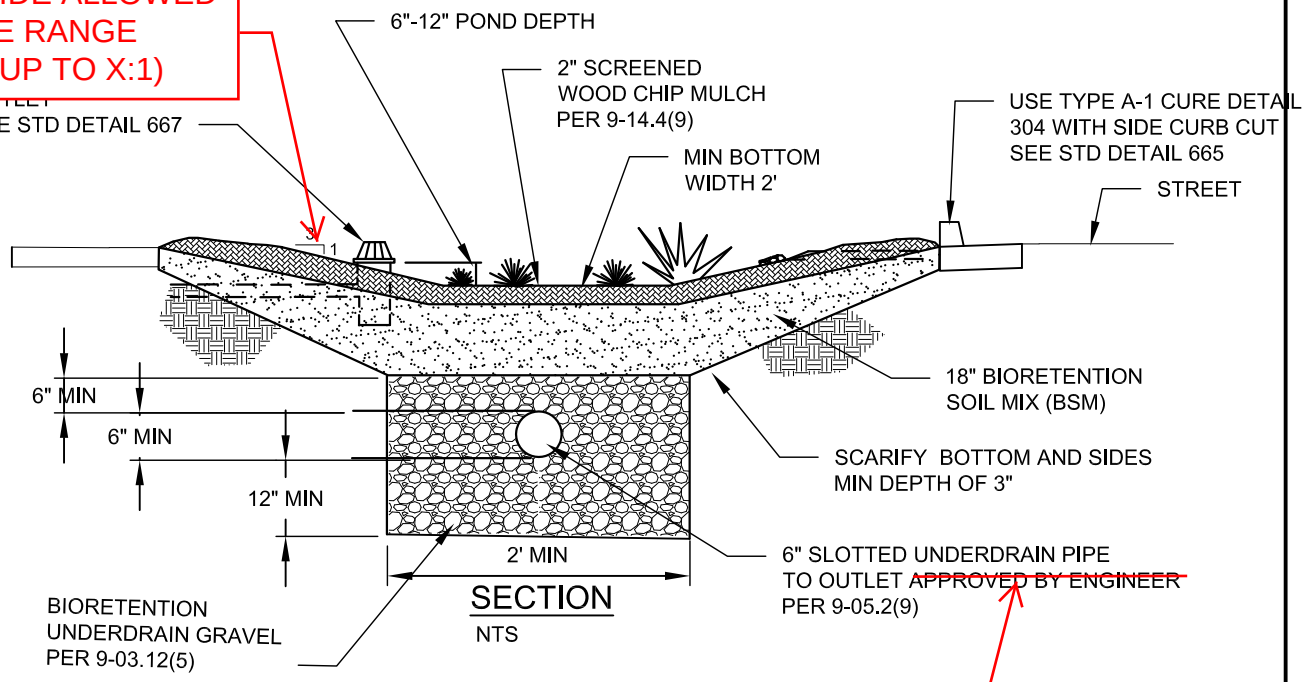
Bioretention Sizing Graphs


OVERLAKE SOUTH SUBAREA
BIORETENTION SIZING
FLOW CONTROL REQUIREMENTS MET
50% OF Q2 NOT MET, 50% Q2 - Q2 NOT MET, Q2 - Q50 MET
50% OF Q2 MET, 50% Q2 - Q2 MET, Q2 - Q50 NOT MET
50% OF Q2 MET, 50% Q2 - Q2 NOT MET, Q2 - Q50 NOT MET
50% OF Q2 NOT MET, 50% Q2 - Q2 NOT MET, Q2 - Q50 NOT MET
Q2 - Q50
50% Q2 - Q2
50% Q2
100%
80%
60%
40%
20%
STORMWATER INFILTRATED
0.0%
1.5%
3.0%
4.5%
6.0%
7.5%
9.0%
10.5%
12.0%
13.5%
15.0%
BIORETENTION AS PERCENTAGE OF SUB-BASIN
NATIVE SOIL INFILTRATION RATE
0.25 IN/HR
0.75 IN/HR
1.00 IN/HR

APPENDIX D

Comments on Bioretention Standard Details

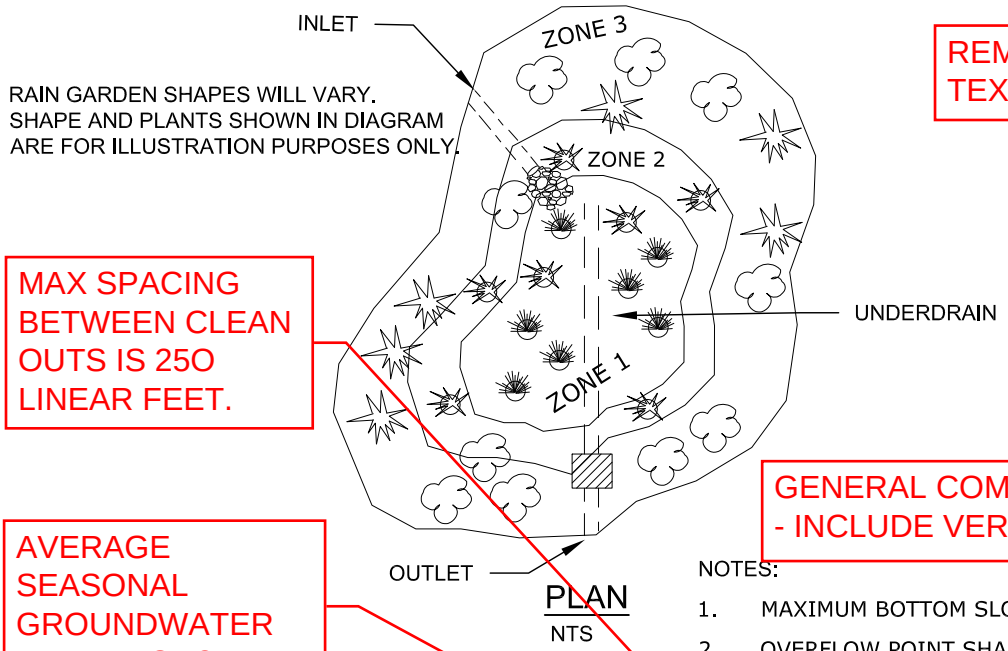
PROVIDE ALLOWED SLOPE RANGE (2.5:1 UP TO X:1)



SECTION

NTS

REMOVE THIS TEXT



RAIN GARDEN SHAPES WILL VARY. SHAPE AND PLANTS SHOWN IN DIAGRAM ARE FOR ILLUSTRATION PURPOSES ONLY.

MAX SPACING BETWEEN CLEAN OUTS IS 25O LINEAR FEET.

PLAN

NTS

GENERAL COMMENTS:
- INCLUDE VERTICAL CONFIG DETAIL

AVERAGE SEASONAL GROUNDWATER ELEVATION?

PLANTING ZONES:

ZONE 1: AREA WITH FREQUENT STANDING WATER

ZONE 2: AREA WITH OCCASIONAL STANDING WATER, AND EXTENDED DRIER PERIOD.

ZONE 3: AREA WITH DRIER CONDITIONS.

NOTES:

1. MAXIMUM BOTTOM SLOPE OF CELL IS 0.5%
2. OVERFLOW POINT SHALL BE AT LEAST 6" BELOW ANY ADJACENT PAVEMENT AREA.
3. INSTALL STREAMBED COBBLE (1" - 4") AT INLET TO DISSIPATE RUNOFF
4. IF OPTIONAL UNDERDRAIN IS USED:
   - 0.5% MIN SLOPE
   - PROVIDE A CLEAN OUT EVERY 250-300 FEET
5. MINIMUM 3' DEPTH BETWEEN UNDERDRAIN (IF PRESENT) OR BOTTOM OF BIORETENTION SOIL MIX (BSM) AND WATER TABLE.
6. MINIMUM SETBACK OF 5' FROM TOP OF BIORETENTION CELL TO BUILDING STRUCTURES AND PROPERTY LINES. DO NOT LOCATE IMMEDIATELY UPSLOPE OF BUILDING STRUCTURES.

7. AVOID COMPACTION OF EXISTING SUBGRADE BELOW PLANTER DURING CONSTRUCTION.

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

CityofRedmond WASHINGTON

STANDARD DETAILS

BIORETENTION FACILITY

FILE NAME: SD655.DWG

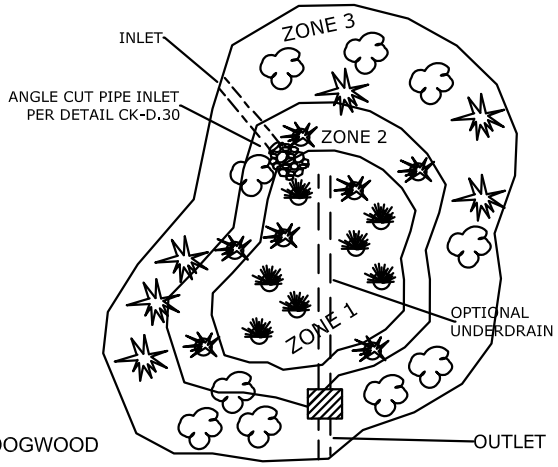
DETAIL NUMBER: **655**

THE FOLLOWING LIST INCLUDES NATIVE AND NON-NATIVE PLANT SPECIES COMMONLY AVAILABLE IN PUGET SOUND, AND SUITABLE FOR BIORETENTION CELLS AND SWALES. SITE CHARACTERISTICS AND PROJECT GOALS MAY REQUIRE MODIFICATIONS TO PLANT PROPOSED HERE (PER APPROVAL BY THE ENGINEER).

ZONE 1: AREA OF PERIODIC OR FREQUENT STANDING OR FLOWING WATER. ZONE I PLANTS SHOULD ALSO TOLERATE SEASONAL DRY PERIODS UNLESS IRRIGATION IS AVAILABLE.

ZONE 2: AREA PERIODICALLY SATURATED DURING LARGER STORMS. PLANTS LISTED UNDER ZONE 2 MAY ALSO BE APPLICABLE IN ZONE 3.

ZONE 3: AREA WITH DRIER SOILS INFREQUENTLY SATURATED. THIS AREA CAN BE USED TO TRANSITION OR BLEND WITH THE EXISTING LANDSCAPE.



ZONE 1 EMERGENT PLANTS
CAREX APERTA / COLUMBIA SEDGE
CAREX OBNUPTA / SLOUGH SEDGE
CAREX ROSTRATA / BEAKED SEDGE
CAREX STIPATA / SAWBEAK SEDGE
DESCHAMPSIA CAESPITOSA /
TUFTED HAIRGRASS
ELEOCHARIS PALUSTRIS / COMMON SPIKE RUSH
JUNCUS EFFUSUS / SOFT RUSH
JUNCUS ENSIFOLIUS / DAGGER-LEAF RUSH
JUNCUS TENUIS / SLENDER RUSH
SCIRPUS ACUTUS / HARDSTEM BULRUSH
SCIRPUS MICROCARPUS /
SMALL-FRUITED BULRUSH
SPARGANIUM SP. / BURREED

ZONE 1 SHRUBS
CORNUS SERICEA / RED-OSIER DOGWOOD
CORNUS S. 'KELSEYI'/
DWARF RED-OSIER DOGWOOD
SALIX PURPUREA 'NANA'/DWARF ARCTIC WILLOW
SPIRAEA DOUGLASII / HARDHACK
SPIRAEA JAPONICA /

ZONE 2 HERBACEOUS PLANTS
AQUILEGIA SP. / COLUMBINE
ARUNCUS SYLVESTER / GOAT'S BEARD
ATHYRIUM FELIX-FEMINA / LADY FERN
IRIS DOUGLASIANA / PACIFIC IRIS
IRIS SIBIRICA / SIBERIAN IRIS

ZONE 2 SHRUBS
CORNUS SERICEA / RED-OSIER DOGWOOD
CORNUS S. 'KELSEYI'/
DWARF RED-OSIER DOGWOOD
LONICERA INVOLUCRATA / BLACK TWINBERRY
OEMLARIA CERASIFORMIS / INDIAN PLUM
SPIRAEA JAPONICA
SYMPHORICARPOS ALBA / SNOWBERRY

ZONE 3 HERBACEOUS PLANTS & GROUNDCOVER
ARCTOSTAPHYLOS SP.
FESTUCA OVINA 'GLAUCA' / BLUE FESCUE
GAULTHERIA SHALLON / SALAL
HEMEROCALIS VARS. / DAYLILY
HEUCHERA VARS. / ALUMROOT
LAVANDULA ANGUSTIFOLIA / LAVENDER
MAHONIA REPENS / CREEPING MAHONIA
POLYSTICHUM ACROSTICHOIDES / CHRISTMAS FERN
POLYSTICHUM MUNITUM / SWORD FERN
RUDBECKIA HIRTA / BLACK-EYED SUSAN

ZONE 3 SHRUBS
ABELIA X GRANDIFLORA
ESCALLONIA VARS.
HOLODISCUS DISCOLOR /
OCEANSPRAY
MAHONIA AQUIIFOLIUM /
OREGON GRAPE
POTENTILLA FRUTICOSA / CINQUEFOIL
RIBES SANGUINEUM /
RED-FLOWERING CURRANT
ROSA GYMNOCARPA / BALDHIP ROSE
VACCINIUM OVATUM /
EVERGREEN HUCKLEBERRY

NOTE: CERTAIN TREES MAY BE APROPRIATE FOR USE IN THESE FACILITIES AND SHOULD BE SELECTED PENDING SITE CONDITIONS.

REVISE FOR VERTICAL BIORETENTION CELLS

SPECIAL CONSIDERATIONS: IN ADDITION TO SOIL MOISTURE ZONES, PLANTS SHOULD BE SELECTED TO FIT EXPOSURE,AESTHETICS AND SAFETY ISSUES .
EXPOSURE: CAREFUL CONSIDERATION SHOULD BE GIVEN TO SELECTING PLANTS FOR SUN / SHADE EXPOSURE AT THE SITE. MANY RAIN GARDENS ARE LARGELY SURROUNDED WITH PAVEMENT WHICH INCREASES THE HEAT EFFECTS OF SUN EXPOSURE.
DROUGHT TOLERANCE: THIS LIST EMPHASIZES NATIVE PLANTS, WHICH ARE GENERALLY WELL ADAPTED TO WET WINTER AND DRY SUMMER CONDITIONS. HOWEVER, SEVERAL ZONE 1 PLANTS WILL REQUIRE IRRIGATION. IN GENERAL, ALL PLANTINGS REQUIRE WATER DURING ESTABLISHMENT.
SIGHT CLEARANCE: ENSURE ADEQUATE SIGHT DISTANCE FOR ALL USERS PER CODE.
TREES: TREES MAY NOT BE APPROPRIATE IN ALL BIORETENTION CELLS, AND PLACEMENT MUST BE APPROVED BY THE ENGINEER. CONSIDER HEIGHT, SPREAD, AND EXTENT OF ROOTS AT MATURITY. USE CAUTION IN TREE SELECTION FOR AREAS WITH UNDER-DRAIN PIPES OR OTHER STRUCTURES. SEE APPENDIX 1: STREET TREES FOR MORE INFORMATION ON TREE SELECTION AND PLACEMENT SUGGESTIONS.

NOTES:

USE A MINIMUM OF 3 DIFFERENT SHRUBS AND 3 EMERGENT/GROUNDCOVER SPECIES IN EACH ZONE.
MINIMUM PLANT QUANTITIES ARE 90 PLANTS PER 100 SQ. FT. TREATMENT AREA, INCLUDING 4 SHRUBS MIN.
BIORETENTION CELLS MUST CONTAIN PLANTING ZONES 1, 2 AND 3.
EMERGENT PLANTS SHALL BE 4" POTS OR 10 C.I.PLUGS, PLACED IN CLUSTERS OF 7-15 PLANTS AT 9" O.C.
SHRUBS SHALL BE 1-GALLON, PLACED IN CLUSTERS OF 3-7.
NO TURF GRASS SHALL BE USED IN BIORETENTION CELLS.

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

CityofRedmond WASHINGTON

STANDARD DETAILS

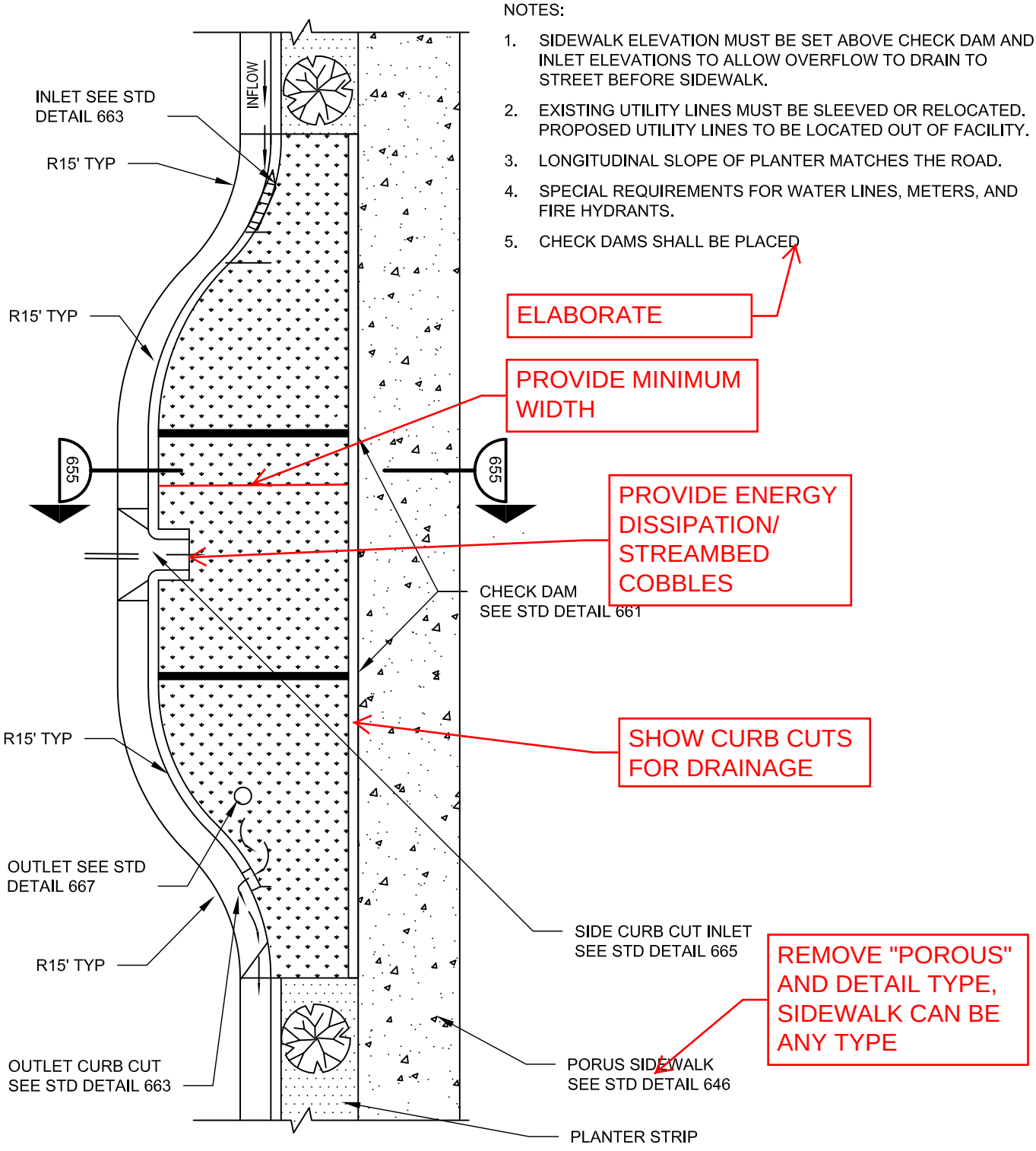
BIORETENTION PLANT PALETTE

FILE NAME: SD657.DWG

DETAIL NUMBER: **657**

NOTES:

1. SIDEWALK ELEVATION MUST BE SET ABOVE CHECK DAM AND INLET ELEVATIONS TO ALLOW OVERFLOW TO DRAIN TO STREET BEFORE SIDEWALK.
2. EXISTING UTILITY LINES MUST BE SLEEVED OR RELOCATED. PROPOSED UTILITY LINES TO BE LOCATED OUT OF FACILITY.
3. LONGITUDINAL SLOPE OF PLANTER MATCHES THE ROAD.
4. SPECIAL REQUIREMENTS FOR WATER LINES, METERS, AND FIRE HYDRANTS.
5. CHECK DAMS SHALL BE PLACED



PLAN

NTS

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

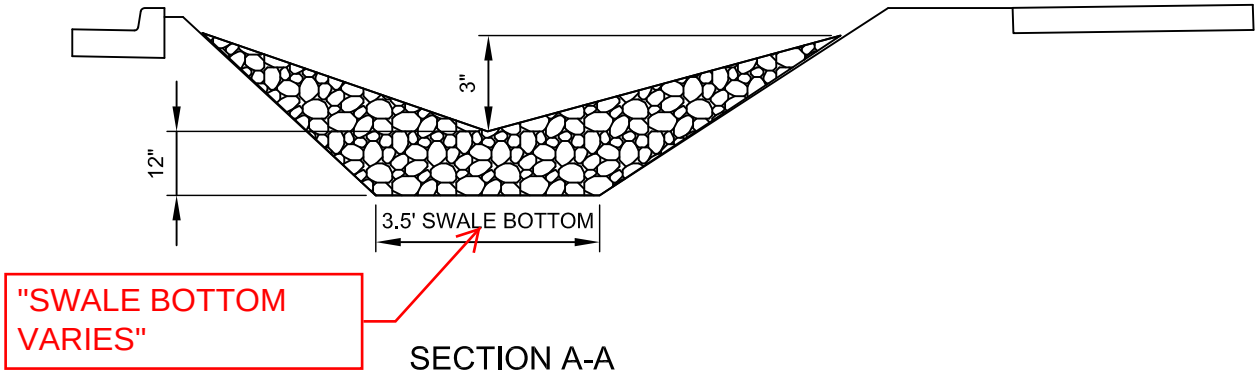
CityofRedmond WASHINGTON

STANDARD DETAILS

BIORETENTION CURB EXTENSION

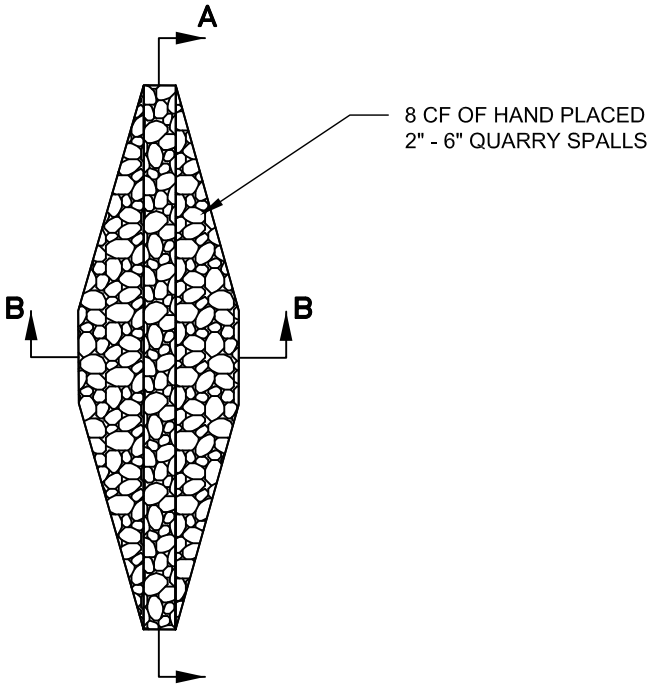
FILE NAME: SD659.DWG

DETAIL NUMBER: **659**



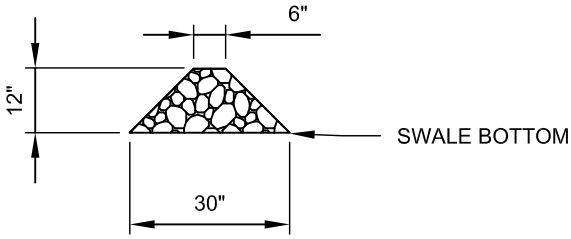
SECTION A-A

NTS



TOP VIEW

NTS



SECTION B-B

NTS

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

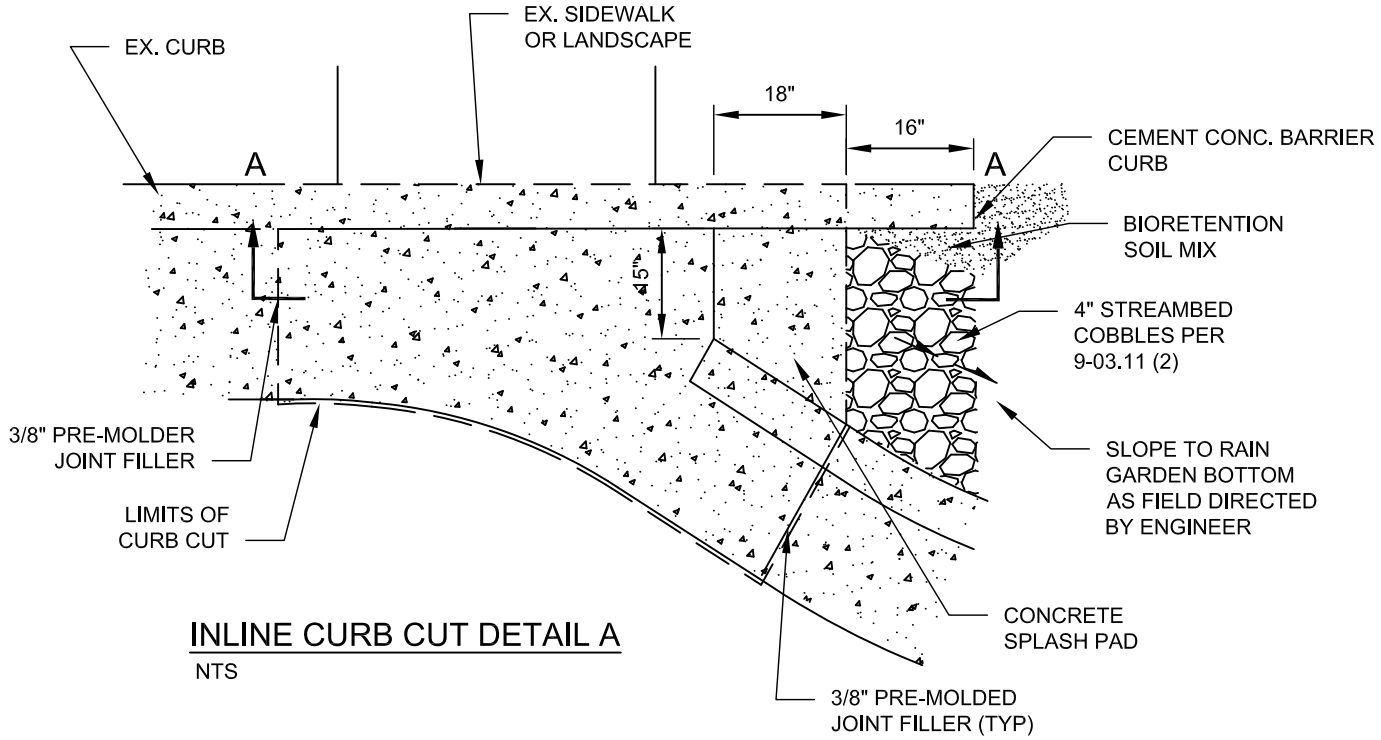
CityofRedmond WASHINGTON

STANDARD DETAILS

BIORETENTION CHECK DAM

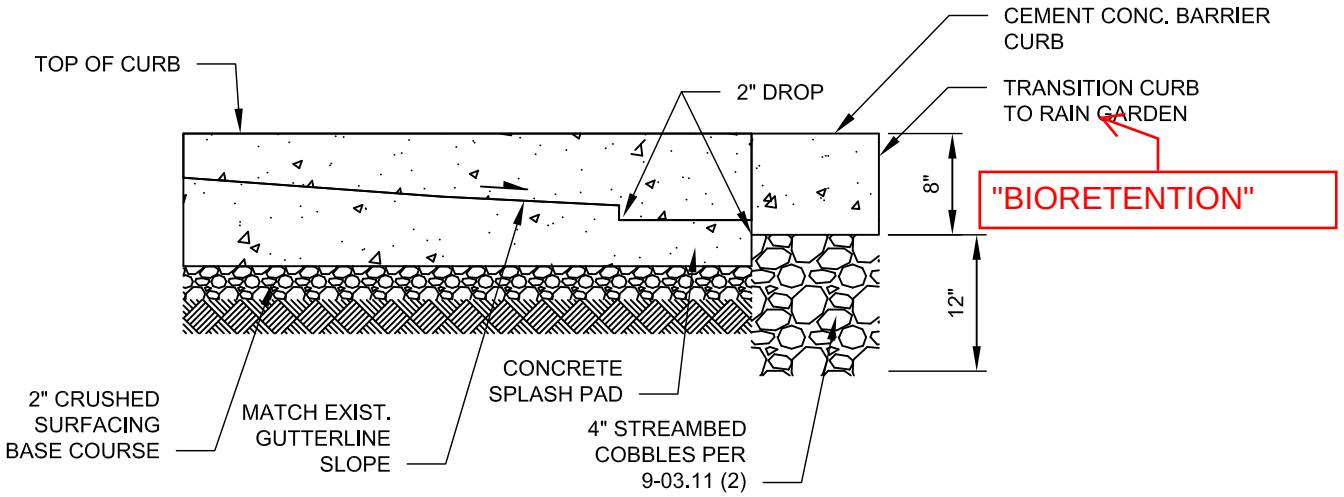
FILE NAME: SD661.DWG

DETAIL NUMBER: **661**



INLINE CURB CUT DETAIL A

NTS



INLINE CURB CUT SECTION A-A

NTS

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

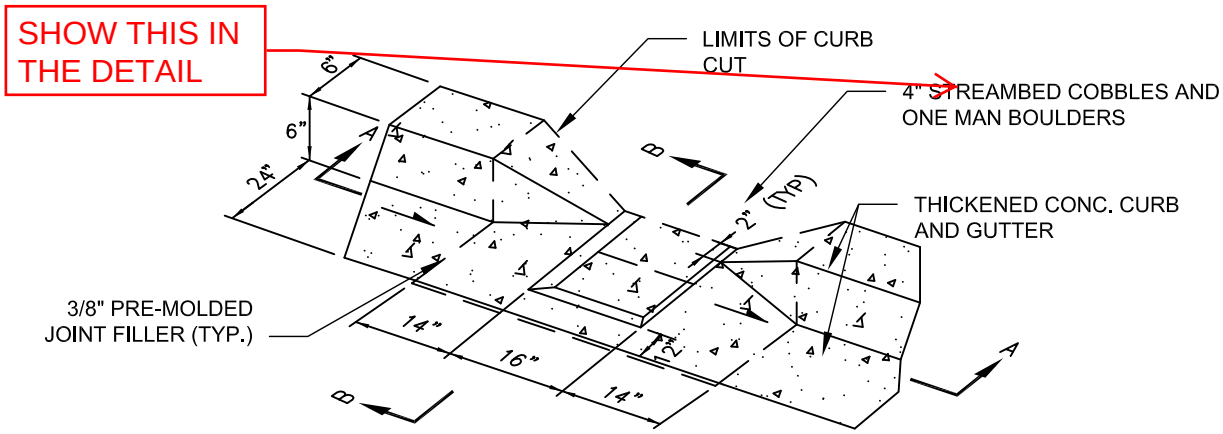
CityofRedmond
WASHINGTON

STANDARD DETAILS

BIORETENTION IN-LINE CURB CUT

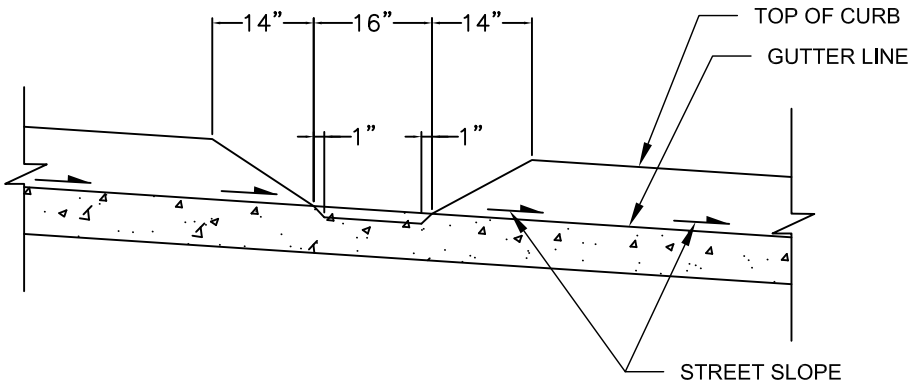
FILE NAME: SD663.DWG

DETAIL NUMBER: **663**



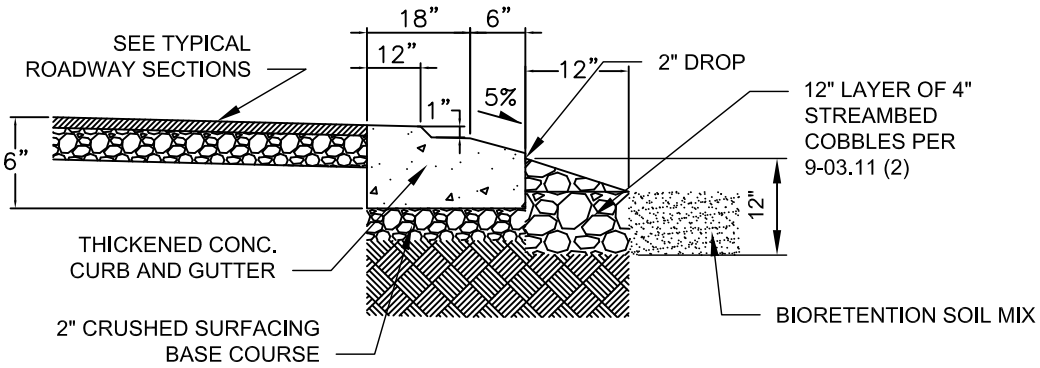
SIDE CURB CUT DETAIL A

NTS



CURB CUT TYPE 2 SECTION A-A

NTS



SIDE CURB CUT SECTION B-B

NTS

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

CityofRedmond WASHINGTON

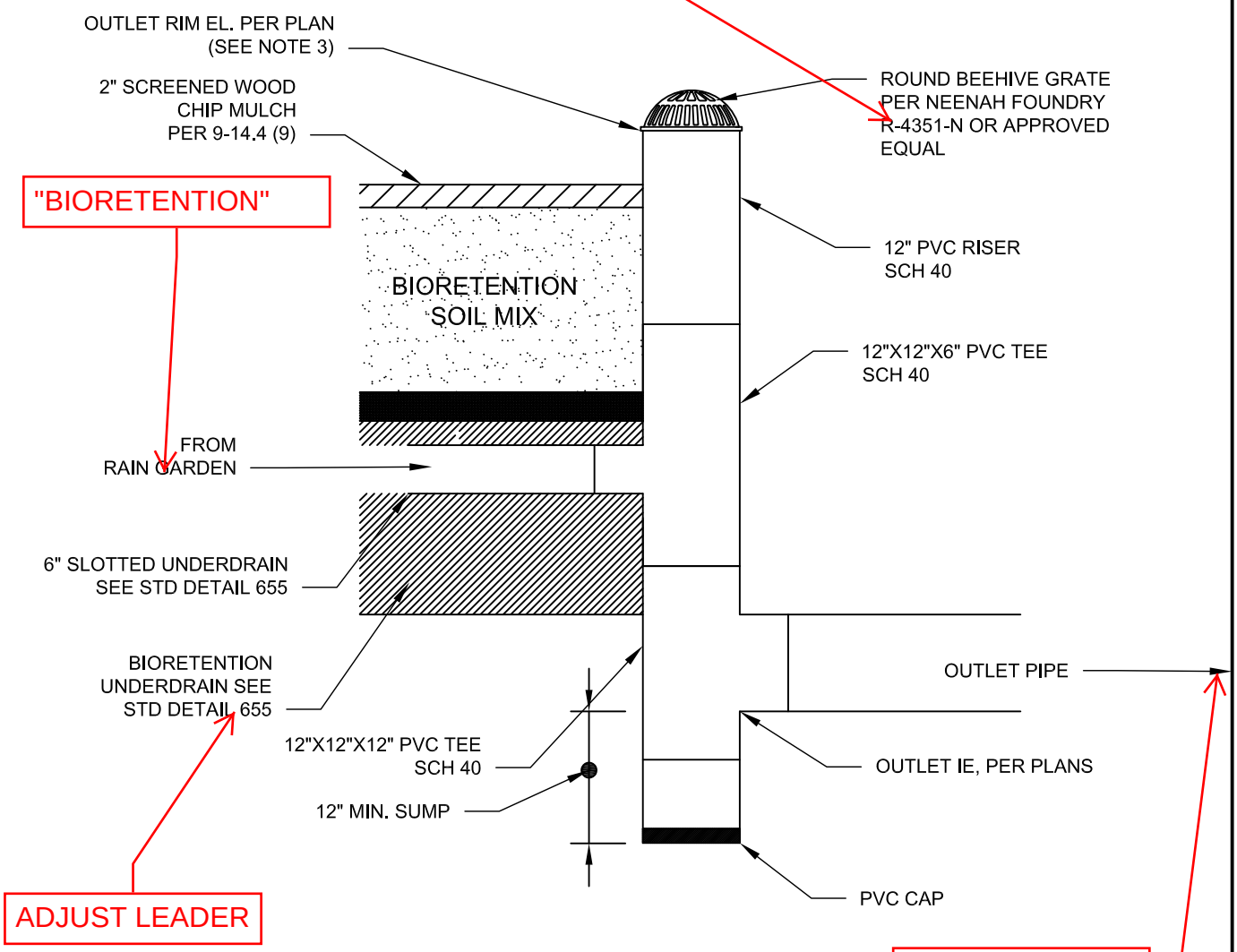
STANDARD DETAILS

BIORETENTION SIDE CURB CUT

FILE NAME: SD665.DWG

DETAIL NUMBER: **665**

THIS MODEL NOT IN THEIR CURRENT (3/2016) CATALOG, REVISE.



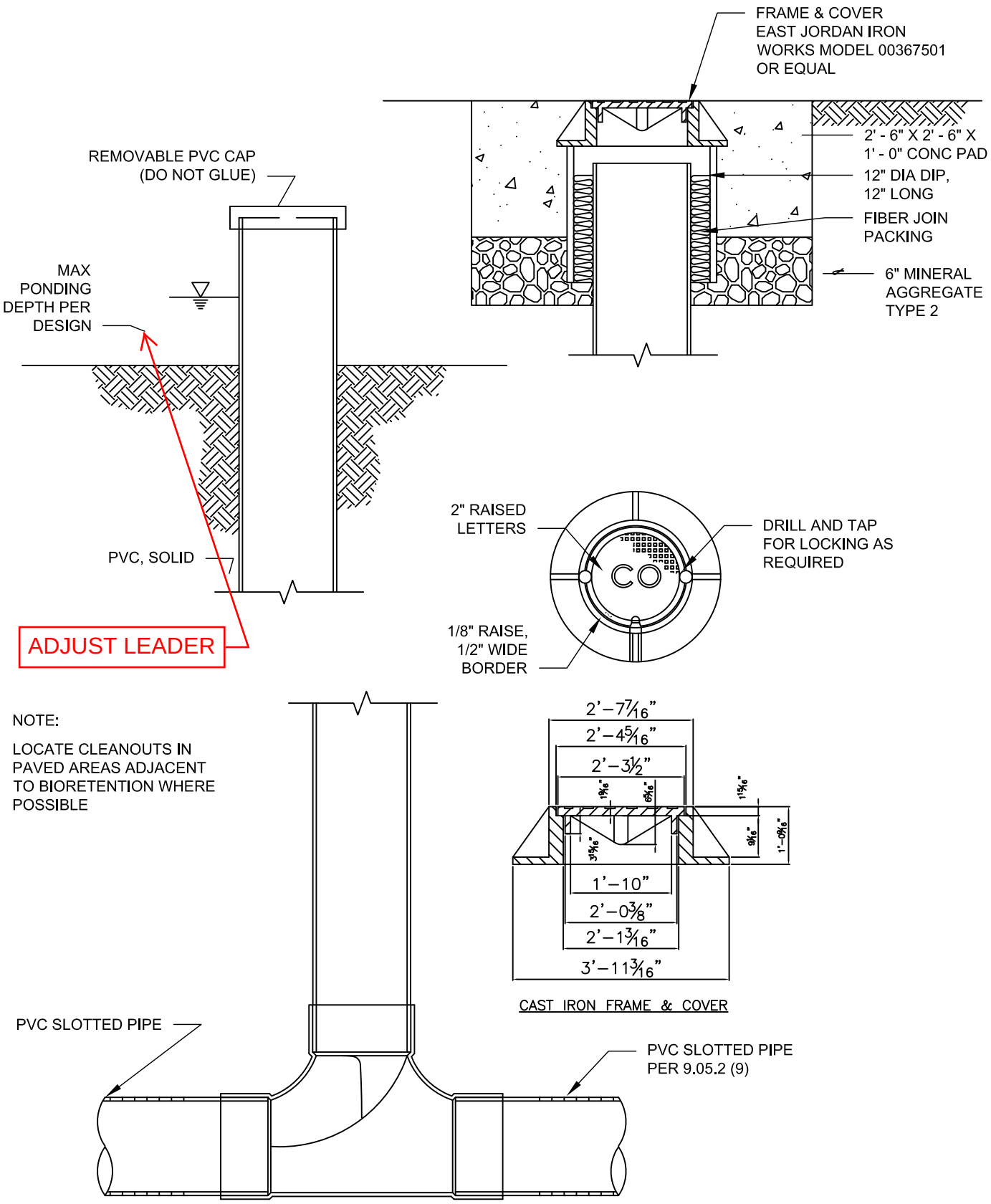
OUTLET STRUCTURE

NTS

NOTES:

1. ALL FITTINGS TO BE RUBBER GASKETED.
2. ALL PVC RISERS AND FITTINGS INSTALLED ABOVE GRADE SHALL HAVE PROTECTIVE ULTRAVIOLET COATING, OPAQUE LATEX WATER BASED PAINT OR APPROVED EQUAL.
3. OUTLET RIM 3" MIN BELOW ADJACENT PAVEMENT OF SIDEWALK

Gary M. Schimek APPROVED BY: GARY M. SCHIMEK NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER	CityofRedmond WASHINGTON	STANDARD DETAILS **BIORETENTION OUTLET STRUCTURE**
REVISION DATE: JULY 01, 2015		FILE NAME: SD667.DWG — DETAIL NUMBER: **667**



Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

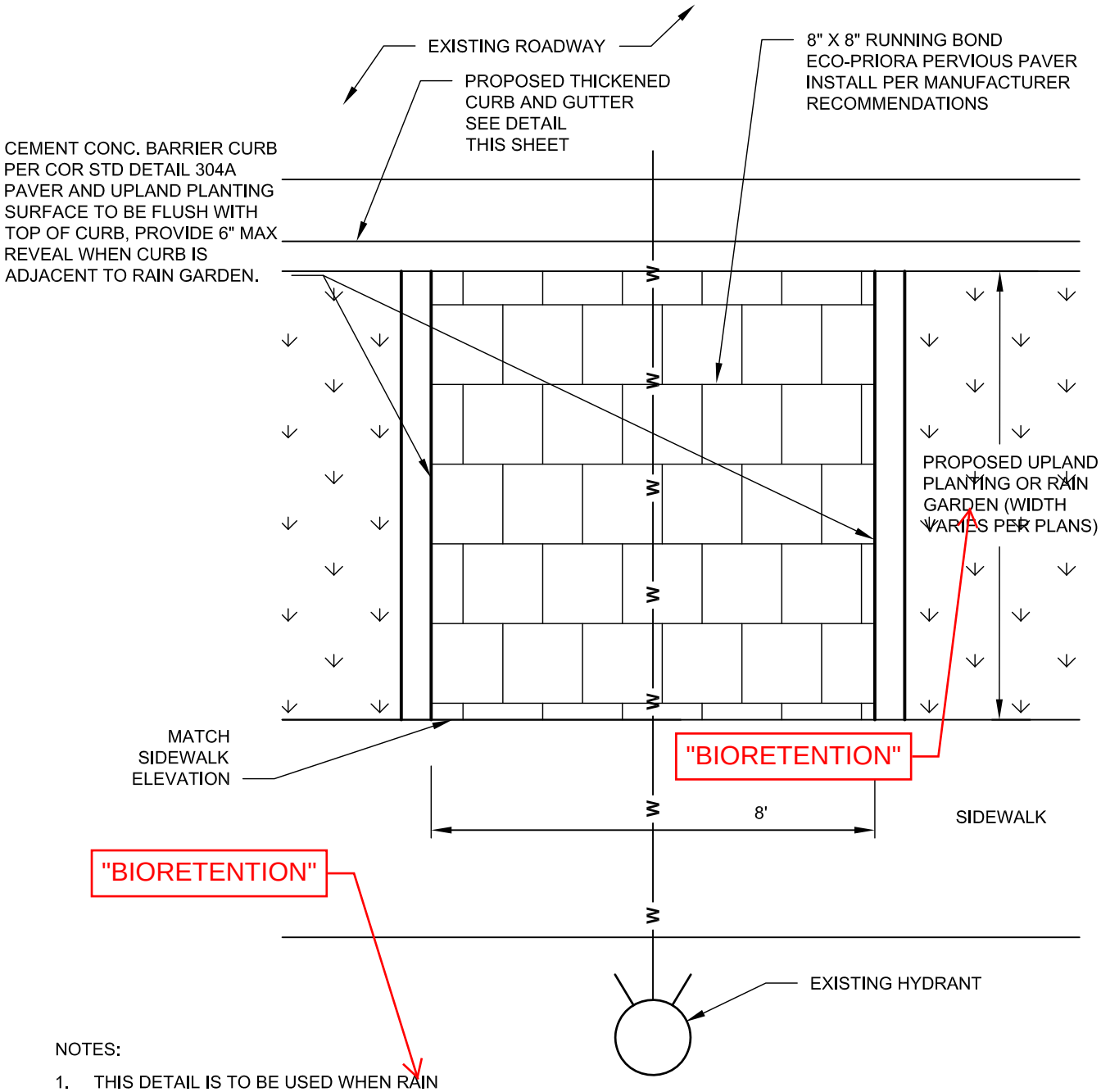
CityofRedmond
WASHINGTON

STANDARD DETAILS

BIORETENTION CLEAN - OUT

FILE NAME: SD669.DWG

DETAIL NUMBER: **669**



NOTES:

1. THIS DETAIL IS TO BE USED WHEN RAIN GARDENS ARE ON BOTH SIDES OF THE STREET, OTHERWISE LOCATE FIRE HYDRANT ON OPPOSITE SIDE OF THE STREET FROM THE RAIN GARDEN

PLAN

NTS

Gary M. Schimek

APPROVED BY: GARY M. SCHIMEK
NATURAL RESOURCES/STORMWATER ENGINEERING MANAGER

REVISION DATE: JULY 01, 2015

CityofRedmond WASHINGTON

STANDARD DETAILS

BIORETENTION HYDRANT ACCESS

FILE NAME: SD671.DWG

DETAIL NUMBER: **671**

APPENDIX E

Developer Toolkit

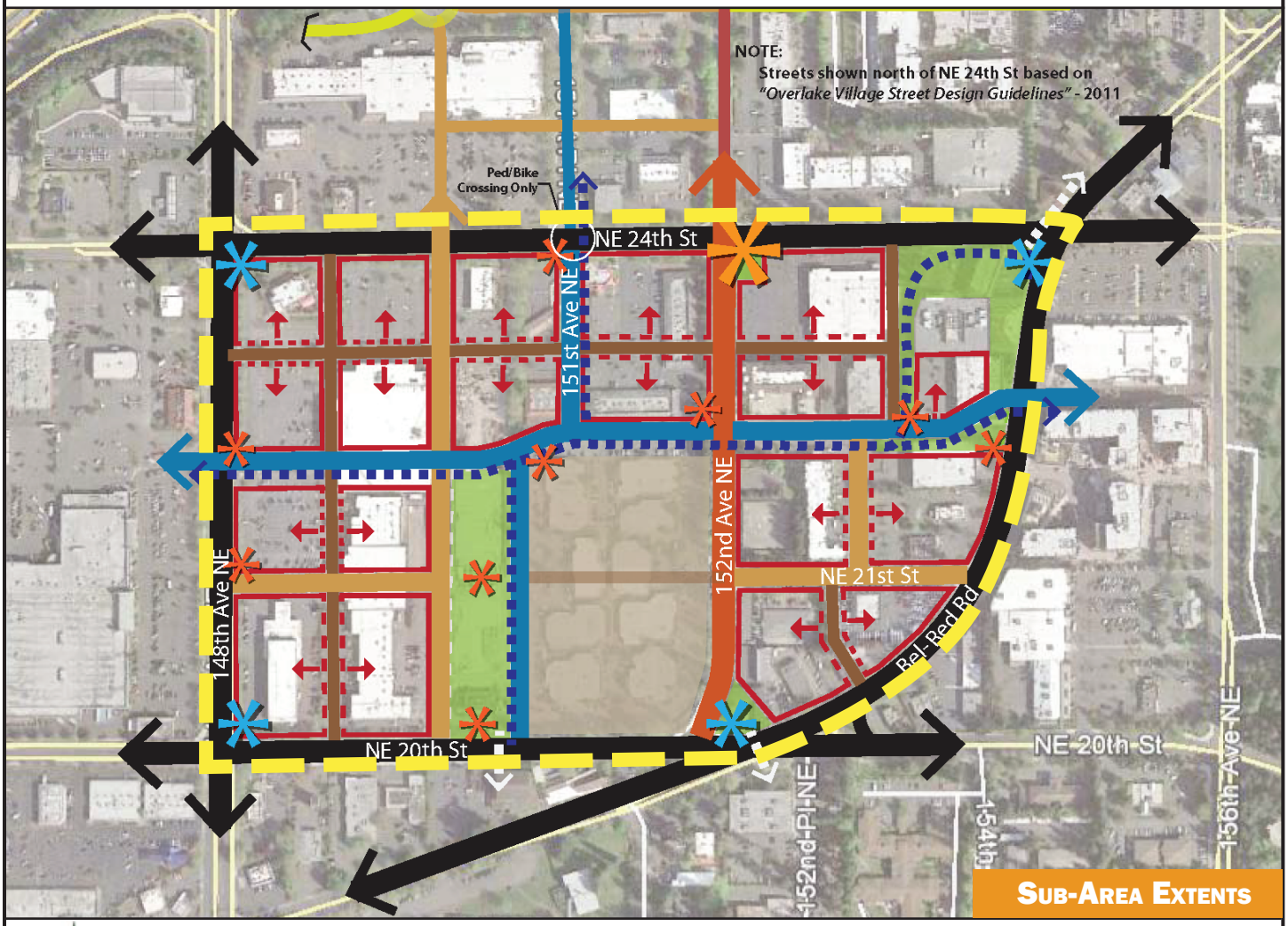
Overlake South Sub-Area
Developer Toolbox
Stormwater Management

What is the Vision of the Overlake South Sub-Area?

Overlake is designed to help meet community shopping, recreation, civic, cultural, entertainment and employment needs; provide attractive and safe places to live close to urban amenities; and be oriented towards pedestrians and bicyclists and served by local and regional bus and rail transit. Zoning regulations for Overlake Village reward urban density, innovation, and sustainability.

What is the Developer Toolbox?

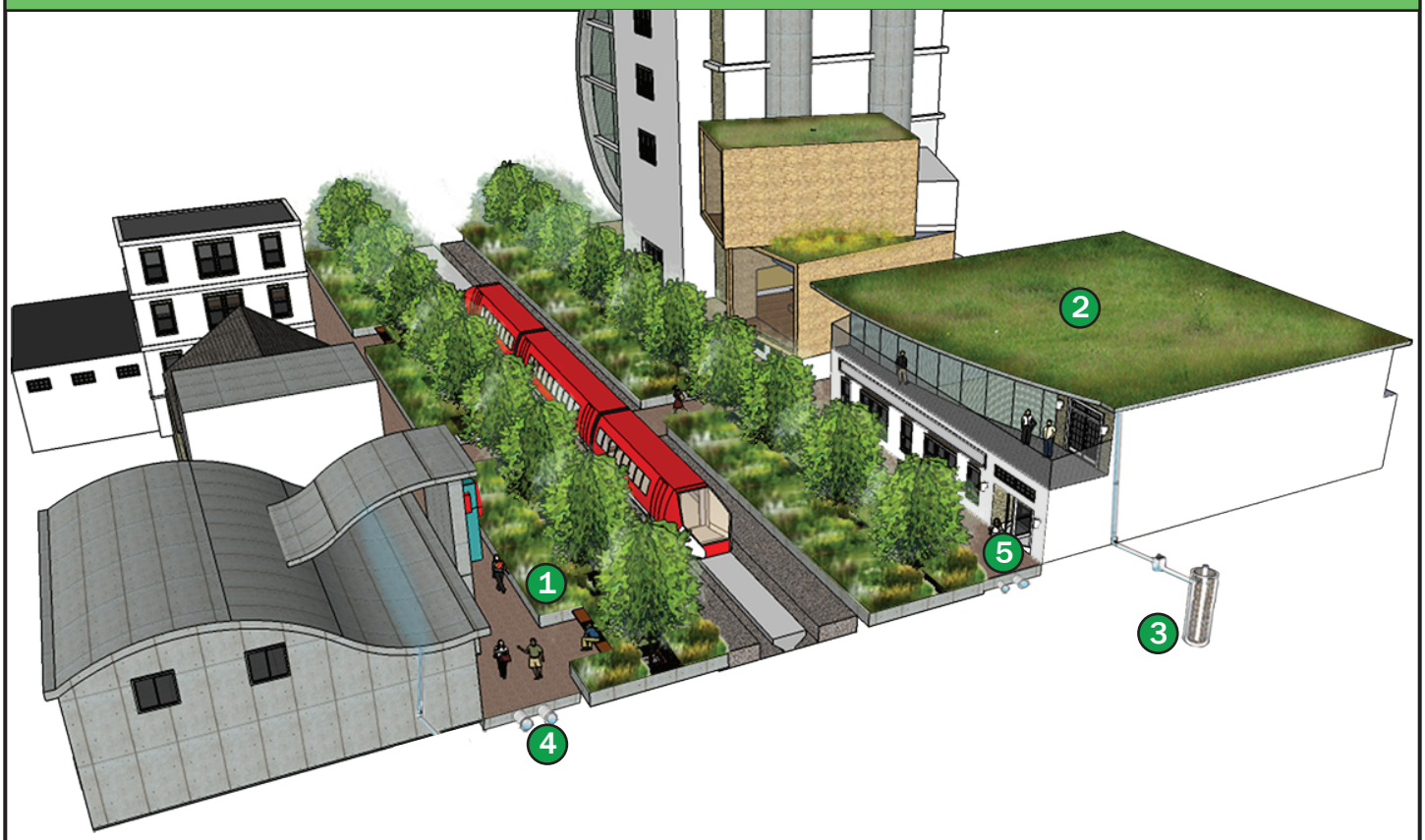
The developer toolbox is a set of stormwater best management practices that can be be utilized on private parcel development in the Overlake South Sub-Area. The best managment practices can be used in any combination to meet applicable Washington State and City of Redmond codes governing use of stormwater solutions.



Sub-Area Extents

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900



What Elements Are in the Toolbox?

Five best management practices are available to developers in the toolbox. The rendering above details how each of the elements could potentially be situated in a typical block development.

The adjoining fact sheets in the toolbox provide additional guidance in utilizing these best management practices.

1. Bioretention
2. Green Roof
3. Roof Infiltration to Drywell
4. On-Site Detention
5. Urban Pathway

Additional References:

1. City Of Redmond. Clearing, Grading and Stormwater Management Technical Notebook. Issue Number 6, Effective February 23, 2012.

2. City of Redmond. Standard Specifications and Details. 2015.

3. Department Of Ecology. Stormwater Management Manual for Western Washington. Volumes 1-5. December 2005.

Legal disclaimer: this toolbox should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all current code and rule requirements.

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

Developer Toolbox
Stormwater Management
Best Management Fact Sheet

BIORETENTION

What Is Bioretention?

Bioretention is an engineered facility sized for specific water quality treatment and flow control objectives that includes a storage component, plants, and designed soil mixes. Bioretention can come in a variety of configurations (typically cells, swale or planters) and provides a green amenity to the surroundings.

How Much Space Is Required?

Each property in the sub-area must provide the functional equivalent of routing the entire roof to a bioretention cell equal to 5% of roof area. This area is of the wetted footprint, and excludes side-slopes of the facility. If other tools are used in conjunction with bioetention, this requirement is reduced.

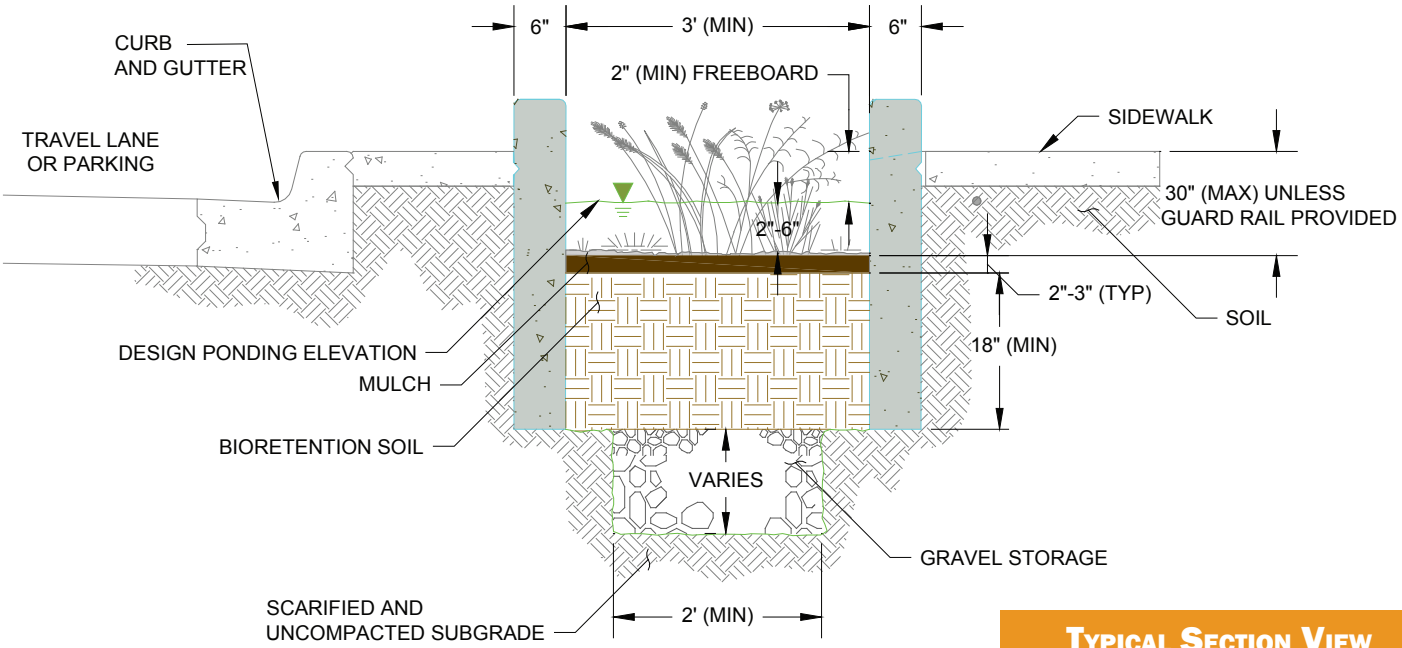
Bioretention With Vertical Walls

How Much Does It Cost?

Bioretention typically costs $25 to $50 per square foot. This includes design and construction, but excludes land acquisition.

What Is A Typical Configuration?

Bioretention can vary in shape to accommodate site conditions and developers preferences. Side-slopes typically are either vertical or 3 feet horizontal to 1 foot vertical or a combination of the two, depending on side.



Typical Section View

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

Developer Toolbox
Stormwater Management
Best Management Fact Sheet

GREEN ROOF

What Is A Green Roof?

A green roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.

Green roofs create green space for tenants, reduce stormwater runoff volume through evapotranspiration, provide peak flow rate attenuation, increase building insulation, increase the roof lifespan, create wildlife habitat and provide an aesthetic amenity.

Typical soil depths for green roofs range from 3-inches to 12 inches.

How Much Space Is Required?

There are no minimum or maximum green roof space requirements. The greater the roof area that can be green roof, the greater the benefit is provided.

Green Roof

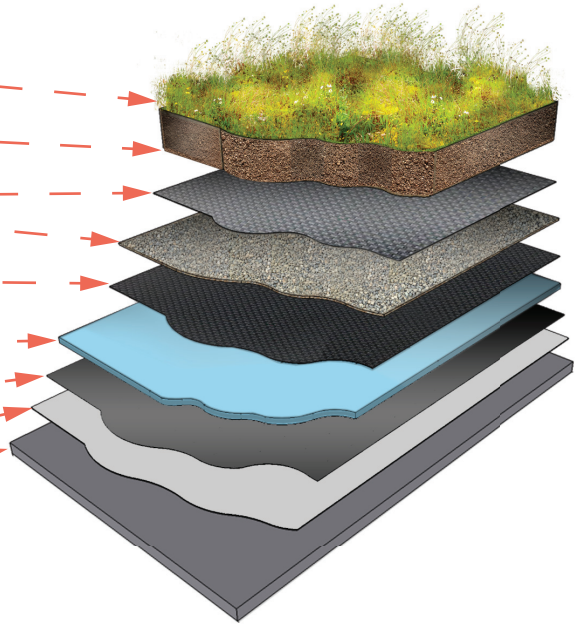
How Much Does It Cost?

Green roof costs depend on several factors such as soil media thickness and additional structural loading requirements. As a general rule, a green roof will cost in the range of $10 to $25 per square foot.

What Is A Typical Configuration?

Typical components of a green roof are as shown:

1) Grasses/Plants
The plant growth portion of the roof.
2) Soil/Growing Medium
Soil for growing plant media.
3) Filter Fabric
Keeps vegetation and growing medium intact.
4) Drainage Layer
Prevents saturation of the soil.
5) Insulation
Additional insulation for the building.
6) Wateproofing Membrane
Keeps water off of the roof deck.
7) Protection Board
Additonal protection.
8) Roof Deck
Roof of the building.



Axonometric View

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

Developer Toolbox
Stormwater Management
Best Management Fact Sheet

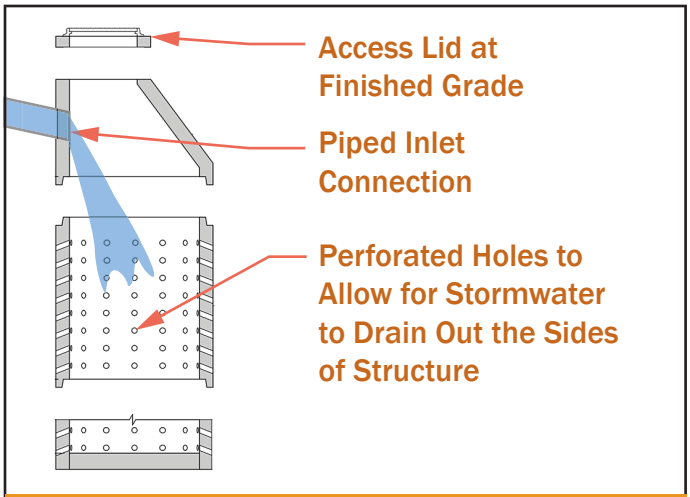
DRY WELL

What Is Drywell Infiltration?

A dry well is an underground structure that infiltrates stormwater runoff. Stormwater is routed through pre-treatment then routed into the dry well itself. Water is stored within the dry well, with perforations throughout the body of the dry well allowing water to seep out and infiltrate into native soil.

How Much Space Is Required?

Dry wells are located entirely underground. The drywell's diameter and depth dictate how much contributing area they can dispose of. Typically, a vertical separation distance is required between groundwater and the bottom of dry well, dictating maximum depth of the dry well.



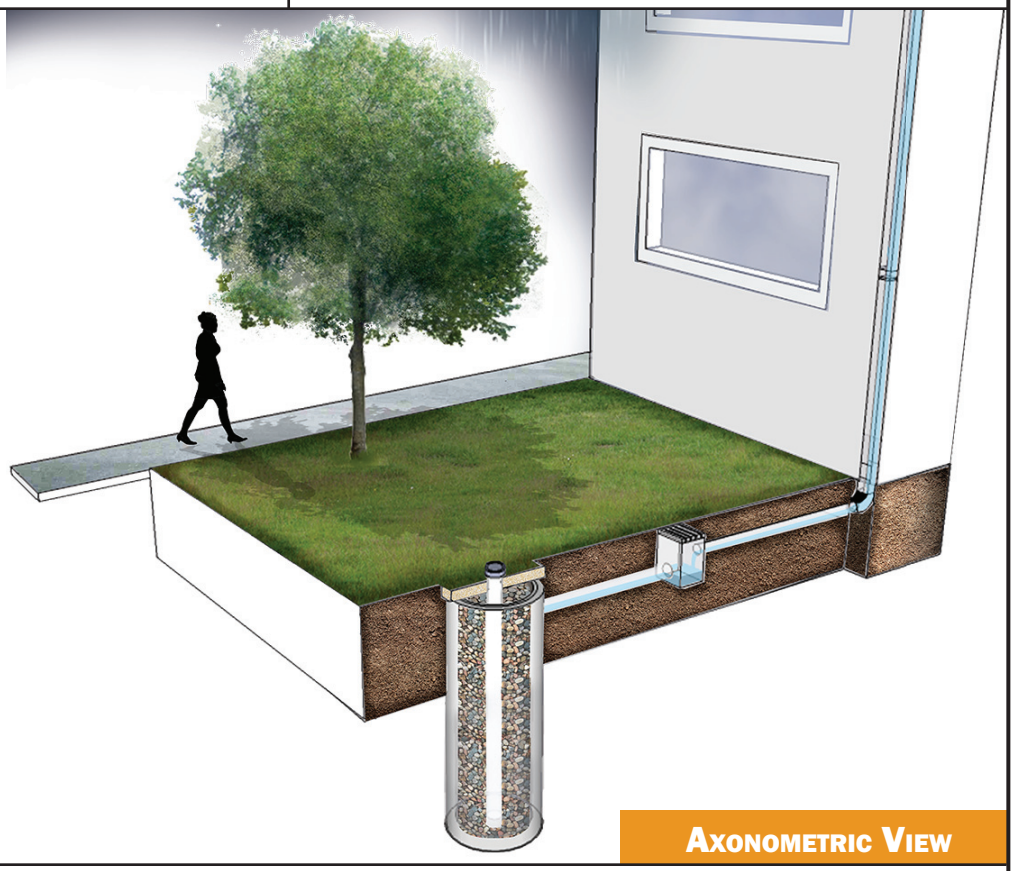
Dry Well Section

How Much Does It Cost?

Typically, costs for a dry well range from $3,000 to $7,000, per each.

What Is A Typical Configuration?

A typical drywell configuration consists of a concrete manhole with an open bottom and perforated holes throughout the manhole. The drywell is commonly filled with drain rock and has a frame and solid lid at the finished grade.



Axonometric View

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

Developer Toolbox
Stormwater Management
Best Management Fact Sheet

ON-SITE DETENTION

What Is On-Site Detention?

On-site detention is a stormwater storage and release system. Water is piped into a vault or chamber and a flow restrictor in the system restricts flows to specifically engineered levels. Stormwater is subsequently discharged into the public storm drain system.

How Much Space Is Required?

Normally, the entire system is located underground, so no surface area is required. Up to 0.5 cubic feet of storage volume per square foot of contributing land area may be required per current stormwater code.

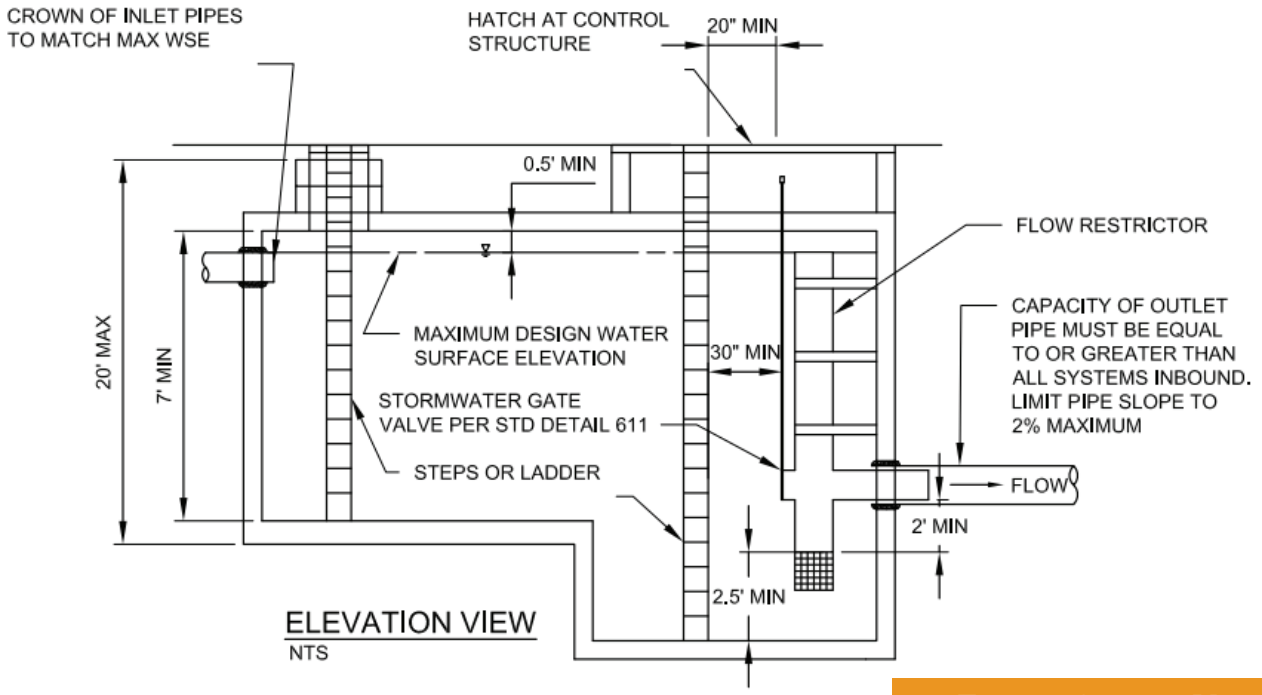
Installation of Concrete Vault

How Much Does It Cost?

Typically, underground on-site detention costs $15 to $30 per cubic foot of storage.

What Is A Typical Configuration?

The typical detention vault section from the City of Redmond Standard Plans is shown below. The structure is constructed of concrete and is installed underground.



Typical Section View

City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

Developer Toolbox
Stormwater Management
Best Management Fact Sheet

URBAN PATHWAY

What Is the Urban pathway?

The urban pathway will be a shared-used path that will be constructed in the sub-area as part of the reconfigured street grid network. The pathway will serve as a regional facility, for public and private stormwater. Underneath the pathway, stormwater chambers will be constructed to provide storage volume and infiltration into the native soil.

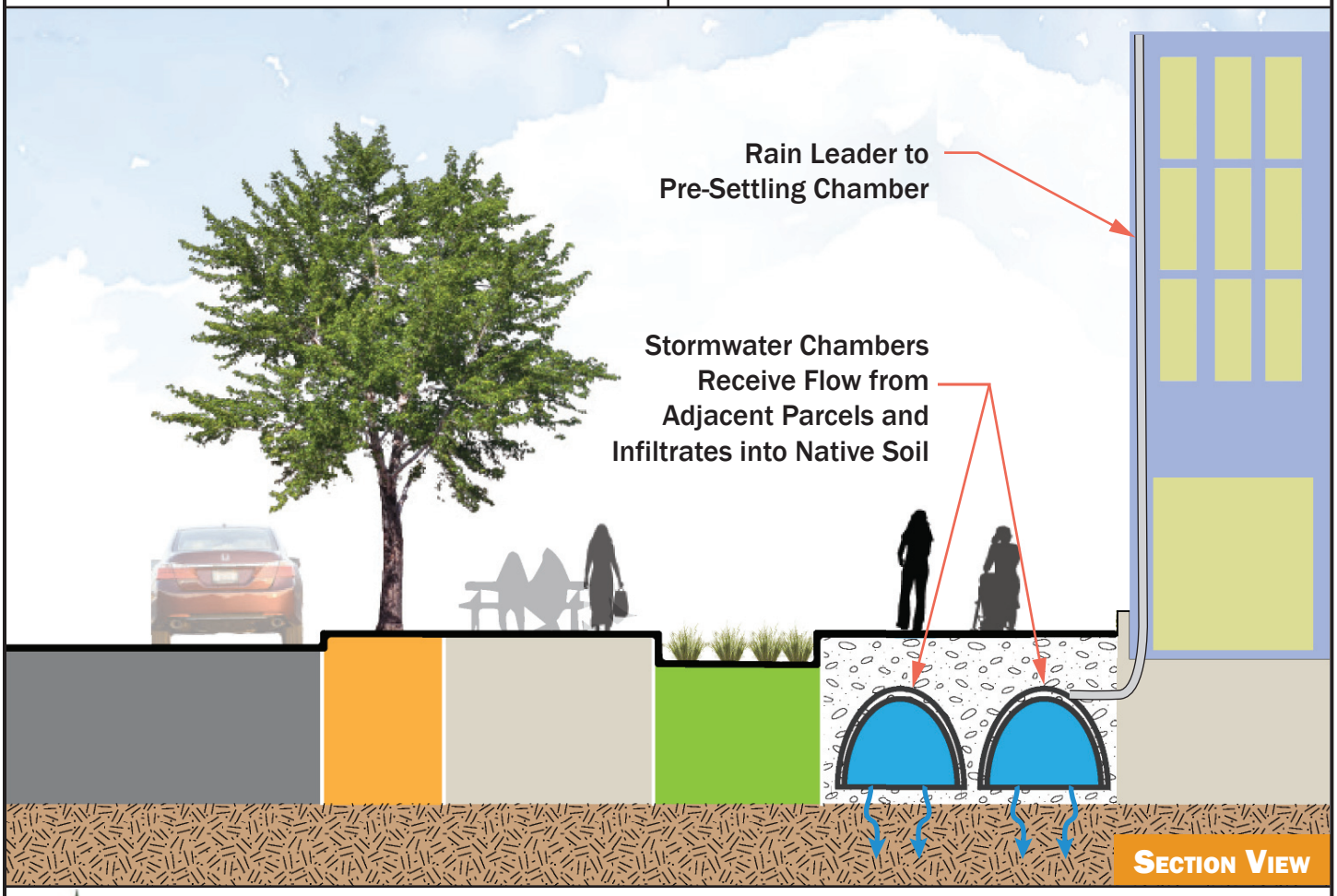
How Much Space Is Required?

The pathway stormwater storage component will be part of the public right-of-way and will be located entirely underground. Except for access points and cleanouts, the stormwater component will be not visible.

How Much Does It Cost?

City to advise on this text. Potential wording:

The urban pathway will be paid for and constructed by the City of Redmond. Developers connecting into the pathway for stormwater use will pay a fee to the City.



City of Redmond
WASHINGTON

PO BOX 98073
REDMOND, WA
425-556-2900

APPENDIX F

Open House Presentation Board

In most communities, a development project is required to construct a large detention vault onsite to manage large storms along with smaller scale infiltration facilities that manage smaller storms onsite. Redmond's regional stormwater facilities program is constructing large regional detention and infiltration vaults that allow developers to pay a fee to the City in lieu of building their own onsite detention vaults. This frees up property for development and is a more efficient and effective use of space within this urban center. The large City vaults also are a good opportunity to collocate park facilities like the future green space shown above. While the City's regional vaults manage the large storms, each public and private development is still required to provide some small onsite stormwater facilities to manage small storms. Developers get credits against their stormwater connection fees if they exceed the minimum onsite stormwater requirements described below. This project team is developing a tool box of equivalent technologies to help developers select their preferred method of providing onsite stormwater management.

Public Right-of-Way

Bioretention

Permeable Sidewalk

Filterra wiith Infiltration Trench

Future Private Parcels

Dry Well

Bioretention

Pervious Pavement

Roof Downspout Infiltration

HDR HERRERA

Onsite Stormwater Treatment Toolbox

Overlake Village South Infrastructure Planning

City of Redmond