REDMOND 13

Preliminary Plat

STORMWATER REPORT

113XX 172nd Avenue NE, Redmond, Washington

DRS Project No. 17088
Redmond File No. LAND-2017-00890

Owner/Applicant

RMJ Holdings, LLC
9675 SE 36th Street, Suite #105
Mercer Island, WA 98040
(206) 588-1147

Report Prepared by

D.R. STRONG Consulting Engineers, Inc.
620 7th Avenue
Kirkland WA 98033
(425) 827-3063

Issued: June 14, 2018
Revision Date: December 19, 2019

REDMOND 13 Preliminary Plat

STORMWATER REPORT

TABLE OF CONTENTS

SECTION I DRAINAGE REPORT SUMMARY 1

A. Drainage Information Summary Form 1

SECTION II EXECUTIVE SUMMARY 2

A. Drainage Plan Description 2
B. Drainage Basins 2
1. Pre-Developed Basin 2
2. Post-Developed Basin(s) 2
C. Offsite Improvements 2
1. Adjacent Offsite Improvements 2
2. Proposed Water Quality Measures 2
3. Downstream Analysis 2
4. Upstream Analysis 3

SECTION III MR 1 – STORMWATER SITE PLAN 4

A. Project Description 4
B. Proposed Development 4
C. Project Minimum Requirements 4
D. Existing Conditions 6
E. Downstream Analysis 6

SECTION IV MR 2 – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (CSWPPP) 15

SECTION V MR 3 – SOURCE CONTROL OF POLLUTION 16

SECTION VI MR 4 – PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS 17

SECTION VII MR 5 – ON-SITE STORMWATER MANAGEMENT 19

A. Site Assessment for LID 19

SECTION VIII MR 6 – RUNOFF TREATMENT 21

SECTION IX MR 7 – FLOW CONTROL 22

SECTION X MR 8 – WETLANDS PROTECTION 25

SECTION XI MR 9 – OPERATIONS AND MAINTENCE MANUAL 26

© 2019 D. R. STRONG Consulting Engineers Inc.

List of Figures

Figure 1 Vicinity Map 8
Figure 2 Aerial Map 9
Figure 3 Predeveloped Conditions Map 10
Figure 4 USDA King County Soils Survey Map 11
Figure 5 Minimum Requirements Flow Chart 14
Figure 6 Basin Map 18
Figure 7 LID Requirement Flow Chart 20
Figure 8 Developed Conditions Map 24

Appendices

APPENDIX A OFFSITE ANALYSIS
APPENDIX B PROJECT GEOTECHNICAL REPORT
APPENDIX C WWHM REPORT

© 2019 D. R. STRONG Consulting Engineers Inc.

SECTION I
DRAINAGE REPORT SUMMARY

A. DRAINAGE INFORMATION SUMMARY FORM

Project Name: Redmond 13

City Project Number: LAND: 2017-00890

Project Engineer: D.R. STRONG Consulting Engineers Inc.

Project Applicant: RMJ Holdings

Project Site Area: 3.006 acres

Project Development Area: 3.006 acres

Number of Lots: 13

Summary Table

Drainage Basin Information		Basin Information		
		A	B	
Project Site Area (Acres)		3.006	0.135	
Project Basin Area (acres)		3.006	0.135	
Type of Storage Proposed		Detention Vault	N/A	
Approx. Total Storage Volume (cu. ft.)		30,327	N/A	
Soil Type(s) Alderwood (AgC) 8-15%				
Pre-developed Runoff Rates				
Q (cfs.)	2 yr.	0.090	N/A	
	10 yr.	0.183	N/A	
	100 yr.	0.286	N/A	
Post-dev. Runoff Rates				
Q (cfs.)	2 yr.	0.064	N/A	
	10 yr.	0.136	N/A	
	100 yr.	0.289	N/A	
Bypass Area (acres)		0.713	N/A	
Offsite Upstream Area				
Number of acres (included in runoff analysis)		N/A	N/A	

Basin A represents Threshold Discharge Area (TDA) 1 and a portion of the frontage improvements. Basin B represents TDA 2 (frontage improvements). These TDAs and the downstream path of each are discussed further in the downstream analysis portion of this report.

SECTION II
EXECUTIVE SUMMARY

A. DRAINAGE PLAN DESCRIPTION

The Project proposes a subdivision of one parcel totaling 3.006 acres into 13 lots for single family residences.

B. DRAINAGE BASINS

1. Pre-Developed Basin

Total existing Site area is approximately, 130,929 s.f. (3.006 acres). Vegetation consists of douglas fir, maple, cherry, alder, pine, willow and cedar trees, as well as lawn, shrubs and bushes. The parcel currently has an existing shop and a gravel access driveway.

The Site, in general, slopes from east to west with grades varying from 3% up to 30% in isolated areas.

The Project is contained within two Threshold Discharge Areas (TDA).

2. Post-Developed Basin(s)

The applicant is seeking approval to create 13 lots with lot sizes ranging from approximately, 4,887 s.f. to 13,344 s.f. The existing structure and improvements will all be removed during plat construction.

C. OFFSITE IMPROVEMENTS

1. Adjacent Offsite Improvements

The Site abuts 172nd Avenue SE to the west. Work in this ROW will include new sidewalks, planter strip, two new ADA ramps, and a new stormwater conveyance system. A full street grind and overlay will also be provided at the intersection of the proposed road and 172nd Avenue NE per City Standards. A half-street grind and overlay will be provided along the entire frontage. The total new plus replaced impervious area in the frontage is 4,185 s.f.

2. Proposed Water Quality Measures

The Project includes more than 5,000 s.f. of new and existing pollution generating impervious surface (PGIS) and is located in the basic water quality treatment area meaning a formal water quality facility is required. A combined detention/wet vault is proposed to meet these requirements of a formal water quality control facility.

3. Downstream Analysis

Runoff currently leaves the Site at three discharge locations. The first Natural Discharge Area (NDA) is NDA Northeast, and the Natural Discharge Location (NDL 1), is sheet flow over the eastern property line. Runoff is captured by an existing 12” PVC inlet located on Hawthorne Lane plat and is conveyed through a series of man-made pipes and structures until it is discharged into Monticello Creek, approximately 350 ft from the Site. Monticello Creek discharges into Bear

Creek after conveying stormwater in an easterly direction for approximately one mile.

The NDL for the second NDA Southeast is sheet flow over the southern property line. After leaving the Site, runoff enters the channel along the southern property line and heads east onto the Hawthorne Lane plat. This runoff sheet flows in a northerly direction and converges with NDA Northeast at the 12" PVC inlet.

NDA Southwest leaves the site as sheet flow over the southern property line near the southwest property corner. This stormwater is also collected by the existing swale on the southern property line and conveyed east before joining the downstream path of NDA Southeast.

The convergence point of these three NDAs is within ¼ mile from the Site, therefore the Site is contained in one Threshold Discharge Area (TDA1).

The Project will also include half street improvements to the east side of 172nd Avenue NE along the Site frontage. This frontage area is a separate TDA2, and is made up of a single NDA with one NDL. This stormwater is collected by an existing swale on the east side of 172nd Avenue NE and is conveyed to a 12" CPP inlet pipe located near the southwest property corner. The runoff then follows an existing conveyance system in 172nd Ave NE until it discharges into a stormwater retention pond approximately 900 ft from the Site. The outlet of this stormwater retention pond conveys stormwater in a northwesterly direction via High School Creek until it enters the Sammamish River.

4. Upstream Analysis

In evaluating the upstream area, we reviewed King County IMAP aerial topography, City of Redmond Property Viewer aerial topography, imagery and conducted field reconnaissance. The local topographical generally slopes from the northwest to the southeast across the Site. Areas to the north and south of the site slope in an easterly direction, away from the Site. The westerly property line is bordered by 172nd Ave SE, which contains an existing conveyance system that collects runoff. The upstream tributary areas for the Site are negligible. There are no anticipated negative impacts to the Site due to upstream runoff.

SECTION III
MR 1 – STORMWATER SITE PLAN

A. PROJECT DESCRIPTION

The Project proposes a subdivision of one parcel totaling 3.006 acres into 13 lots for single family residences. The Tax Parcel Number is 362605-9098. The Project is located in the NW ¼, Sec. 36, Twp. 26 N., R.5 E., W.M. The Project site (Site) is zoned R-4. The Project has frontage on 172nd Avenue NE to the west. The Project will meet the drainage requirements of the City's 2019 Stormwater Technical Notebook and the 2012 Stormwater Management Manual for Western Washington, as amended in 2014 (Manual).

B. PROPOSED DEVELOPMENT

The applicant is seeking approval to create 13 lots with lot sizes ranging from approximately, 4,887 s.f. to 13,344 s.f. The existing structure and improvements will all be removed during plat construction.

The Project is located within the City's flow control required zone. All surface water runoff from impervious surfaces on site will be collected and conveyed to the proposed stormwater detention facility centrally located along the eastern property line. The proposed impervious area added to the Site frontage will be collected via a proposed conveyance system and conveyed south to the existing system in 172nd Avenue NE. This frontage area will not be considered when sizing the proposed combined detention/wet vault facility, as it is part of a separate TDA and runoff from this TDA will not be collected and routed to the combined detention/wet vault facility. The total new plus replaced impervious area along the frontage is 4,185 s.f. A combined detention/wet vault is proposed to meet the detention and water quality treatment requirements.

C. PROJECT MINIMUM REQUIREMENTS

The Minimum Requirements that apply to this Project were determined using the Flow Chart for New Development.

Per the chart, Minimum Requirements #1- #9 apply to all new and replaced impervious surfaces, and disturbed pervious surfaces. Since, the project contains two TDAs, each TDA must be evaluated to determine how to apply all of the minimum requirements. The Minimum Requirements, as identified by the 2014 DOE Manual, and a brief discussion of how they are met follows:

1. **Preparation of Stormwater Site Plans**

   The Plat Engineering Drawings and this Report constitute the Stormwater Site Plans.

2. **Construction Stormwater Pollution Prevention**

   A formal SWPPP will be provided during the engineering review process.

3. **Source Control of Pollution**

   Source Control of Pollution will be addressed in the SWPPP.

4. Preservation of Natural Drainage Systems and Outfalls

TDA1 proposes to discharge stormwater at the natural discharge point of NDA Northeast. A more detailed breakdown of the existing natural drainage systems can be found in the downstream analysis portion of this report. TDA2 is proposing to construct a conveyance system and discharge the runoff to the existing natural drainage system.

5. On-site Stormwater Management

For this Project, full infiltration, limited infiltration, permeable pavement, and bioretention of runoff is not feasible due to the native soils on-site per the geotechnical report. Full dispersion is also infeasible due to the limited availability of vegetated flowpaths. Instead Basic Dispersion may be implemented via splash blocks, sheet flow dispersion, rock pads, or gravel filled trenches. The final design and location of these flow control BMP devices will be included at the time of final engineering. Perforated Stub-out Connections (BMP T5.10C) will also be implemented to manage roof runoff where necessary. Post Construction Soil Quality and Depth (BMP T5.13), will be implemented where required. On-site stormwater management BMP selection is discussed in Section VII.

Per Chapter 2.5.5.1 of the Stormwater Technical Notebook, TDA2 must apply BMP T5.13: Post-Construction Soil Quality and Depth since it is exempt from Minimum Requirements 7 (discussed below). This will be implemented where required.

6. Runoff Treatment

TDA1 is proposing over 5,000 s.f. of pollution generating hard surface (PGHS) meaning that a formal water quality treatment facility is required. A combined detention/wet vault was selected to meet the Manual requirements for water quality treatment. See Section VIII for a detailed breakdown of the WWHM analysis used to size the water quality volume.

TDA2 is proposing less than 5,000 s.f. of PGHS and is exempt from runoff treatment. Per the Thresholds in Chapter 2.5.6, “Projects in which the total of pollution generating hard surface (PGHS) is 5,000 s.f. or more in a threshold discharge area of the project” require the construction of a stormwater treatment facility.

7. Flow Control

TDA 1 is proposing over 10,000 s.f. of effective impervious area meaning that a formal flow control facility is required. The Project is located in a Basic Flow Control required area per the City of Redmond and therefore a formal flow control facility is required. A combined detention/wet vault was selected as the flow control facility and Section IX details the WWHM area breakdown used to size this vault.

TDA2 is proposing less than 10,000 s.f. of effective impervious area and is exempt from flow control. Per the Thresholds in Chapter 2.5.7, “Projects in which

the total effective impervious surfaces is 10,000 s.f. or more in a threshold discharge area", require achievement of the standard flow control requirement.

8. **Wetlands Protection**

   The Project is proposing to route collected runoff through the combined detention/wet vault and to the existing conveyance system in the Hawthorne Park Plat. This existing conveyance system outlets directly to a wetland. See Section X for more details.

9. **Operation and Maintenance**

   An operations and maintenance manual is included in Section XI of this report.

D. EXISTING CONDITIONS

Total existing Site area is approximately, 130,929 s.f. (3.006 acres). Vegetation consists of douglas fir, maple, cherry, alder, pine, willow and cedar trees, as well as lawn, shrubs and bushes. The parcels are currently developed with one single-family residence and a gravel access driveway.

The Site, in general, slopes from east to west with grades varying from 3% up to 30% in isolated areas.

The Project is contained within two Threshold Discharge Areas (TDA).

E. DOWNSTREAM ANALYSIS

Runoff currently leaves the Site at three discharge locations. The first Natural Discharge Area (NDA) is NDA Northeast, and the Natural Discharge Location (NDL 1), is sheet flow over the eastern property line. Runoff is captured by an existing 12" PVC inlet located on Hawthorne Lane plat and is conveyed through a series of man-made pipes and structures until it is discharged into Monticello Creek, approximately 350 ft from the Site. Monticello Creek discharges into Bear Creek after conveying stormwater in an easterly direction for approximately one mile.

The NDL for the second NDA Southeast is sheet flow over the southern property line. After leaving the Site, runoff enters the channel along the southern property line and heads east onto the Hawthorne Lane plat. This runoff sheet flows in a northerly direction and converges with NDA Northeast at the 12" PVC inlet.

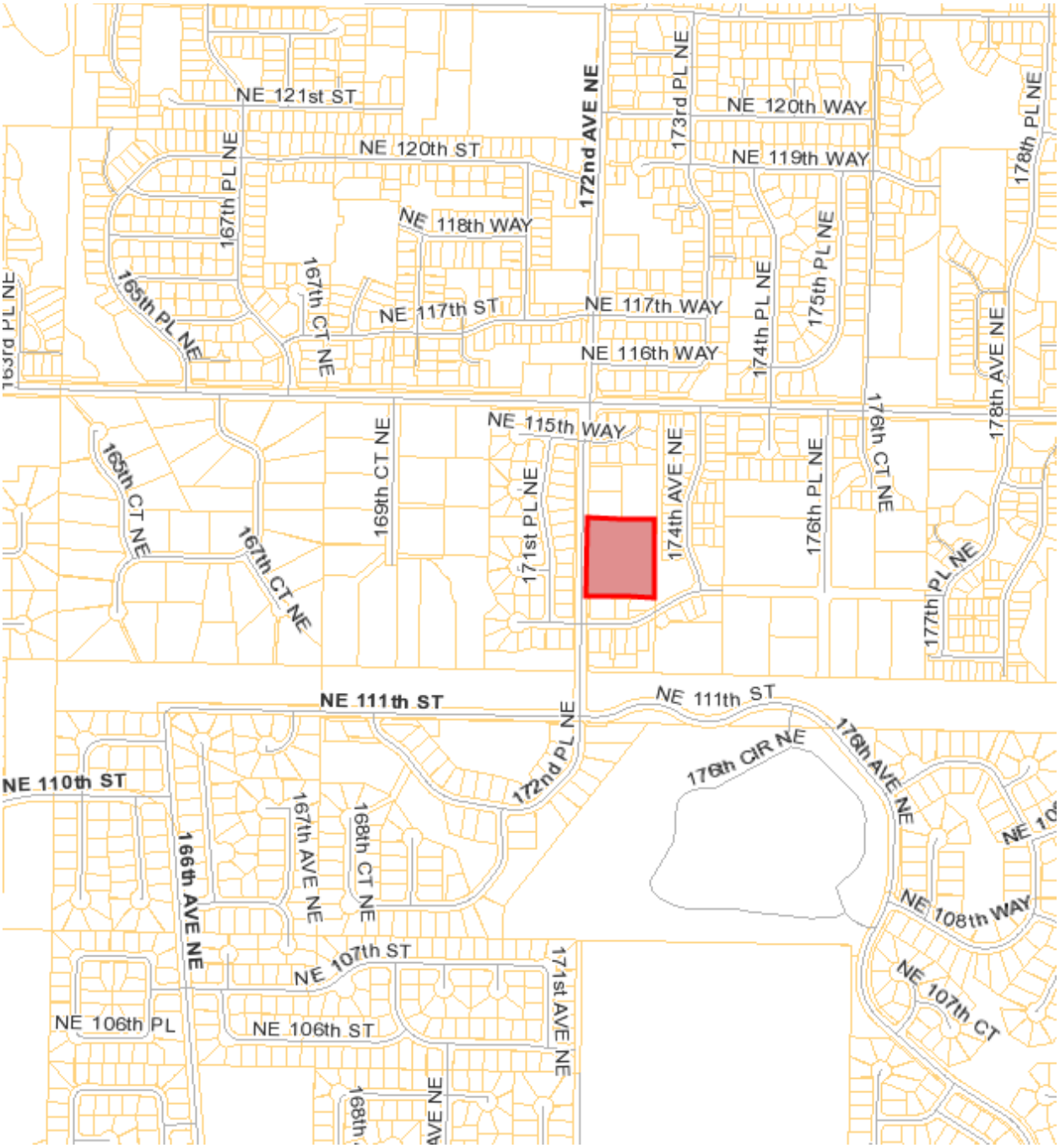
NDA Southwest leaves the site as sheet flow over the southern property line near the southwest property corner. This stormwater is also collected by the existing swale on the southern property line and conveyed east before joining the downstream path of NDA Southeast.

The convergence point of these three NDAs is within ¼ mile from the Site, therefore the Site is contained in one Threshold Discharge Area (TDA1).

The Project will also include half street improvements to the east side of 172nd Avenue NE along the Site frontage. This frontage area is a separate TDA2, and is made up of a single NDA with one NDL. This stormwater is collected by an existing swale on the east side of 172nd Avenue NE and is conveyed to a 12" CPP inlet pipe located near the southwest property corner. The runoff then follows an existing conveyance system in

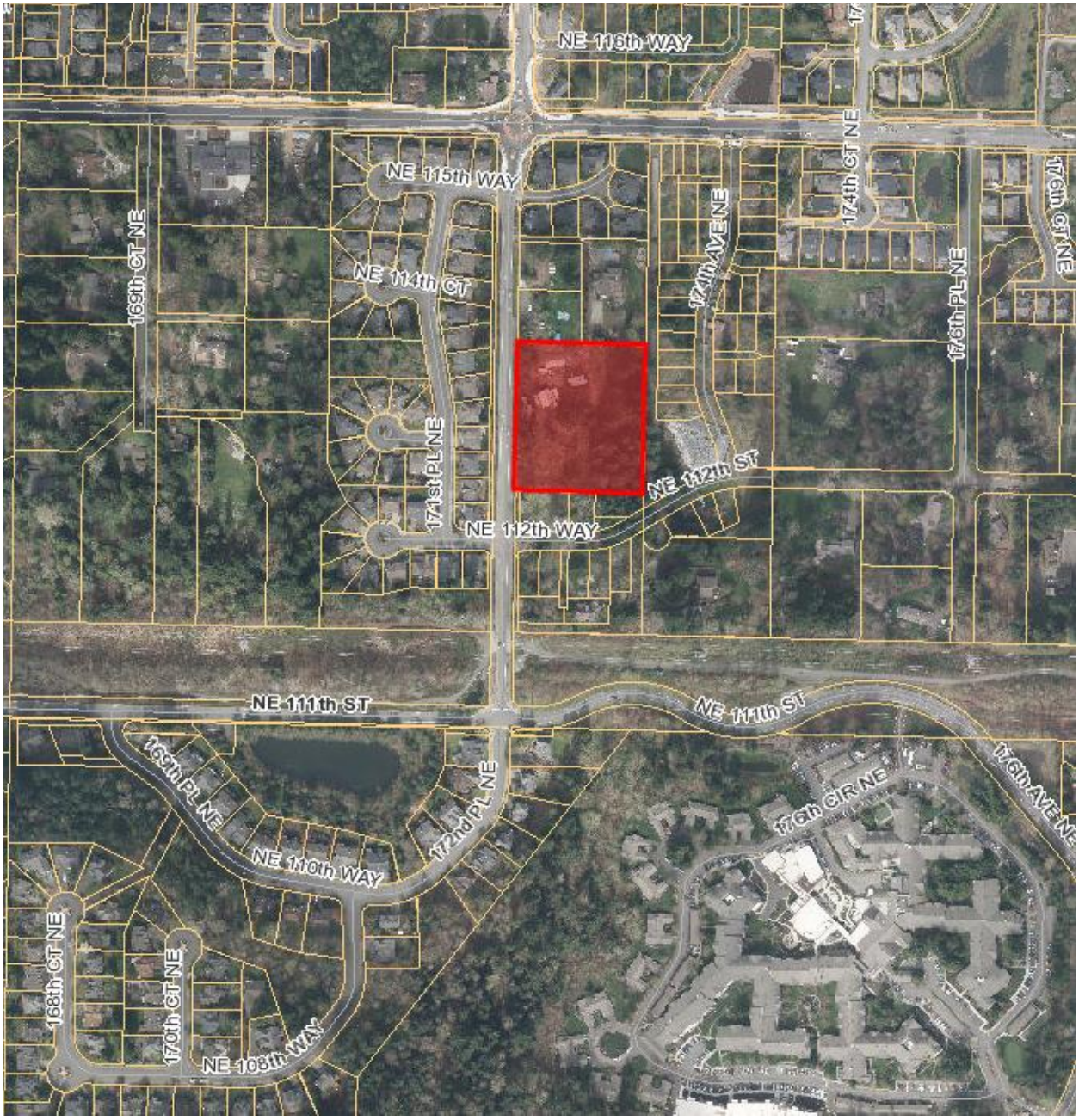
172nd Ave NE until it discharges into a stormwater retention pond approximately 900 ft from the Site. The outlet of this stormwater retention pond conveys stormwater in a northwesterly direction via High School Creek until it enters the Sammamish River.

FIGURE 1
VICINITY MAP



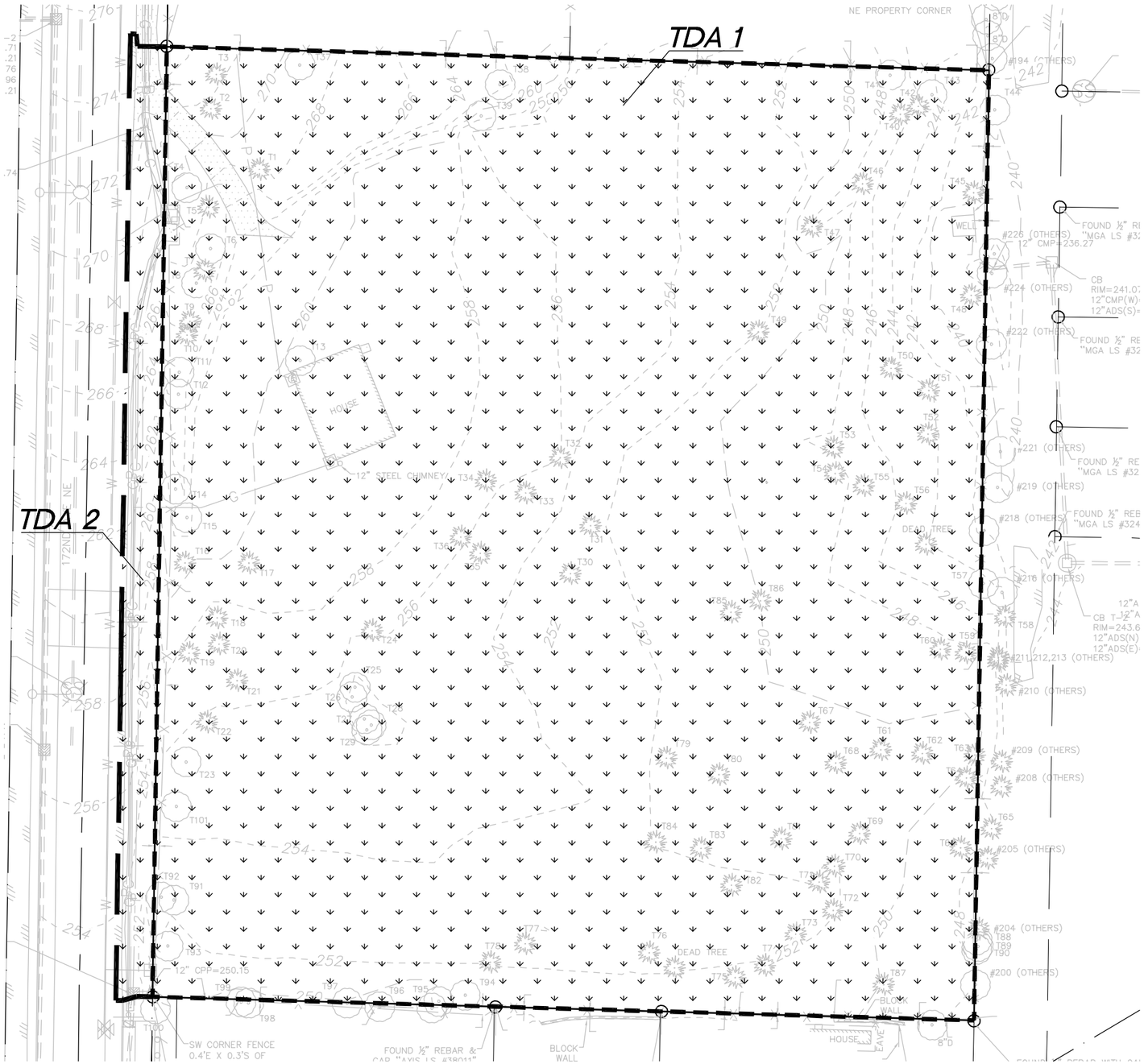
Source: City of Redmond's Property Viewer

FIGURE 2
AERIAL MAP



Source: City of Redmond's Property Viewer

FIGURE 3
PREDEVELOPED CONDITIONS MAP



AREA BREAKDOWN:

TOTAL SITE AREA:	130,929 S.F. (3.006 AC)
TOTAL PROJECT AREA TDA 1:	130,929 S.F. (3.006 AC)
TOTAL PROJECT AREA TDA 2:	5,859 S.F. (0.135 AC)

LEGEND:

PROJECT BOUNDARY

TDA BOUNDARY

PREDEVELOPED AREA / C, FOREST, MOD

NORTH

GRAPHIC SCALE

0 25 50 100

1 INCH = 50 FT.

COPYRIGHT © 2016 . D.R. STRONG CONSULTING ENGINEERS INC.

D.R. STRONG
CONSULTING ENGINEERS

ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 3

PRE-DEVELOPED CONDITIONS MAP

REDMOND 13

DRAFTED BY: GLB
DESIGNED BY: GLB
PROJECT ENGINEER: MAJ
DATE: 08.12.19
PROJECT NO.: 17088

FIGURE: 3

FIGURE 4
USDA KING COUNTY SOILS SURVEY MAP

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	3.1	100.0%
Totals for Area of Interest		**3.1**	**100.0%**

AgC—Alderwood gravelly sandy loam, 6 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2t626
Elevation: 50 to 800 feet
Mean annual precipitation: 20 to 60 inches
Mean annual air temperature: 46 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): Shoulder
Landform position (three-dimensional): Nose slope, 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: 8 to 15 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
Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA)
Hydric soil rating: No

Minor Components

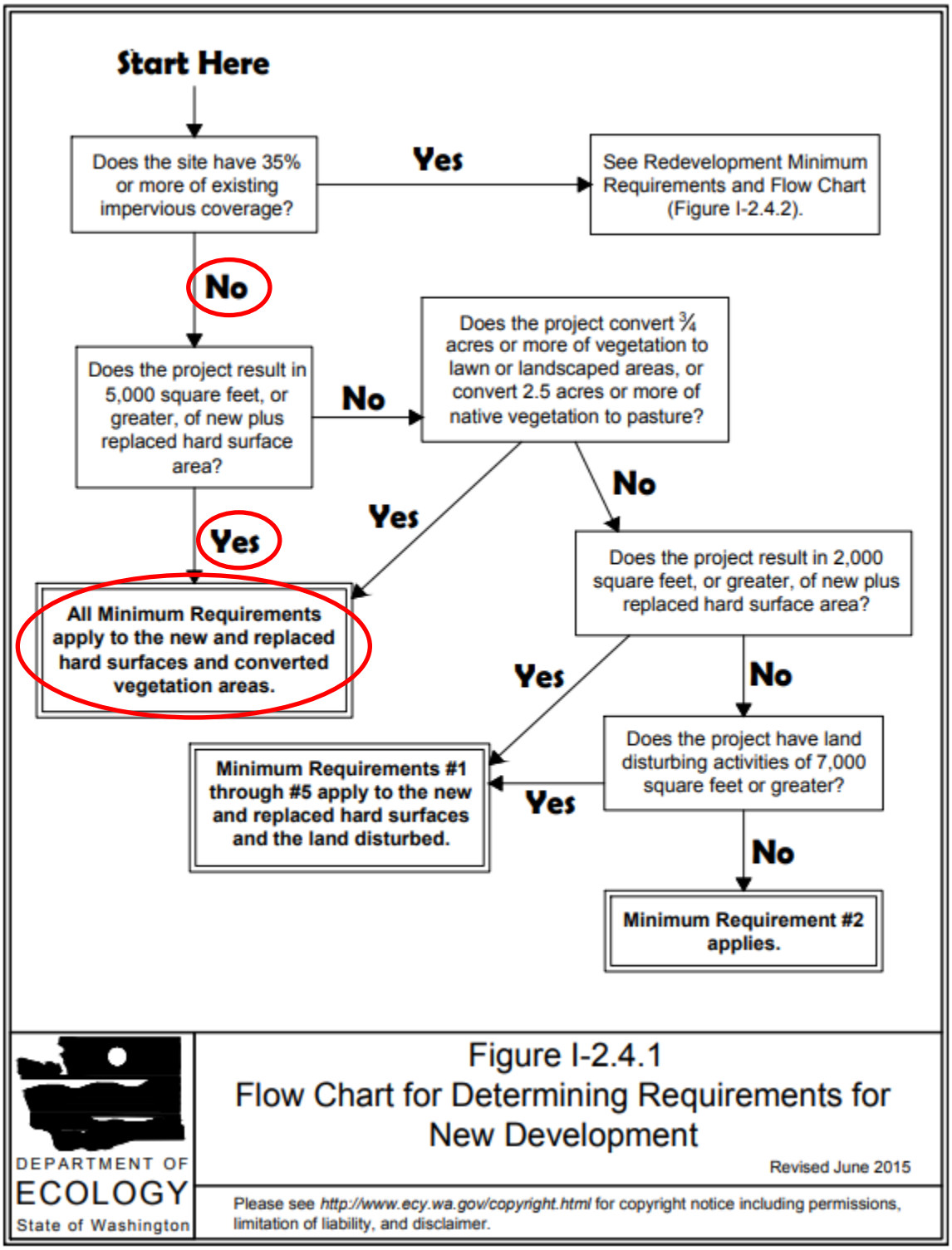
Everett
Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola
Percent of map unit: 5 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
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

FIGURE 5
MINIMUM REQUIREMENTS FLOW CHART



SECTION IV
MR 2 – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (CSWPPP)

The Construction Stormwater Pollution Prevention Plan (CSWPPP) will be prepared during final engineering.

SECTION V
MR 3 – SOURCE CONTROL OF POLLUTION

To be prepared as a part of the CSWPPP document.

SECTION VI
MR 4 – PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The Site is contained within three Natural Discharge Areas (NDAs) and two Threshold Discharge Area (TDAs). The Site, in general, slopes from east to west with grades varying from 3% up to 30% in isolated areas.

Runoff currently leaves the Site at three Natural Discharge Locations. The first, labeled as Natural Discharge Area (NDA) Northeast, sheet flows over the eastern property line. NDA Southeast sheet flows over the southern property line into a swale directly to the south of the property. NDA Southwest discharges from the site as sheet flow over the southwestern property corner. After sheet flowing to the southwest corner, runoff from TDA southwest moves as channel flow along the southern property line back to the east.

The convergence point of NDA Northeast, NDA Southeast, and NDA southwest are within ¼ mile from the Site, therefore the Site is contained in one Threshold Discharge Area (TDA1).

The Site itself has one TDA, however the frontage adjacent to the Site along 172nd Avenue NE is considered its own TDA2, meaning that the Project is made up of two total TDAs.

The discharge point of the frontage TDA2 will remain the same in the predevelopment and post development.

The proposed developed conditions for the on-site TDA1 will require a formal flow control and water quality treatment facility as the impervious surface and PGIS being added are over the 5,000 s.f. threshold. The discharge point of the proposed detention facility will match the Natural Discharge Location of TDA1 Northeast. The WWHM area breakdown used to size the flow control and water quality facilities can be found in Section IX.

FIGURE 6
BASIN MAP

COPYRIGHT © 2016 , D.R. STRONG CONSULTING ENGINEERS INC.

D.R. STRONG
CONSULTING ENGINEERS
ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 6
BASIN MAP
REDMOND 13

DRAFTED BY: GLB
DESIGNED BY: GLB
PROJECT ENGINEER: MAJ
DATE: 08.12.19
PROJECT NO.: 17088

FIGURE: 6

SECTION VII
MR 5 – ON-SITE STORMWATER MANAGEMENT

The Project is subject to Minimum Requirement 5, as detailed in the City of Redmond Stormwater Notebook section 2.5.5. The Project is located within the flow control required zone, per Appendix F of the Stormwater Notebook. Meeting the LID Performance Standard is not required for this project, and instead on-site stormwater management BMPs from List #2 in section 2.5.5 will be applied, according to feasibility, to each type of surface. A completed LID Requirement Flow Chart is provided in Figure 7.

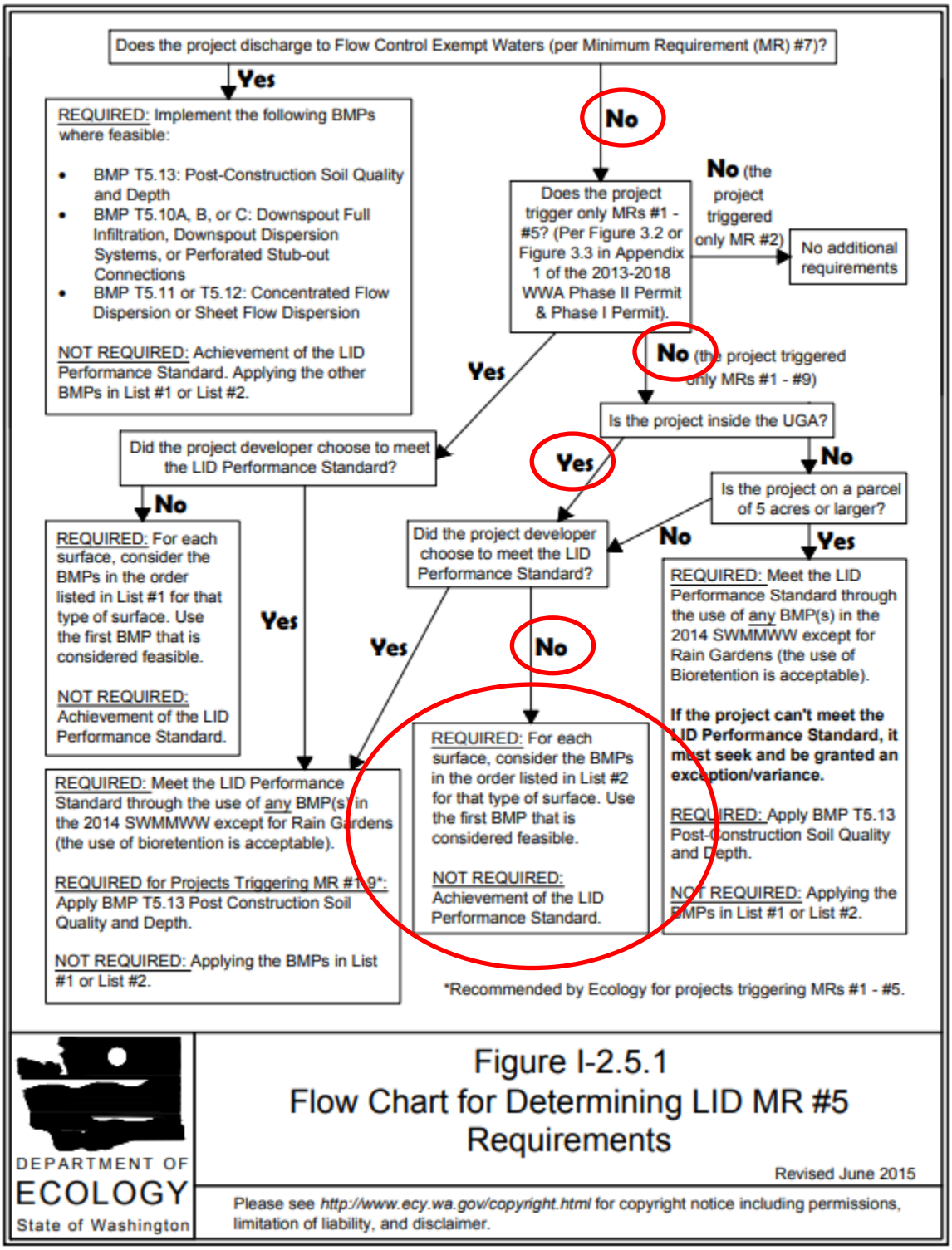
A. SITE ASSESSMENT FOR LID

A site assessment for LID feasibility is required. The site assessment considers onsite conditions to determine which of the LID BMPS can be implemented. For this Project, a geotechnical investigation was performed by Earth Solutions LLC and a geotechnical report was prepared which addresses the infiltration potential for the Site. According to this geotechnical report, infiltration is not feasible for the Site given the presence of glacial till soils across the Site which is not conducive to infiltration of stormwater runoff. Bioretention and the use of permeable pavers are also considered infeasible given the geotechnical report.

Full dispersion is also infeasible due to the limited availability of vegetated flowpaths. Instead Basic Dispersion may be implemented via splash blocks, sheet flow dispersion, rock pads, or gravel filled trenches. The final design and location of these flow control BMP devices will be included at the time of final engineering.

Perforated Stub-out Connections (BMP T5.10C) will also be implemented to manage roof runoff when necessary and Post Construction Soil Quality and Depth (BMP T5.13) will be implemented across the entire site where applicable.

FIGURE 7
LID REQUIREMENT FLOW CHART



SECTION VIII
MR 6 – RUNOFF TREATMENT

The Project Site is located in the basic water quality treatment area per the Manual Appendix E. Infiltration of runoff is not feasible per the geotechnical report, and therefore a combined detention/wet vault was selected to meet the basic water quality treatment requirements. A detail of the proposed combined detention/wet vault has been included in the plan set. WWHM was used to analyze the required water quality volume. Figure 8 represents the area breakdown and design input in WWHM for calculating the required water quality volume.

SECTION IX
MR 7 – FLOW CONTROL

The project site is located within a basic flow control required area as designated by the City of Redmond in the Manual Appendix F. WWHM2012 was used to model the predeveloped and developed (mitigated) site conditions used to design the combined detention/wet vault for the Project. The total area to be collected and routed to the vault includes all of TDA1 and a portion of TDA2 around the proposed intersection of Road A and 172nd Avenue NE that will be collected as a result of road grading. The total area collected is approximately 2.313 acres. Approximately 0.713 acres will bypass the detention facility. A more detailed breakdown of this area can be found below and in the WWHM report in Appendix B.

EXISTING SITE HYDROLOGY

The predeveloped site hydrology was based off the historic site conditions as determined by the Manual. This means that the coverage type for the site was assumed to be forested. The geotechnical report provided for the site indicates that the soils will not be able to accommodate full infiltration, which is indicitive of soil group C. The project area for TDA1 is 3.006 acres. This project area (TDA1) was modeled as C, Forest, with moderate slopes. The predeveloped basin conditions can be found in the WWHM report in Appendix B.

DEVELOPED SITE HYDROLOGY

For the developed site conditions, the soil type remained the same meaning that all pervious surfaces were considered C soil types. All pervious area will be modeled as pasture per Appendix III-C.9 of the Manual. The Manual states that all areas that meet the soil quality and depth requirement may be entered into the model as pasture rather than lawn/landscaping. All pervious areas will be required to implement BMP T5.13: Post-Construction Soil Quality and Depth. The total pervious area for TDA1 is approximately 1.446 acres which includes areas bypassing the detention facility.

The Site is zoned R-4, low density residential, meaning that a maximum of 60% of the lot size can be covered with impervious area according to the Redmond Zoning Code. Per Chapter 2.4 Applicability of the Minimum Requirements in the Stormwater Technical Notebook, “For purposes of applying the thresholds, all single-family developments that include subdivision of property shall be classified as New Development and all their hard surfaces classified as new hard surfaces. Hard surfaces shall be assumed to equal 80% of the maximum impervious area allowed by zoning code. If actual proposed impervious area is unknown, for large single-family lots, 4,200 s.f. of impervious area per lot may be used with approval from the Stormwater Engineer.” Therefore, 80% of the maximum impervious area allowed per zoning was assumed for all of the lots except lots 5, 7 and 9. Due to the large portions of undisturbed area on these lots, an impervious area of 4,200 s.f. per lots was assumed. The total impervious area created by the lots is approximately 0.996 acres. The internal right-of-way and tracts generate an additional 0.534 acres of impervious area which includes areas bypassing the detention facility. The impervious area within the lots was broken down into driveways,

roof, and sidewalk areas per the WWHM input requirements. The WWHM report in Appendix B also contains all the specific values input for the RDIN basin.

Approximatley 885 s.f. portion of TDA 2 will be collected and conveyed to the proposed combined detention/wet vault and included in the WWHM calculations. This area accounts for the difference between TDA1 and the total area used for sizing the combined detention/wet vault.

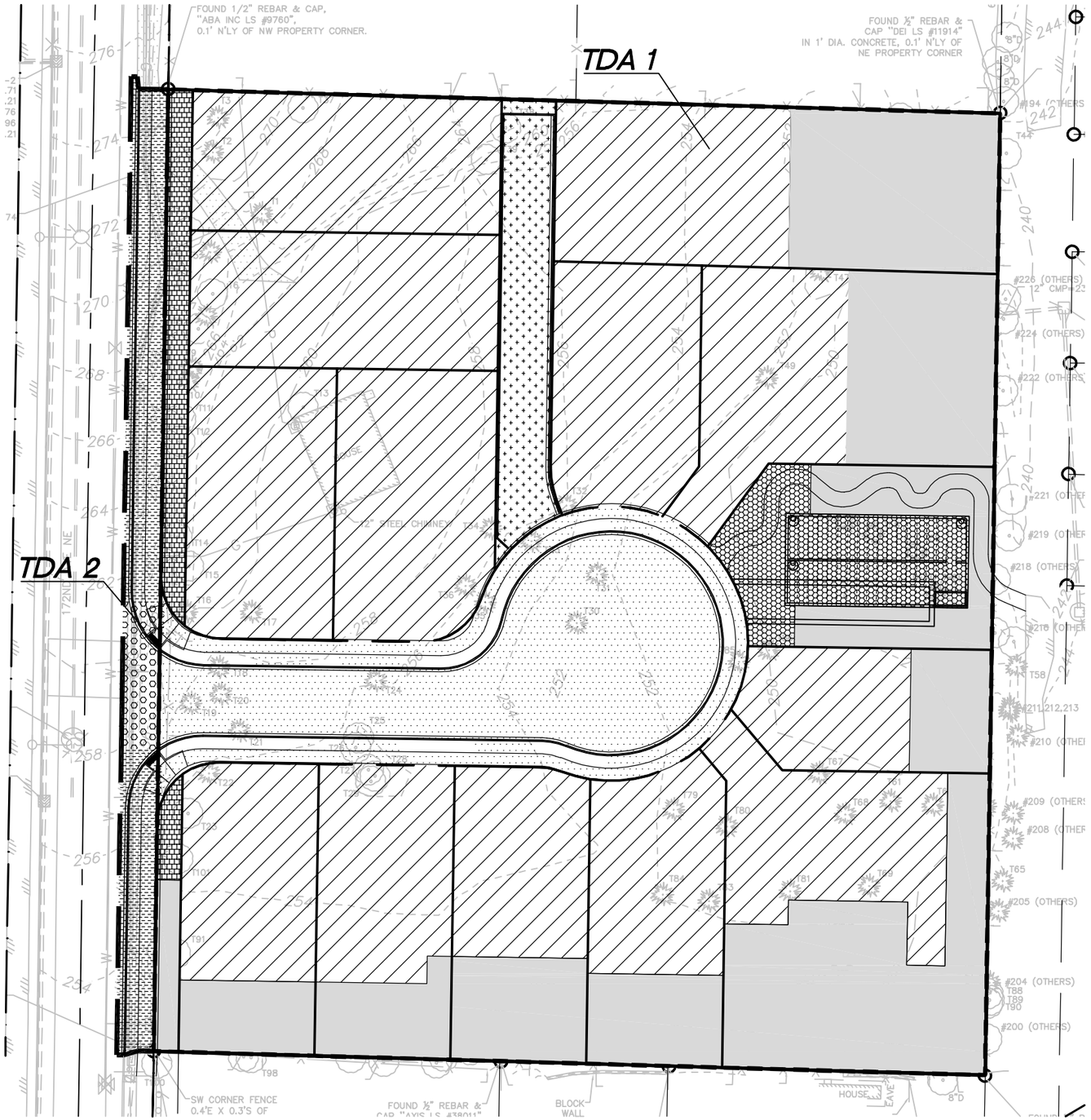
Approximatley 31,041 s.f. of impervious and pervious area within TDA 1 was also designated as bypass for the purpose of sizing the combined detention/wet vault as this area will not be collected and conveyed to the vault due to the proposed grading.

The runoff from the remaining frontage along 172nd Avenue NE, not inculding the 885 s.f. discussed above, is a considered a separate TDA. A proposed conveyance system in 172nd Avenue NE will collect the runoff from the proposed frontage and convey it south to the NDL of the frontage TDA2 where it enters the existing conveyance system. As discussed earlier, due to the amount of impervious area being added to the frontage TDA2, a formal water quality and detention facility are not required when mitigating this runoff.

The existing and developed basins discussed above were used to size the combined detention/wet vault that will control site runoff. The final vault was sized at 72 feet long and 38.85 feet wide (internal dimensions), with an effective depth of 12-feet with a riser height of 11-feet. The orifice diameters and heights were also sized using WWHM.

The report in Appendix B contains all of the vault sizing information and shows the results of the WWHM analysis which confirm that the combined detention/wet vault will be able to meet the requirments stated in the Manual for reducing the mitigated basins peak flows and discharge rates. Figure 3 shows the pre-developed basin and Figure 8 shows the mitigated conditions for the entire Project.

FIGURE 8
DEVELOPED CONDITIONS MAP



LEGEND:

PROJECT BOUNDARY

TDA BOUNDARY

TOTAL PROJECT AREA TDA 1:	130,929 S.F. (3.006 AC)
COLLECTED LOT AREA:	72,138 S.F. (1.656 AC)
TOTAL IMPERVIOUS:	43,370 S.F. (0.996 AC)
TOTAL PERVIOUS:	28,768 S.F. (0.660 AC)
IMPERVIOUS BYPASS:	0 S.F. (0 AC)
PERVIOUS BYPASS:	27,155 S.F. (0.623 AC)
INTERNAL RIGHT-OF-WAY AREA:	16,831 S.F. (0.386 AC)
IMPERVIOUS:	15,531 S.F. (0.357 AC)
PERVIOUS:	1,300 S.F. (0.030 AC)
COLLECTED TRACT A/D AREA:	2,478 S.F. (0.057 AC)
TOTAL IMPERVIOUS:	0 S.F. (0 AC)
TOTAL PERVIOUS:	2,478 S.F. (0.057 AC)
IMPERVIOUS BYPASS:	0 S.F. (0 AC)
PERVIOUS BYPASS:	692 S.F. (0.016 AC)
COLLECTED TRACT B AREA:	4,477 S.F. (0.103 AC)
TOTAL IMPERVIOUS:	3,350 S.F. (0.077 AC)
TOTAL PERVIOUS:	1,127 S.F. (0.026 AC)
IMPERVIOUS BYPASS:	560 S.F. (0.013 AC)
PERVIOUS BYPASS:	2,634 S.F. (0.060 AC)
TRACT C AREA:	3,964 S.F. (0.091 AC)
IMPERVIOUS:	3,814 S.F. (0.088 AC)
PERVIOUS:	150 S.F. (0.003 AC)
COLLECTED FRONTAGE AREA:	885 S.F. (0.020 AC)
IMPERVIOUS:	885 S.F. (0.020 AC)
PERVIOUS:	0 S.F. (0 AC)
UN-COLLECTED FRONTAGE AREA:	4,974 S.F. (0.114 AC)
IMPERVIOUS:	3,300 S.F. (0.076 AC)
PERVIOUS:	1,674 S.F. (0.038 AC)

BYPASS AREA

WWHM INPUT:	
ROADS, FLAT:	20,230 S.F. (0.464 AC)
ROOF TOPS, FLAT:	31,200 S.F. (0.716 AC)
DRIVEWAYS, FLAT:	9,856 S.F. (0.226 AC)
SIDEWALKS, FLAT:	5,670 S.F. (0.130 AC)
PASTURE, FLAT:	33,823 S.F. (0.776 AC)
BYPASS:	
C, PASTURE, FLAT:	4,750 S.F. (0.109 AC)
C, PASTURE, MOD:	25,731 S.F. (0.591 AC)
SIDEWALKS/MOD:	560 S.F. (0.013 AC)

NORTH

GRAPHIC SCALE

0 25 50 100

1 INCH = 50 FT.

COPYRIGHT © 2016 , D.R. STRONG CONSULTING ENGINEERS INC.

D.R. STRONG CONSULTING ENGINEERS
ENGINEERS PLANNERS SURVEYORS
820 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 8
DEVELOPED CONDITIONS MAP
REDMOND 13

DRAFTED BY: GLB
DESIGNED BY: GLB
PROJECT ENGINEER: MAJ
DATE: 08.12.19
PROJECT NO.: 17088

FIGURE: 8

SECTION X
MR 8 – WETLANDS PROTECTION

The Project is proposing to route collected runoff through the combined detention/wet vault and to the existing conveyance system in the Hawthorne Park Plat which then outlets directly to a wetland in the northeastern corner of Hawthorne Park Plat. The Project does not propose to change the location or method of conveyance that brings stormwater runoff to this wetland.

SECTION XI
MR 9 – OPERATIONS AND MAINTENCE MANUAL

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of those standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

The Operations and Maintenance Manual will be included at the time of final engineering.

APPENDICES

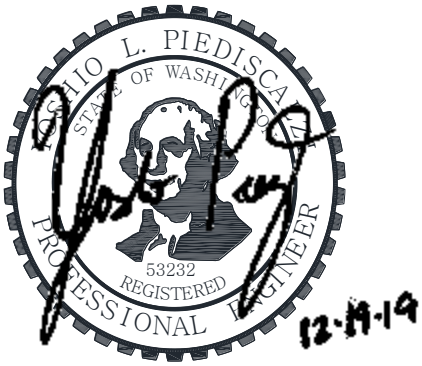
APPENDIX A
OFFSITE ANALYSIS

An Offsite Analysis prepared by D.R. STRONG Consulting Engineers Inc. is included in this Appendix.

REDMOND 13

Preliminary Plat

OFFSITE ANALYSIS



DRS Project No. 17088
Redmond File No. LAND-2017-00890

Owner/Applicant

RMJ Holdings, LLC
9675 SE 36th St, Suite 105
Mercer Island, WA 98040
(206) 588-1147

Report Prepared by

D.R. STRONG Consulting Engineers, Inc.
607 - 7th Avenue
Kirkland WA 98033
(425) 827-3063

Issued: December 19, 2019

©2018 D. R. STRONG Consulting Engineers Inc.

REDMOND 13

Preliminary Plat

OFFSITE ANALYSIS

TABLE OF CONTENTS

TASK 1 DEFINE AND MAP THE STUDY AREA 1

TASK 2 RESOURCE REVIEW 5

TASK 3 FIELD INSPECTION 15

Upstream Tributary Area 15
General Onsite and Offsite Drainage Description 15

TASK 4 DRAINAGE SYSTEM DESCRIPTION AND POTENTIAL PROBLEMS 16

Drainage System Description 16
Downstream Path NDA Northeast 16
Downstream Path NDA Southeast 17
Downstream Path NDA Southwest 17
Downstream Path Frontage NDA 17

TASK 5 MITIGATION OF EXISTING OR POTENTIAL PROBLEMS 26

List of Figures

Figure 1 Vicinity Map 2
Figure 2 Site Map 3
Figure 3 Topography 4
Figure 4 Streams and 100-Year Floodplains 6
Figure 5 King County iMap Wetlands 7
Figure 6 King County iMap Erosion Hazard Areas 8
Figure 7 King County iMap Landslide Hazard Areas 9
Figure 8 King County iMap Seismic Hazard Areas 10
Figure 9 City of Redmond Drainage Complaints 11
Figure 10 USDA King County Soils Survey Map 12
Figure 11 Downstream Map 19
Figure 12 Downstream Tables 20

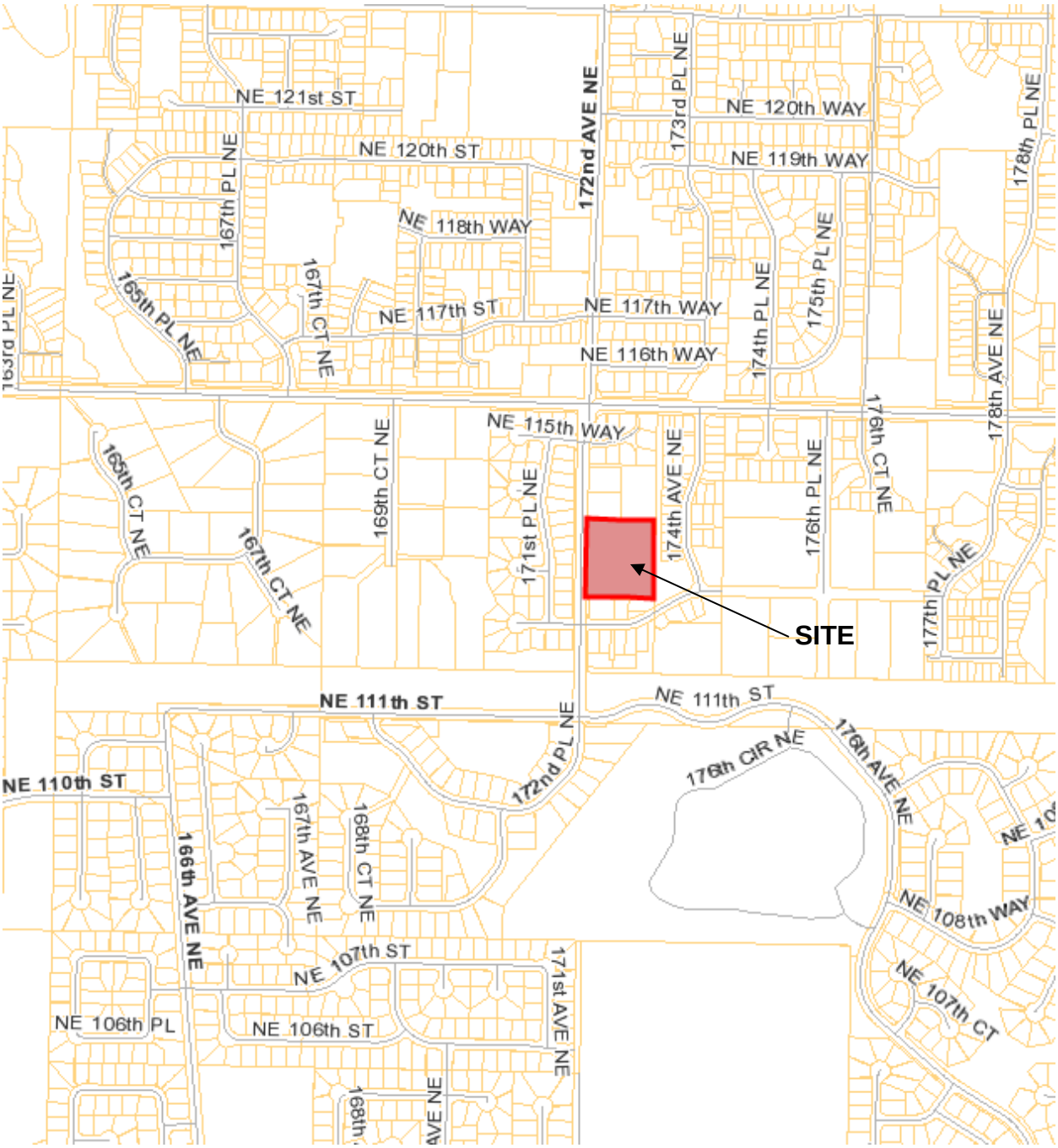
©2019 D. R. STRONG Consulting Engineers Inc.

TASK 1
DEFINE AND MAP THE STUDY AREA

This Offsite Analysis was prepared in accordance with Volume 1, Section 2.6.2 of the 2012 Stormwater Management Manual for Western Washington (Manual) and the City of Redmond 2017 Stormwater Notebook. The Site (tax parcel 3626059098 is located at approximately 11609 172nd NE Street in Redmond, Washington.

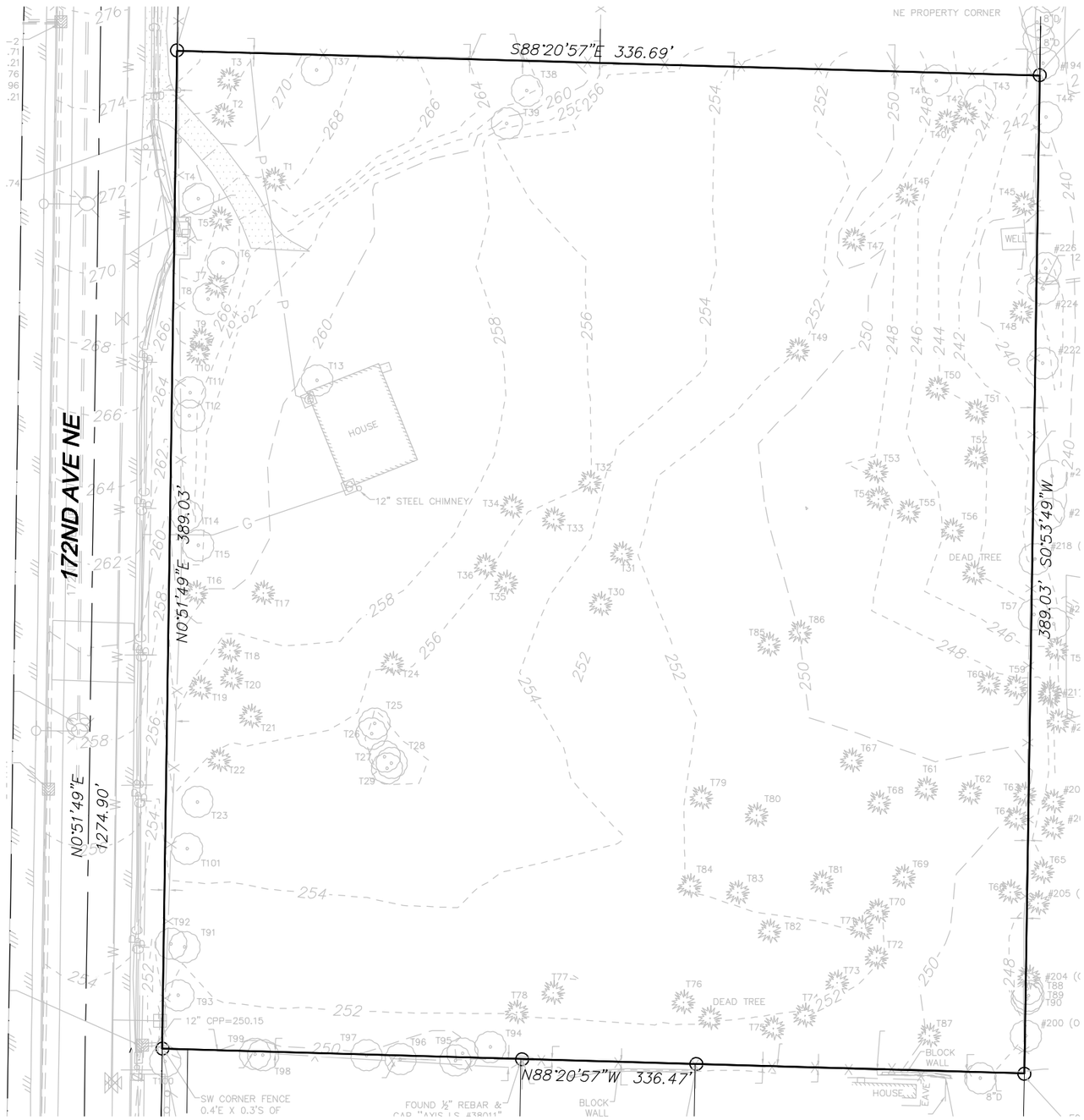
See Figure 1, Figure 2, and Figure 3 for maps of the study area.

FIGURE 1
VICINITY MAP



Source: City of Redmond's Property Viewer

FIGURE 2
SITE MAP



AREA BREAKDOWN:

TOTAL SITE AREA:	130,929 S.F. (3.006 AC)
TOTAL PROJECT AREA:	105,208 S.F. (2.415 AC)

NORTH

GRAPHIC SCALE

0 25 50 100

1 INCH = 50 FT.

COPYRIGHT © 2016 , D.R. STRONG CONSULTING ENGINEERS INC.

D.R. STRONG CONSULTING ENGINEERS

ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 2

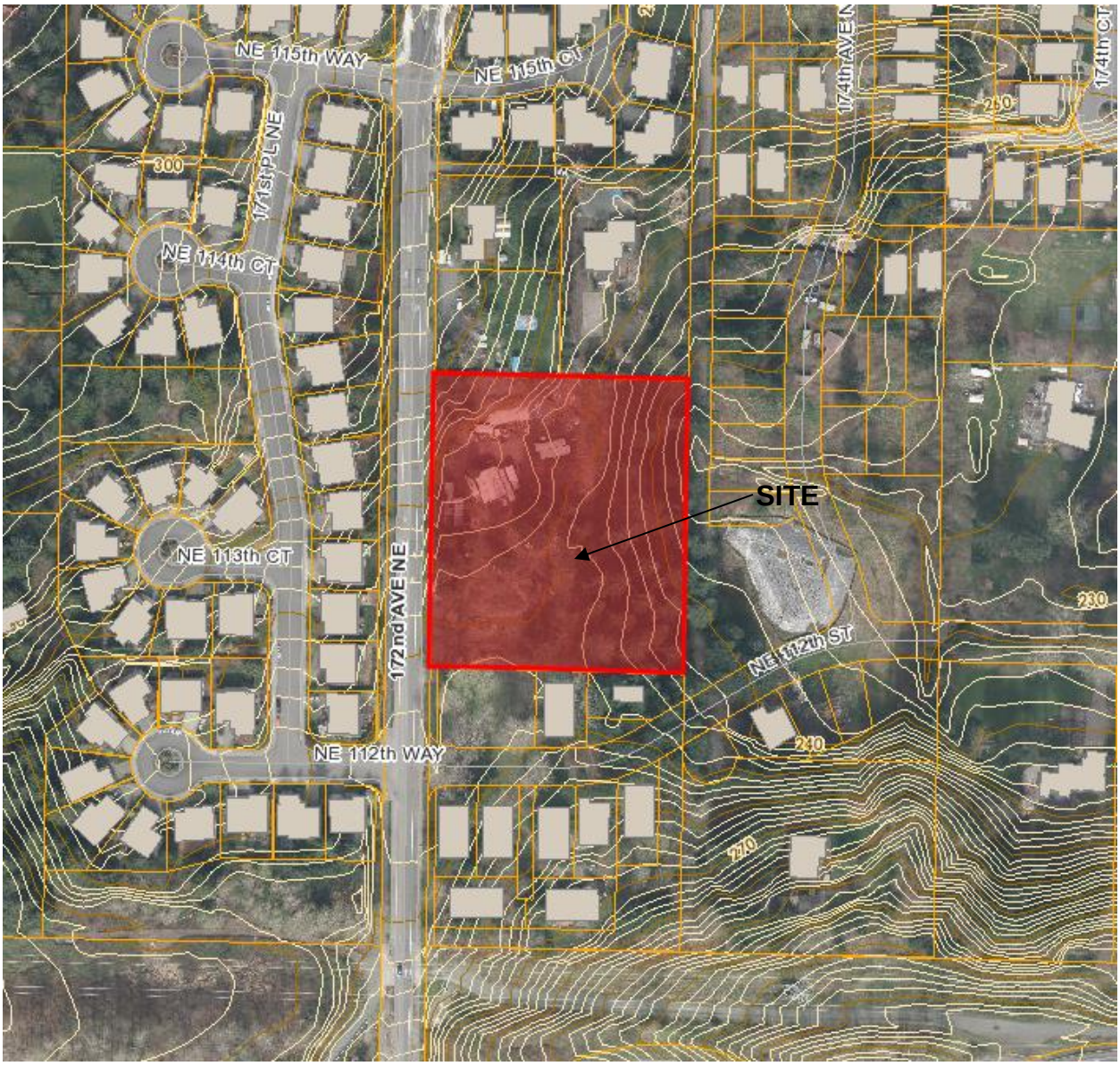
SITE MAP

REDMOND 13

DRAFTED BY: GLB
DESIGNED BY: GLB
PROJECT ENGINEER: MAJ
DATE: 08.12.19
PROJECT NO.: 17088

FIGURE: 2

FIGURE 3
TOPOGRAPHY

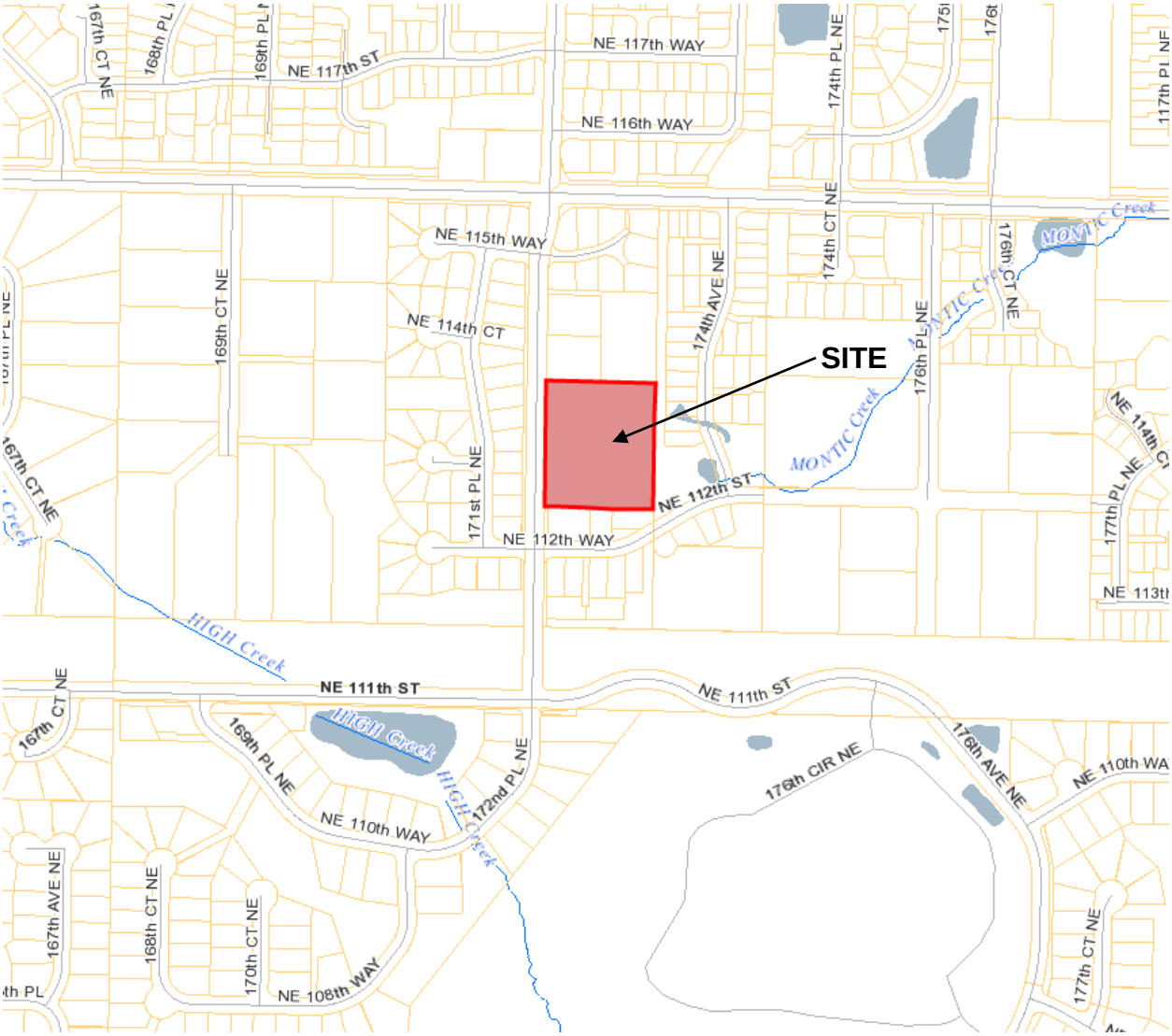


Source: City of Redmond's Property Viewer

TASK 2
RESOURCE REVIEW

- Adopted Basin Plans: *No basin plans available*.
- Floodplain/Floodway (FEMA) Map: *There are no FEMA maps available for the Site area.*
- Other Offsite Analysis Reports: *Snodgrass Stormwater Report Dated August 26, 2015 and Hawthorne Lane PRD Final Drainage Report, Dated December 2012..*
- Sensitive Areas Folio Maps: *See Figures 4-8 for documentation of the distance downstream from the proposed project to the nearest critical areas. Included, are sections of the King County Sensitive Areas Folio which indicate the following:*
    - **Figure 4 Streams and 100-Year Floodplains and Floodway:** *There is a 100 year floodplain within one mile of the Site along the downstream path*.
    - **Figure 5 Wetlands:** *There are no mapped Wetlands within one mile of the Site along the downstream path.*
    - **Figure 6 Erosion Hazard:** *There are no mapped Erosion Hazard Areas within one mile of the Site along the downstream path.*
    - **Figure 7 Landslide Hazard:** *There are no mapped Landslide Hazard Areas within one mile of the Site along the downstream path.*
    - **Figure 8 Seismic Hazard:** *There are no mapped Seismic Hazard Areas within one mile of the Site along the downstream path.*
- City of Redmond Drainage Complaints: A*s shown in Figure 9, there are no drainage complaints within 1 mile of the Site along the downstream paths within the past 10 years.*
- Road Drainage Problems: *None noted.*
- USDA King County Soils Survey: *See Figure 10.*
- Wetlands Inventory: *Vol. 1 North (1990) – The wetland inventory revealed no additional wetlands within the downstream path.*
- Migrating River Studies: *Bear Creek Watershed Management Study.*
- Washington State Department of Ecology's latest published Clean Water Act Section 303d list of polluted waters: *Sammamish River has 3 listings for Category 5 water: Dissolved Oxygen, Bacteria, and Temperature.*
- King County Designated Water Quality Problems: *None at this time.*

FIGURE 4
STREAMS AND 100-YEAR FLOODPLAINS



Source: City of Redmond's Property Viewer

FIGURE 5
KING COUNTY IMAP WETLANDS

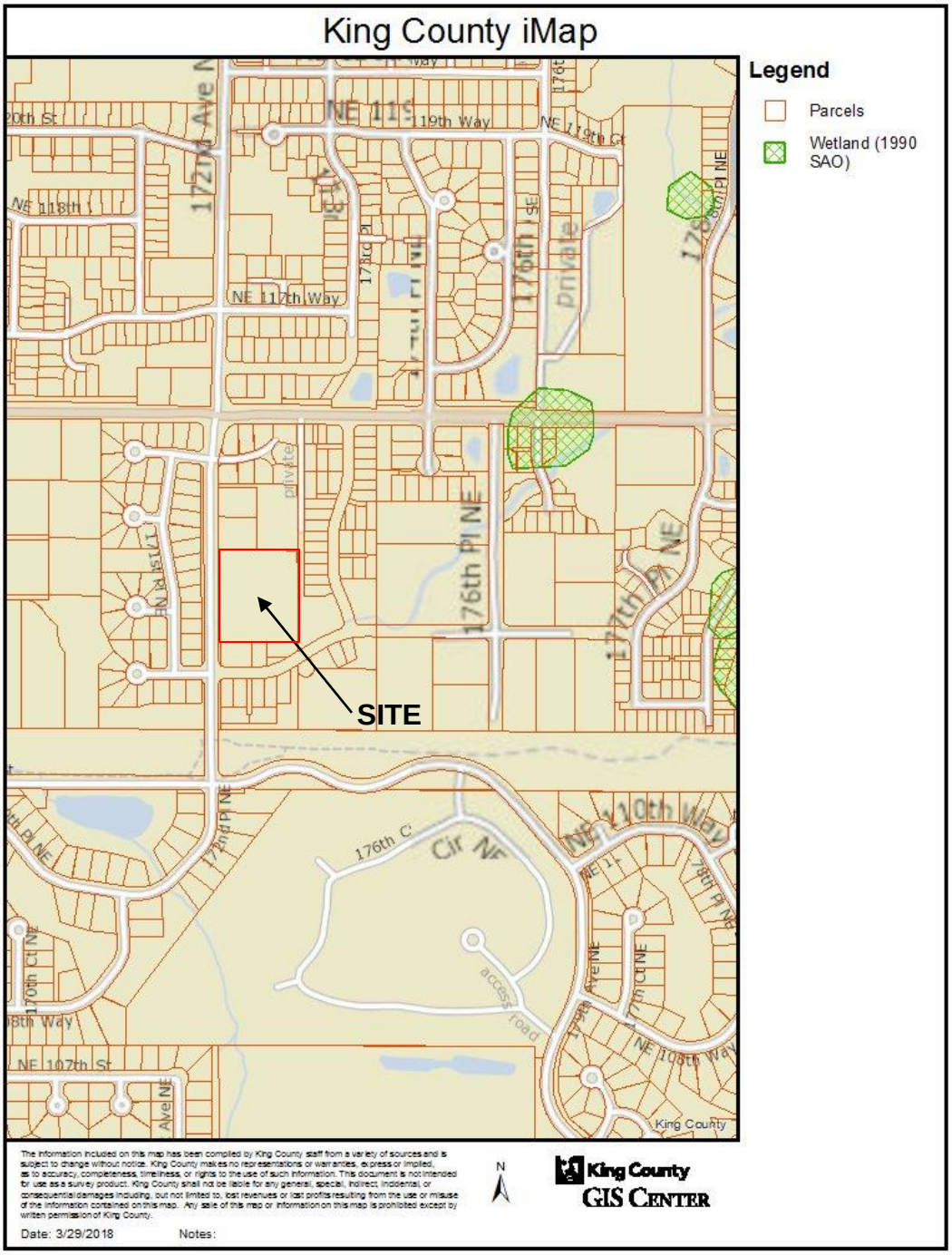


FIGURE 6
KING COUNTY IMAP EROSION HAZARD AREAS

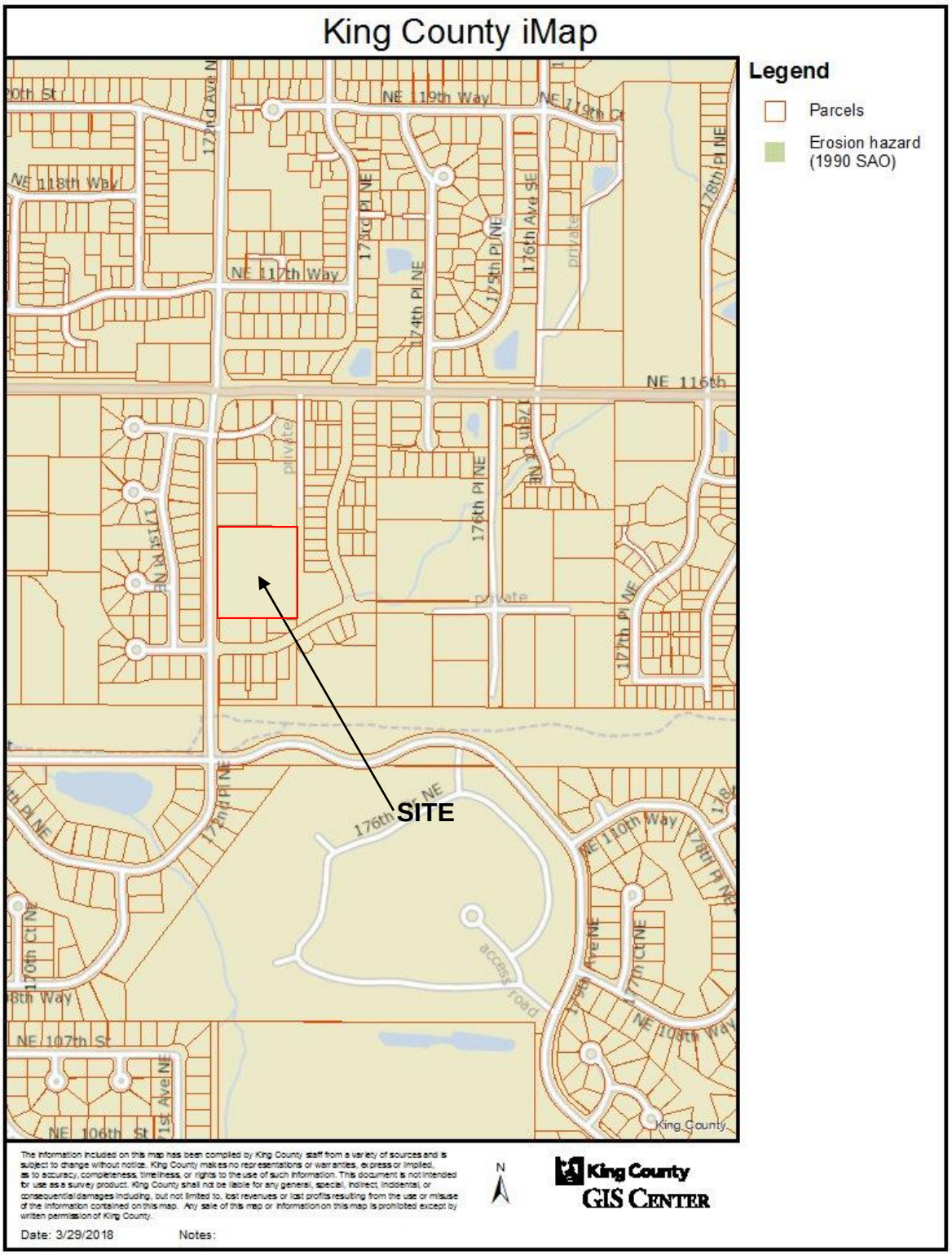


FIGURE 7
KING COUNTY IMAP LANDSLIDE HAZARD AREAS

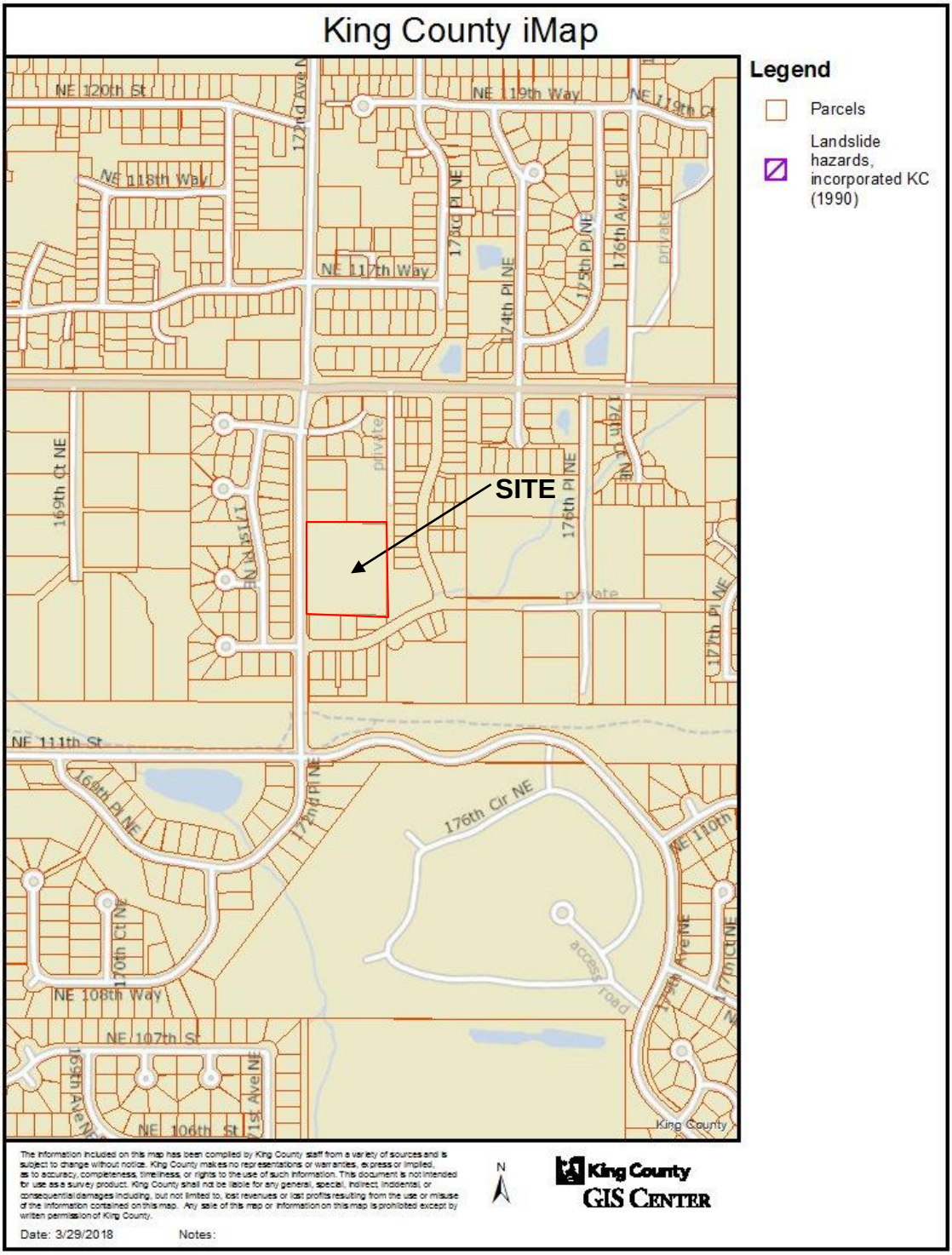


FIGURE 8
KING COUNTY IMAP SEISMIC HAZARD AREAS

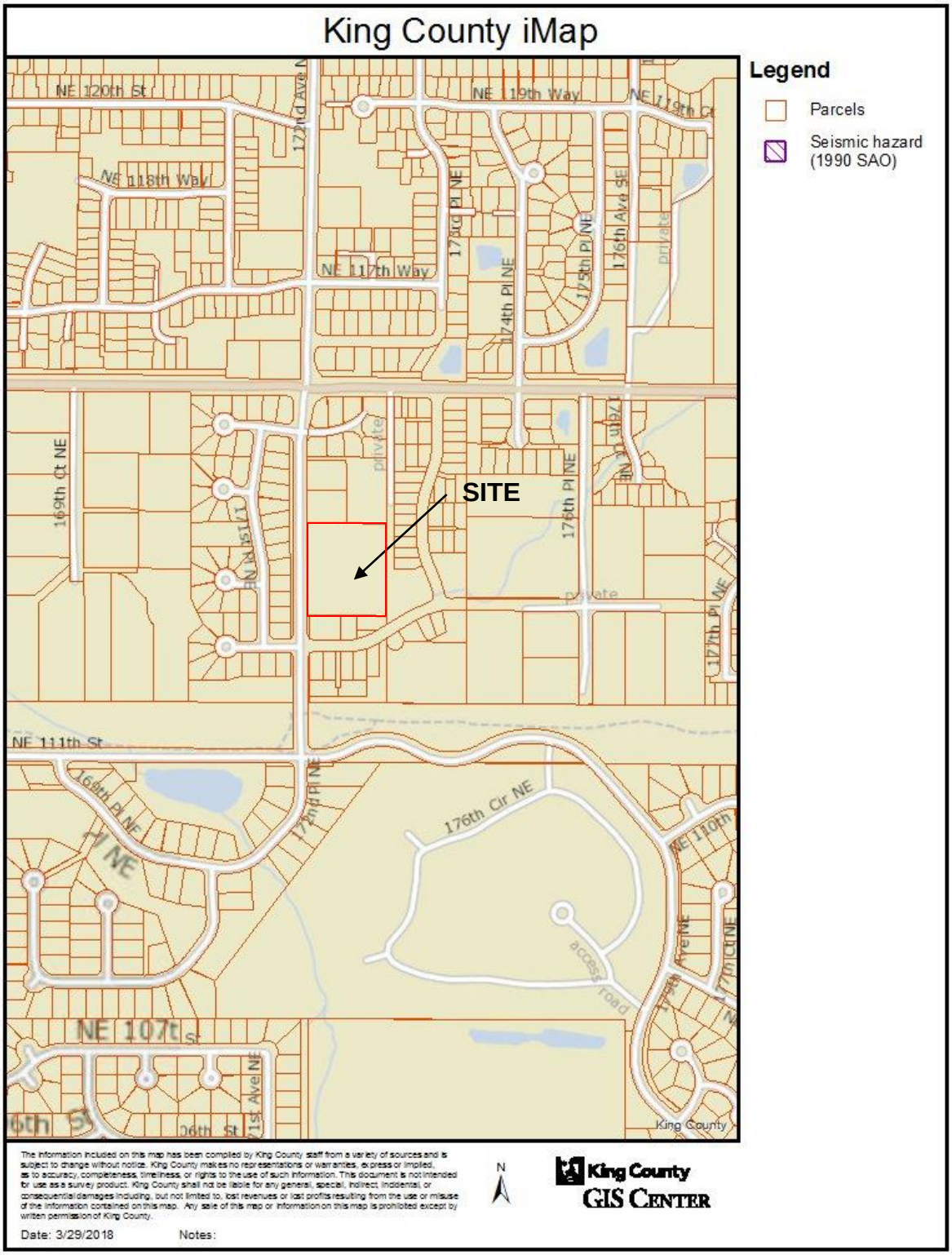


FIGURE 9
CITY OF REDMOND DRAINAGE COMPLAINTS

TDA Northeast

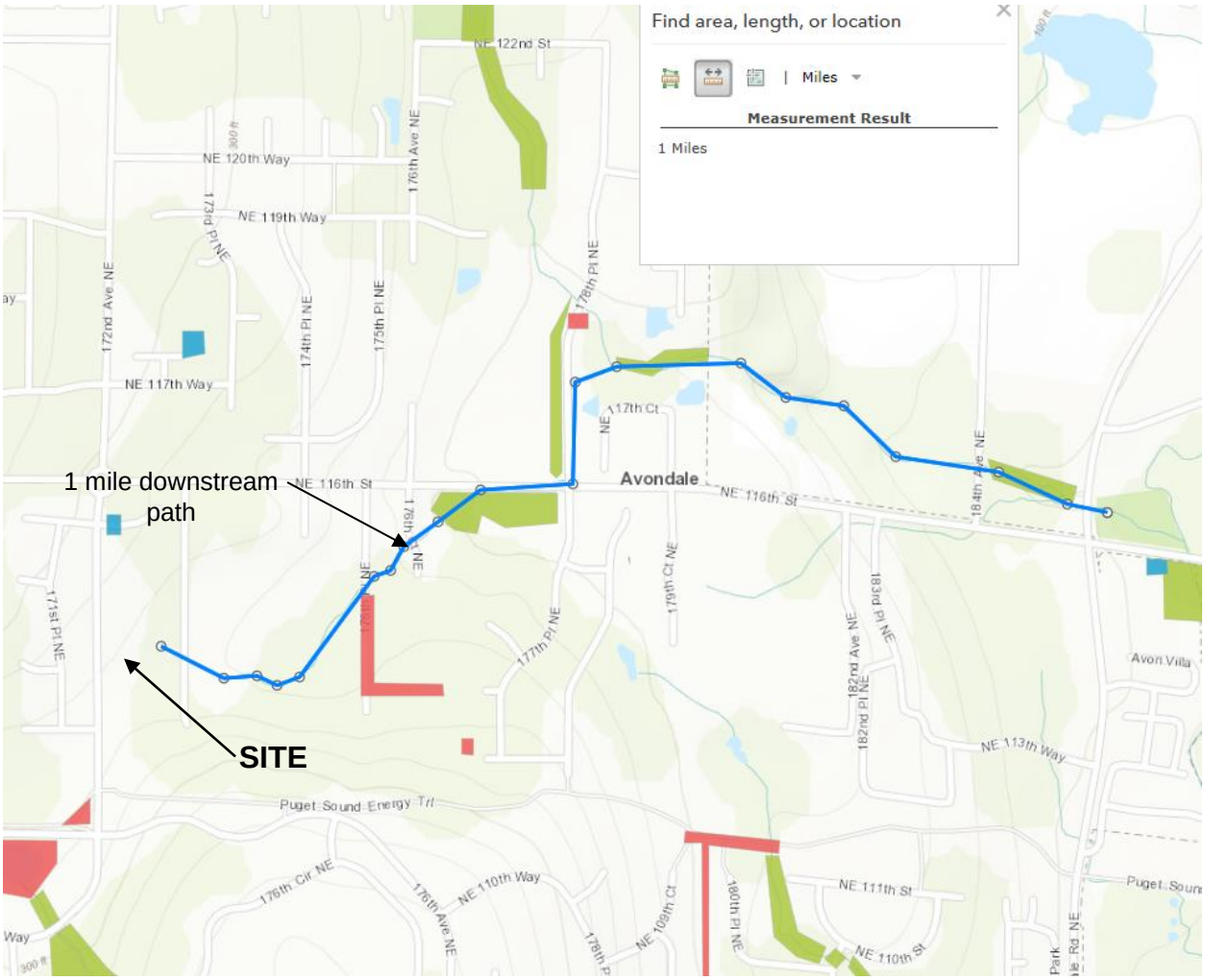


FIGURE 10
USDA KING COUNTY SOILS SURVEY MAP

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	2.9	100.0%
Totals for Area of Interest		**2.9**	**100.0%**

AgC—Alderwood gravelly sandy loam, 6 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2t626
Elevation: 50 to 800 feet
Mean annual precipitation: 20 to 60 inches
Mean annual air temperature: 46 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): Shoulder
Landform position (three-dimensional): Nose slope, 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: 8 to 15 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
Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA)
Hydric soil rating: No

Minor Components

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

Indianola
Percent of map unit: 5 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
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

TASK 3
FIELD INSPECTION

UPSTREAM TRIBUTARY AREA

In evaluating the upstream area, we reviewed King County IMAP aerial topography, City of Redmond Property Viewer aerial topography, imagery and conducted field reconnaissance. The local topographical generally slopes down from the northwest to the southeast across the Site. Areas to the north and south of the site slope in an easterly direction, away from the Site. The westerly property line is bordered by 172nd Ave SE, which contains an existing conveyance system that collects runoff. The upstream tributary areas for the Site are negligible. There are no anticipated negative impacts to the site due to upsteam runoff.

GENERAL ONSITE AND OFFSITE DRAINAGE DESCRIPTION

Total existing Site area is approximately, 130,929 s.f. (3.006 acres). Vegetation consists of Douglas fir, birch and cedar trees, as well as lawn, shrubs and bushes. The parcel is currently developed with one workshop and associated gravel driveway. In general, the Site is situated with a 0-15% slope from west to east.

Runoff currently leaves the Site at three discharge locations. The first Natural Discharge Area (NDA) is NDA Northeast, and the Natural Discharge Location (NDA 1), is sheet flow over the eastern property line. Runoff is captured by an existing 12” PVC inlet located on Hawthorne Lane plat and is conveyed through a series of man-made pipes and structures until it is discharged into Monticello Creek, approximately 350 ft from the Site. Monticello Creek discharges into Bear Creek after conveying stormwater in an easterly direction for approximately one mile.

The NDL for the second NDA Southeast is sheet flow over the southern property line. After leaving the Site, runoff enters the channel along the southern property line and heads east onto the Hawthorne Lane plat. This runoff sheet flows in a northerly direction and converges with NDA Northeast at the 12” PVC inlet.

NDA Southwest leaves the site as sheet flow over the southern property line near the southwest property corner. This stormwater is also collected by the existing swale on the southern property line and conveyed east before joining the downstream path of NDA Southeast.

The convergence point of these three NDAs is within ¼ mile from the Site, therefore the Site is contained in one Threshold Discharge Area (TDA).

The Project will also include half street improvements to the east side of 172nd Avenue NE along the Site frontage. This frontage area is a separate TDA, and is made up of a single NDA with one NDL. This stormwater is collected by an existing swale on the east side of 172nd Avenue NE and is conveyed to a 12” CPP inlet pipe located near the southwest property corner. The runoff then follows an existing conveyance system in 172nd Ave NE until it discharges into a stormwater retention pond approximately 900 ft from the Site. The outlet of this stormwater retention pond conveys stormwater in a northwesterly direction via High School Creek until it enters the Sammamish River.

TASK 4
DRAINAGE SYSTEM DESCRIPTION AND POTENTIAL PROBLEMS

DRAINAGE SYSTEM DESCRIPTION

The downstream analysis is further illustrated and detailed in the Downstream Map (Figure 11) and Downstream Table (Figure 12). NDA Northeast, Southeast, and Southwest are located within the Bear Creek Watershed. The Frontage NDA is located in the Sammamish River Watershed. The downstream area was evaluated by reviewing available resources.

Downstream Path NDA Northeast

Point “A1” is a natural discharge point of the Site. Runoff exits the Site as sheet flow over the eastern property line.

From Point “A1” to Point “A2”, runoff heads easterly as sheet flow to a depression in nearby topography. (0’ - ±5’).

Point “A2” is a 12” PVC conveyance pipe.

From Point “A2” to Point “A3”, runoff is conveyed easterly via a 12” PVC pipe (±5’ – ±25’).

Point “A3” is a Type 1 Catch Basin.

From Point “A3” to Point “A4”, runoff is conveyed southerly via a 12” PVC (±25’ – ±137’).

Point “A4” is a Type 2 Catch Basin with a solid lid.

From Point “A4” to Point “A5”, runoff is conveyed easterly via a 12” PVC (±137’ – ±210’).

Point “A5” is a Type 2 Catch Basin with a solid lid.

From Point “A5” to Point “A6”, runoff is conveyed northeasterly via a 12” PVC (±210’ – ±339’).

Point “A6” is a rip-rap lined outfall.

From Point “A6” to Point “A7”, runoff is conveyed northeasterly as stream flow via Monticello Creek (±339’ – ±1227’).

Point “A7” is a 12” Corrugated Metal Pipe (CMP) culvert.

From Point “A7” to Point “A8”, runoff is conveyed northeasterly via a 12” CMP (±1227’ – ±1292’).

Point “A8” is a Type 2 Catch Basin with a solid lid.

From Point “A8” to Point “A9”, runoff is conveyed northeasterly via a 24” Corrugated Plastic Pipe (CPP) (±1292’ – ±1333’).

Point “A9” is a 24” CPP outfall into Monticello Creek. Field investigations ended here.

Downstream Path NDA Southeast

Point “B1” is a natural discharge point of the Site. Runoff exits the Site as sheet flow over the southern property line.

From Point “B1” to Point “B2”, runoff heads southerly as sheet flow over natural vegetation. (0’ - ±6’).

Point “B2”, runoff enters drainage swale along the southern property line that conveys stormwater to the east.

From Point “B2” to Point “B3”, runoff heads easterly as open channel flow via the existing drainage swale. (±6’ - ±214’).

Point “B3”, is the outlet of the drainage swale onto the adjacent parcel to the east.

From Point “B3” to Point “A2”, runoff heads northerly as sheet flow over wood chip walking path and planter to a small depression in surrounding topography. (214’ - ±522’).

Point “A2” is a 12” PVC Conveyance pipe and the convergence point for NDA Northeast and NDA Southeast.

Downstream Path NDA Southwest

Point “C1” is a natural discharge point of the Site. Runoff exits the Site as sheet flow over the southern property line near the southwest property corner.

From Point “C1” to Point “C2”, runoff heads southerly as sheet flow over natural vegetation. (0’ - ±6’).

Point “C2”, runoff enters drainage swale along the southern property line that conveys stormwater to the east.

From Point “C2” to Point “B2,” runoff is conveyed easterly as open channel flow via the existing drainage swale via a 12” CPP (±6’- ±144’).

Point “B2” is the convergence of the downstream path for NDA Southwest and NDA Southeast.

Downstream Path Frontage NDA

Point “D1” is a natural discharge point of the frontage area. Runoff exits the NDA as channel flow via the 3.5’ deep, 13’ wide conveyance swale.

From Point “D1” to Point “D2”, runoff heads westerly as channel flow through the existing conveyance swale. (0’ - ±5’).

Point “D2” is a 12” CPP conveyance pipe.

From Point “D2” to Point “D3,” runoff is conveyed westerly via a 12” CPP (±5’- ±10’.

Point “D3” is a Type 1 Catch Basin.

From Point “D3” to Point “D4”, runoff is conveyed southerly via a 12” PVC conveyance pipe. (±10’ – ±122’).

Point “D4” is a Type 1 Catch Basin.

From Point “D4” to Point “D5”, runoff is conveyed southerly via a 12” CPP (±122’ – ±164’).

Point “D5” is a Type 2 Catch Basin with a solid lid.

From Point “D5” to Point “D6”, runoff is conveyed southerly via an 18” CPP (±164’ – ±433’).

Point “D6” is a Type 2 Catch Basin with a solid lid.

From Point “D6” to Point “D7”, runoff is conveyed southerly via an 18” CPP (±433’ – ±491’).

Point “D7” is a Type 2 Catch Basin with a solid lid.

From Point “D7” to Point “D8”, runoff is conveyed southwesterly via a 18” CPP (±491’ – ±704’).

Point “D8” is a Type 2 Catch Basin with a solid lid.

From Point “D8” to Point “D9”, runoff is conveyed southwesterly via an 18” CPP (±704’ – ±774’).

Point “D9” is a outfall into a stormwater retention pond located at parcel #0011520690. Outfall location could not be located in field, however Redmond GIS services confirms conveyance direction.

From Point “D9” to Point “D10”, runoff is conveyed westerly as surface water flow across a stormwater retention pond (±774’ – ±1216’).

Point “D10” is an outlet from a stormwater retention pond. This outlet is a 24” CMP with a metal debris cage.

From Point “D10” to Point “D11”, runoff is conveyed northwesterly via a 24” CMP (±1216’ – ±1302’).

Point “D11” is a Type 2 Catch Basin with a solid locking lid. This point was confirmed with Redmond GIS services.

From Point “D11” to Point “D12”, runoff is conveyed northwesterly via an unknown conveyance pipe. Both points “D11” and “D12” were locked, therefore conveyance method could not be confirmed in the field. (±1302’ – ±1354’).

Point “D12” is a Type 2 Catch Basin with a solid locking lid. This point was confirmed with Redmond GIS services. From this point, stormwater is discharged and conveyed in a northwesterly direction as stream flow via High School Creek. This is the end of field investigations

FIGURE 11
DOWNSTREAM MAP

Attachment 10

COPYRIGHT © 2016 , D.R. STRONG CONSULTING ENGINEERS INC.

D.R. STRONG
CONSULTING ENGINEERS
ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 11
DOWNSTREAM ANALYSIS MAP
REDMOND 13

DRAFTED BY: GLB
DESIGNED BY: GLB
PROJECT ENGINEER: MAJ
DATE: 08.12.19
PROJECT NO.: 17088

FIGURE: 11

FIGURE 12
DOWNSTREAM TABLES

NDA Northeast

Basin: Sammamish Subbasin Name: Bear Creek Subbasin Number: N/A

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi=1,320 ft	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts.
A1	Natural Discharge Point	Sheet flow across east property line	%	±0’	None Observed	None Anticipated	
A1-A2	Easterly Sheet Flow	Sheet flow over planter			None Observed	None Anticipated	
A2	12” PVC Conveyance Pipe			±5’	None Observed	None Anticipated	
A2-A3	Easterly Pipe Flow	12” PVC			None Observed	None Anticipated	
A3	Type 1 Catch Basin			±25’	None Observed	None Anticipated	
A3-A4	Southerly Pipe Flow	12” PVC			None Observed	None Anticipated	
A4	Type 2 Catch Basin with solid lid			±137’	None Observed	None Anticipated	
A4-A5	Easterly Pipe Flow	12” PVC			None Observed	None Anticipated	
A5	Type 2 Catch Basin with solid lid			±210’	None Observed	None Anticipated	
A5-A6	Northeasterly Pipe Flow	12” PVC			None Observed	None Anticipated	
A6	Rip-rap lined outfall			±339’	None Observed	None Anticipated	
A6-A7	Northeasterly Stream Flow	Monticello Creek			None Observed	None Anticipated	

A7	12” CMP			±1227’	None Observed	None Anticipated	
A7-A8	Northeasterly Pipe Flow	12” CMP			None Observed	None Anticipated	
A8	Type 2 Catch Basin with solid lid			±1292’	None Observed	None Anticipated	
A8-A9	Northeasterly Pipe Flow	24” CPP			None Observed	None Anticipated	
A9	Outfall into Monticello Creek	24” CPP		±1333’	None Observed	None Anticipated	

NDA Southeast

Basin: Sammamish Subbasin Name: Bear Creek Subbasin Number: N/A

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi=1,320 ft	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts.
B1	Natural Discharge Point	Sheet flow across southern property line	%	±0’	None Observed	None Anticipated	
B1-B2	Southerly Sheet Flow	Sheet flow over natural vegetation			None Observed	None Anticipated	
B2	Existing Drainage Swale			±6’	None Observed	None Anticipated	
B2-B3	Easterly Open Channel Flow	Open channel flow through existing drainage swale			None Observed	None Anticipated	
B3	End of Drainage Swale			±214’	None Observed	None Anticipated	
B3-A2	Northerly Sheet Flow	Sheet flow over planter, wood chip walking path			None Observed	None Anticipated	
A2	12” PVC Conveyance Pipe			±522’	None Observed	None Anticipated	

NDA Southwest

Basin: Sammamish Subbasin Name: Bear Creek Subbasin Number: N/A

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi=1,320 ft	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts.
C1	Natural Discharge Point	Sheet flow across southern property line near southwest property corner	%	±0’	None Observed	None Anticipated	
C1-C2	Southerly Sheet Flow	Sheet flow over natural vegetation			None Observed	None Anticipated	
C2	Existing Drainage Swale			±6’	None Observed	None Anticipated	
C2-B2	Easterly Open Channel Flow	Open channel flow through existing drainage swale			None Observed	None Anticipated	
B2	Existing Drainage Swale	Convergence of downstream path for NDA Southeast and NDA Southwest		±144’	None Observed	None Anticipated	

NDA Frontage

Basin: Sammamish Subbasin Name: Sammamish River Subbasin Number: N/A

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mi=1,320 ft	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		tributary area, likelihood of problem, overflow pathways, potential impacts.
D1	Natural Discharge Point	Open channel flow across southern border of frontage area	%	±0’	None Observed	None Anticipated	
D1-D2	Westerly Channel Flow	13’ wide, 3.5’ deep, 2’ bottom width conveyance swale			None Observed	None Anticipated	
D2	12” CPP			±5’	None Observed	None Anticipated	
D2-D3	Westerly Pipe Flow	12” CPP			None Observed	None Anticipated	
D3	Type 1 Catch Basin			±10’	None Observed	None Anticipated	
D3-D4	Southerly Pipe Flow	12” PVC			None Observed	None Anticipated	
D4	Type 1 Catch Basin			±122’	None Observed	None Anticipated	
D4-D5	Southerly Pipe Flow	12” CPP			None Observed	None Anticipated	
D5	Type 2 Catch Basin with solid lid			±164’	None Observed	None Anticipated	
D5-D6	Southerly Pipe Flow	18” CPP			None Observed	None Anticipated	
D6	Type 2 Catch Basin with solid lid			±433’	None Observed	None Anticipated	
D6-D7	Southerly Pipe Flow	18” CPP			None Observed	None Anticipated	
D7	Type 2 Catch Basin with solid lid			±491’	None Observed	None Anticipated	

D7-D8	Southwesterly Pipe Flow	18” CPP			None Observed	None Anticipated	
D8	Type 2 Catch Basin with solid lid			±704’	None Observed	None Anticipated	
D8-D9	Southwesterly Pipe Flow	18” CPP			None Observed	None Anticipated	
D9	Outfall into Stormwater retention pond.			±774’	None Observed	None Anticipated	Parcel #0011520690. Outfall could not be located in field.
D9-D10	Westerly surface water flow	Stormwater Retention Pond					
D10	24” CMP Pond outlet			±1216’			
D10-D11	Northwesterly Pipe Flow	24” CMP					
D11	Type 2 Catch Basin with locked solid lid			±1302’			Flow direction confirmed via Redmond GIS. Could not be confirmed in field.
D11-D12	Northwesterly Pipe Flow	Could not be confirmed in field.					
D12	Type 2 Catch Basin with locked solid lid			±1354’			Flow direction confirmed via Redmond GIS. This catch basin eventually discharges into High School Creek. Could not be confirmed in field. End of field investigations

TASK 5 MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

A review of the documented drainage complaints available from the City of Redmond within one mile of the downstream flow path revealed no complaints within the last ten years.

The Project should not create any problems and therefore is not required to provide Drainage Problem Impact Mitigation.

Runoff from the developed Site will be collected and conveyed by a typical catch basin/ pipe network to the proposed detention vault on Site. This vault will tie into the existing conveyance system located in Hawthorne Lane plat, which is the natural discharge point of NDA Northeast. Frontage improvements including standard curb and gutter along 172nd Avenue NE will replace the existing conveyance swale to the east of 172nd Avenue NE. During construction, standard sediment and erosion control methods will be utilized. This will include the use of a stabilized construction entrance, perimeter silt fencing, and other necessary measures to minimize soil erosion during construction.

R:\2017\0\17088\3\Documents\Reports\Preliminary\Offsite Analysis 17088.docx

APPENDIX B
PROJECT GEOTECHNICAL REPORT

The Project Geotechnical Report prepared by Earth Solutions NW, LLC is included in this Appendix.

Attachment 10

Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Services
Construction Observation/Testing

GEOTECHNICAL ENGINEERING STUDY
PROPOSED REDMOND 13 RESIDENTIAL DEVELOPMENT
115XX - 172ND AVENUE NORTHEAST
REDMOND, WASHINGTON

ES-5619

1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

RMJ HOLDINGS, LLC

June 5, 2018

Bogdan S. Tirtu, G.I.T.
Staff Geologist

Scott S. Riegel, L.G., L.E.G.
Senior Project Manager

Kyle R. Campbell, P.E.
Principal Engineer

GEOTECHNICAL ENGINEERING STUDY
PROPOSED REDMOND 13 RESIDENTIAL DEVELOPMENT
115XX – 172ND AVENUE NORTHEAST
REDMOND, WASHINGTON

ES-5619

Earth Solutions NW, LLC
1805 – 136th Place Northeast, Suite 201
Bellevue, Washington 98005
Phone: 425-449-4704 | Fax: 425-449-4711
www.earthsolutionsnw.com

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

Copyright 2004 by ASFE, Inc. Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with ASFE's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of ASFE, and only for purposes of scholarly research or book review. Only members of ASFE may use this document as a complement to or as an element of a geotechnical engineering report. Any other firm, individual, or other entity that so uses this document without being an ASFE member could be committing negligent or intentional (fraudulent) misrepresentation.

Attachment 10

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

June 5, 2018
ES-5619

RMJ Holdings, LLC
9675 Southeast 36th Street, Suite 105
Mercer Island, Washington 98040

Attention: Mr. Justin Lagers

Dear Mr. Lagers:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Proposed Redmond 13 Residential Development, 115XX – 172nd Avenue Northeast, Redmond, Washington". Based on the results of our investigation, the proposed residential development is feasible from a geotechnical standpoint. Our study indicates the site is underlain primarily by uncontrolled fill of varying thickness transitioning into native glacial till (Qvt) deposits at depth. During our subsurface exploration completed on October 4, 2017, and March 7, 2018, groundwater was not encountered at the test pit locations, which extended to about 16 feet beneath the existing ground surface (bgs).

The proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil or new structural fill placed directly on competent native soils. Competent soil suitable for foundation support will be encountered at various depths across the subject site. Overexcavation of unsuitable uncontrolled fill will be necessary across the majority of the site to achieve competent native soils suitable for support of foundations or placement of structural fill. Slab-on-grade floors for the proposed structures should be supported on firm and unyielding subgrades comprised of competent native soil or compacted structural fill. Unstable or yielding areas of the subgrades should be overexcavated and replaced with suitable structural fill, prior to construction of the foundations and/or slabs.

Pertinent geotechnical recommendations are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Bogdan S. Tirtu, G.I.T.
Staff Geologist

1805 - 136th Place N.E., Suite 201 • Bellevue, WA 98005 • (425) 449-4704 • FAX (425) 449-4711

Table of Contents

ES-5619

	PAGE
INTRODUCTION	1
General	1
Project Description	2
SITE CONDITIONS	2
Surface	2
Subsurface	3
Topsoil and Fill	3
Native Soil	3
Geologic Setting	3
Groundwater	4
CRITICAL AQUIFER RECHARGE AREA	4
Critical Areas Assessment	4
Level II Hydrogeologic Assessment	6
DISCUSSION AND RECOMMENDATIONS	9
General	9
Site Preparation and Earthwork	10
Temporary Erosion Control	10
Excavations and Slopes	10
In-situ and Imported Soils	11
Structural Fill	11
Foundations	12
Seismic Design	12
Slab-on-Grade Floors	12
Retaining Walls	13
Drainage	13
Infiltration Feasibility	14
Preliminary Detention Vault Design	14
Utility Support and Trench Backfill	15
Preliminary Pavement Sections	16
LIMITATIONS	17
Additional Services	17

Table of Contents

Cont'd

ES-5619

GRAPHICS

Plate 1	Vicinity Map
Plate 2	Test Pit Location Plan
Plate 3	Critical Areas Map
Plate 4	Retaining Wall Drainage Detail
Plate 5	Footing Drain Detail

APPENDICES

Appendix A	Subsurface Exploration Test Pit Logs Well Logs
Appendix B	Laboratory Test Results

GEOTECHNICAL ENGINEERING STUDY
PROPOSED REDMOND 13 RESIDENTIAL DEVELOPMENT
115XX – 172ND AVENUE NORTHEAST
REDMOND, WASHINGTON

ES-5619

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential development to be constructed on the east side of 172nd Avenue Northeast, just north of the intersection with Northeast 112th Way in Redmond, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this study included the following:

- Excavation of test pits for purposes of characterizing site soil and groundwater conditions;
- Laboratory testing of soil samples collected at the test pit locations;
- Engineering analyses, and;
- Preparation of this report.

The following documents and maps were reviewed as part of our study preparation:

- Preliminary Site Plan, prepared by D.R. Strong Consulting Engineers, Inc., dated August 31, 2017;
- Preliminary Grading Plan, prepared by D.R. Strong Consulting Engineers, Inc., undated;
- Prep Pre-App Information for Project Proponents: LAND-2017-00890, prepared by the City of Redmond, dated September 28, 2017;
- Appendix 1 – Critical Areas Reporting Requirements of the Redmond Zoning Code (RZC);
- Washington State Department of Ecology Online Well Viewer;
- Water Quality Report, prepared by the City of Redmond, dated Summer 2017;
- Critical Area's Maps, prepared by the City of Redmond, dated April 16, 2011;
- City of Redmond Water Table Map and Geologic Cross Section of Redmond, endorsed by the King County Groundwater Protection Program, dated October 2005;
- Online Web Soil Survey (WSS) resource, maintained by the Natural Resources Conservation Service under the United States Department of Agriculture;
- King County Liquefaction Susceptibility Map, endorsed by the King County Flood Control District, May 2010, and;
- Geologic Map of the Redmond Quadrangle, Washington, by James P. Minard and Derek B. Booth, 1988.

Project Description

We understand the site will be redeveloped with up to 13 single-family residences and related infrastructure improvements. We understand stormwater will be managed using a stormwater detention vault to be constructed in the northeastern corner of the site.

At the time of this report submission, specific building loads were not available for review; however, based on our experience with similar developments, the proposed structures will likely consist of two to three story lightly loaded wood framed residences supported on conventional continuous and spread footing foundations. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf). Review of the referenced site plan indicates grading will be limited to cuts and fills generally less than about six feet

The subject site has been periodically filled over time and includes uncontrolled fill across the majority of the surface. Deleterious fill must be removed and grades will be restored with structural fill. The proposed road will provide ingress and egress to the development via easterly extension of 172nd Avenue Northeast. The site lies within a Wellhead Protection Zone 3, as such, a Critical Areas and Level II Hydrogeological assessment have been included in this report. Further discussion can be found in the *Critical Aquifer Recharge Area* section of this report.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located along the east side of 172nd Avenue Northeast, north of the intersection with Northeast 112th Way in Redmond, Washington. The approximate location of the subject site is depicted on Plate 1 (Vicinity Map). The property is comprised of one tax parcel (King County Parcel No. 362605-9098) totaling approximately three acres.

The site is bordered to the north by a single-family residence and associated improvements, to the south and east by undeveloped land, and to the west by 172nd Avenue Northeast. The site is currently occupied by a storage structure, well shed, and associated improvements. We understand the onsite storage structure and well shed will be removed as part of site redevelopment. The site generally descends toward the east, at gradients of about 15 percent with about 34 feet of total topographic change.

Subsurface

An ESNW representative observed, logged, and sampled 17 test and exploration pits within accessible locations of the property boundaries, on October 4, 2017 and March 7, 2018, using a trackhoe and operator retained by the client. The test pits were completed for the purpose of assessing and classifying site soil and groundwater conditions within accessible areas of the site. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Some test pits were not logged because the focus at the time was determining the limits of uncontrolled fill at the site. Select soil samples collected at the test pit locations were analyzed in general accordance with Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was generally not encountered at the surface of the subject site. Rather, fill was encountered beginning at or very near the surface, extending to depths up to about 16 feet bgs in the deepest location. Plate 2 delineates the approximate depths and limits of existing fill in two-foot contours. The existing fill is unsuitable for direct support of foundations or for re-use as structural fill. The fill should be overexcavated and may be used in non-structural areas or removed from the site.

Native Soil

Underlying fill, native soils were encountered consisting primarily as silty sand with gravel (USCS: SM). In general, the native soils were observed to be in a medium dense to dense and moist condition extending to the terminus of test pits. The maximum exploration depth at the subject site was approximately 16 feet bgs.

Geologic Setting

The referenced geologic map resource identifies the site as underlain primarily by glacial till deposits (Qgt). As described on the geologic map resource, glacial till is generally compact, coherent, and is locally termed hardpan.

Glacial till is comprised of a mixture of clay, silt, sand, pebbles, and cobbles in varying amounts. The material is typically very dense and weakly cemented as a result of glacial overburden. Distinct features of the material are compactness, ability to maintain near-vertical slopes, and a heterogenous and nonsorted internal structure which resembles concrete mix.

The referenced WSS resource identifies Alderwood gravelly sandy loam material (Map Unit Symbol: AgC) as the primary soil unit underlying the subject site and surrounding area. Soils of the Alderwood series are associated with glacial drift and/or glacial outwash deposition over dense glaciomarine deposits. Such material typically takes the landform of ridges or hills.

Based on our field observations, native soils likely to be exposed during grading activities will be consistent with Alderwood series glacial till soils, as outlined in this section.

Groundwater

During our subsurface exploration completed on October 4, 2017, and March 7, 2018, groundwater seepage was not encountered at the test pit locations. However, perched zones of groundwater seepage are common within glacial till deposits, as such, it is our opinion that groundwater may be encountered during subsequent construction activities, depending on the time of year construction takes place. The contractor should be prepared to respond as appropriate to perched seepage. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

CRITICAL AQUIFER RECHARGE AREA

The site has been designated within Wellhead Protection Zone 3 of the Critical Aquifer Recharge Area (CARA) by the City of Redmond. Accordingly, a critical areas assessment and Level Two hydrogeologic assessment has been completed in accordance with Appendix 1 of the referenced RZC. The minimum required report elements and/or information are listed in italics, followed by our responses.

Critical Areas Assessment

Name of proposal as shown on City applications.

Redmond 13 residential development

Name of applicant as shown on City applications.

RMJ Holdings, LLC

Name of organization and individual providing this information.

Earth Solutions NW, LLC: Kyle R. Campbell, P.E., Principal Engineer
Scott S. Riegel, L.G., L.E.G., Senior Project Manager
Bogdan S. Tirtu, G.I.T., Staff Geologist

List any technical expertise/special qualifications of person providing this information.

Scott S. Riegel has prepared numerous hydrogeologic and critical aquifer recharge/critical areas reports for projects in and around the Puget Sound region including Redmond. Kyle R. Campbell has over 32 years of experience in the geotechnical engineering field and has prepared numerous critical areas reports in the Puget Sound Region.

Date the information was prepared.

June 1, 2018

Location of the proposed activity (street address and tax parcel number), including a vicinity map.

East side of 172nd Avenue Northeast, approximately 100 to 550 feet north of the intersection with Northeast 112th Way. APN# 362605-9098. Please see our attached vicinity map

Clearly identify the development proposal being addressed; including City file number and key project drawing references (originator of drawings, originator's reference number if shown on the drawings, sheet numbers, revision numbers and dates for each sheet, and include reduced copies of key drawings in the report).

The development proposal includes construction of 13 single-family residences. File Number LAND-2017-00890. Key drawings utilized for this report have been referenced in the *Introduction* section of this report.

Give a succinct but inclusive description of the existing site, including acreage and current and past uses on the property.

The site is approximately three acres and was previously used as a contractor storage yard. The property is served by a private septic system. Septic systems should be abandoned per Chapter 13.04.054 of the Code of King County Board of Health, Title 13. Report of wastewater tank abandonment to be submitted to King County Department of Health. Based on online review, we are not aware of underground storage tanks being present at the site.

A copy of an aerial photo with overlays displaying site boundaries and critical areas.

Plate 3 (Critical Areas Map) displays an aerial photo of the site boundary and critical area overlay.

A single map showing all critical areas at one inch equals 20 feet scale.

The entire site is encompassed by a Wellhead Protection Zone 3. Plate 3 displays the Wellhead Protection Zone around the site and surrounding area.

A statement specifying the accuracy of the report and key project specific assumptions made and relied upon. List recommendations, if any, for further reporting regarding critical areas related to the proposed project as the project proceeds.

This critical areas report is based on our understanding of the current project details, information acquired from site exploration and review of the resources listed previously. Assumptions were made regarding some of the site-specific hydrologic characteristics relating to this project, there are no city monitoring wells within 1,300 feet of the site.

Provide a bibliography of published information referenced, including maps and best available science materials.

Best available science material and maps utilized in this report have been referenced in the *Introduction* section of this report.

Level II Hydrogeologic Assessment

Available information regarding geologic and hydrogeologic characteristics of the site, including the surface location of all critical aquifer recharge areas located on site or immediately adjacent to the site, and permeability of the unsaturated zone.

The subject site is located within a level 3 wellhead protection zone of the Redmond-Bear Creek Aquifer. The site lies within an Upland Advance Outwash (Qva) confined aquifer. Based on geologic mapping and cross-sections of the Redmond area, nearby well logs, as well as our site reconnaissance, the native soils on this site are predominately glacial till. Glacial till consists of nonsorted sands, gravels, and silts in varying amounts within a silty-clayey matrix. Such soils are typically very dense and compact due to the overburden of glaciers. Glacial till is locally termed hardpan. The permeability of such soils is very low. As such, glacial till deposits represent the aquitard unit overlying the mapped advance outwash aquifer.

Groundwater depth, flow direction and gradient based on available information.

Utilizing groundwater table maps provided by King County, the aquifer near the subject site area typically lies at elevations with upper bounds of about 200 feet. The flow direction of the aquifer trends eastward toward Bear Creek at gradients likely mimicking existing topography, of about 10 percent or less. Based on our review of available well information, the static groundwater table is typically not encountered in the area until depths approaching 60 feet bgs. However, zones of perched groundwater seepage are common within glacial till soils, especially during the winter, spring, and early summer months. Based on the referenced Pre-App information, a nearby development encountered groundwater seepage at depths of about three to five feet bgs. This type of seepage is likely not hydraulically connected to the deeper groundwater table, rather, represents perched zones within the glacial till aquitard unit.

Currently available data on wells and springs within 1,300 feet of the project area.

Available map resources indicate that historically, the headwaters of a spring originated at the site. The site has largely been filled in, and surface water emergence appears to have attenuated. Utilizing the King County well viewer application, there are six documented domestic wells within 1,300 feet of the subject area, as seen on Plate 3. The City of Redmond does not have monitoring wells within 1,300 feet of the site vicinity; however, a City supply well is located 1.4 miles south of the parcel. Please see Plate 3 for the location of documented domestic wells.

Well 1: The well has been decommissioned, but previously extended to 68 feet bgs.

Well 2: The well extends to 164 feet beneath the existing grade, the groundwater table was encountered during installation at 69 feet bgs.

Well 3: This well was a resource protection exploration well for the Emerald Heights development. The exploratory boring extended to 15 feet bgs, no groundwater was encountered.

Well 4: This well extends to 31 feet and was used for dewatering purposes. It is our opinion that the well was likely used to dewater zones of perched groundwater seepage above the local groundwater resource.

Well 5: The well has been decommissioned, but previously extended to 40 feet bgs.

Well 6: The well extends to 130 feet bgs, the groundwater table was encountered at a depth of 77 feet bgs during installation. This well noted a transition from glacial till into the sandy groundwater resource at depths of 72 feet bgs.

Location of other critical areas, including surface waters, within 1,300 feet of the project site.

A southeast to northwest trending stream is located approximately 1,000 feet southwest of the site. There are no other critical areas within the site or surrounding vicinity to our knowledge.

Available historic water quality data for the area to be affected by the proposed activity.

The Redmond water quality report indicates that City groundwater wells were below EPA limits for all detectable compounds.

Best management practices proposed to be utilized.

At a minimum, BMP's should comply with current City of Redmond zoning code requirements. The owner or operator of any facility or activity shall provide secondary containment for hazardous material or other deleterious substances in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds.

Construction equipment fueling, equipment maintenance, and vehicle areas shall have a containment system for collecting and treating all runoff from such areas and preventing release of fuels, oils, lubricants, and other automotive fluid into soil, surface water, or groundwater. Emergency response spill kits should be kept on site during transfer, handling, use, production, or disposal of hazardous materials or other deleterious substances.

The site shall comply with clean fill standards in accordance with those specified in RMC 15.24.095.

Historic water and elevation quality data for the area to be affected by the proposed activity compiled for at least the previous five-year period.

There are no City monitoring wells within the site vicinity. Public data on historic water levels within the area is unavailable.

Groundwater monitoring plan provisions.

During our site explorations, we did not encounter groundwater within our test pits. It is our opinion that, considering grading plans, the groundwater table will not be encountered or influenced during construction or on a permanent basis. We do not anticipate that groundwater monitoring will be necessary for the subject site.

Discussion of the effects of the proposed project on the groundwater quality and quantity, including:

> *Predictive evaluation of groundwater withdrawal effects on nearby wells and surface water features.*
>
> We do not anticipate that the subject site will adversely affect nearby wells or surface water features. Active wells around the site extend beneath the overlying glacial till aquitard. Site grading will not extend into the local water table or groundwater resource. Surficial site soils display poor hydraulic conductivity characteristics.
>
> *Predictive evaluation of contaminant transport based on potential releases to groundwater.*
>
> Given the presence of glacial till soils with low permeability, we anticipate that contaminant transport affecting groundwater will be negligible.
>
> *Predictive evaluation of groundwater (recharge, elevation, dewatering feasibility, constructability, discharge permitting, etc.) on the proposed project.*
>
> Construction of the proposed development will not interfere or extend into the regional water table. Active dewatering will not be necessary at the subject site. The proposed development will not affect current recharge levels of the underlying aquifer. The aquifer is not surficially exposed at the subject site, therefore construction is unlikely to affect the aquifer.

Identification of the type and quantities of any deleterious substances or hazardous materials that will be stored, handled, treated, used, produced, recycled, or disposed of on the site, including but not limited to materials, such as elevator lift/hydraulic fluid, hazardous materials used during construction, materials used by the building occupants, proposed storage and manufacturing uses, etc.

At the time of this report preparation, we are unaware of any deleterious substances or hazardous materials that will be stored, handled, treated, used, or produced on the site.

Proposed methods of storing any of the above substances, including containment methods to be used during construction and/or use of the proposed facility.

A spill prevention plan will be developed, submitted and approved to the City of Redmond which will at a minimum provide site and project specific standard operating procedures for Hazardous Materials Control Plan (HMCP)/Spill Prevention and Cleanup Plan (SPCC). Secondary containment should be provided for hazardous materials.

Proposed plan for implementing Protection Standards During Construction (RZC 21.64.050(D)(3)(f).

As part of the approved project plans, development of the site will be conducted in accordance with the approved HMCP/SPCC as described above. During construction, the superintendent will have the primary responsibility of implementation and inspection of the HMCP/SPCC plans and confirm compliance.

A spill plan that identifies equipment and/or structures that could fail, resulting in an impact. Spill plans shall include provisions for regular inspection, repair, and replacement of structures and equipment that could fail.

A spill plan conforming to, or based on EPA Title 40, Part 112 (40 CFR Part 12) shall be prepared, submitted and approved by City of Redmond prior to proceeding with grading.

A complete discussion of past environmental investigations, sampling, spills, or incidents that may have resulted in or contributed to contaminated soil or groundwater at the site. Attach copies of all historical and current reports and sampling results.

At the time of this report, we are unaware of past environmental investigations, sampling, spills or incidents at the site. Much of the site has been raised with fill, as such, much of the existing fill will be overexcavated and replaced with clean fill.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include removing unsuitable, previously placed fill, protecting the aquifer/groundwater resource, and foundation and slab-on-grade support.

The proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil or new structural fill placed directly on competent native soils. Competent soil suitable for foundation support will be encountered at various depths across the subject site. Overexcavation will be necessary across the majority of the site to achieve competent native soils suitable for support of foundations or placement of structural fill. Slab-on-grade floors for the proposed structures should be supported on firm and unyielding subgrades comprised of competent native soil or compacted structural fill. Unstable or yielding areas of the subgrades should be overexcavated and replaced with suitable structural fill, prior to construction of the foundations and/or slabs.

This study has been prepared for the exclusive use of RMJ Holdings, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, and removing existing fill. Subsequent earthwork activities will involve site grading and related infrastructure improvements.

Temporary Erosion Control

Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide a stable access entrance surface. Geotextile fabric may be placed beneath the quarry spalls to provide greater stability of the temporary construction entrance. Erosion control measures should include silt fencing placed around the site perimeter. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Additional BMPs should be incorporated into construction activities as site conditions warrant to maintain stable site conditions and reduce off-site impacts.

The site lies within a Wellhead Protection Zone 3, as such, specialized BMPs such as secondary containment must be used when handling hazardous materials and when fueling or servicing construction vehicles. Further discussion can be found in the *Level II Hydrogeologic Assessment* section of this report.

Excavations and Slopes

Excavation activities are likely to expose uncontrolled fill soils transitioning to medium dense to dense glacial till soils. Provided appropriate methods of sloping for the excavations are incorporated into the design and construction, overall stability of site excavations is anticipated to be good. Based on the soil conditions observed at the test pit locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Loose to medium dense fill soils — 1.5H:1V (Type C)
- Areas exposing groundwater seepage — 1.5H:1V (Type C)
- Medium dense to dense glacial till soils — 0.75H:1V (Type A)

Steeper temporary slope inclinations within compact, undisturbed native deposits may be feasible based on the soil and groundwater conditions exposed within the excavations. Steeper inclinations may be considered, and must be approved by ESNW, during grading.

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion, and should maintain a gradient of 2H:1V or flatter. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

In-situ and Imported Soils

Much of the site is underlain by uncontrolled fill which must be removed from structural areas. On-site soils are highly moisture sensitive, and successful use as structural fill will largely dictated by the moisture content at the time of placement and compaction. Remedial measures, such as soil aeration, may be necessary as part of site grading and earthwork activities. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill if grading activities take place during periods of extended rainfall activity. Soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill placed and compacted during site grading activities should meet the following specifications and guidelines:

• Structural fill material	Granular soils*
• Moisture content	At or slightly above optimum**
• Relative compaction (minimum)	95 percent (Modified Proctor)
• Loose lift thickness (maximum)	12 inches

* *Existing uncontrolled fill soils are not suitable for use as structural fill. Native soils may not be suitable unless the soil is at or near the optimum moisture content at the time of placement and compaction.*

** *Soils shall not be placed dry of optimum and should be evaluated by ESNW during construction.*

With respect to underground utility installations and backfill, local jurisdictions may dictate the soil type(s) and compaction requirements. Areas of fill or otherwise unsuitable material and debris should be removed from structural areas and replaced with structural fill. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill, but, where encountered, may be used in non-structural areas as desired.

Foundations

The proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil or new structural fill placed directly on competent native soils during grading activities. The existing fill is unsuitable for direct support of foundations. Competent soil suitable for foundation support will be encountered at varying depths (up to 16 feet) beneath current site grades. Where encountered, existing fill must be overexcavated to native soil and replaced with new structural fill, prior to construction of the foundations and/or slabs. Provided foundations will be supported as prescribed, the following parameters may be used for design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of approximately one-half inch is anticipated. The majority of anticipated settlement should occur during construction, as dead loads are applied.

Seismic Design

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. In accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class D should be used for design.

The referenced liquefaction susceptibility map indicates the subject site maintains low liquefaction susceptibility. Based on the soil conditions observed at the test pit locations, in our opinion, the proposed building footprint of the site has a very low susceptibility to liquefaction. This opinion is based off of the relative density of the native soils and lack of a uniform and shallow groundwater table.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed structures should be supported on a well-compacted, firm and unyielding subgrade. Where feasible, native soils exposed at the slab-on-grade subgrade level can likely be compacted in-situ to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, prior to construction of the slab.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

• Active earth pressure (yielding condition)	35 pcf (equivalent fluid)
• At-rest earth pressure (restrained condition)	55 pcf
• Traffic surcharge* (passenger vehicles)	70 psf (rectangular distribution)
• Passive earth pressure	300 pcf (equivalent fluid)
• Coefficient of friction	0.40
• Seismic surcharge	6H psf**

* *Where applicable*
** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil, if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 4. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Temporary measures to control surface water runoff during construction would likely involve passive elements such as interceptor trenches and sumps. ESNW should be consulted during preliminary grading activities to evaluate seepage areas and provide recommendations to reduce the potential for seepage-related instability.

Finish grades should be designed to direct surface drain water away from structures and slopes. The grade adjacent to buildings should be sloped away from the buildings at a gradient of at least 2 percent for a horizontal distance up to ten feet or the maximum allowed by adjacent structures. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 5.

Infiltration Feasibility

We understand that because the site is located within a Wellhead Protection Zone, infiltration should be considered for clean roof runoff into raingardens or similar infiltration area as long as no contaminants are vented to the roof and the roof is constructed of non-toxic material. As indicated in the *Subsurface* section of this report, soils encountered during our fieldwork were characterized primarily as fill material transitioning to native glacial till deposits at depths. Irrespective of gravel content, fines contents within the glacial till soils were on the order of about 15 to 30 percent. From a geotechnical standpoint, it is our opinion that accommodation of infiltration facilities will be difficult given the presence of fill across the subject site which will be removed. Based on the preliminary grading plans, we anticipate that much of the existing fill will be removed and restored with structural fill. As such, it will be difficult to find areas on the site that will not feature engineered soils at the bottom of shallow facilities such as rain gardens.

In our experience, glacial till soils, such as those found at the site, are not suitable for infiltration. Such soils typically rely on lateral interflow and overflow connections for stormwater conveyance during heavy rainfall events. Glacial till soils are prone to seasonal, perched groundwater seepage during the winter, spring, and early summer months. It is our opinion that the subject site should not pursue infiltration implementation as a means for stormwater conveyance given the amount of fill removal and replacement, and the unfavorable soil conditions at depth. However, ESNW can evaluate the capacity of infiltration into native soils via in-situ pilot infiltration testing (PIT). To perform a PIT, ESNW will need information regarding the proposed location of facilities and bottom of facilities. It is our opinion that infiltration testing will likely yield measured rates approaching the minimum threshold (0.30 inches-per-hour) for infiltration implementation, or less. As necessary, ESNW can provide further evaluation of, and recommendations for, stormwater flow control BMPs upon request.

Preliminary Detention Vault Design

It is our understand that a stormwater detention vault (vault) will be constructed in the northeastern corner of the site. Vault foundations should be supported directly on dense native soil. Should overexcavation(s) be necessary at the vault foundation subgrade, quarry spalls should be used to restore grades. The final vault design must incorporate adequate buffer space from property boundaries such that temporary excavations to construct the vault structure may be successfully completed. The following preliminary design parameters may be used for detention vault design:

• Allowable soil bearing capacity	5,000 psf (dense native soil)
• Active earth pressure (unrestrained)	35 pcf
• Active earth pressure (unrestrained, hydrostatic)	80 pcf
• At-rest earth pressure (restrained)	55 pcf
• At-rest earth pressure (restrained, hydrostatic)	100 pcf
• Coefficient of friction	0.40
• Passive earth pressure	300 pcf
• Seismic surcharge	6H psf*

**Where H equals the retained height (in feet)*

Vault retaining walls should be backfilled with free-draining material or suitable sheet drainage that extends along the height of the walls. The upper one foot of the wall backfill may consist of a less permeable soil, if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. If the elevation of the vault bottom is such that gravity flow to an outlet is not possible, the portions of the vault below the drain should be designed to include hydrostatic pressure.

ESNW should observe subgrade conditions prior to concrete forming and pouring. If the soil conditions encountered during construction differ from those anticipated, supplementary recommendations may be provided. ESNW should be contacted to review final vault designs to confirm that appropriate geotechnical parameters have been incorporated.

Utility Support and Trench Backfill

In our opinion, on-site soils will generally be suitable for support of utilities. However, overexcavation to bearing soils and replacement with structural fill may be necessary in fill areas. On-site soils may not be suitable for use as structural backfill throughout utility trench excavations unless the soil is at (or slightly above) the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the City of Redmond or other responsible jurisdiction or agency.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;
- A minimum of two inches of HMA placed over three inches of asphalt treated base (ATB).

For relatively high volume, heavily loaded pavements areas subjected to occasional truck traffic, the following preliminary pavement sections may be considered:

- A minimum of three inches of HMA placed over six inches of CRB, or;
- A minimum of three inches of HMA placed over four inches of ATB.

The HMA, ATB and CRB materials should conform to WSDOT/King County Road Standards specifications. All soil base material should be compacted to at least 95 percent of the maximum dry density. Final pavement design recommendations can be provided once final traffic loading has been determined. County road standards may supersede the recommendations provided in this report.

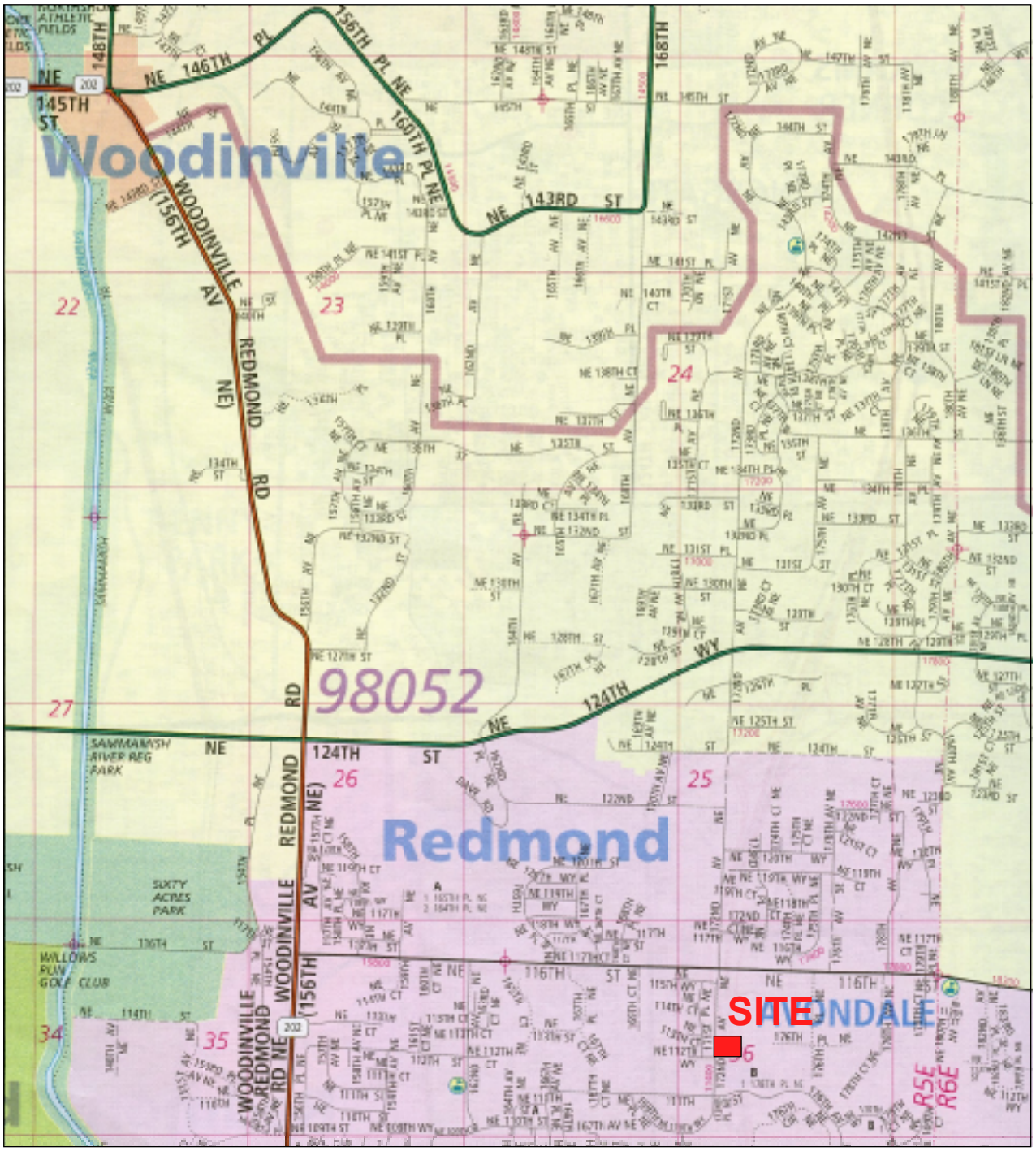
An ESNW representative should be requested to observe the subgrade conditions prior to placement of crushed rock or ATB. Supplemental recommendations for achieving subgrade stability and drainage can be provided, as necessary.

LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
King County, Washington
Map 507
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

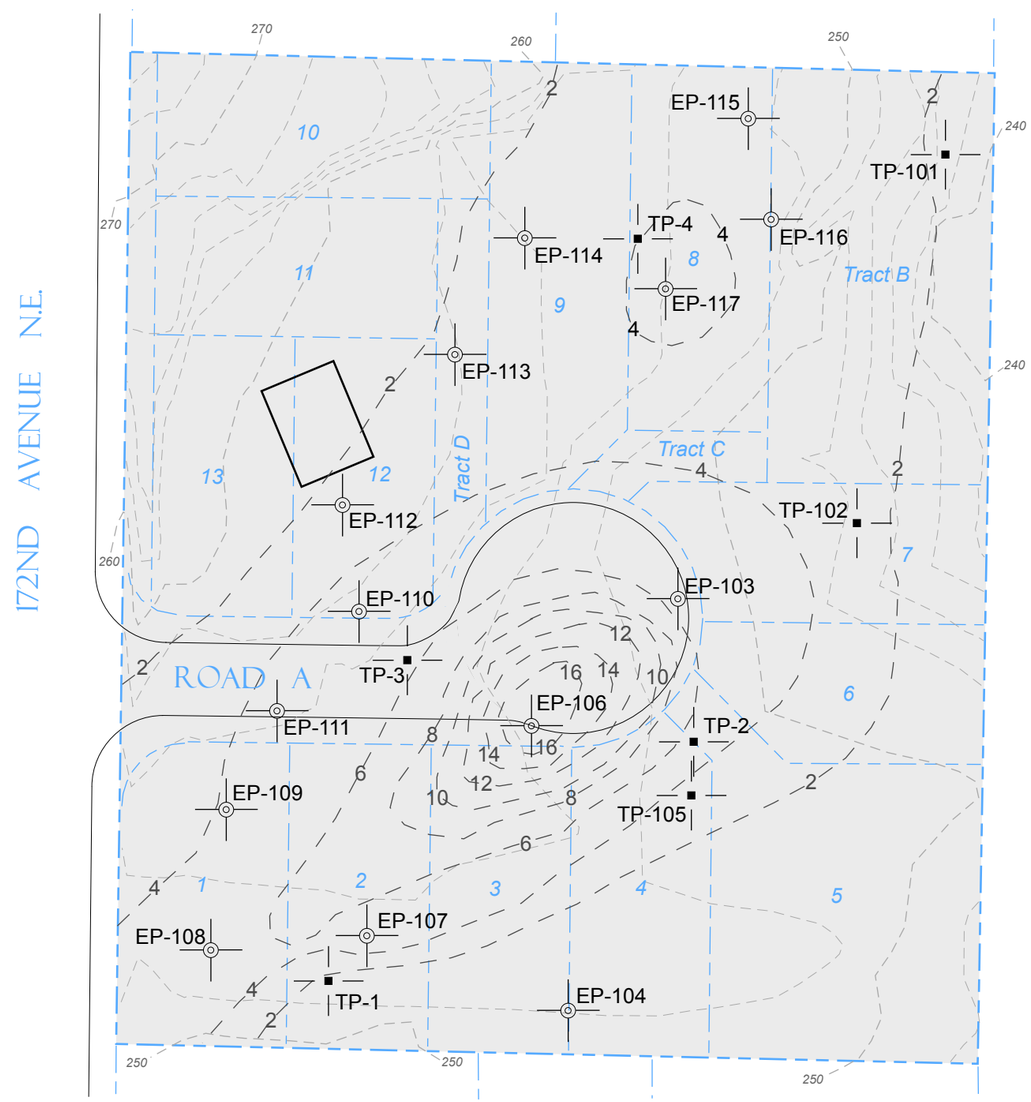
Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Redmond 13
Redmond, Washington

Drwn. MRS	Date 04/25/2018	Proj. No. 5619
Checked BST	Date April 2018	Plate 1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



LEGEND

- TP-101 — Approximate Location of ESNW Test Pit, Proj. No. ES-5619, March 2018
- TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ESNW Test Pit, Proj. No. ES-5619, Oct. 2017
- Approximate Location of Exploration Pit
- Subject Site
- Existing Building
- 5 Proposed Lot Number
- 2 Fill Depth Contours

NORTH

0 30 60 120

1"=60' Scale in Feet

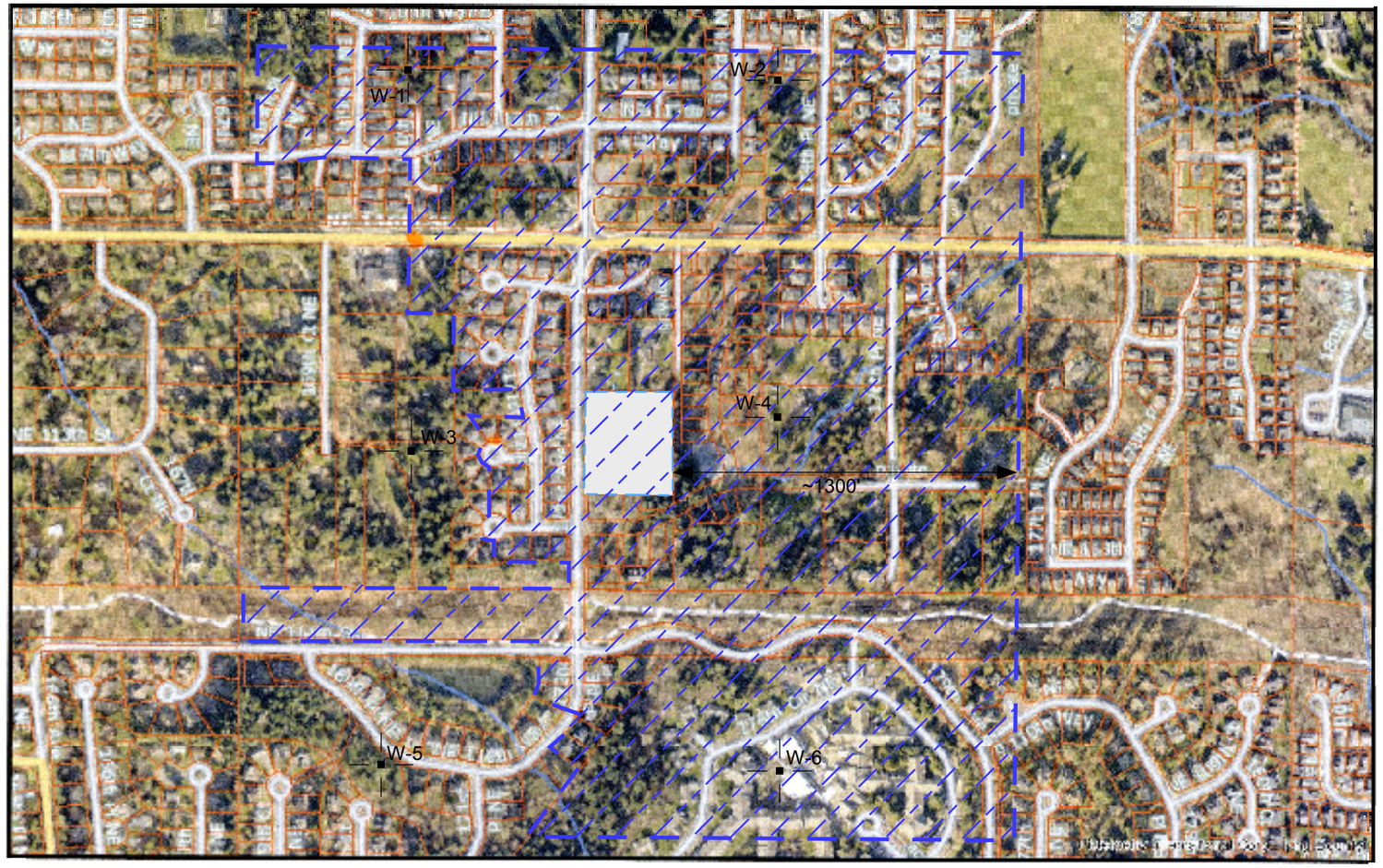
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Redmond 13
Redmond, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By	MRS
Checked By	BST
Date	06/04/2018
Proj. No.	5619
Plate	2



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

NORTH

NOT - TO - SCALE

LEGEND

Subject Site

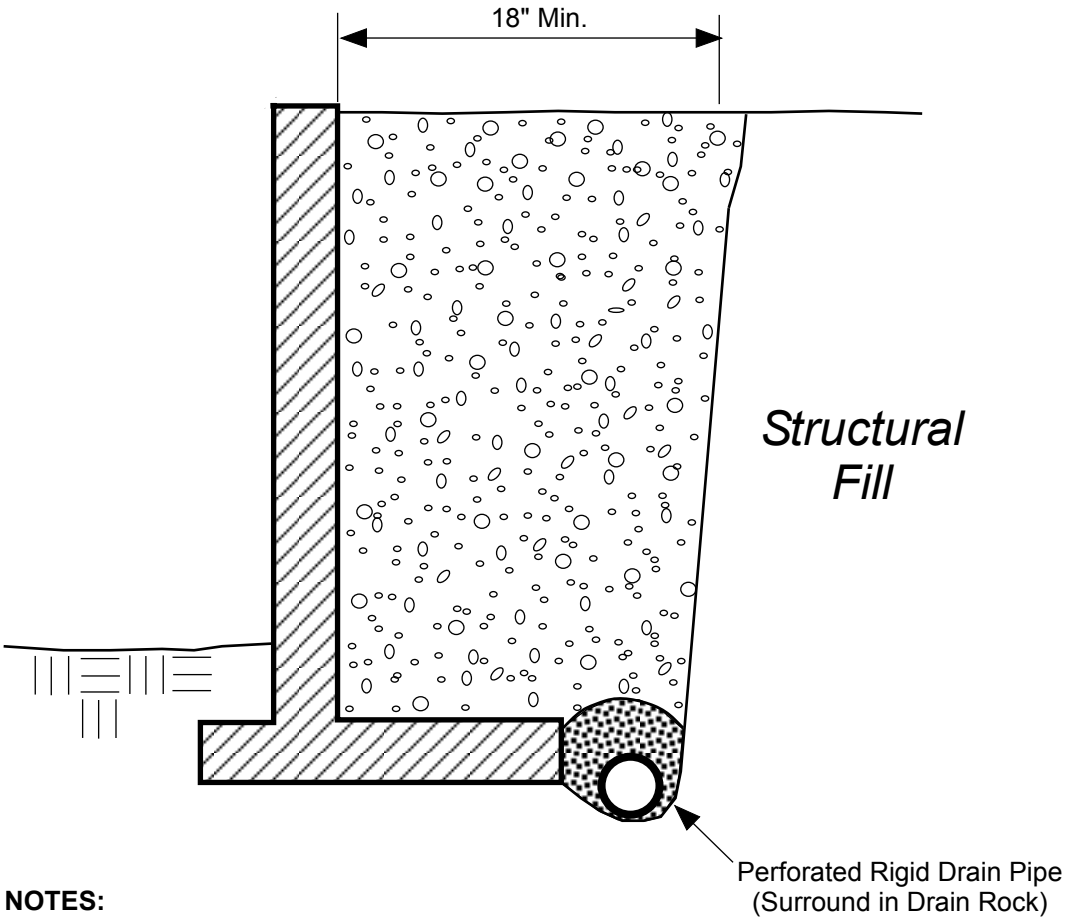
Well Protection Zone 3

W-1 Approximate Location of Wells

Critical Areas Map
Redmond 13
Redmond, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By	MRS
Checked By	BST
Date	06/01/2018
Proj. No.	5619
Plate	3



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

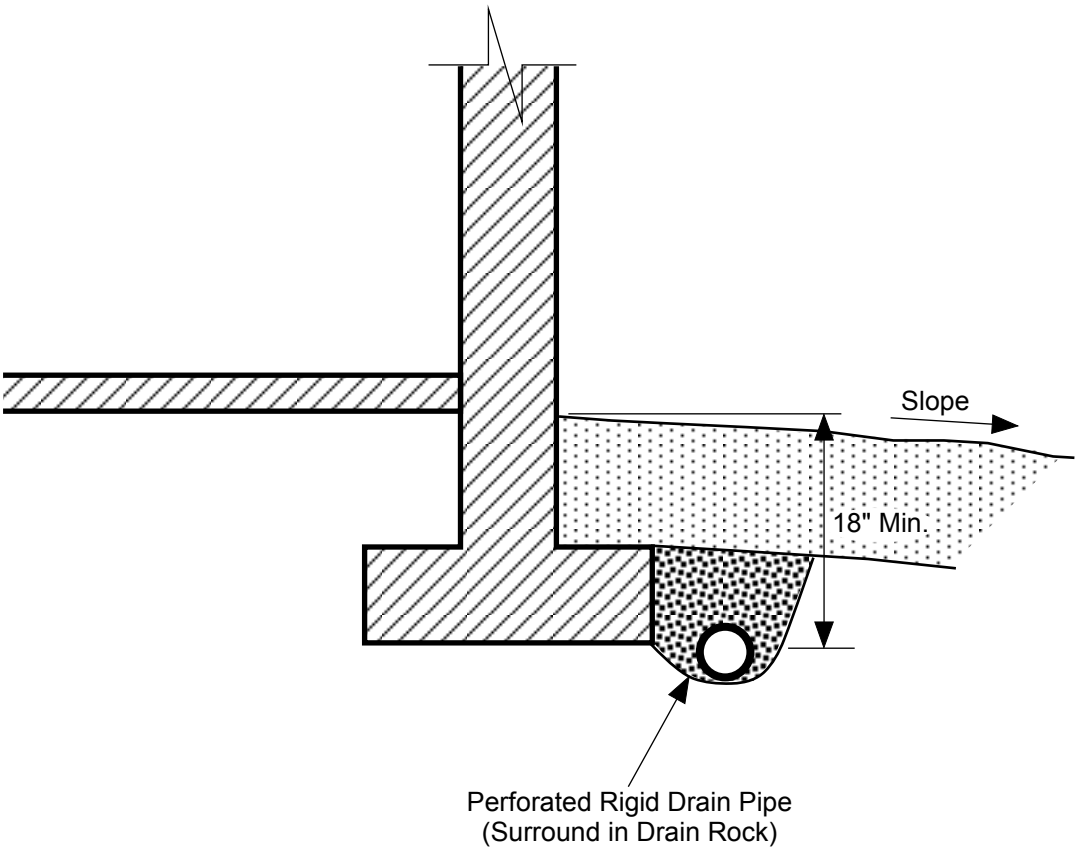
Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering Construction Observation/Testing and Environmental Services

RETAINING WALL DRAINAGE DETAIL
Redmond 13
Redmond, Washington

Drwn. MRS	Date 05/07/2018	Proj. No. 5619
Checked BST	Date May 2018	Plate 4



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

FOOTING DRAIN DETAIL
Redmond 13
Redmond, Washington

Drwn. MRS	Date 05/07/2018	Proj. No. 5619
Checked BST	Date May 2018	Plate 5

Appendix A

Subsurface Exploration
Test Pit Logs
Well Logs

ES-5619

Subsurface conditions at the subject site were explored on October 4, 2017, and March 7, 2018 by excavating 17 total pits using excavators and operators retained by the client. The approximate locations of the test pits are illustrated on Plate 2 of this study. The test pit logs are provided in this Appendix, it should be noted some exploration pits were not logged when determining the limits of fill at the site. The test pits were excavated to a maximum depth of approximately 16 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 10/4/17 **COMPLETED** 10/4/17 **GROUND ELEVATION** 254 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY BST **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Surface Conditions: grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0		SM		Brown silty SAND with gravel, loose to medium dense, moist (Fill)	
				-stell wire, fabric	
1.0					253.0
		SM		Brownish gray silty SAND with gravel, medium dense to dense, moist	
5				-trace roots at 5'	
6.0					248.0
		SP-SM		Gray poorly graded silty SAND, dense, moist	
7.0					247.0
				Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.	
				Bottom of test pit at 7.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 10/4/17 **COMPLETED** 10/4/17 **GROUND ELEVATION** 251 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY BST **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Surface Conditions: grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					
		SM		Brown silty SAND with gravel, loose to medium dense, moist (Fill) -scattered organics -concrete slab, brick -slight caving from TOH to 5.5'	
5				5.3	245.8
		SM		Tan silty SAND with gravel, dense, moist -light iron oxide staining	
				7.0	244.0
				Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. Caving observed from TOH to 5.5 feet. Bottom of test pit at 7.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 10/4/17 **COMPLETED** 10/4/17 **GROUND ELEVATION** 256 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY BST **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Surface Conditions: grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					
		SM		Brown silty SAND with gravel, loose to medium dense, moist (Fill) -scattered organics -slight caving from TOH to 5' -logs	
5				5.0	251.0
		SM		Gray sandy SILT, dense, moist -4"- 6" sand lens	
				6.0	250.0
				Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. Caving observed from TOH to 5.0 feet. Bottom of test pit at 6.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 10/4/17 **COMPLETED** 10/4/17 **GROUND ELEVATION** 254 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY BST **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Surface Conditions: subgrade **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0		SM		Dark brown silty SAND with gravel, loose to medium dense, moist (Fill) -organic rich -roots -slight caving from TOH to 3'	
3.0					251.0
		SM		Gray silty SAND with gravel, medium dense, moist -light iron oxide staining	
5					
7.0					247.0
				Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. Caving observed from TOH to 3.0 feet. Bottom of test pit at 7.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-101

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 3/7/18 **COMPLETED** 3/7/18 **GROUND ELEVATION** 244 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 18" **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Brown highly organic TOPSOIL (Fill) 1.5 242.5
			SM		Brown silty SAND, medium dense, wet
5					-becomes gray, dense, moist -groundwater seepage
		MC = 10.90% Fines = 18.90%			7.5 236.5
					Test pit terminated at 7.5 feet below existing grade. Groundwater seepage encountered at 5.0 feet during excavation. No caving observed. Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-102

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 3/7/18 **COMPLETED** 3/7/18 **GROUND ELEVATION** 248 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 18" **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
			SM		Brown highly organic TOPSOIL (Fill)	
					1.5	246.5
			SM		Brown silty SAND, medium dense, moist to wet	
5					-becomes gray, dense, moist	
		MC = 16.80%			5.5	242.5
					Test pit terminated at 5.5 feet below existing grade. No groundwater encountered during excavation. No caving observed. Bottom of test pit at 5.5 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-105

PROJECT NUMBER ES-5619 **PROJECT NAME** RMJ Redmond

DATE STARTED 3/7/18 **COMPLETED** 3/7/18 **GROUND ELEVATION** 251 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6" **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		0.5 Dark brown highly organic TOPSOIL	250.5
			SM		Brown silty SAND, medium dense, damp -becomes gray, dense, moist	
5		MC = 15.00%			5.0	246.0
					Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. Bottom of test pit at 5.0 feet.	

E: ORIG. & FIRST COPY - DEPT. OF ECOLOGY
SECOND COPY - OWNER; THIRD COPY - DRILLER

WATER WELL REPORT
STATE OF WASHINGTON

Attachment 10

STATE IDENTIFICATION NO. AE31726
UNIQUE WELL ID N/A
WATER RIGHT PERMIT NO N/A

I) OWNER NAME: QUADRANT HOMES C/O CC EDWARDS CONST. ADDRESS: 2415 INTERAVENUE SUITE A PUYALLUP WA 98372
) LOCATION OF WELL : County KING NW 1/4 NE 1/4 SEC 36 TWP 26N R 5E
) STREET ADDRESS OF WELL (or nearest address): 11416 172ND AVE NE REDMOND PARCEL 3626059100

) PROPOSED USE: ABANDONED
) TYPE OF WORK: DECOMMISSIONING
METHOD: PERFORATE / GROUT

) DIMENSIONS: Diameter of well 6 inches.
Drilled feet. Depth of completed well ft.

) CONSTRUCTION DETAILS
Casing instld: " Diam. From ft. to ft.
Welded ☐ " Diam. From ft. to ft.
Liner ☐ " Diam. From ft. to ft.
Threaded ☐

Perforations: Yes ☑ No ☐
Type of perforator used MILLS KNIFE
Size of perforations 0.3 in. by 2 in.
264 perforations from 2 ft. to 66' in.
perforations from ft. to in.
perforations from ft. to in.

Screens: Yes ☐ No ☐
Manufacturer's Name:
Type Model No.
Diam Slot size from ft. to ft.
Diam Slot size from ft. to ft.

Gravel packed Yes ☐ No ☑ Size of gravel?
Gravel packed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of Strata ft.
Method of sealling strata off

PUMP: Manufacturer's Name
Type H. P.

WATER LEVELS: Surface elev above mean sea level ft.
Static level below top of well Date
Artesian pressure lbs. Per sq. in. Date
Artesian pressure is controlled by

WELL TESTS: Pump test made? By Whom
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Recovery data:
Wtr Lvl. Time Wtr Lvl. Time Wtr Lvl.

Date of test:
test gal./min with ft. drawdown after hrs.
t gal/min stem set at ft. for hrs.
on flow gal/min Date
erature of water Was chemical analysis made?

.(10) WELL LOG OR DECOMMISSIONING PROCEDURE DESCRIPTION

MATERIAL	FROM	TO
EXISTING WELL - DEPTH 68' DIAMETER - 6" STEEL		
DECOMMISSIONED WELL PER DOE REGULATIONS WAC 173-160-381-1A		
PERFORATED CASING 4 CUTS PER ROW, ONE ROW PER FOOT FROM 68' UP TO 2' BELOW GROUND LEVEL.		
TREMMIED 20+% SOLIDS BENTONITE QUICKGROUT FROM THE BOTTOM TO THE TOP.		
CUT CASING APPROX 2' BELOW GRADE.		

RECEIVED
JUN 24 2015
WA State Department
of Ecology (SWRO)

Work Started 04/30/15 Completed: 04/30/15

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Name: RICHARDSON WELL DRILLING COMPANY INC.
Address: P. O. BOX 44427 TACOMA, WA 98444
(Signed) (Well Driller) Lic No. 2081
Contractor's Registration No. RICHAW*3210B DATE 5/7/15

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

2

Attachment 10

Start Card No. [redacted]

26/5/36C

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Water Right Permit No.

(1) OWNER: Name Bob Hattested Address 11523 169 Court. NE. Wnndvl.

(2) LOCATION OF WELL: County King NE ¼ NW ¼ Sec. 36 T. 26 N., R. 5E W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) Same As Above 116th & Avondale rd.

(3) PROPOSED USE: ☒ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☒ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 164 feet. Depth of completed well 164 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from -1 ft. to 163 ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐
Threaded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Houston
Type SS. Model No.
Diam. 6. Slot size .16 from 155 ft. to 165 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Goulds
Type: Sub. 13EM10412 H.P. 1

(8) WATER LEVELS: Land-surface elevation above mean sea level 270' ft.
Static level 69' ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 10 gal./min. with 20' ft. drawdown after 1 hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Redish clay sand gravel	0	3
Light. Brown clay sand gravel	3	20
Brown clay gravel ½" moist.	20	40
Brown clay sand some gravel dry	40	60
Brown clay sand Trace H2O	60'	80'
20' of water in hole AM.		
Brown clay sand No water	80'	97'
gray clay sand	97'	100'
gray clay sand gravel water	100'	105'
gray clay sand No water	105'	115'
mach Rotary of well 8/19/92		
Heavy gray sand clay	115'	120'
gray clay sand open hole	120'	126'
gray clay sand Hard.	126'	128'
Dark gray clay sand gravel	128	135'
gray clay sand (Heavy)	135	151'
gray clay gravel sand	151	157'
gravel sand water	157	164

RECEIVED
JAN 04 1993
DEPT. OF ECOLOGY

Work started AUG 6 1992 Completed Oct. 11, 1992

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME B&J Drilling CO 392-3826
(PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 9026 38th AV. SW. Seattle

(Signed) R. Cannon (WELL DRILLER) License No. 0071

Contractor's Registration No. 088DT Date Oct. 29, 1992

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

3 Attachment 10 20-SE-806

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. SE02322

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☒ Construction

☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number: 309809

Consulting Firm

Unique Ecology Well IDTag No.

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Fadich, Nick

Driller/Engineer /Trainee Signature Nick Fadich

Driller or Trainee License No. 2862

If trainee, licensed driller's Signature and License Number:

Type of Well *("x in box)*

☐ Resource Protection

☒ Geotech Soil Boring

Property Owner Emerald Heights

Site Address 10901 176th Cir NE

City Redmond County King

Location SW 1/4-1/4 NE 1/4 Sec 36 Twn 26 R 5

EWM ☑ or WWM ☐

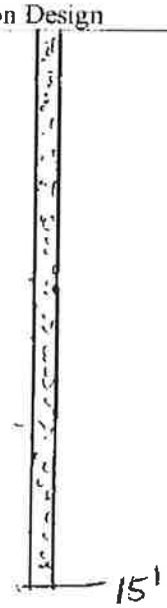
Lat/Long (s, t, r still REQUIRED) Lat Deg ____ Min ____ Sec ____ Long Deg ____ Min ____ Sec ____

Tax Parcel No.

Cased or Uncased Diameter 6" Static Level

Work/Decommission Start Date 5/1/08

Work/Decommission Completed Date 5/1/08

Construction Design	Well Data	Formation Description
	0 ft to 15 ft bentonite chips	0 ft to 5 ft gray silty sandy fill 5 ft to 10 ft tan sand 10 ft to 15 ft silty sandy soil ____ ft to ____ ft

RECEIVED
JUN 24 2008
DEPT. OF ECOLOGY

SCALE: 1"= 5' PAGE 1 OF 2

ECY 050-12 (Rev. 7/06)

Ecology is an Equal Opportunity Employer

4

Attachment 10

Start Card No. D04983

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

ENTERED

WATER WELL REPORT

STATE OF WASHINGTON

Water Right Permit No. 26/5/36 F

(1) OWNER: Name BURNSTEAD CONSTRUCTION, INC. Address 1215 120th Ave. Ne BELLEVUE, WA 98005

(2) LOCATION OF WELL: County KING SE ¼ NW ¼ Sec. 36 T. 26 N., R. 5 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) NE 111th Street 300' SOUTH OF 169th PL. N.E. REDMOND

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ■ DeWater Industrial ☐ Test Well ☐ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☐ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ■ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 30" inches.
Drilled 31' feet. Depth of completed well 31 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 10" Diam. from 0 ft. to 31 ft.
Welded ☐ Liner installed ☐ Threaded ☐ " Diam. from ft. to ft.
Perforations: Yes ☒ No ☐
Type of perforator used
SIZE of perforations .30 in. by 3" in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
Screens: Yes ■ No ☐
Manufacturer's Name
Type PVC Model No.
Diam. 10" Slot size .30 from 10' ft. to 31' ft.
Diam. Slot size from ft. to ft.
Gravel packed: Yes ■ No ☐ Size of gravel 5/8"
Gravel placed from -5 ft. to 31' ft.
Surface seal: Yes ☐ No ☒ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

RECEIVED
JUN 30 1994
DEPT. OF ECOLOGY

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test

Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
WELLS ARE INSIDE EXCAVATION : NO SURFACE SEAL REQUIRED		
10" PVC BLANK — FINE LIGHT BROWN SAND 10'		10'
10" .30 SLOT — COURSE BROWN SAND	10'	25'
DARK BROWN SANDY CLAY W/ COBBLES	25'	31'

Work started 6/27/94, 19. Completed 8/30/94, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME SLEAD'S CONSTRUCTION, INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 2703 East 96th Street, Tacoma, Wa 98445

(Signed) [signature] (WELL DRILLER) License No. 1759

Contractor's Registration No. SLEADC*325KO Date 6/30/ 94, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- ® 18

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

RECEIVED
JUN 1 8 2002
DEPARTMENT OF ECOLOGY
WELL DRILLING UNIT

114805

5

Attachment 10

HAYES DRILLING,INC

5696 Ershig Rd
Bow WA 98232-9672
HAYESDI106J5

HAYES DRILLING

phone 360-766-6110
fax 360-766-6133
www hayesdrilling com

WELL REPORT

JOB NUMBER	A2443	START CARD NO	A60404
PROJECT NAME		COUNTY	King
OWNER NAME		TAX ID NO	
REPRESENTATIVE	Jeff Knutzen	SW 1/4 SE 1/4	SEC 25 TWN 26 RNG 5 E
CONSULTING FIRM	John F Buchan Const	ADDRESS	17444NE 116th St Redmond Wa
DRILLER	Curtis Issacson	WELL ID NO	
COMPANY NAME	Hayes Drilling Inc	WATER ELEVATION	
DRILLING METHOD	Abandonment	INSTALLED	Abandonment
LAND ELEVATION		DEVELOPED	

AS BUILT	WELL DATA	FORMATION DESCRIPTION
0'	Diameter of Well 6' x 6' Depth of Well 40' Static Level 7' Back filled with chlorinated sand two feet above static and then with concrete to surface	

Date Completed 6/7/2002 Driller Curtis Issacson License No 2542

6 Attachment 10 26/05 – 25 P

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No.

(1) OWNER: Name Glenn S Miller Address 16808 N.E 116th Redmond Wa.

(2) LOCATION OF WELL: County King — SE ¼ SW ¼ Sec 25 T 26 N., R 5E W.M.

Bearing and distance from section or subdivision corner 27' East and 48' north of S.W corner

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 130 ft Depth of completed well 130 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from ft. to 122 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type SS Model No.
Diam 6 Slot size 12 from 122 ft. to 125 ft.
Diam 6 Slot size 10 from 125 ft. to 130 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name STA-Rite
Type: Submersible H.P. 1½

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 77 ft. below top of well Date 3/15
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 20 gal./min. with 2 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water 48 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Soil sand and gravel		2
Clay sand and gravel	2	15
Hardpan	15	40
Streaks of sand in Hdpn	40	65
Sticky gray clay w/aggregate	65	70
Hardpan	70	72
Sandy blue clay	72	76
Streaks of sand	76	79
Streaks of clays and sand	79	116
Sand and clays w/water	116	130

Work started 3/2, 1978 Completed 3/17, 1978

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ralph Medlen (Person, firm, or corporation) (Type or print)

Address 417 N. 87th

[Signed] Ralph Medlen (Well Driller)

License No. 0306 Date 3/25, 1978

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

3

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appendix B

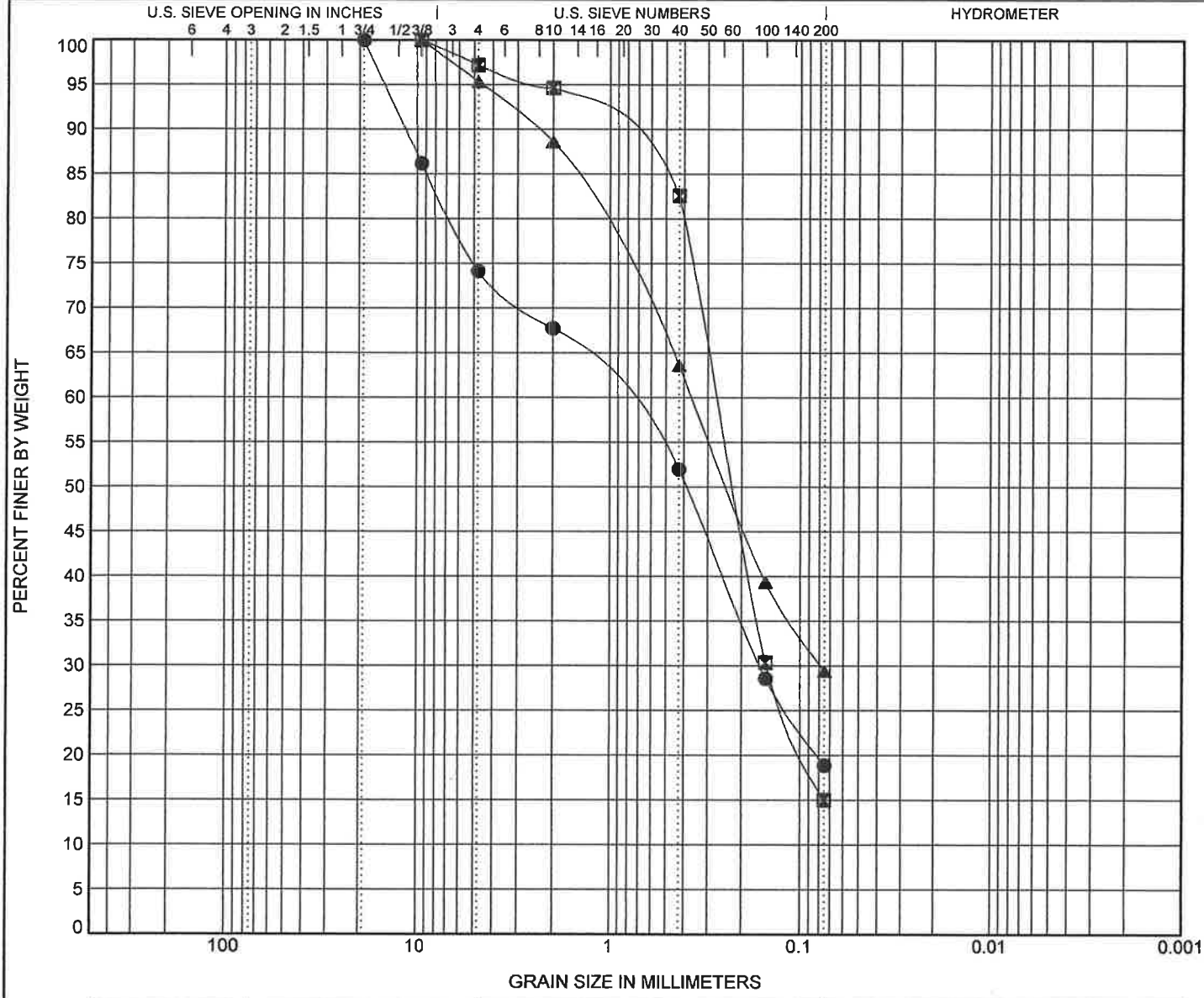
Laboratory Test Results

ES-5619

GRAIN SIZE DISTRIBUTION

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

PROJECT NUMBER ES-5619.00 **PROJECT NAME** RMJ Redmond



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-101	7.50ft.	**USCS: Brown SM with Gravel.**		
⊠	TP-102	5.50ft.	**USCS: Brown SM.**		
▲	TP-105	5.00ft.	**USCS: Brown SM.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-101	7.5ft.	19	0.935	0.16					18.9	
⊠	TP-102	5.5ft.	9.5	0.271	0.148					15.0	
▲	TP-105	5.0ft.	9.5	0.364	0.078					29.4	

Report Distribution

ES-5619

EMAIL ONLY

RMJ Holdings, LLC
9675 Southeast 36th Street, Suite 105
Mercer Island, Washington 98040

Attention: Mr. Justin Lagers

APPENDIX C
WWHM REPORT

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Redmond 13
Site Name:	Redmond 13
Site Address:	
City:	
Report Date:	11/21/2019
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2018/10/10
Version:	4.2.16

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

PREDEV

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	3.006
Pervious Total	3.006
Impervious Land Use	acre
Impervious Total	0
Basin Total	3.006

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

RDIN

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.776
Pervious Total	0.776
Impervious Land Use	acre
ROADS FLAT	0.464
ROOF TOPS FLAT	0.716
DRIVEWAYS FLAT	0.226
SIDEWALKS FLAT	0.13
Impervious Total	1.536
Basin Total	2.312

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

BYPASS

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.109
C, Pasture, Mod	0.591
Pervious Total	0.7
Impervious Land Use	acre
SIDEWALKS MOD	0.013
Impervious Total	0.013
Basin Total	0.713

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements

Predeveloped Routing

Mitigated Routing

Vault 1

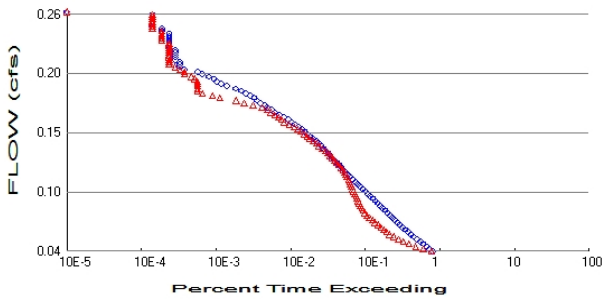
Width:	37.75 ft.
Length:	72 ft.
Depth:	12 ft.
Discharge Structure	
Riser Height:	11 ft.
Riser Diameter:	18 in.
Orifice 1 Diameter:	0.715 in. Elevation:0 ft.
Orifice 2 Diameter:	0.84 in. Elevation:7.6 ft.
Orifice 3 Diameter:	1.26 in. Elevation:8.45 ft.
Element Flows To:	
Outlet 1	Outlet 2

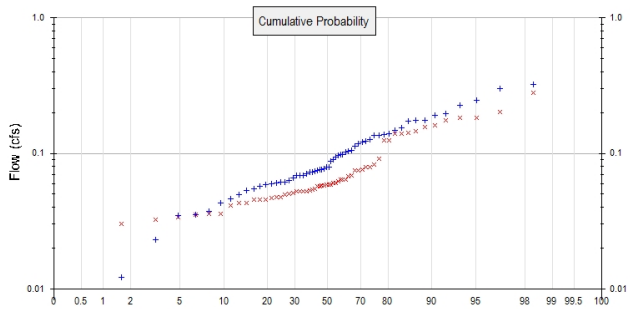
Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.062	0.000	0.000	0.000
0.1333	0.062	0.008	0.005	0.000
0.2667	0.062	0.016	0.007	0.000
0.4000	0.062	0.025	0.008	0.000
0.5333	0.062	0.033	0.010	0.000
0.6667	0.062	0.041	0.011	0.000
0.8000	0.062	0.049	0.012	0.000
0.9333	0.062	0.058	0.013	0.000
1.0667	0.062	0.066	0.014	0.000
1.2000	0.062	0.074	0.015	0.000
1.3333	0.062	0.083	0.016	0.000
1.4667	0.062	0.091	0.016	0.000
1.6000	0.062	0.099	0.017	0.000
1.7333	0.062	0.108	0.018	0.000
1.8667	0.062	0.116	0.019	0.000
2.0000	0.062	0.124	0.019	0.000
2.1333	0.062	0.133	0.020	0.000
2.2667	0.062	0.141	0.020	0.000
2.4000	0.062	0.149	0.021	0.000
2.5333	0.062	0.158	0.022	0.000
2.6667	0.062	0.166	0.022	0.000
2.8000	0.062	0.174	0.023	0.000
2.9333	0.062	0.183	0.023	0.000
3.0667	0.062	0.191	0.024	0.000
3.2000	0.062	0.199	0.024	0.000
3.3333	0.062	0.208	0.025	0.000
3.4667	0.062	0.216	0.025	0.000
3.6000	0.062	0.224	0.026	0.000
3.7333	0.062	0.232	0.026	0.000
3.8667	0.062	0.241	0.027	0.000
4.0000	0.062	0.249	0.027	0.000
4.1333	0.062	0.257	0.028	0.000
4.2667	0.062	0.266	0.028	0.000
4.4000	0.062	0.274	0.029	0.000
4.5333	0.062	0.282	0.029	0.000
4.6667	0.062	0.291	0.030	0.000
4.8000	0.062	0.299	0.030	0.000
4.9333	0.062	0.307	0.030	0.000

5.0667	0.062	0.316	0.031	0.000
5.2000	0.062	0.324	0.031	0.000
5.3333	0.062	0.332	0.032	0.000
5.4667	0.062	0.341	0.032	0.000
5.6000	0.062	0.349	0.032	0.000
5.7333	0.062	0.357	0.033	0.000
5.8667	0.062	0.366	0.033	0.000
6.0000	0.062	0.374	0.034	0.000
6.1333	0.062	0.382	0.034	0.000
6.2667	0.062	0.391	0.034	0.000
6.4000	0.062	0.399	0.035	0.000
6.5333	0.062	0.407	0.035	0.000
6.6667	0.062	0.416	0.035	0.000
6.8000	0.062	0.424	0.036	0.000
6.9333	0.062	0.432	0.036	0.000
7.0667	0.062	0.440	0.036	0.000
7.2000	0.062	0.449	0.037	0.000
7.3333	0.062	0.457	0.037	0.000
7.4667	0.062	0.465	0.037	0.000
7.6000	0.062	0.474	0.038	0.000
7.7333	0.062	0.482	0.045	0.000
7.8667	0.062	0.490	0.048	0.000
8.0000	0.062	0.499	0.051	0.000
8.1333	0.062	0.507	0.053	0.000
8.2667	0.062	0.515	0.055	0.000
8.4000	0.062	0.524	0.057	0.000
8.5333	0.062	0.532	0.071	0.000
8.6667	0.062	0.540	0.080	0.000
8.8000	0.062	0.549	0.087	0.000
8.9333	0.062	0.557	0.093	0.000
9.0667	0.062	0.565	0.098	0.000
9.2000	0.062	0.574	0.103	0.000
9.3333	0.062	0.582	0.108	0.000
9.4667	0.062	0.590	0.112	0.000
9.6000	0.062	0.599	0.116	0.000
9.7333	0.062	0.607	0.120	0.000
9.8667	0.062	0.615	0.123	0.000
10.000	0.062	0.624	0.127	0.000
10.133	0.062	0.632	0.130	0.000
10.267	0.062	0.640	0.133	0.000
10.400	0.062	0.648	0.136	0.000
10.533	0.062	0.657	0.140	0.000
10.667	0.062	0.665	0.143	0.000
10.800	0.062	0.673	0.145	0.000
10.933	0.062	0.682	0.148	0.000
11.067	0.062	0.690	0.425	0.000
11.200	0.062	0.698	1.558	0.000
11.333	0.062	0.707	3.039	0.000
11.467	0.062	0.715	4.485	0.000
11.600	0.062	0.723	5.563	0.000
11.733	0.062	0.732	6.178	0.000
11.867	0.062	0.740	6.764	0.000
12.000	0.062	0.748	7.256	0.000
12.133	0.062	0.757	7.716	0.000
12.267	0.000	0.000	8.149	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 3.006
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.476
Total Impervious Area: 1.549

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.089504
5 year	0.146661
10 year	0.183411
25 year	0.227127
50 year	0.257408
100 year	0.285692

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.063806
5 year	0.102647
10 year	0.135786
25 year	0.187531
50 year	0.234222
100 year	0.288767

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.103	0.069
1950	0.122	0.074
1951	0.196	0.182
1952	0.061	0.042
1953	0.050	0.047
1954	0.076	0.053
1955	0.122	0.064
1956	0.098	0.075
1957	0.079	0.057
1958	0.088	0.058

1959	0.075	0.050
1960	0.135	0.142
1961	0.074	0.059
1962	0.046	0.036
1963	0.063	0.051
1964	0.090	0.057
1965	0.060	0.060
1966	0.057	0.047
1967	0.137	0.079
1968	0.077	0.055
1969	0.075	0.052
1970	0.060	0.045
1971	0.068	0.059
1972	0.148	0.147
1973	0.066	0.059
1974	0.073	0.053
1975	0.102	0.064
1976	0.073	0.053
1977	0.011	0.030
1978	0.061	0.054
1979	0.037	0.036
1980	0.175	0.140
1981	0.055	0.048
1982	0.113	0.091
1983	0.097	0.060
1984	0.058	0.043
1985	0.035	0.035
1986	0.153	0.079
1987	0.135	0.124
1988	0.053	0.043
1989	0.035	0.032
1990	0.324	0.182
1991	0.172	0.139
1992	0.070	0.050
1993	0.069	0.046
1994	0.023	0.034
1995	0.098	0.062
1996	0.227	0.176
1997	0.175	0.158
1998	0.043	0.053
1999	0.192	0.125
2000	0.068	0.046
2001	0.012	0.028
2002	0.079	0.067
2003	0.118	0.076
2004	0.126	0.160
2005	0.094	0.058
2006	0.105	0.064
2007	0.245	0.280
2008	0.299	0.203
2009	0.139	0.082

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.3241	0.2798
2	0.2986	0.2034
3	0.2450	0.1825

4	0.2270	0.1819
5	0.1956	0.1763
6	0.1921	0.1603
7	0.1752	0.1576
8	0.1748	0.1466
9	0.1719	0.1419
10	0.1534	0.1396
11	0.1485	0.1390
12	0.1392	0.1249
13	0.1374	0.1244
14	0.1354	0.0910
15	0.1349	0.0822
16	0.1262	0.0792
17	0.1223	0.0789
18	0.1216	0.0764
19	0.1181	0.0745
20	0.1133	0.0744
21	0.1053	0.0687
22	0.1030	0.0673
23	0.1015	0.0643
24	0.0982	0.0640
25	0.0980	0.0636
26	0.0970	0.0619
27	0.0936	0.0604
28	0.0899	0.0603
29	0.0878	0.0588
30	0.0791	0.0587
31	0.0791	0.0586
32	0.0774	0.0579
33	0.0761	0.0578
34	0.0753	0.0570
35	0.0753	0.0570
36	0.0742	0.0546
37	0.0729	0.0540
38	0.0725	0.0534
39	0.0702	0.0527
40	0.0685	0.0526
41	0.0682	0.0526
42	0.0682	0.0522
43	0.0658	0.0508
44	0.0634	0.0501
45	0.0614	0.0498
46	0.0613	0.0477
47	0.0604	0.0474
48	0.0598	0.0471
49	0.0584	0.0457
50	0.0574	0.0455
51	0.0549	0.0455
52	0.0535	0.0432
53	0.0496	0.0429
54	0.0462	0.0415
55	0.0429	0.0358
56	0.0371	0.0357
57	0.0354	0.0353
58	0.0347	0.0340
59	0.0230	0.0325
60	0.0123	0.0303
61	0.0106	0.0277

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0448	17075	16472	96	Pass
0.0469	15481	12805	82	Pass
0.0490	14070	10076	71	Pass
0.0512	12799	8269	64	Pass
0.0533	11567	6932	59	Pass
0.0555	10515	5950	56	Pass
0.0576	9561	5103	53	Pass
0.0598	8750	4537	51	Pass
0.0619	8031	4105	51	Pass
0.0641	7347	3747	51	Pass
0.0662	6733	3465	51	Pass
0.0684	6188	3174	51	Pass
0.0705	5728	2885	50	Pass
0.0727	5309	2648	49	Pass
0.0748	4924	2430	49	Pass
0.0770	4569	2231	48	Pass
0.0791	4235	2092	49	Pass
0.0813	3951	1992	50	Pass
0.0834	3643	1919	52	Pass
0.0856	3388	1828	53	Pass
0.0877	3133	1781	56	Pass
0.0899	2915	1727	59	Pass
0.0920	2706	1663	61	Pass
0.0942	2490	1620	65	Pass
0.0963	2314	1550	66	Pass
0.0985	2136	1497	70	Pass
0.1006	1972	1448	73	Pass
0.1027	1828	1398	76	Pass
0.1049	1706	1352	79	Pass
0.1070	1579	1312	83	Pass
0.1092	1445	1269	87	Pass
0.1113	1327	1223	92	Pass
0.1135	1235	1179	95	Pass
0.1156	1148	1121	97	Pass
0.1178	1087	1067	98	Pass
0.1199	1020	1001	98	Pass
0.1221	950	931	98	Pass
0.1242	887	875	98	Pass
0.1264	827	824	99	Pass
0.1285	760	769	101	Pass
0.1307	725	727	100	Pass
0.1328	674	678	100	Pass
0.1350	626	624	99	Pass
0.1371	589	561	95	Pass
0.1393	552	510	92	Pass
0.1414	506	471	93	Pass
0.1436	469	428	91	Pass
0.1457	427	382	89	Pass
0.1479	388	354	91	Pass
0.1500	356	325	91	Pass
0.1522	328	293	89	Pass
0.1543	297	263	88	Pass
0.1565	270	237	87	Pass

0.1586	242	204	84	Pass
0.1607	218	173	79	Pass
0.1629	198	161	81	Pass
0.1650	174	147	84	Pass
0.1672	152	130	85	Pass
0.1693	130	116	89	Pass
0.1715	119	103	86	Pass
0.1736	104	88	84	Pass
0.1758	95	67	70	Pass
0.1779	83	51	61	Pass
0.1801	75	40	53	Pass
0.1822	69	24	34	Pass
0.1844	61	19	31	Pass
0.1865	53	14	26	Pass
0.1887	46	12	26	Pass
0.1908	39	12	30	Pass
0.1930	30	12	40	Pass
0.1951	25	12	48	Pass
0.1973	22	12	54	Pass
0.1994	20	11	55	Pass
0.2016	17	10	58	Pass
0.2037	14	8	57	Pass
0.2059	12	8	66	Pass
0.2080	8	7	87	Pass
0.2102	7	6	85	Pass
0.2123	7	5	71	Pass
0.2144	7	5	71	Pass
0.2166	6	5	83	Pass
0.2187	6	5	83	Pass
0.2209	6	5	83	Pass
0.2230	6	5	83	Pass
0.2252	6	5	83	Pass
0.2273	5	5	100	Pass
0.2295	5	5	100	Pass
0.2316	5	5	100	Pass
0.2338	5	4	80	Pass
0.2359	5	4	80	Pass
0.2381	5	4	80	Pass
0.2402	5	4	80	Pass
0.2424	4	4	100	Pass
0.2445	4	3	75	Pass
0.2467	3	3	100	Pass
0.2488	3	3	100	Pass
0.2510	3	3	100	Pass
0.2531	3	3	100	Pass
0.2553	3	3	100	Pass
0.2574	3	3	100	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2081 acre-feet
On-line facility target flow:	0.2459 cfs.
Adjusted for 15 min:	0.2459 cfs.
Off-line facility target flow:	0.1383 cfs.
Adjusted for 15 min:	0.1383 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	256.47			☐	0.00			
Total Volume Infiltrated		256.47	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

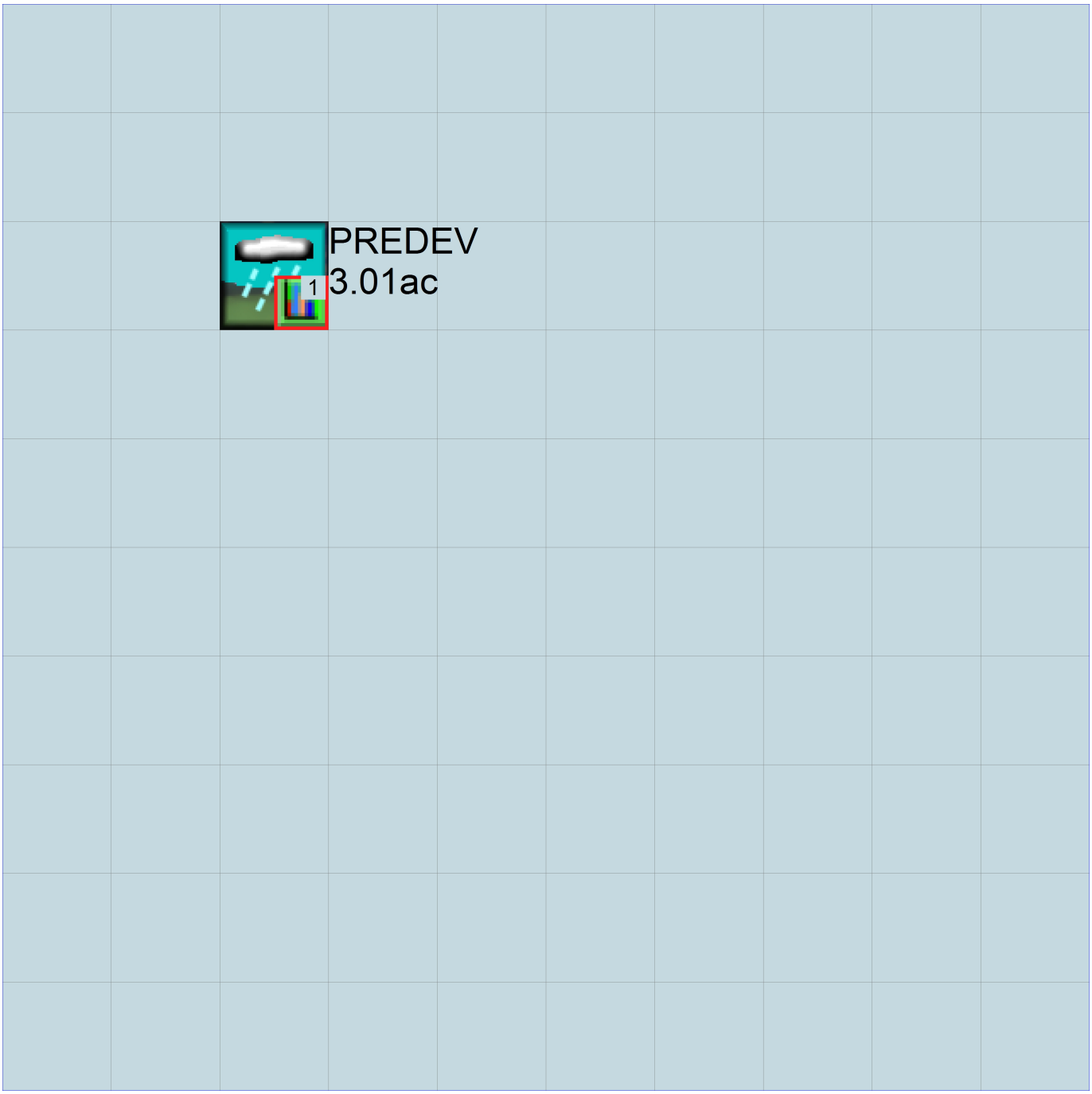
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Redmond 13.wdm
MESSU      25   MitRedmond 13.MES
           27   MitRedmond 13.L61
           28   MitRedmond 13.L62
           30   POCRedmond 131.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND       4
      IMPLND       5
      IMPLND       8
      PERLND      14
      IMPLND       9
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
   14     C, Pasture, Mod         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
```

```
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
   14         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   14         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
   14         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
   14              0       4.5      0.06       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13              0         0         2         2         0         0         0
   14              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13           0.15       0.4       0.3         6       0.5       0.4
   14           0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   13              0         0         0         0       2.5         1         0
   14              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    5      DRIVEWAYS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
    9      SIDEWALKS/MOD          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
```

```
    9         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
    9         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
    9         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
    9            400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1             0         0
    4             0         0
    5             0         0
    8             0         0
    9             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
    4             0         0
    5             0         0
    8             0         0
    9             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
RDIN***
PERLND  13                       0.776     RCHRES   1      2
PERLND  13                       0.776     RCHRES   1      3
IMPLND   1                       0.464     RCHRES   1      5
IMPLND   4                       0.716     RCHRES   1      5
IMPLND   5                       0.226     RCHRES   1      5
IMPLND   8                        0.13     RCHRES   1      5
BYPASS***
PERLND  13                       0.109     COPY   501     12
PERLND  13                       0.109     COPY   601     12
PERLND  13                       0.109     COPY   501     13
PERLND  13                       0.109     COPY   601     13
```

```
PERLND  14                      0.591     COPY   501     12
PERLND  14                      0.591     COPY   601     12
PERLND  14                      0.591     COPY   501     13
PERLND  14                      0.591     COPY   601     13
IMPLND   9                      0.013     COPY   501     15
IMPLND   9                      0.013     COPY   601     15

******Routing******
PERLND  13                      0.776     COPY     1     12
IMPLND   1                      0.464     COPY     1     15
IMPLND   4                      0.716     COPY     1     15
IMPLND   5                      0.226     COPY     1     15
IMPLND   8                       0.13     COPY     1     15
PERLND  13                      0.776     COPY     1     13
RCHRES   1                          1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                             ***
    1     Vault  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES
```

```
SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.062397  0.000000  0.000000
  0.133333  0.062397  0.008320  0.005066
  0.266667  0.062397  0.016639  0.007164
  0.400000  0.062397  0.024959  0.008774
  0.533333  0.062397  0.033278  0.010131
  0.666667  0.062397  0.041598  0.011327
  0.800000  0.062397  0.049917  0.012408
  0.933333  0.062397  0.058237  0.013403
  1.066667  0.062397  0.066556  0.014328
  1.200000  0.062397  0.074876  0.015197
  1.333333  0.062397  0.083196  0.016019
  1.466667  0.062397  0.091515  0.016801
  1.600000  0.062397  0.099835  0.017548
  1.733333  0.062397  0.108154  0.018265
  1.866667  0.062397  0.116474  0.018954
  2.000000  0.062397  0.124793  0.019619
  2.133333  0.062397  0.133113  0.020263
  2.266667  0.062397  0.141433  0.020886
  2.400000  0.062397  0.149752  0.021492
  2.533333  0.062397  0.158072  0.022081
  2.666667  0.062397  0.166391  0.022655
  2.800000  0.062397  0.174711  0.023214
  2.933333  0.062397  0.183030  0.023760
  3.066667  0.062397  0.191350  0.024294
  3.200000  0.062397  0.199669  0.024817
  3.333333  0.062397  0.207989  0.025329
  3.466667  0.062397  0.216309  0.025830
  3.600000  0.062397  0.224628  0.026322
  3.733333  0.062397  0.232948  0.026805
  3.866667  0.062397  0.241267  0.027280
  4.000000  0.062397  0.249587  0.027746
  4.133333  0.062397  0.257906  0.028205
  4.266667  0.062397  0.266226  0.028656
  4.400000  0.062397  0.274545  0.029100
  4.533333  0.062397  0.282865  0.029538
  4.666667  0.062397  0.291185  0.029969
  4.800000  0.062397  0.299504  0.030394
  4.933333  0.062397  0.307824  0.030814
  5.066667  0.062397  0.316143  0.031227
  5.200000  0.062397  0.324463  0.031635
  5.333333  0.062397  0.332782  0.032038
  5.466667  0.062397  0.341102  0.032436
  5.600000  0.062397  0.349421  0.032830
  5.733333  0.062397  0.357741  0.033218
  5.866667  0.062397  0.366061  0.033602
  6.000000  0.062397  0.374380  0.033982
  6.133333  0.062397  0.382700  0.034357
  6.266667  0.062397  0.391019  0.034729
  6.400000  0.062397  0.399339  0.035096
  6.533333  0.062397  0.407658  0.035460
  6.666667  0.062397  0.415978  0.035820
  6.800000  0.062397  0.424298  0.036176
  6.933333  0.062397  0.432617  0.036529
  7.066667  0.062397  0.440937  0.036879
  7.200000  0.062397  0.449256  0.037225
  7.333333  0.062397  0.457576  0.037568
  7.466667  0.062397  0.465895  0.037908
  7.600000  0.062397  0.474215  0.038245
  7.733333  0.062397  0.482534  0.045571
  7.866667  0.062397  0.490854  0.048798
  8.000000  0.062397  0.499174  0.051349
  8.133333  0.062397  0.507493  0.053548
```

```
  8.266667  0.062397  0.515813  0.055521
  8.400000  0.062397  0.524132  0.057334
  8.533333  0.062397  0.532452  0.071461
  8.666667  0.062397  0.540771  0.080670
  8.800000  0.062397  0.549091  0.087617
  8.933333  0.062397  0.557410  0.093526
  9.066667  0.062397  0.565730  0.098794
  9.200000  0.062397  0.574050  0.103610
  9.333333  0.062397  0.582369  0.108083
  9.466667  0.062397  0.590689  0.112285
  9.600000  0.062397  0.599008  0.116264
  9.733333  0.062397  0.607328  0.120054
  9.866667  0.062397  0.615647  0.123683
  10.00000  0.062397  0.623967  0.127171
  10.13333  0.062397  0.632287  0.130535
  10.26667  0.062397  0.640606  0.133788
  10.40000  0.062397  0.648926  0.136941
  10.53333  0.062397  0.657245  0.140003
  10.66667  0.062397  0.665565  0.142983
  10.80000  0.062397  0.673884  0.145888
  10.93333  0.062397  0.682204  0.148723
  11.06667  0.062397  0.690523  0.425188
  11.20000  0.062397  0.698843  1.558666
  11.33333  0.062397  0.707163  3.039375
  11.46667  0.062397  0.715482  4.485484
  11.60000  0.062397  0.723802  5.563229
  11.73333  0.062397  0.732121  6.178504
  11.86667  0.062397  0.740441  6.764304
  12.00000  0.062397  0.748760  7.256063
  12.13333  0.062397  0.757080  7.716110
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
```

```
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages. Software Copyright © by : Clear Creek Solutions, Inc. 2005-2019; All Rights Reserved.

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com