GeoEngineers
8410 154th Avenue NE
Redmond, Washington 98052
425.861.6000

March 21, 2016

The City of Redmond
c/o PFS Studio
1777 West 3rd Avenue
Vancouver, BC V6J IK7

Attention: Kelty McKinnon

Subject: Redmond Downtown Park
Hydrogeological Critical Areas Report
Redmond, Washington
File No. 0500-205-00

INTRODUCTION

This letter report presents a hydrogeologic evaluation of the proposed Redmond Downtown Park project relative to critical areas designated in Redmond, Washington. The location of the proposed park is shown on the Vicinity Map (Figure 1).

The purpose of this study is to provide a Level 2 Hydrogeologic Assessment by reviewing the potential impacts of the proposed Downtown Park on the hydrogeology of critical aquifer recharge areas relative to the City of Redmond's (City) Wellhead Protection Program.

GeoEngineers, Inc.'s (GeoEngineers) hydrogeologic services were completed in general accordance with our services agreement dated May 15, 2015. Our scope of work includes:

- Evaluate City of Redmond sensitive areas ordinance issues as they pertain to hydrogeology.
- Summarize the results of the evaluation in a letter report addressing requirements of the Redmond Zoning Code (RZC, Section 21.64.050) for Critical Aquifer Recharge Areas with a level 2 hydrogeologic assessment.

The work was performed within the context of a larger GeoEngineers project that provided environmental and geotechnical support to the City and PFS Studio in development of plans for the new Downtown Park.

Project Description

Our understanding of the project is based on discussions with and data provided by the park designers PFS Studio, in conjunction with the City, the Redmond Downtown Park project team, and on our experience with similar projects.

The park is planned for a site that was previously occupied by commercial buildings that were demolished prior to the construction of the 161st Street extension, which borders the west side of the park site. Park improvements will include an elevated lawn with bench retaining wall (the Great Lawn), a splash pad, a pavilion structure (the Pavilion), and a maintenance building. The proposed park layout and features are shown on the Site Plan (Figure 2). Please note this figure is modified from the GeoEngineers geotechnical report (2015) and includes cross section locations provided specifically in that report.

Site exploration has included the drilling of borings and installation of monitoring wells by GeoEngineers, together with a Ground Penetrating Radar (GPR) survey conducted by others to delineate the presence of peat (see Figure 2). The project will also likely include removal of unsuitable peat deposits below the Great Lawn on the west side of the site, as revealed by these explorations.

REQUIREMENTS OF REDMOND ZONING CODE

The following sections are quoted from Redmond Zoning Code (RZC, Section 21.64.050) under which is part of Title 21 of the Redmond Municipal Code and defines Critical Aquifer Recharge Areas in relation to the City's Wellhead Protection Program and the Washington Administrative Code (WAC), as overseen by the City of Redmond Technical Committee:

> *Critical Aquifer Recharge Areas within the City of Redmond shall be rated or classified according to their characteristics, function and value, and/or their sensitivity to disturbance.*
>
> > *Critical Aquifer Recharge Areas Classification. Critical aquifer recharge areas are those areas with a critical recharging effect on aquifers used for potable water. Wellhead protection involves the management of activities that have a potential to degrade the quality of groundwater produced by a supply well. The City of Redmond is classified into four wellhead protection zones that are based on proximity to and travel time of groundwater to the City's public water source wells, and are designated using guidance from the Washington Department of Health Wellhead Protection Program pursuant to Chapter 246-290 WAC.*
> >
> > *a. Wellhead Protection Zone 1 represents the land area overlying the six-month time-of-travel zone of any public water source well owned by the City.*
> >
> > *b. Wellhead Protection Zone 2 represents the land area that overlies the one-year time-of-travel zone of any public water source well owned by the City, excluding the land area contained within Wellhead Protection Zone 1.*
> >
> > *c. Wellhead Protection Zone 3 represents the land area that overlies the five-year and 10-year time-of-travel zones of any public water source well owned by the City, excluding the land area contained within Wellhead Protection Zones 1 or 2.*
> >
> > *d. Wellhead Protection Zone 4 represents all the remaining land area in the City not included in Wellhead Protection Zones 1, 2, or 3.*
> >
> > *Classification of wellhead protection zones shall be determined in accordance with the City's adopted Wellhead Protection Zone Map, which serves to designate Zones 1 through 4. The Committee, at its discretion, may consider the following factors:*

a. *Maps adopted pursuant to this chapter;*

b. *Application of the criteria contained in these regulations; and*

c. *Consideration of the technical reports submitted by qualified consultants in connection with applications subject to these regulations.*

In addition, RZC Section 21.64.050, Subsection C defines Prohibited Activities in Wellhead Protection Zones:

1. *Land uses or activities for new development or redevelopment that pose a significant hazard to the City's groundwater resources, resulting from storing, handling, treating, using, producing, recycling, or disposing of hazardous materials or other deleterious substances, shall be prohibited in Wellhead Protection Zones 1 and 2. These land uses and activities include, but are not limited to:*

   a. *Large on-site sewage systems, as defined in WAC Chapter 246-272A;*

   b. *Hazardous liquid pipelines as defined in RCW Chapter 81.88 and ~ ;*

   c. *Solid waste landfills;*

   d. *Solid waste transfer stations;*

   e. *Liquid petroleum refining, reprocessing, and storage;*

   f. *Bulk storage facilities as defined in ~ , Definitions;*

   g. *The storage or distribution of gasoline treated with the additive MTBE;*

   h. *Hazardous waste treatment, storage, and disposal facilities except those defined under permit by rule for industrial wastewater treatment processes per WAC 173-303-802(5)(c);*

   i. *Chemical manufacturing, including but not limited to organic and inorganic chemicals, plastics and resins, pharmaceuticals, cleaning compounds, paints and lacquers, and agricultural chemicals;*

   j. *Dry cleaning establishments using the solvent perchloroethylene;*

   k. *Primary and secondary metal industries that manufacture, produce, smelt, or refine ferrous and nonferrous metals from molten materials;*

   l. *Wood preserving and wood products preserving;*

   m. *Mobile fleet fueling operations;*

   n. *Class I, Class III, Class IV, and the following types of Class V wells: 5A7, 5F1, 5D3, 5D4, 5W9, 5W10, 5W11, 5W31, 5X13, 5X14, 5X15, 5W20, 5X28, and 5N24 as regulated under RCW Chapter 90.48 and WAC Chapters 173-200 and 173-218, as amended;*

   o. *Permanent dewatering of the aquifer for new projects and redevelopment;*

   p. *Irrigation with graywater or reclaimed water;*

2. *Other land uses and activities that the City determines would pose a significant groundwater hazard to the City's groundwater supply.*
3. *Wellhead Protection Zones. Development within the City of Redmond shall implement the performance standards contained in RZC 21.64.050.D below that apply to the zone in which it is located.*

RZC Section 21.64.050, Subsection D defines the City's Wellhead Protection Zone Performance Standards.

SITE BACKGROUND

Site Geology

Geologic information for the project vicinity was obtained from the map entitled "Geologic Map of King County" (Booth, et al., 2007). A geologic map of the project vicinity is presented in Site Geology, Figure 3.

The project site lies within the floor of the Sammamish River Valley, a broad, north-south trending valley resulting from several glacial episodes of glacial scouring in the Puget Sound region. The valley was subsequently filled with recessional glacial outwash deposits, post glacial deposits and recent alluvial deposits. Recessional outwash, and alluvial deposits, with transitional beds mapped in the uplands southwest of the Sammamish River. The project site itself is underlain by recent alluvium. Alluvial deposits typically consist of peat, silt, sand and gravel.

Portions of the valley have been modified as a result of past and present agricultural and construction activities. The project site lies within roadway grading and commercial developments associated with Downtown Redmond. The ground around the project sites may be locally disturbed as a result of these activities.

Review of Subsurface Conditions

GeoEngineers' understanding of subsurface conditions is based on review of existing geotechnical information, previous explorations in the site vicinity, the results of 14 borings (designated B-1 through B-14) drilled at the site in 2015, and the results of the geophysical testing completed for the geotechnical study. The data analysis, results and conclusions are contained in the *Geotechnical Engineering Services Report* prepared for the project by GeoEngineers, dated September 29, 2015 and referred to herein as the Geotechnical Report (GeoEngineers, 2015). The approximate locations of recent and previous explorations are presented on the Site Plan, Figure 2.

The soils encountered at the site consist of fill overlying alluvial deposits and recessional outwash. The following is a summary of subsurface conditions encountered taken from the Geotechnical Report (GeoEngineers, 2015, which contains interpretive cross-sections shown on Figure 2, together with copies of all exploration logs):

- **Fill.** In each of the borings, grass and topsoil or asphalt concrete pavement was encountered at the surface with a thickness of approximately 2 to 3 inches. The surficial grass or asphalt was underlain by 4 to 15 feet of fill typically consisting of loose to medium dense sand and gravel with variable silt

content. Drilling resistance in the borings on the eastern portion of the site also indicated the presence of cobbles in the fill.

- **Alluvial deposits.** Alluvial deposits were encountered below the fill in the northwestern portion of the site, to the depths explored in borings B-2, B-3, B-4, and B-5, and to depths of 8 to 11½ feet in borings B-1, B-7, B-8, B-9 and B-10. The alluvial deposits typically consisted of up to 6 feet of peat overlying loose to medium dense silty sand with gravel and sand with silt and gravel to the depth of the borings. The peat is thickest in the northwest portion of the site and gradually thins to the south and east. Peat was not observed in all borings (as detailed in the Geotechnical Report). Geophysical testing consisting of GPR and electromagnetic (EM) survey was used in combination with the borings to estimate the approximate depths of the peat deposits in the northwestern portion of the site. The results of the GPR studies completed at this site are presented in Appendix D of the Geotechnical Report (GeoEngineers, 2015).
- **Recessional outwash.** Recessional outwash was encountered below the fill or alluvial deposits in borings B-1 and B-6 through B-14. The recessional outwash consisted of sand and gravel with variable silt content and cobbles.

Groundwater

The alluvial deposits and recessional outwash deposits form an extensive and prolific aquifer that extends beneath the City of Redmond. The aquifer is fed from the east by recharge and aquifer throughflow generated in Bear Creek and Evans Creek valleys. Groundwater typically flows from east to west through the downtown Redmond area and is in hydraulic continuity with the Sammamish River; the stage of which strongly controls groundwater levels in the aquifer. Groundwater level contour maps created for the City of Redmond Wellhead Protection program are presented for 2012, 2013 and 2015 in Attachments A, B and C respectively.

Groundwater in the aquifer underlying the City is relatively shallow and levels fluctuate both seasonally and in response to flood events. Direct infiltration as well as water level changes in the Sammamish River and in Bear Creek also influence groundwater levels. As part of the City's wellhead protection program, groundwater levels in a numerous array of monitoring wells distributed throughout the city have been read regularly over the past several years, affording a database of groundwater levels throughout the city and subsequently around the project area.

On-going groundwater level readings obtained as part the City's wellhead protection program suggest that the seasonal groundwater levels in the project vicinity fluctuate between highs of about Elevation 29 to 27 feet (10 to 12 feet below existing site grades) and lows of Elevation 24 to 22 feet (15 to 17 feet below existing grades).

Groundwater monitoring and water supply wells within 1,300 feet of the proposed project (and several other wells that are in the vicinity) are present on the Well Location Map (Figure 4).

PROPOSED IMPROVEMENTS

The project will involve construction of an approximate 2-acre park at the site bounded by Redmond Way to the north, Cleveland Street to the south, 161st Avenue NE to the west, and existing restaurants and retail shops to the east. Park features will include an elevated "Great Lawn" area, a pavilion structure and

hardscape. Peat will be removed below the elevated "Great Lawn" area which will be backfilled with gravel borrow material having a design infiltration rate of 2 inches per hour to facilitate the infiltration of stormwater. The park is being designed to infiltrate stormwater run-off from 80 percent of the total site area.

CRITICAL AREAS EVALUATION

The specific information required by the City of Redmond to complete the critical areas evaluation is described in this section, in accordance with provisions of the Redmond Zoning Code (RZC) 21.64.050. The information requirements per Appendix 1 of the code are reproduced below *in italics*, with specific responses for the Redmond Downtown Park project provided **in bold.**

General Information

The following Information is required to be submitted for sites containing critical areas:

1. *Name of proposal as shown on City applications.*

   Redmond Downtown Park.

2. *Name of applicant as shown on City applications.*

   City of Redmond.

3. *Name of organization and individual providing this information.*

   GeoEngineers, Inc. sub PFS Studio. Elson T. Barnett, LG, LEG and Michael A.P. Kenrick, PE, LG, LHG of GeoEngineers compiled and provided the information in the report.

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

   Michael Kenrick is a licensed hydrogeologist with extensive hydrogeologic experience in groundwater resources, water supply, civil engineering, mining, and environmental industries in the Pacific Northwest. He has taken responsibility in senior technical and management roles for the groundwater aspects of numerous water resources projects covering evaluation, planning and development, design, construction and monitoring. He has more than 30 years of experience. His major areas of groundwater resources and water supply expertise include watershed analysis to understand infiltration and groundwater recharge; hydrogeologic and hydrogeochemical characterization; well siting, drilling, testing; aquifer hydraulics, and groundwater modeling for water supply, water rights and ASR projects. Michael is also a sought-after expert on construction dewatering in the Pacific Northwest, and has diverse experience in contaminant hydrogeology, groundwater monitoring, and mining hydrology.

5. *Date the information was prepared.*

   October 13, 2015.

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

   The proposed project site is shown in the Vicinity Map (Figure 1). The project includes eight parcels between 161st Avenue Northeast to the west, Redmond Way to the north, Cleveland Street to the south, and commercial buildings west of Leary Way Northeast to the east.

The tax parcel numbers are 7792400190, 7792400100, 7792400111, 8029700010, 7792400095, 7792400090, 7792400089 and 8029700030.

7. *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 City of Redmond has identified the projects numbers as 20020943 and 20020245. We understand a 30 percent set of design drawings has been prepared by PFS Studio.

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

   The park is planned for a site that was previously occupied by commercial buildings that were demolished prior to the construction of the 161st Street extension. Currently, the proposed project site consists of a grassy lawn area (approximately 0.91 acres), a parking lot (approximately 0.23 acres), and an open clearing where the commercial buildings used to be (approximately 1.06 acres).

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

   An aerial photo is included in Figure 5. The critical areas for this report are Wellhead Protection Zone 2 which is identified in the attached City of Redmond Map 64.6: Wellhead Protection Zones (Attachment D), and seismic, which is identified in the attached City of Redmond Map 64.9: Seismic Hazard Areas (Attachment E). The site is not within an erosion critical area, as identified in City of Redmond 64.8: Erosion Hazard Areas (Attachment F).

10. *A single map showing all critical areas at one inch equals 20 feet scale, depicting:*

    a. *Identified critical areas and required buffers;*

    b. *Limits of any areas to be disturbed;*

    c. *Site boundary property lines and roads;*

    d. *Rights-of-way and easements;*

    e. *Existing physical improvements (buildings, fences, impervious surfaces, utilities, etc.);*

    f. *Contours at two-foot intervals;*

    g. *All natural and manmade features within the maximum buffer area of any critical area on or near the site (in no case less than a minimum 50 feet from the site).*

    A map (1-inch: 40-feet) showing critical areas and other listed features as applicable, is included in Figure 6.

11. *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.*

    The critical areas analysis relies on geological information found in the Geotechnical Report (GeoEngineers 2015). Groundwater information is from the City's Wellhead Protection Monitoring.

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

    A bibliography is provided in the References section located at the end of this report.

    a. *For sites with mitigation, also provide the following information identified in 13 through 17 below.*

       (Information in this section is to be provided only if there are critical areas within or in the vicinity of the site that will be impacted by the proposed project.)

13. *A summary description of reasonable efforts made to apply mitigation sequencing pursuant to RZC 21.64.010.L,* Mitigation Standards, Criteria, and Plan Requirements*, to avoid, minimize, and mitigate impacts to critical areas.*

    Other than the implementation of Best Management Practices (BMPs) for Stormwater management and infiltration, mitigation measures are not anticipated at this time.

14. *Plans for adequate mitigation, as needed, to offset any impacts, including but not limited to:*

    a. *The impacts to on-site and affected off-site critical areas:*

       Not applicable.

    b. *The impacts of any proposed alteration of a critical area or buffer on the development proposal, other properties, and the environment.*

       No long term impacts are anticipated. Dewatering is not anticipated because peat excavation from underneath the Great Lawn will be scheduled to occur during a period of seasonal low groundwater levels.

15. *A listing of applicable performance standards and a summary of how each applicable performance standard was addressed. (See RZC 21.64.010.M,* Performance Standards for Mitigation Planning*.)*

    Not applicable.

16. *A discussion of ongoing management practices that will protect the critical area after the project site has been developed, including proposed monitoring and maintenance programs. [verify stormwater treatment]*

    <u>Wellhead Protection Critical Area</u>

    Industrial activities will no longer occur within the project areas after they are developed. The project team's objective is to infiltrate stormwater run-off from approximately 81 percent of the site by conveying surface water to infiltrate below the Great Lawn. The Geotechnical recommendations for the design are provided by GeoEngineers (2015):

    - **Site drains conveying surface runoff to the backfill below the Great Lawn should lead to a perforated drainpipe within a clean crushed gravel storage layer below the Great Lawn. The perforated drainpipe should consist of perforated Schedule 40 polyvinyl chloride (PVC) pipes with a minimum diameter of 4 inches and should be installed with the perforations oriented downward.**
    - **The gravel storage layer consisting of 18 inches of clean crushed gravel with a maximum particle size of 1½ inches and negligible sand or silt (similar to AASHTO Grading No. 57 in Section 9-03.1(4)C of the 2014 WSDOT Standard Specifications) should be installed between the upper soil section for the Great Lawn and the gravel borrow backfill placed for the peat**

removal excavation. Geotextile filter fabric meeting the requirements of construction geotextile for underground drainage, WSDOT Standard Specification 9-33, should be placed above and below the clean crushed gravel layer.

- **We recommend a design infiltration rate of 2 inches per hour for gravel borrow meeting the requirements described in the "Earthwork" section that is used to backfill the peat removal excavation. If on-site sand and gravel is used to backfill the excavation, a design infiltration rate of 1 inch per hour can be used.**
- **Where conveying surface water toward the Great Lawn is not practical, a design infiltration rate of 1 inch per hour may be used for infiltration into existing soils below the park pavement section or landscaping berms.**

Seismic Critical Area

As described in the Geotechnical Report, the site was reviewed for seismic hazards, including liquefaction potential (GeoEngineers 2015). Due to the location of the site and the site's topography, the risk of adverse impacts resulting from seismically induced slope instability, surface displacement due to faulting, or lateral spreading is considered to be low.

Liquefaction potential is low to moderate because of the presence of medium dense, relatively clean sand layers within the alluvial deposits and recessional outwash deposits below the groundwater table. The foundation design for the Pavilion and maintenance building structures took the earthquake engineering parameters into account.

17. *Additional information may be required. The Technical Committee may require additional information to be included in the critical areas report when deemed necessary to the review of the proposed activity.*

Geologically Hazardous Area Reporting

A geologically hazardous areas report shall be prepared by a geotechnical engineer or geologist, licensed in the State of Washington, with experience analyzing geologic, hydrologic, and groundwater flow systems; or by a geologist who earns his or her livelihood from the field of geology and/or geotechnical analysis, with experience analyzing geologic, hydrologic, and groundwater flow systems, who has experience preparing reports for the relevant type of hazard.

1. *A geologically hazardous area report must be submitted to the City. The purpose of this report is to evaluate the actual presence of geologic conditions giving rise to geologic hazards; determine the appropriate class of hazard, according to the classification of potential hazards contained in these regulations; evaluate the safety and appropriateness of proposed activities; and recommend appropriate construction practices, monitoring programs and other mitigation measures required to ensure achievement of the purpose and intent of these regulations. The information required by this report should be coordinated with the study and reporting requirements for any other critical areas located on the site.*
2. *The approach of the City of Redmond critical area regulations is to require a level of study and analysis commensurate with potential risks associated with geologic hazards on particular sites and for particular proposals. Depending on the particular geologic hazard, geologic, hydrologic, and/or*

topographic studies may be required. At a minimum, all applicants shall review the history of the site and conduct a surface reconnaissance.

3. *Geologically Hazardous Area Report. The geologically hazardous area report shall include the following information:*

   a. *Geologically Hazardous Areas Map. Geologic hazards shall be located on a site map with an engineering scale of one inch equals 20 feet. The map must show the surveyed locations of all geologic hazards and their required buffers/setbacks. In addition, the map must show topography at two-foot intervals.*

      The proposed project site is not within one-quarter mile (1,320 feet) of a mapped erosion hazards area (Attachment F), but is located within a Seismic Hazard Area (Attachment E). (nb: The scale for maps showing the critical areas is substantially reduced in consequence of their large size.)

   b. *A written geologically hazardous area report which includes the following information:*

      i. A written geologic hazards characterization. This characterization shall describe specific descriptions of geologic hazards present on-site, including topography; a characterization of soils, geology, and drainage; a characterization of groundwater conditions, including the presence of any public or private wells within one quarter mile of the site; and groundwater elevation, gradient and direction data, including depth and duration of seasonally high water table if any proposed grading, borings, pilings, or excavation work may extend to groundwater depth; identification of any areas that have previously been disturbed or degraded by human activity or natural processes; and a site history.

         Only seismic hazards are mapped at the site. The Geotechnical Report (GeoEngineers, 2015) presents a characterization of soils, geology, and drainage, and found that site conditions indicated that the liquefaction risk is low to moderate. Other seismic hazards, such as seismically induced slope instability, surface displacement due to faulting, or lateral spreading, is low due to the location of the site and the site's topography. No erosion or landslide hazards exist within one-quarter mile of the site. Groundwater conditions are also described in the Geotechnical Report. Water wells within 1300 feet of the site are depicted in Figure 4. Seasonal high water table maps are provided in Attachments A, B and C. All areas of the site have previously been disturbed or degraded by human activity.

      ii. *A written analysis of proposed clearing, grading and construction activities, including construction scheduling; potential direct and indirect, on-site and off-site impacts from development, including dewatering activities. The analysis shall include identification of proposed mitigation measures, including any special construction techniques, monitoring or inspection program, erosion or sedimentation programs (during and after construction), and surface water management and protection controls.*

         The proposed grading for the Redmond Downtown Park is discussed in detail in the Geotechnical Report. The grading plan includes constructing permanent cut and fill slopes no steeper than 2H:1V, properly compacting fill, and a plan to control erosion and

sedimentation. The basic planning principles for erosion and sedimentation control include:

- **Scheduling grading and construction to reduce soil exposure.**
- **Retaining existing vegetation whenever feasible.**
- **Preventing erosion from occurring by: minimizing the area of disturbance; providing blanket protection of disturbed areas; and grading to avoid concentration of surface runoff onto or off of cut or fill slopes, access roadways, or natural slopes.**
- **Intercepting surface runoff onto or off of disturbed areas to minimize sediment transport by use of brush barriers, straw wattles, swales, etc.**
- **Providing erosion control system redundancies. For example, combine the above preventive measures with installation of silt fences, straw bales, and rock check dams where appropriate to provide the desired redundancy.**
- **Inspecting and maintaining erosion control measures frequently.**
- **Hydroseeding or placing crushed rock surfacing on disturbed areas as soon as possible after completion.**

Dewatering will be avoided to the extent possible by excavating the peat layer during seasonal low groundwater levels, but for excavations deeper than 1 to 2 feet below the water table, dewatering using wellpoints or deeper dewatering wells may be necessary. If dewatering is required, the contractor will be required to submit a proposed dewatering system design and plan layout to City for review and comment prior to beginning construction.

Management of stormwater during construction activities including temporary erosion and sedimentation controls (TESC) will follow the site Stormwater Pollution Prevention Plan (SWPPP), to be prepared by others.

c. *Critical Landslide Hazard Areas*

Not applicable

d. *Critical Erosion Hazard Areas.*

Not applicable

e. *Seismic Hazard Areas. In addition to the geologically hazardous area report required above, the following tasks and information are required for seismic hazard areas:*

i. *For one- and two-story single-family structures, conduct an evaluation of site response and liquefaction potential based on the performance of similar structures under similar foundation conditions.*

Not applicable.

ii. *For all other proposals, conduct an evaluation of site response and liquefaction potential, including sufficient subsurface exploration to provide a site coefficient (S) for use in the static lateral force procedure described in the International Building Code.*

The Geotechnical Report found that site conditions indicated that the liquefaction risk is low to moderate.

Critical Aquifer Recharge Areas (Wellhead Protection) Reporting Requirements

Critical Aquifer Recharge Areas (Wellhead Protection) Reporting Requirements (in addition to the General Information listed in RZC) 21.64.050, Appendix 1.A above and the general information listed in Appendix 1.E above) are listed in Appendix 1 Section F of the code.

A critical aquifer recharge areas report shall be prepared by a qualified professional who is a hydrogeologist, geologist, or engineer, who is licensed in the State of Washington and has experience in preparing hydrogeologic assessments.

1. *A critical aquifer recharge area report must be submitted to the City. The purpose of the report is to evaluate the actual presence of geologic conditions giving rise to the critical aquifer recharge area; determine the appropriate wellhead protection zone; evaluate the safety and appropriateness of proposed activities; and recommend appropriate construction practices, monitoring programs, and other mitigation measures required to ensure achievement of the purpose and intent of these regulations. The information required by this report should be coordinated with the study and reporting requirements for any other critical areas located on the site.*

   The gravel borrow backfill under the Great Lawn and routing systems to direct stormwater to the Great Lawn are designed to address potential impacts to aquifer recharge associated with the development of the Redmond Downtown Park. This project is being designed to meet the drainage requirements of the Ecology Stormwater Management Manual for Western Washington (Ecology 2012) and the Redmond Stormwater Technical Notebook. Pre-treatment of stormwater for solids prior to infiltration in the Great Lawn will be included via hydrodynamic separator or similar means.

2. *The approach of the City of Redmond critical area regulations is to require a level of study and analysis commensurate with potential risks to wellhead protection areas associated with particular sites and particular proposals. Geologic, hydrologic, and/or topographic studies may be required. At a minimum, all applicants shall review the history of the site and conduct a surface reconnaissance.*

   As part of our CARA evaluation we reviewed King County iMAP aerial topography, imagery, well logs, and property information, Ecology's well log viewer database, the DOH's Sentry Internet for water system data, and DOH's Source Water Assessment Program (SWAP) Maps. More detailed information is provided in Geotechnical Report.

3. *Hydrologic Assessment Required. For all proposed activities to be located in a critical aquifer recharge area, a critical aquifer recharge area report shall contain a level-one hydrological assessment. A level-two hydrogeologic assessment shall be required for any of the following proposed activities*:

a. *Activities that result in 5,000 square feet or more impervious site area.*

Development of the Redmond Downtown Park will result in 67,664 square feet of impervious area and 28,082 square feet of pervious area. This equates to approximately 57,450 square feet more impervious site area than current site conditions, and approximately 11,490 square feet more impervious site area than before the 161st Street Extension.

b. *Activities that divert, alter, or reduce the flow of surface or groundwaters, including dewatering or otherwise reduce the recharging of the aquifer.*

The Redmond Downtown Park is being designed to infiltrate stormwater run-off from at least 80 percent of the site area by conveying surface water to infiltrate into the backfill of the peat removal excavation below the Great Lawn. The design infiltration rate is 2 inches per hour for the gravel borrow backfill (or 1 inch per hour if native materials are used as the backfill), and 1 inch per hour when infiltrating into existing soils below the park pavement section or landscaping berms.

Dewatering will be avoided if possible by excavating the peat layer underneath the Great Lawn during seasonal low water levels, but for excavations deeper than 1 to 2 feet below the water table, dewatering using wellpoints or deep wells may be necessary. If dewatering is required, the contractor will be required to submit a proposed dewatering system design and plan layout to the City for review and comment prior to beginning construction.

c. *The storage, handling, treatment, use, production, recycling, or disposal of deleterious substances or hazardous materials, other than household chemicals used according to the directions specified on the packaging for domestic applications.*

None proposed.

d. *The use of injection wells, including on-site septic systems, except those domestic septic systems releasing less than 14,500 gallons of effluent per day and that are limited to a maximum density of one system per one acre.*

Injection wells are not a part of the proposed project.

e. *Any other activity determined by the Technical Committee likely to have an adverse impact on groundwater quality or quantity, or on the recharge of the aquifer.*

4. *Written Level-One Hydrogeologic Assessment. A level-one hydrogeologic assessment shall include the following site and proposal-related information at a minimum:*

a. *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 site is located on fill and younger alluvial deposits of silty sand to gravel and peat as described in the Geotechnical Report. The younger alluvial deposits make up the aquifer from which the City of Redmond gets a portion of its drinking water supply. For this reason, the proposed Downtown Park project is taking measures to ensure infiltration to recharge the aquifer and to maintain the water quality of the infiltrating water.

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

The groundwater depth across the site varies from seasonal highs of about Elevation 29 to 27 feet. On-going groundwater level readings obtained as part the City's Wellhead Protection program suggest that the seasonal groundwater levels in the project vicinity fluctuate between highs of about Elevation 29 to 27 feet (10 to 12 feet below existing site grades) and lows of Elevation 24 to 22 feet (15 to 17 feet below existing grades). Water levels measured in nearby wells over the last 5 years are summarized in Table 1. Static groundwater was observed in some of the borings at the time of exploration (June 2015) at depths ranging between 12½ and 16 feet (Elevations 26½ and 23 feet). Groundwater flow directions are to the northwest at the site as shown in the Groundwater Surface Contour Maps (Attachments A, B and C). The hydraulic gradient at the site is approximately 8.77 feet per mile.

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

As shown on Figure 4, 24 wells are located within 1,300 feet of the project site. All of these wells are monitoring wells for the City of Redmond's Wellhead Protection Program. No Group A or B water systems or springs were identified within the search radius.

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

The project site is located within a Seismic Hazard Area (Attachment E). There are no surface water bodies within 1,300 feet of the project site.

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

Periodic reports are provided to the City of Redmond by GeoEngineers for the wellhead protection monitoring program. A summary of available data is provided in Table 2.

f. *Best management practices proposed to be utilized.*

Project components have been designed by PFS Studio implementing appropriate BMPs.

5. *Written Level-Two Hydrogeologic Assessment. A level-two hydrogeologic assessment shall include the following site and proposal-related information at a minimum, in addition to the requirements for a level one hydrogeological assessment:*

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

Water quality data is available from the City's ground water monitoring program for MW0004 has been sampled regularly from 2010 to 2015 and is summarized for available data in Table 1 (attached). Available Water Elevation data for City of Redmond monitoring wells within 1,300 feet of the proposed project site is summarized in Table 2 below. Locations of the wells are shown in the Well Locations Map (Figure 4).

TABLE 2: HISTORIC WATER LEVELS FOR MONITORING WELLS WITHIN 1,300 FEET OF THE PROJECT SITE.

Well ID	Water Elevation (NAVD88)				
	August 2010	August 2011	August 2012	January 2013	January 2015
MW004	25.32	24.52	24.94	27.64	28.28
MW005	22.58	24.68	25.10	27.78	28.40
MW019	36.78	36.65	35.51	41.61	40.47
MW038	25.42	24.68	25.04	26.96	34.85
MW040	25.73	<25.40	<25.40	27.27	28.11
MW042	26.11	24.06	25.46	27.45	28.16
MW043	26.22	25.48	25.84	--	28.42
MW044	26.36	25.66	--	23.31	--
MW045	26.81	25.98	26.35	26.78	27.62
MW062	25.39	26.98	25.01	26.86	27.25
MW065	24.53	23.69	23.96	26.21	--
MW066	24.23	23.37	23.62	25.80	--
MW067	24.24	23.38	23.71	25.80	--
MW068	24.72	23.78	24.07	26.39	--
MW069	24.15	23.28	23.57	25.66	--
MW071	24.57	23.74	24.05	26.24	--
MW088	26.00	23.45	25.47	27.24	28.24
MW089	26.34	24.55	25.37	27.18	28.17

b. *Groundwater monitoring plan provisions.*

The City has a groundwater monitoring program already in place for the project area that includes 24 wells within 1,300 feet of the project site (Well Location Map, Figure 4). These wells a periodically monitored for water level and water quality.

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

iii. *Predictive evaluation of groundwater withdrawal effects on nearby wells and surface water features.*

No groundwater withdrawal is anticipated for Redmond Downtown Park since the excavation of peat (which may extend up to 14 feet below site grade) is planned to occur at seasonally low groundwater levels (which are typically 15 to 17 feet below existing grade).

If dewatering is necessary for excavations deeper than 1 to 2 feet below the water table, dewatering using well-points or deep wells may be necessary. If dewatering is required, the contractor will be required to submit a proposed dewatering system design and plan layout to the City for review and comment prior to beginning construction.

iv. *Predictive evaluation of contaminant transport based on potential releases to groundwater.*

Contaminant transport potential release is not anticipated as a result of the project.

v. *Predictive evaluation of groundwater (recharge, elevation, dewatering feasibility, constructability, discharge permitting, etc.) on the proposed project.*

The proposed project will avoid <u>significant adverse impacts to downgradient water resources by implementing required stormwater management controls, and by creating an infiltration area underneath the Great Lawn. Runoff from the splash pad and runoff east of the splash pad/pavilion (i.e. the drive path, pavement behind the pavilion, etc.) will be drain to the conveyance connecting to Redmond Way. This is in part to help protect the quality of the water that drains to the aquifer.</u>

The design infiltration rate into the gravel borrow underneath the Great Lawn is 2 inches per hour. All other grassy areas are estimated to have an infiltration rate of about 1 inch per hour. These infiltration rates are based on generally conservative design guidelines. On-site PIT testing may be completed to establish a more site-specific infiltration performance value. The area of the Great Lawn is approximately 18,790 square feet, and other permeable surfaces are approximately 9,290 square feet. This means that the park has a weighted average infiltration capacity of 1.67 inches/hour over a total 28,082 pervious square feet.

If dewatering is necessary for the project, a dewatering plan complete with discharge permitting, etc. will be made.

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.

The contractor may have hazardous materials on-site and used during the construction with their equipment. The contractor will prepare a Spill Prevention Control and Countermeasure (SPCC) plan to address the potential for a spill. All construction activities will follow the site Stormwater Pollution Prevention Plan (SWPPP), to be prepared by others.

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

This will be addressed in the site SWPPP prepared by others.

e. *Proposed plan for implementing RZC 21.64.050.D.3.F, Protection* Standards During Construction.

This is addressed in the site SWPPP prepared by others.

f. *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.*

The City's typical spill plan for existing roadways can be implemented for this site if desired.

g. *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.*

The studies listed below have been completed by GeoEngineers for parcels within 1,300 feet of the project area and have been provided to the project team.

- GeoEngineers, Inc., 2000. "Phase I Environmental Site Assessment, Redmond Center, 15800 Redmond Way," June 15, 2000.
- GeoEngineers, Inc., 2001. "Phase II Environmental Site Assessment, The Cleaning Center of Redmond, Redmond, Washington." March 22, 2001.
- GeoEngineers, Inc., 2007. "Phase I and II Environmental Site Assessment, Redmond Shopping Square, Redmond, Washington." October 26, 2007.
- GeoEngineers, Inc., 2010. "BNSF Rail Corridor Master Plan, Sammamish Valley Study Area – Critical Area Reconnaissance; DRAFT Memorandum." September 9, 2010.
- GeoEngineers, Inc. 2012. "Final Cleanup Report Remedial Excavation of cPAH Contaminated Soil, 164th Avenue NE Extension, Redmond, Washington." November 9, 2012.

CONCLUSIONS AND CONCEPTUAL MITIGATION

The potential exists for temporary dewatering during construction of the Great Lawn as described earlier. Impacts to the aquifer will be temporary, and are unlikely to cause interference drawdown or impairment of any of The City of Redmond's water supply wells. Recharge to the alluvium aquifer will likely not decrease significantly despite an increase in impermeable surfaces because of the creation of the gravel borrow backfill underneath the Great Lawn and plan to infiltrate 80 percent of the stormwater onsite. Water quality will be maintained by directing runoff from the splash pad into the City's stormwater drains rather than directly infiltrating onsite.

ACCURACY, ASSUMPTIONS AND RECOMMENDATIONS

The critical areas analysis relies on geologic information collected from the Geotechnical report written by GeoEngineers dated September 29, 2015, monitoring wells for the City of Redmond's Wellhead Protection Program, and our experience working on other projects throughout the City of Redmond.

The critical areas analysis relies on groundwater information collected for the City's Wellhead Protection Monitoring Program. The project area includes nearby monitoring well data over limited periods of record. Continued regular monitoring of the wells is recommended to evaluate potential impacts of approved infiltration.

REFERENCES

Booth, D.B., Troost, K.A., and Wisher A.P., Pacific Northwest Center for Geologic Mapping Studies, "Geologic Map of King County, Washington." Available at http://geomapnw.ess.washington.edu/services/publications/map/data/KingCo_composite.pdf), 2007.

City of Redmond, Wellhead Protection Zones, April 16, 2011, RZC 21.64

City of Redmond, 2013, Redmond Zoning Code, RZC 21.64, Appendix 1 Critical Areas Reporting Requirements, accessed on June 12, 2013, http://www.zoningplus.com/regs/redmond/index.aspx?index=4221

City of Redmond, 2013, Redmond Zoning Code, RZC 21.64, Critical Areas Regulations, last revised May 18, 2013.

GeoEngineers, Inc., 2000. "Phase I Environmental Site Assessment, Redmond Center, 15800 Redmond Way," June 15, 2000.

GeoEngineers, Inc., 2001. "Phase II Environmental Site Assessment, The Cleaning Center of Redmond, Redmond, Washington." March 22, 2001.

GeoEngineers, Inc., 2007. "Phase I and II Environmental Site Assessment, Redmond Shopping Square, Redmond, Washington." October 26, 2007.

GeoEngineers, Inc., 2010. "BNSF Rail Corridor Master Plan, Sammamish Valley Study Area –Critical Area Reconnaissance; DRAFT Memorandum." September 9, 2010.

GeoEngineers, Inc. 2012. "Final Cleanup Report Remedial Excavation of cPAH Contaminated Soil, 164th Avenue NE Extension, Redmond, Washington." November 9, 2012.

GeoEngineers, Inc., 2015. "Geotechnical Engineering Services: Redmond Downtown Park, Redmond, WA." Prepared for the City of Redmond and PFS Studio. 29 September, 2015.

LIMITATIONS

We have prepared this report for use by PFS Studio and the City of Redmond to assist them in evaluating critical areas for the Downtown Park project in Redmond, Washington. Other analysis, design, permitting, preparation of plans and specification, and surveying are not included.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

We appreciate the opportunity to provide services to you for this project. Please contact us if you have any questions or wish to discuss this letter.

Sincerely,
GeoEngineers, Inc.

Elson T. Barnett, LEG
Senior Engineering Geologist

State of Washington
Hydrogeologist
1964
Licensed Geologist
3/21/16
Michael Kenrick

Michael A. P. Kenrick, PE, LHG
Senior Principal Hydrogeologist

ETB:MAPK:cam

Attachments:
Table 1. Water Quality Data for MW0004
Figure 1. Vicinity Map
Figure 2. Site Plan
Figure 3. Surface Geology
Figure 4. Well Location Map
Figure 5. Aerial Photo
Figure 6. Critical Area Site Plan Existing Conditions
Attachment A. February 2012 Groundwater Surface Contour Map
Attachment B. January 2013 Groundwater Surface Contour Map
Attachment C. January 2015 Groundwater Surface Contour Map
Attachment D. Map 64.6 - Wellhead Protection Zones
Attachment E. Map 64.9 -Seismic Hazard Areas
Attachment F. Map 64.8 - Erosion Hazard Areas

One copy submitted electronically

Disclaimer: Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Table 1

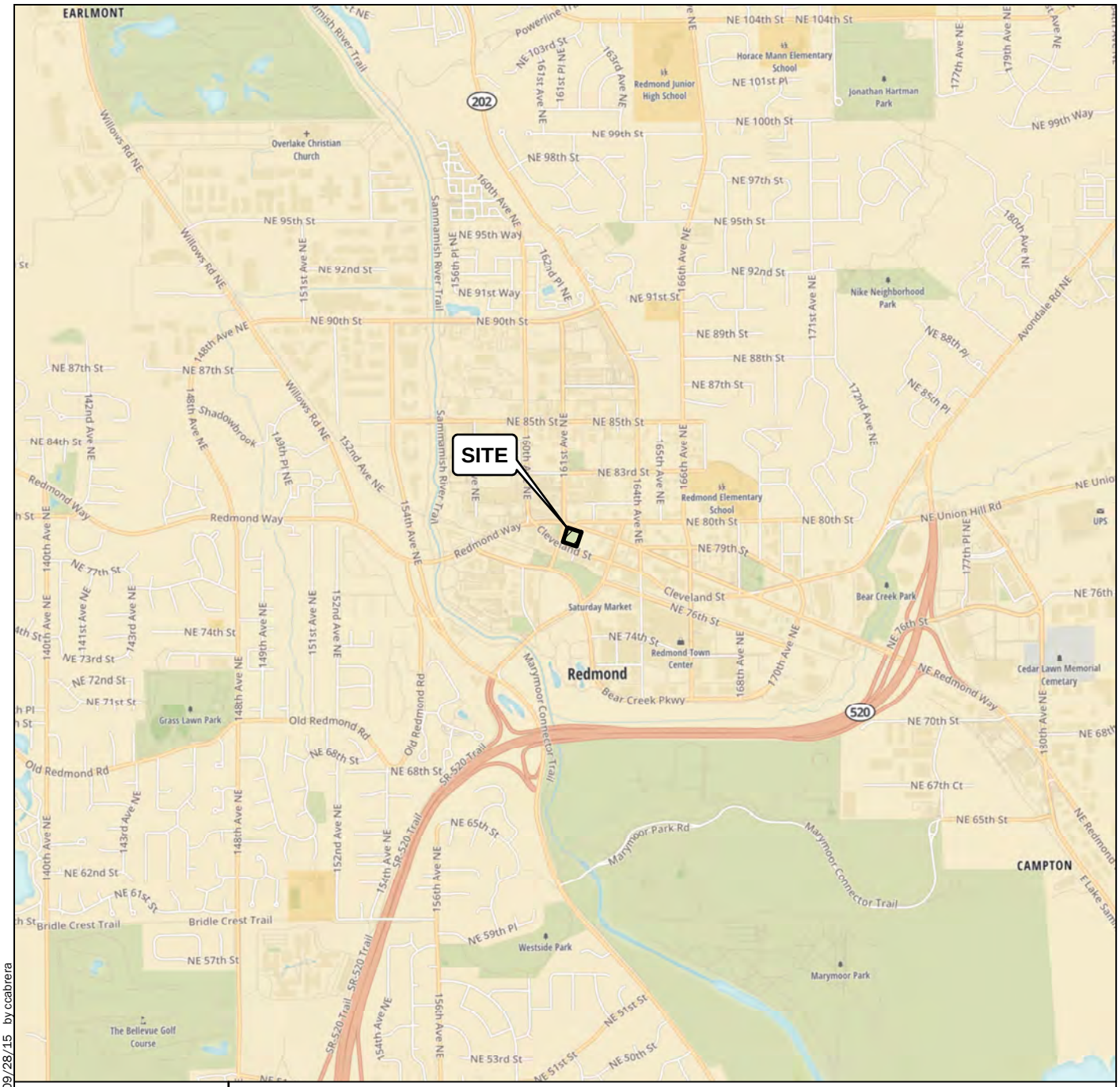
Water Quality Data for MW0004

City of Redmond - Downtown Park Geotechnical Consultation

Redmond, Washington

Location ID	560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004		560000MW004	
Location Name	MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004		MW004	
Sample Date	12/12/2007		7/11/2008		7/11/2008		2/6/2009		7/29/2009		2/8/2010		8/16/2010		2/17/2011		8/16/2011		2/8/2012		8/22/2012		1/29/2013		1/30/2015		8/6/2015	
Sample Type Code	N		FD		N		N		N		N		N		N		N		N		N		N		N		N	
Analayte	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit
																	< 5	ug/L	< 5	ug/L		ug/L						
1,1,1,2-Tetrachloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1,1-Trichloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1,2,2-Tetrachloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1,2-Trichloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1-Dichloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1-Dichloroethene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,1-Dichloropropene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2,3-Trichlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2,3-Trichloropropane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2,4-Trichlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2,4-Trimethylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2-Dibromo-3-Chloropropane	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
1,2-Dichlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2-Dichloroethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,2-Dichloropropane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,3,5-Trimethylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,3-Dichlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,3-Dichloropropane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
1,4-Dichlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
2,2-Dichloropropane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
2-Butanone	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L
2-Chloroethylvinylether	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 2.0	ug/L	< 1.0	ug/L
2-Chlorotoluene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
2-Hexanone	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L
4-Chlorotoluene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Acetone	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L	< 5.0	ug/L
Aluminum	760	ug/L	180	ug/L	< 110	ug/L	< 110	ug/L	170	ug/L	370	ug/L	< 56	ug/L	< 110	ug/L	< 110	ug/L	< 110	ug/L	< 110	ug/L	< 110	ug/L	< 110	ug/L	< 110	ug/L
Antimony	< 5.6	ug/L	< 5.6	ug/L	< 5.6	ug/L	< 5.6	ug/L									< 5.6	ug/L										
Arsenic	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L	< 3.3	ug/L
Barium	< 11	ug/L	< 28	ug/L	< 28	ug/L	< 56	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L
Benzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Beryllium	< 11	ug/L	< 11	ug/L	< 11	ug/L											< 11	ug/L										
BICARBONATE ION							88000	ug/L	98000	ug/L	88000	ug/L	90000	ug/L	88000	ug/L	94000	ug/L	84000	ug/L	86000	ug/L	88000	ug/L	98000	ug/L	86000	ug/L
Bromobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Bromochloromethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Bromoform	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Bromomethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Cadmium	< 4.4	ug/L	< 4.4	ug/L	< 4.4	ug/L											< 4.4	ug/L										
Calcium	17000	ug/L	12000	ug/L	16000	ug/L	16000	ug/L	17000	ug/L	16000	ug/L	14000	ug/L	16000	ug/L	16000	ug/L	16000	ug/L	16000	ug/L	16000	ug/L	16000	ug/L	15000	ug/L
Carbon Disulfide	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Carbon Tetrachloride	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
CFC-11	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
CFC-12	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Chloride			5400	ug/L	5300	ug/L	6000	ug/L	5200	ug/L	6100	ug/L	6700	ug/L	6500	ug/L	5600	ug/L	7000	ug/L	7700	ug/L	7600	ug/L	10000	ug/L	7100	ug/L
Chlorobenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Chloroethane	< 0.2	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Chloroform	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	0.30	ug/L

Chloromethane	< 0.2	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Chromium	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L
Cis-1,2-Dichloroethene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Cis-1,3-Dichloropropene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Cobalt	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L
Copper	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L
Cyanide							5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L	< 5	ug/L												
Dibromochloromethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Dibromomethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Dichlorobromomethane	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
DIESEL RANGE HYDROCARBONS													< 260	ug/L	< 260	ug/L	< 260	ug/L	< 260	ug/L	< 260	ug/L	< 260	ug/L			< 260	ug/L
DISSOLVED OXYGEN	8100	ug/L					8100	ug/L	120	ug/L	5230	ug/L	4980	ug/L	6600	ug/L	4450	ug/L	11980	ug/L	9180	ug/L	8000	ug/L	7300	ug/L	4300	ug/L
Ethylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Ethylene dibromide	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Fluoride							37	ug/L	39	ug/L	80	ug/L	40	ug/L	37	ug/L	95	ug/L	47	ug/L	47	ug/L	40	ug/L	< 20	ug/L	29	ug/L
Gasoline																					< 100	ug/L						
Gasoline, natural													< 100	ug/L	< 100	ug/L	< 100	ug/L	< 100	ug/L			< 100	ug/L			< 100	ug/L
Hexachlorobutadiene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Iron	660	ug/L	180	ug/L	< 56	ug/L	< 56	ug/L	210	ug/L	410	ug/L	< 56	ug/L	140	ug/L	< 56	ug/L	< 56	ug/L	< 56	ug/L	< 56	ug/L	71	ug/L	< 56	ug/L
Iron, Ferrous, Fe+2									0	ug/L		ug/L																
Isopropylbenzene (Cumene)	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Lead	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L	< 1.1	ug/L
LUBE OIL RANGE HYDROCARBONS													< 410	ug/L	< 410	ug/L	< 410	ug/L	< 410	ug/L	< 410	ug/L	< 420	ug/L			< 410	ug/L
Magnesium	11000	ug/L	5900	ug/L	11000	ug/L	11000	ug/L	11000	ug/L	11000	ug/L	10000	ug/L	11000	ug/L	10000	ug/L	11000	ug/L	11000	ug/L	11000	ug/L	11000	ug/L	10000	ug/L
Manganese	32	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	16	ug/L	26	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L
Mercury	< 0.5	ug/L	< 0.5	ug/L	< 0.5	ug/L																						
Methyl Iodide	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Methyl isobutyl ketone	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L
Methyl t-butyl ether	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Methylene Chloride	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Naphthalene	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.3	ug/L	< 1.0	ug/L
n-Butylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Nickel	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L	< 22	ug/L
Nitrate			1500	ug/L	1100	ug/L	1600	ug/L	1500	ug/L	1400	ug/L	1100	ug/L	1400	ug/L	810	ug/L	1400	ug/L	1300	ug/L	1200	ug/L	1300	ug/L	840	ug/L
n-Propylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
p-Isopropyltoluene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Potassium	1900	ug/L	2100	ug/L	1700	ug/L	1700	ug/L	1600	ug/L	1800	ug/L	1600	ug/L	1800	ug/L	1900	ug/L	1800	ug/L	1900	ug/L	1800	ug/L	1900	ug/L	1700	ug/L
Sec-Butylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Selenium	< 5.6	ug/L	< 5.6	ug/L	< 5.6	ug/L											< 5.6	ug/L										
Silver	< 11	ug/L	< 11	ug/L	< 11	ug/L									< 11	ug/L	< 11	ug/L										
Sodium	11000	ug/L	6900	ug/L	10000	ug/L	10000	ug/L	10000	ug/L	10000	ug/L	10000	ug/L	11000	ug/L	10000	ug/L	9900	ug/L	10000	ug/L	11000	ug/L	11000	ug/L	9500	ug/L
Styrene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Sulfate			14000	ug/L	13000	ug/L	13000	ug/L	14000	ug/L	17000	ug/L	13000	ug/L	14000	ug/L	14000	ug/L	13000	ug/L	14000	ug/L	13000	ug/L	13000	ug/L	13000	ug/L
Tert-Butylbenzene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Tetrachloroethene	0.29	ug/L	0.28	ug/L	0.27	ug/L	< 1	ug/L	0.29	ug/L	0.68	ug/L	0.42	ug/L	0.63	ug/L	0.44	ug/L	0.58	ug/L	0.67	ug/L	0.42	ug/L	0.60	ug/L	0.57	ug/L
Thallium	< 5.6	ug/L	< 5.6	ug/L	< 5.6	ug/L											< 5.6	ug/L										
Toluene	< 0.2	ug/L	< 1	ug/L	< 1	ug/L	1.9	ug/L	< 1	ug/L	< 1	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
TOTAL DISSOLVED SOLIDS	99000	ug/L	150000	ug/L	140000	ug/L	68000	ug/L	76000 120000	ug/L ug/L	110000	ug/L	130000	ug/L	150000	ug/L	100000	ug/L	100000	ug/L	100000	ug/L	110000	ug/L	150000	ug/L	110000	ug/L
Total Xylenes			< 0.4	ug/L	< 0.4	ug/L																						
Trans-1,2-Dichloroethene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Trans-1,3-Dichloropropene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Trichloroethene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Vanadium	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L	< 11	ug/L
Vinyl Acetate	< 5	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 2.0	ug/L	< 1.0	ug/L	< 1.0	ug/L	< 1.0	ug/L
Vinyl Chloride	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
Xylene	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.2	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L	< 0.20	ug/L
XYLENE,P-, M-	< 0.4	ug/L					< 0.4	ug/L	< 0.4	ug/L	< 0.4	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L	< 0.40	ug/L
Zinc	< 56	ug/L	< 56	ug/L	< 56	ug/L	< 56	ug/L	< 56	ug/L	< 28	ug/L	< 56	ug/L	< 28	ug/L	< 56	ug/L	< 28	ug/L	< 28	ug/L	< 28	ug/L	< 56	ug/L	< 28	ug/L



N
W E
S

2,000 0 2,000

Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2015

Projection: NAD 1983 UTM Zone 10N

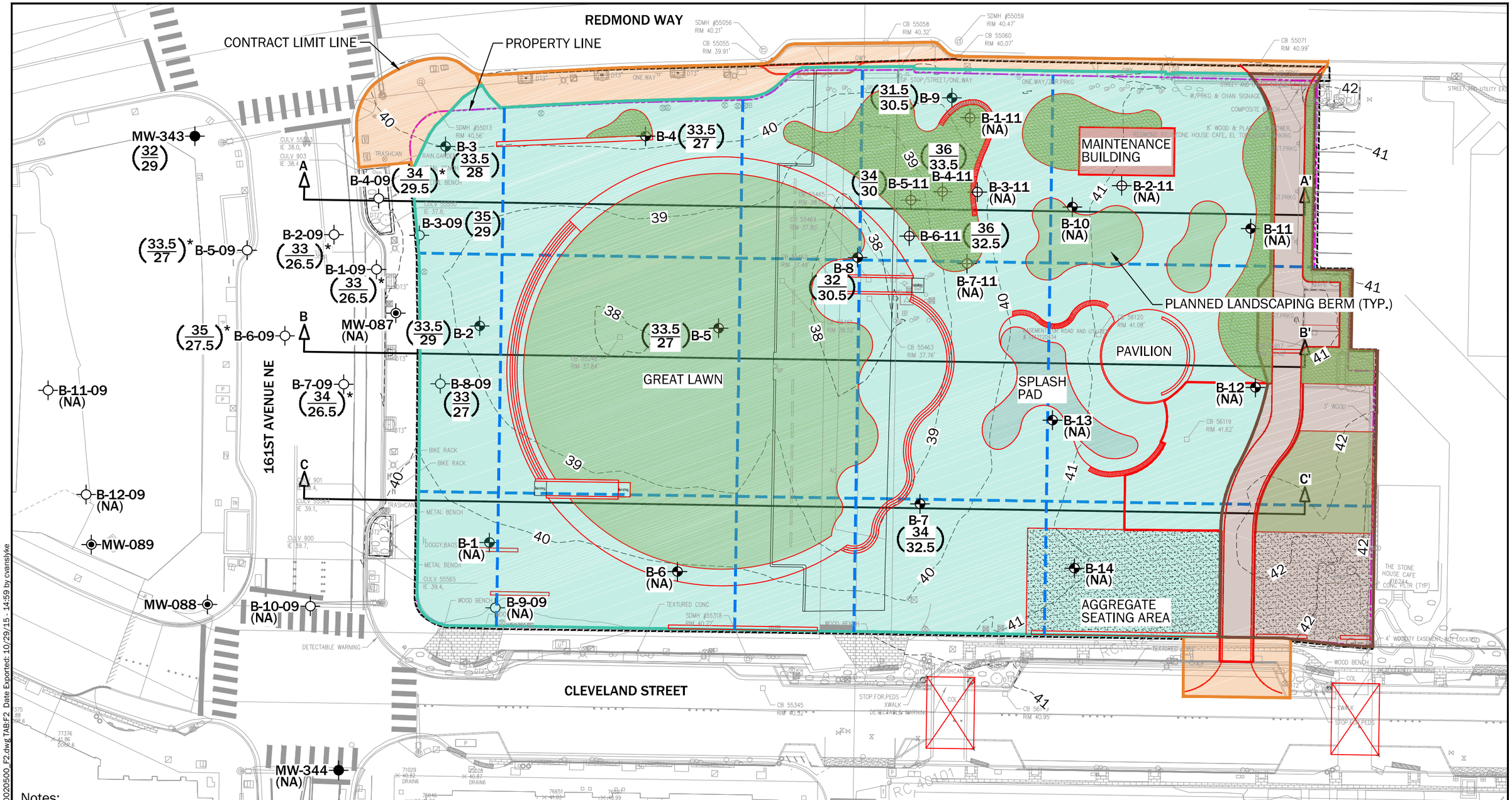
Vicinity Map

Redmond Downtown Park
Redmond, Washington

GEOENGINEERS

Figure 1

\\red\projects\0\0500205\GIS\MXD\050020500_F1_VM.mxd Date Exported: 09/28/15 by ccabrera



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Field survey base drawing provided by KPG, Inc. and architect design by PFS Studio.

Vertical Datum: City of Redmond Vertical Control Datum (NAVD 88).

Projection: NAD83 Washington State Planes, North Zone, US Foot.

Legend

- B-1 — Boring by GeoEngineers, Inc., 2015
- B-1-11 — Boring by GeoEngineers, Inc., 2011
- MW-343 — Monitoring Well by GeoEngineers, Inc., 2010
- B-1-09 — Boring by GeoEngineers, Inc., 2009
- MW-087 — Monitoring Well by GeoEngineers, Inc., 2007

GPR Survey Line

A — A' Approximate cross section location

(33/27)* (Top Elev. of Peat / Bot. Elev. of Peat)

* Peat removed for 161st Ave NE extension

Infiltration Basin Area

Existing Basin Area

Bypass Basin Area

N E S W

0 40

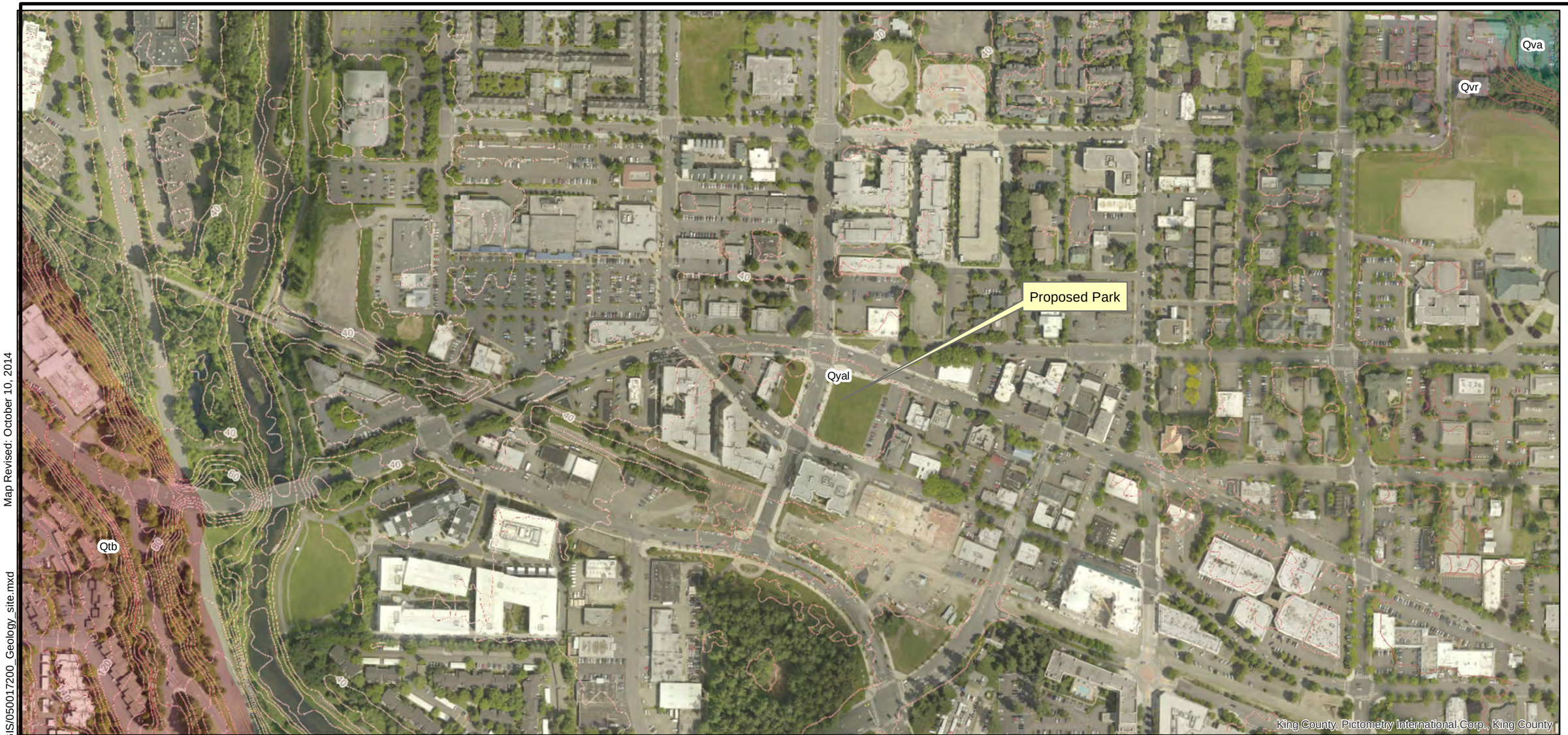
Site Plan

Redmond Downtown Park
Redmond, Washington

GEOENGINEERS

Figure 2

\\REDpz\Projects\0\0500205\00\CAD\050020500_F2.dwg TAB:F2 Date Exported: 10/29/15 - 14:59 by cvanslyke



Data Sources: King County Digital Geologic Mapping provided by King County GIS, 2006. King County Aerial Photo, 2009.

All locations are approximate.

Lambert Conformal Conic
Washington State Plane North
North American Datum 1983

Note: This drawing is for informational purposes. It is intended to assist in showing features discussed in an attached document.

N

Legend

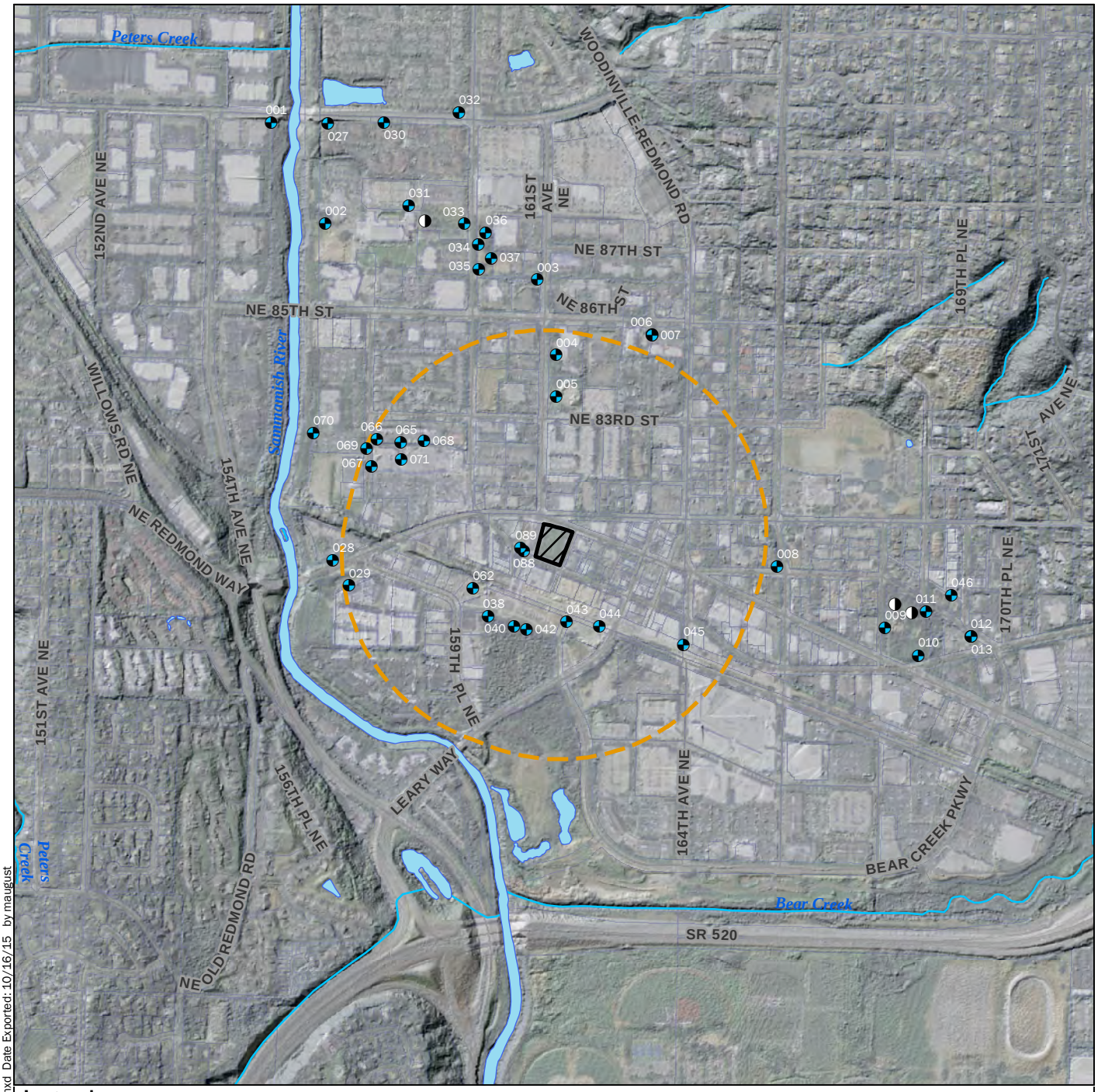
Surface Geology

- Qyal- Recent Alluvium
- Qoal - Older Alluvium
- Qtb - Transitional Beds
- Qvr - Recessional Outwash
- Qvt - Glacial Till
- Qva- Advance Outwash
- contours - 5 foot (below 1000 feet) and 10 foot

GEOENGINEERS

REDMOND DOWNTON PARK
SITE GEOLOGY
FIGURE 3

Office: REDM Path: Redmond P:/0/0500172/02/GIS/050017200_Geology_site.mxd Map Revised: October 10, 2014



Legend

- Site Boundary
- City of Redmond Monitoring Well
- City of Redmond Water Supply Well (Approximate Location)
- 1,300-foot Site Buffer
- King County Tax Parcel Boundary

1,000 0 1,000

Feet

N W E S

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source:

Projection: NAD 1983 HARN StatePlane Washington North FIPS 4601 Feet

Well Location Map

Downtown Park
Redmond, Washington

GEOENGINEERS

Figure 4

\\redpz\projects\0\0500205\GIS\MXD\050020500_WellLocations_rebuild.mxd Date Exported: 10/16/15 by maugust

Legend

Site Boundary

1,000 0 1,000

Feet

N W E S

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI Data & Maps, King County GIS

Projection: WGS 1984 Web Mercator Auxiliary Sphere

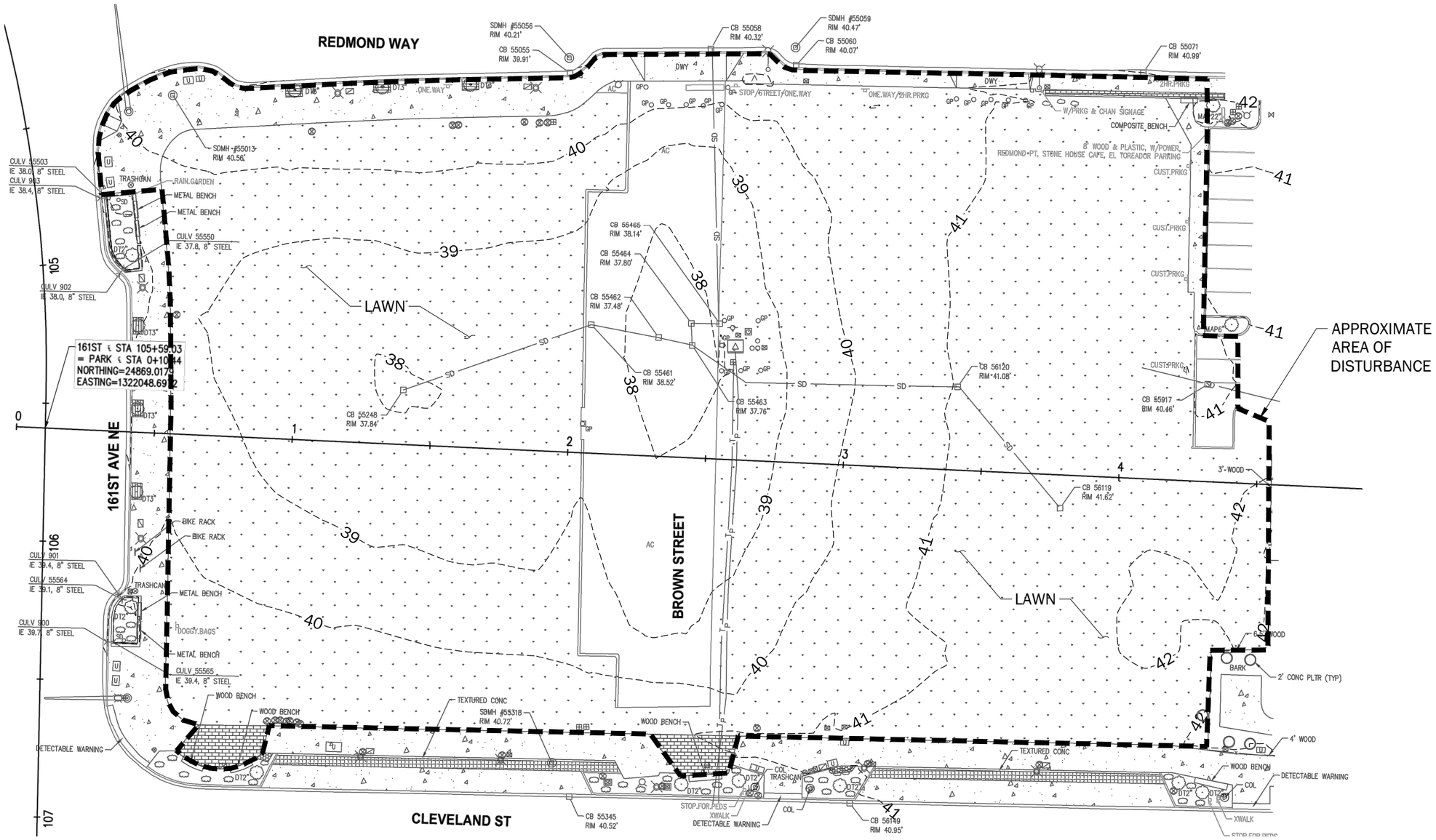
Aerial Photo

Downtown Park
Redmond, Washington

GEOENGINEERS

Figure 5

W:\Redmond\Projects\0\0500205\GIS\MXD\050020500_Aerial.mxd Date Exported: 10/14/15 by maugust



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Sheet C0.02 "Survey Control and Abbreviations" by PFS Studio dated 10-29-15.

Vertical Datum: City of Redmond Vertical Control Datum (NAVD 88).

Projection: NAD83 Washington State Planes, North Zone, US Foot.

Critical Areas

Entire project area is located within Well Head Protection Zone 2 and Seismic Hazard Areas

N E S W

0 40

Critical Area Site Plan Existing Condition

Redmond Downtown Park
Redmond, Washington

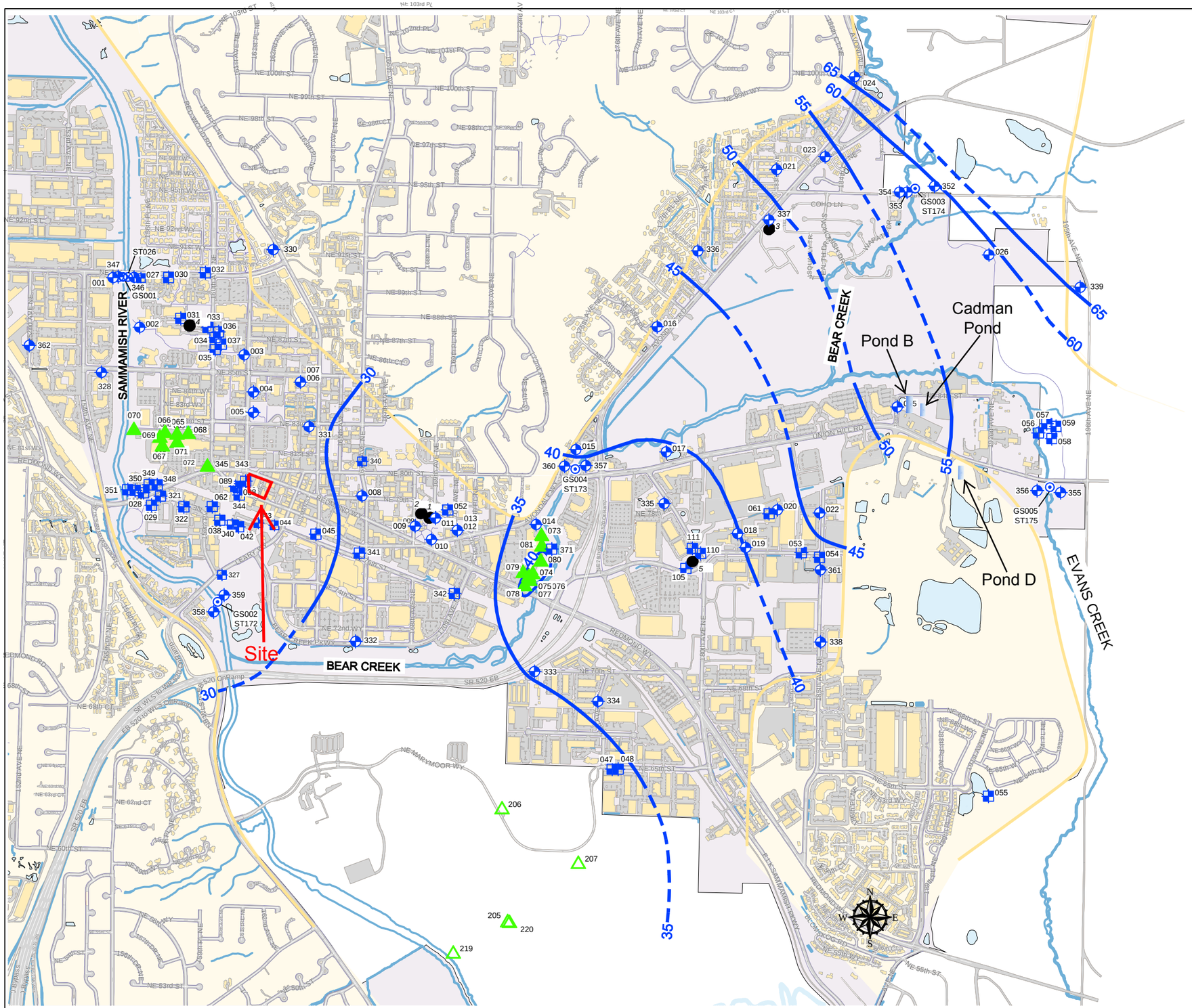
GEOENGINEERS

Figure 6

P:\0\0500205\00\CAD\050020500_F6.dwg TAB:F6 Date Exported: 12/03/15 - 10:53 by tmichaud

Attachment A

February 2012 Groundwater Surface Contour Map



REFERENCE: ALL TOPOLOGY PROVIDED BY CITY OF REDMOND MARCH 2008 INFORMATION SERVICES DEPARTMENT.

LEGEND

- GS001 — CITY OF REDMOND GAUGING STATION
- ST026 — CITY OF REDMOND IN-STREAM PIEZOMETER
- 001 — CITY OF REDMOND MONITORING WELL (INSTALLED AS PART OF THE GROUNDWATER MONITORING PROGRAM BETWEEN 2007 AND 2011)
- 027 — CITY OF REDMOND MONITORING WELL (INSTALLED DURING OTHER INVESTIGATIONS)
- 055 — THE GROUNDWATER LEVEL IN MW055 WAS ANOMALOUSLY HIGH (100.1 FEET ELEVATION), CONSISTENT WITH IT TAPPING A PERCHED UPLAND AQUIFER, AND NOT THE ALLUVIAL VALLEY AQUIFER.
- 065 — PRIVATELY OWNED MONITORING WELL
- 330 — THE GROUNDWATER LEVEL IN MW330 WAS ANOMALOUSLY HIGH (65.2 FEET ELEVATION CONSISTENT WITH A PERCHED CONDITION AND NOT REPRESENTATIVE OF THE ALLUVIAL VALLEY AQUIFER.
- 205 — KING COUNTY MONITORING WELL
- 1 — CITY OF REDMOND WATER SUPPLY WELL
- GROUNDWATER LEVEL CONTOUR, BASED ON FEBRUARY 2, 2012 MEASUREMENTS, ELEVATION IN FEET (NAVD 88), DASHED WHERE INFERRED.
- CITY OF REDMOND LIMITS
- UPLAND AREAS

MONITORING WELL NAMES HAVE BEEN ABBREVIATED TO THE LAST THREE UNIQUE NUMBERS. THE COMPLETE MONITORING WELL NAMES ARE LISTED IN TABLE 1.

REFER TO TABLE 5 FOR A COMPLETE LIST OF MEASURED GROUNDWATER LEVELS AT EACH MONITORING WELL.

0 1400' 2800'

GEOENGINEERS

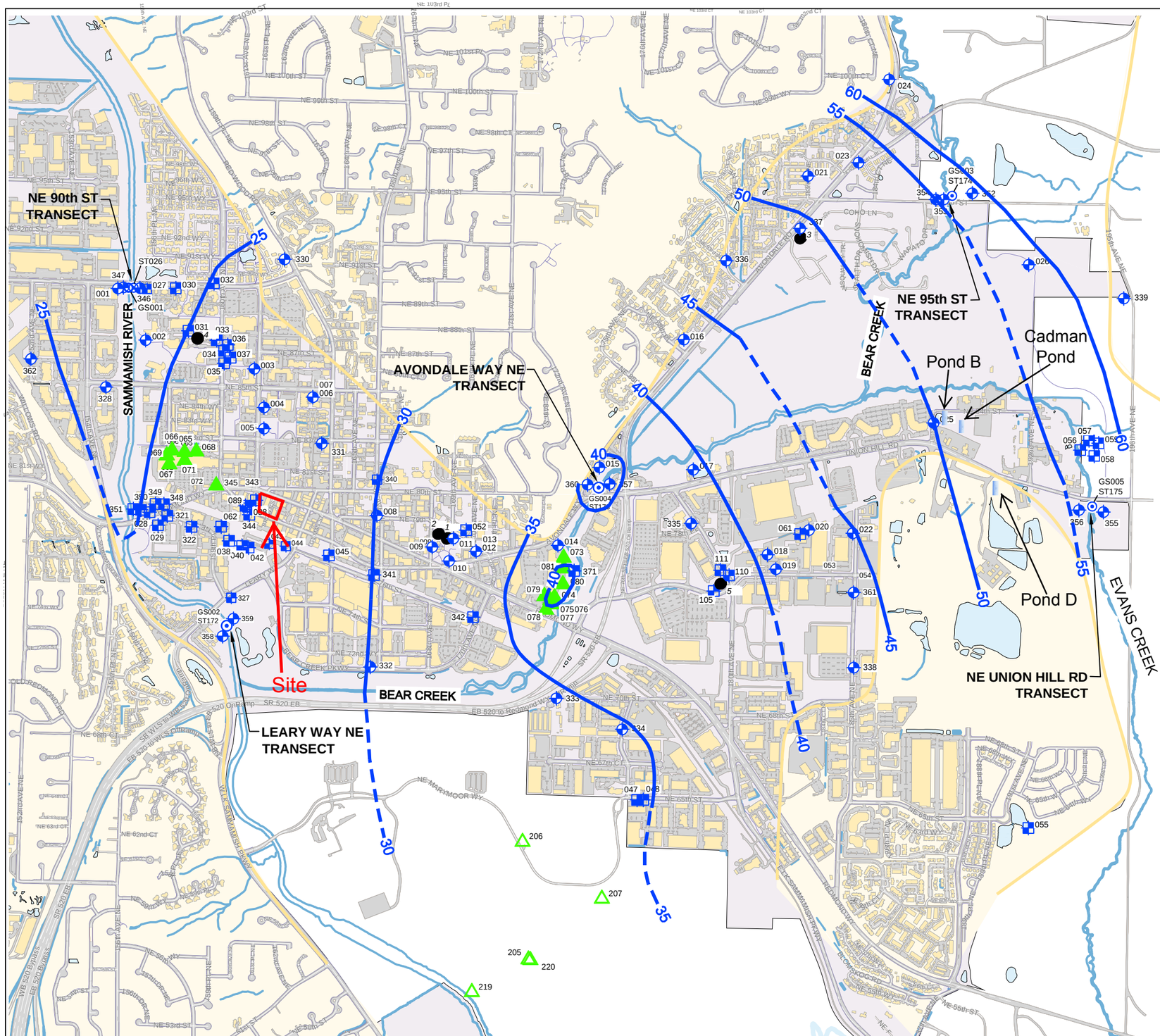
THE LOCATIONS OF ALL FEATURES SHOWN ARE APPROXIMATE. THIS FIGURE IS FOR INFORMATIONAL PURPOSES ONLY. IT IS INTENDED TO ASSIST IN THE IDENTIFICATION OF FEATURES DISCUSSED IN A RELATED DOCUMENT. DATA WERE COMPILED FROM SOURCES AS LISTED IN THIS FIGURE. THE DATA SOURCES DO NOT GUARANTEE THESE DATA ARE ACCURATE OR COMPLETE. THERE MAY HAVE BEEN UPDATES TO THE DATA SINCE THE PUBLICATION OF THIS FIGURE. THIS FIGURE IS A COPY OF A MASTER DOCUMENT. THE MASTER DOCUMENT HARD COPY IS STORED BY GEOENGINEERS, INC. AND WILL SERVE AS THE OFFICIAL DOCUMENT OF RECORD.

FEBRUARY 2012 GROUNDWATER SURFACE CONTOUR MAP CITY OF REDMOND

ATTACHMENT C

Attachment B

February 2013 Groundwater Surface Contour Map



LEGEND

- GROUNDWATER LEVEL CONTOUR, BASED ON JANUARY 23, 2013 MEASUREMENTS, ELEVATION IN FEET (NAVD 88), DASHED WHERE INFERRED.
- GS001 — CITY OF REDMOND GAUGING STATION
- ST026 — CITY OF REDMOND RIVERBED PIEZOMETER
- 001 — CITY OF REDMOND MONITORING WELL (INSTALLED AS PART OF THE GROUNDWATER MONITORING PROGRAM BETWEEN 2007 AND 2011)
- 027 — CITY OF REDMOND MONITORING WELL (INSTALLED DURING OTHER INVESTIGATIONS)
- 065 — PRIVATELY OWNED MONITORING WELL
- 205 — KING COUNTY MONITORING WELL
- 1 — CITY OF REDMOND WATER SUPPLY WELL
- CITY OF REDMOND LIMITS
- UPLAND AREAS

MONITORING WELL NAMES HAVE BEEN ABBREVIATED TO THE LAST THREE UNIQUE NUMBERS.

NOTES:
THE GROUNDWATER LEVEL IN MW055 AND MW330 WAS ANOMALOUSLY HIGH, CONSISTENT WITH IT TAPPING A PERCHED UPLAND AQUIFER AND NOT THE ALLUVIAL VALLEY AQUIFER

GEOENGINEERS

THE LOCATIONS OF ALL FEATURES SHOWN ARE APPROXIMATE. THIS FIGURE IS FOR INFORMATIONAL PURPOSES ONLY. IT IS INTENDED TO ASSIST IN THE IDENTIFICATION OF FEATURES DISCUSSED IN A RELATED DOCUMENT. DATA WERE COMPILED FROM SOURCES AS LISTED IN THIS FIGURE. THE DATA SOURCES DO NOT GUARANTEE THESE DATA ARE ACCURATE OR COMPLETE. THERE MAY HAVE BEEN UPDATES TO THE DATA SINCE THE PUBLICATION OF THIS FIGURE. THIS FIGURE IS A COPY OF A MASTER DOCUMENT. THE MASTER DOCUMENT HARD COPY IS STORED BY GEOENGINEERS, INC. AND WILL SERVE AS THE OFFICIAL DOCUMENT OF RECORD.

N W E S

0 1400' 2800'

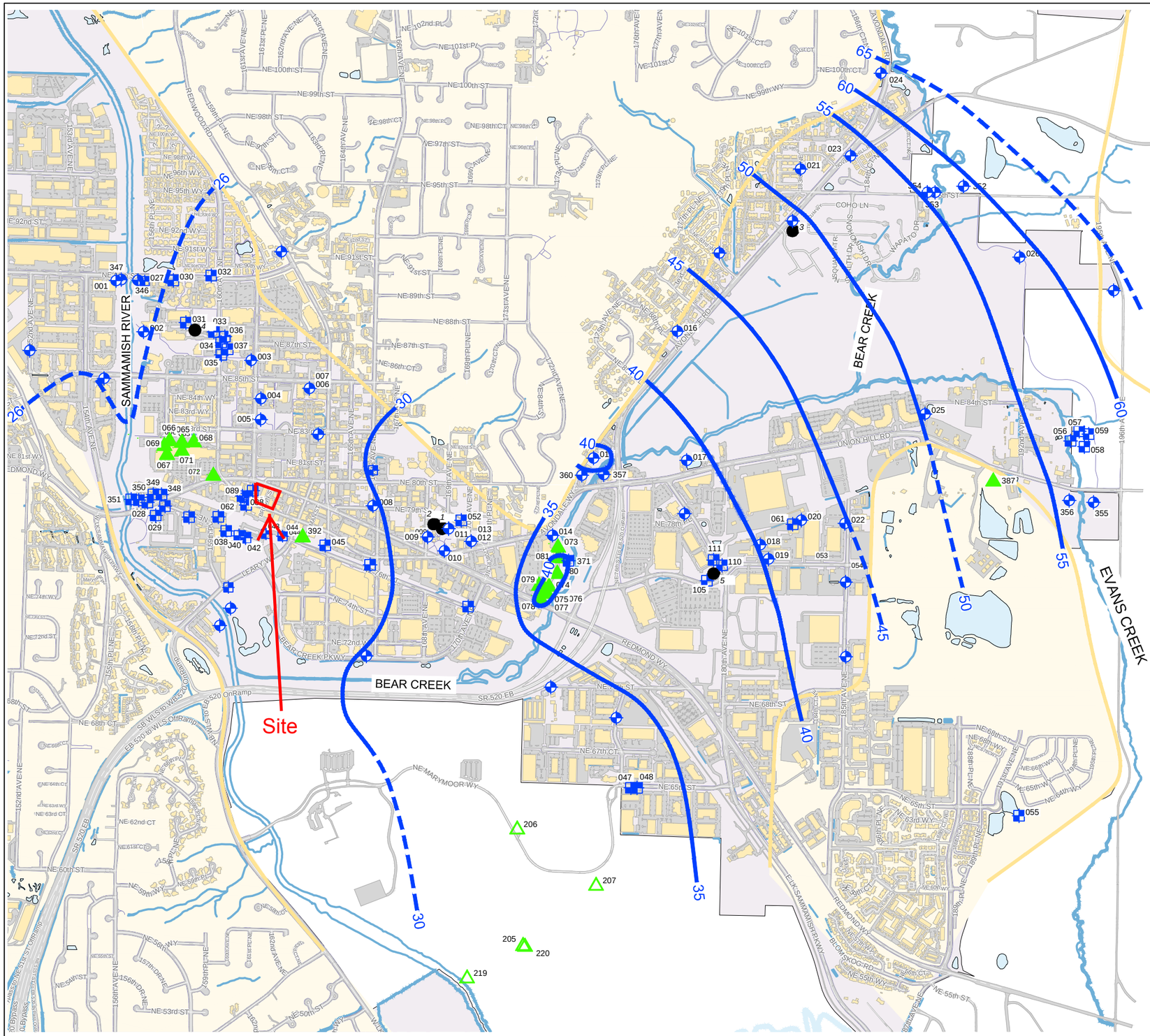
JANUARY 2013
GROUNDWATER SURFACE CONTOUR MAP
CITY OF REDMOND

REFERENCE: ALL TOPOLOGY PROVIDED BY CITY OF REDMOND MARCH 2008 INFORMATION SERVICES DEPARTMENT.

ATTACHMENT D

Attachment C

February 2015 Groundwater Surface Contour Map



LEGEND

GROUNDWATER LEVEL CONTOUR, BASED ON JANUARY 28, 2015 MEASUREMENTS, ELEVATION IN FEET (NAVD 88), DASHED WHERE INFERRED.

001 CITY OF REDMOND MONITORING WELL (INSTALLED AS PART OF THE GROUNDWATER MONITORING PROGRAM BETWEEN 2007 AND 2011)

027 CITY OF REDMOND MONITORING WELL (INSTALLED DURING OTHER INVESTIGATIONS)

065 PRIVATELY OWNED MONITORING WELL

205 KING COUNTY MONITORING WELL

1 CITY OF REDMOND WATER SUPPLY WELL

CITY OF REDMOND LIMITS

UPLAND AREAS

MONITORING WELL NAMES HAVE BEEN ABBREVIATED TO THE LAST THREE UNIQUE NUMBERS.

NOTES:
THE GROUNDWATER LEVELS IN MW055, MW330, AND MW038 WERE ANOMALOUSLY HIGH. THE GROUNDWATER LEVELS IN MW076 AND MW321 WERE ANOMALOUSLY LOW.

GEOENGINEERS

THE LOCATIONS OF ALL FEATURES SHOWN ARE APPROXIMATE. THIS FIGURE IS FOR INFORMATIONAL PURPOSES ONLY. IT IS INTENDED TO ASSIST IN THE IDENTIFICATION OF FEATURES DISCUSSED IN A RELATED DOCUMENT. DATA WERE COMPILED FROM SOURCES AS LISTED IN THIS FIGURE. THE DATA SOURCES DO NOT GUARANTEE THESE DATA ARE ACCURATE OR COMPLETE. THERE MAY HAVE BEEN UPDATES TO THE DATA SINCE THE PUBLICATION OF THIS FIGURE. THIS FIGURE IS A COPY OF A MASTER DOCUMENT. THE MASTER DOCUMENT HARD COPY IS STORED BY GEOENGINEERS, INC. AND WILL SERVE AS THE OFFICIAL DOCUMENT OF RECORD.

N W E S

0 1400' 2800'

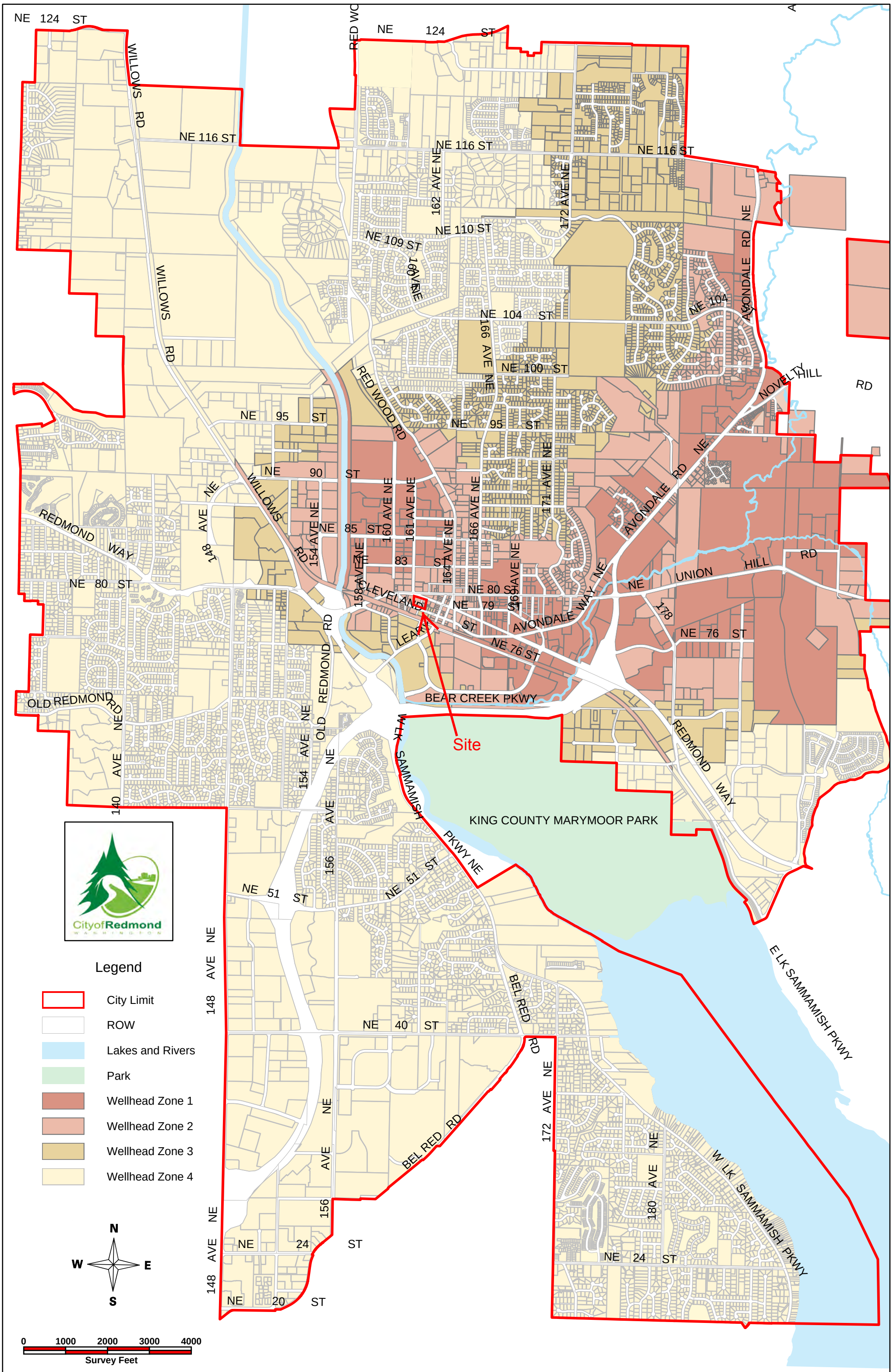
JANUARY 2015
GROUNDWATER SURFACE CONTOUR MAP
CITY OF REDMOND

FIGURE 1

REFERENCE: ALL TOPOLOGY PROVIDED BY CITY OF REDMOND MARCH 2008 INFORMATION SERVICES DEPARTMENT.

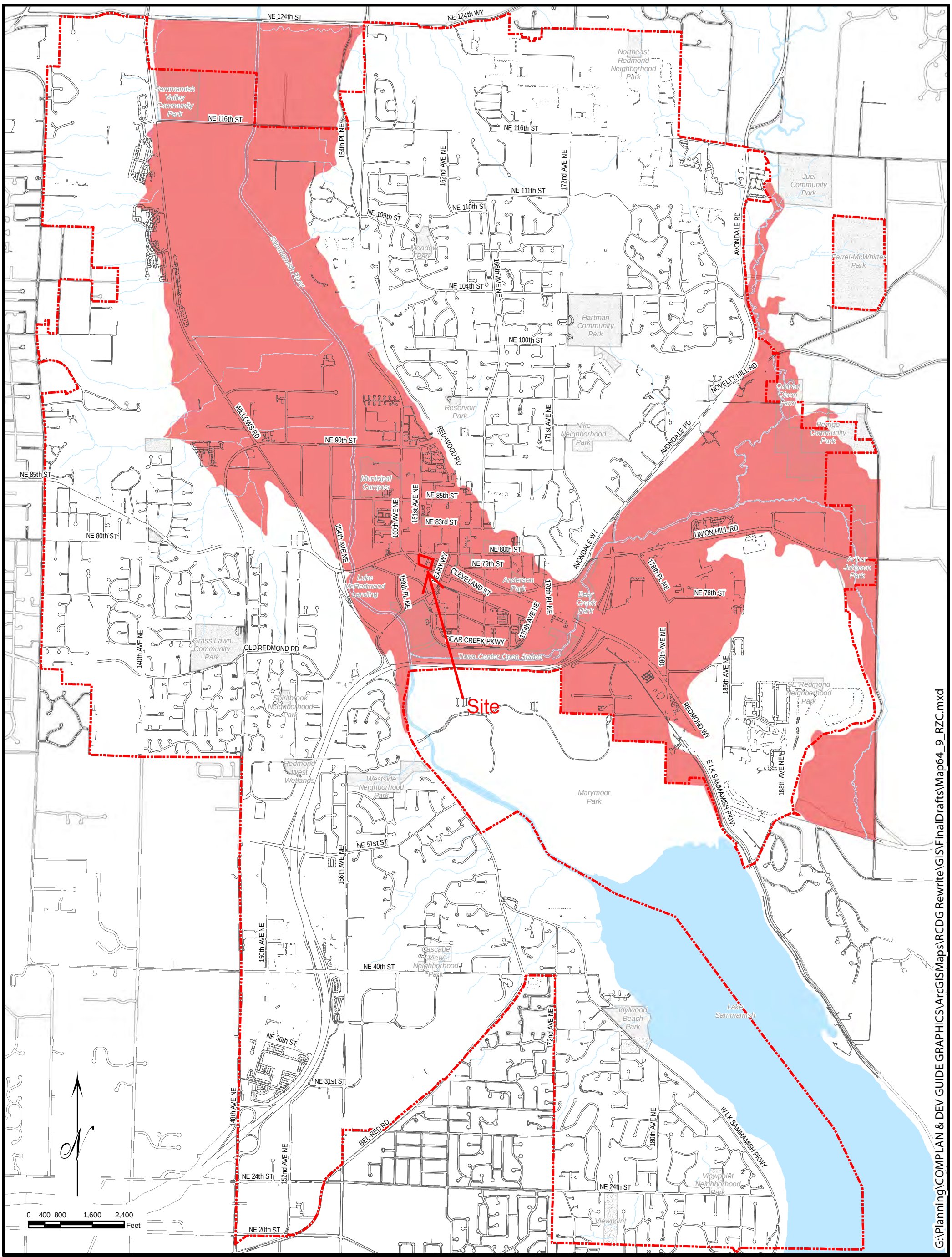
Attachment D

Map 64.6 - Wellhead Protection Zones


NE 124 ST
WILLOWS RD
NE 116 ST
RED WOOD RD
162 AVE NE
172 AVE NE
NE 110 ST
NE 109 ST
160 AVE NE
NE 104 ST
166 AVE NE
NE 100 ST
AVONDALE RD NE
NOVELTY HILL RD
NE 95 ST
NE 90 ST
NE 85 ST
NE 83 ST
NE 80 ST
NE 79 ST
NE 76 ST
REDMOND WAY
148 AVE NE
154 AVE NE
160 AVE NE
161 AVE NE
164 AVE NE
166 AVE NE
171 AVE NE
158 AVE NE
156 AVE NE
178 AVE NE
CLEVELAND ST
LEARY ST
AVONDALE WAY NE
UNION HILL RD NE
BEAR CREEK PKWY
OLD REDMOND RD
140 AVE NE
154 AVE NE
OLD REDMOND RD
Site
W LK SAMMAMISH PKWY
KING COUNTY MARYMOOR PARK
NE 51 ST
156 AVE NE
BEL RED RD
NE 40 ST
148 AVE NE
172 AVE NE
180 AVE NE
NE 24 ST
NE 20 ST
E LK SAMMAMISH PKWY
W LK SAMMAMISH PKWY
Legend
City Limit
ROW
Lakes and Rivers
Park
Wellhead Zone 1
Wellhead Zone 2
Wellhead Zone 3
Wellhead Zone 4
N
W
E
S
0 1000 2000 3000 4000
Survey Feet
Downloaded June 11, 2015

Attachment E

Map 64.9 - Seismic Hazard Areas



City of Redmond

Critical Areas Map
Effective: April 16, 2011

Map 64.9 Seismic Hazard Areas

Legend:

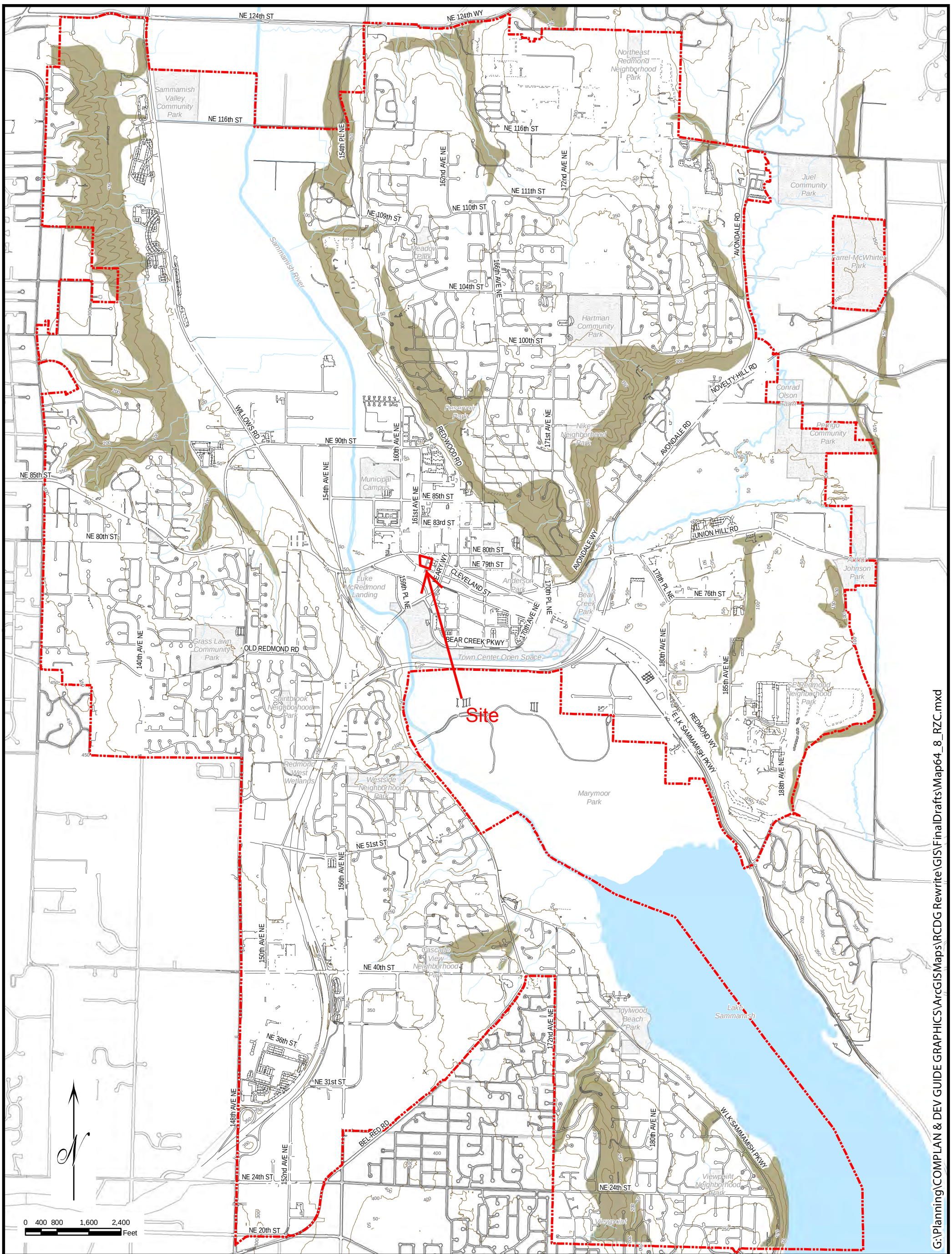
- Seismic Hazard Areas
- Redmond City Limits

Sources:
USGS Geologic Maps

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.

Attachment F

Map 64.9 - Erosion Hazard Areas



City of Redmond

Critical Areas Map
Effective: April 16, 2011

Map 64.8 Erosion Hazard Areas

Legend:

- Erosion Hazard Areas
- Contours
- Redmond City Limits

Sources:
SCS Soil Survey

Note:
This map shall be used as a general guide. It represents approximate locations. Consult the Critical Areas Ordinance (CAO) for reporting requirements. In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.