

**CRITICAL AREAS RECHARGE REPORT
PROPOSED TOWNHOUSES
8502 - 166TH AVE NE & 16640 NE 85TH ST
REDMOND, WASHINGTON**

G-3821

Prepared for

Mr. Erich Armbruster
Ashworth Homes LLC
14419 Greenwood Ave N #A179
Seattle, WA 98133

March 6, 2015

GEO GROUP NORTHWEST, INC.

13240 NE 20th Street, Suite 10

Bellevue, Washington 98005

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GEO Group Northwest, Inc.



March 6, 2015

G-3821

Mr. Erich Armbruster
Ashworth Homes LLC
14419 Greenwood Ave N #A179
Seattle, WA 98133

**SUBJECT: CRITICAL AREAS RECHARGE REPORT
PROPOSED TOWNHOUSES
8502 166TH AVE NE & 16640 NE 85TH ST
REDMOND, WASHINGTON**

Dear Mr. Armbruster:

GEO Group Northwest, Inc. has researched the groundwater conditions with regard to the proposed development and prepared the following report in order to meet the City of Redmond Wellhead Protection requirements for the proposed development. This report is based upon information obtained from our subsurface investigation at the site in February 2015 and available City of Redmond records.

Introduction

The project site consists of two residential lots located at the addresses 8502 - 166th Ave NE and 16640 NE 85th St in Redmond, Washington as shown on the attached **Plate 1 - Vicinity Map**.

An existing two-story multi-family apartment building is located at the 8502 166th Ave NE lot. A paved parking lot is located at the northern side of the existing building. The lot at 16640 NE 85th St is a currently vacant lot. Based upon the survey by Harstad Consultants (2008) we understand that a residential duplex house with garage was previously located at the site. We have attached a plan showing the existing conditions for the subject two lots with the added notation "House and Garage Removed" as **Plate 2 - Existing Site Plan**.

Based upon the preliminary plans provided by Daniel Umbach Architect we understand that the subject parcel is proposed to be developed with four townhouse buildings containing a total of eighteen units. Each of the buildings is to be located roughly near one of the four corners of the

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rectangular property boundaries with a paved parking/driveway area will be located between the buildings. Access to the property will be from a driveway on NE 85th Street. The current proposed plan is for the buildings to be arranged on the subject site as shown on **Plate 3 - Proposed Site Plan**. According to Mr. Umbach the approximate proposed impervious area is 19,000 square feet.

Per information provided by Mr. Umbach, the project architect, we understand that no known underground storage tanks are located at the subject lots. The proposed buildings are to be wood-framed. The new buildings' roofs are proposed to be low-slope with a likely application of a TPO membrane or PVC.

Geology, Subsurface Investigation and Gradational Analysis

Based upon the geologic map for the site vicinity the soils at the site are reportedly Quaternary-aged Advance Outwash (Qva). These soils typically consist of sands and gravels deposited by flowing water from the glaciers, during the most recent period of glacial advance. The map indicates that Vashon Till soils are located northeast of the site on the hillside nearby. Vashon Till soils are typically a dense to very dense mixture of silt, sand and gravel which were consolidated by glacial ice.

GEO Group Northwest, Inc., explored the subsurface soil conditions at the site by excavating two hand-auger borings at the subject site. One of the borings HA-1 was located near the western boundary of the eastern lot, roughly at the same elevation as the parking lot on 8502 166th Ave NE lot. The second boring HA-2 was excavated near the center of the eastern lot at the lowest elevation on-site at the previous building structure was location. The borings were advanced to a maximum depth of 39-inches below the ground surface.

The underlying soils encountered at both of the boring locations were dense to very dense very silty SAND with gravel and gravelly silty SAND. At the HA-2 boring, at the apparent previous building pad on the eastern lot, an 18-inch thickness of apparent construction debris (concrete and brick rubble and disturbed soils) overlies the dense very silty SAND with gravel (native soil).

The underlying soils observed at the site appear to be the Vashon Till, per the geologic map for the site vicinity.

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Groundwater seepage was observed at a depth of 30-inches bgs at the lowest boring location, located at the center of the eastern lot. This seepage is likely a perched layer of seepage within the apparent glacial till deposit. No groundwater seepage was encountered boring near the boundary between the eastern and western lots. It should be noted that groundwater conditions may fluctuate seasonally, depending on rainfall, surface runoff and other factors.

A soil sample of the underlying native soil (30-39" below ground surface) deposit was obtained from the HA-2 boring. Gradational analysis was performed using this sample and the soil was classified as a very silty SAND with gravel. The silt content for this soil sample was found to be 18%. The results of the Gradational Analysis are attached as **Plate 4 - Gradational Analysis**.

Based upon the gradational analysis the sampled soil has grain size $D_{10} = 0.03$ mm. In accordance with the commonly used correlation $K = C \times (D_{10})^2$ where $C = 100$ (1/cm-sec) the site soils may be assumed to have a short-term percolation rate of 47 min/inch or infiltration rate of 1.3 inches/hour for this soil. Correction factors for plugging and the high groundwater table should be applied if an infiltration system is to be installed. In general, the site soils are not favorable for infiltration due to their silty gradation, dense to very dense condition and apparent high groundwater seepage level.

Because the groundwater seepage level was observed at a depth of only 30-inches below ground surface at one of the boring locations and due to the relatively impermeable soil conditions we do not recommend infiltration of site stormwater at the project site.

City of Redmond Wellhead Protection - Critical Areas

There is a shallow aquifer located below portions of the City of Redmond. Wellhead Protection is a requirement for Class A water systems in order to protect people using groundwater for drinking supplies. Based upon the City of Redmond Wellhead Protection program mapping the a portion of the subject development site is located within Wellhead Protection Zone 1, which is considered to be a Critical Area. The portion not located in Wellhead Protection Zone 1 is located in Wellhead Protection Zone 2. Water which falls on any property located within Zone 1 is estimated to have the shortest time-frame (6 months) from the time it enters the aquifer until it reaches a drinking water well. The City of Redmond Code requires that a Critical Area Report (C.A.R.) be prepared for development within Wellhead Protection Zone #1 & #2. The attached **Plate 5 -Wellhead Zones** shows the subject site in relation to the Wellhead Protection Zone.

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Based upon the City of Redmond Critical Area reporting requirements a written level 2 hydrogeologic assessment is required for the proposed development due to the following:

1. Based upon Dan Umbach the proposed development will include approximately 19,000 square feet of impervious site area which is greater than the 5,000 square foot standard.

Site History

Based upon our review of King County records the property at 8502 166th Ave NE has been developed with an a residential apartment building since that building was built in 1975. We are not aware of the property use prior to that time. A residential duplex home with garage was located at the 16640 NE 85th St lot prior to 2012 when it was demolished. We are not aware of when this residence was constructed or what the property use was prior to that time.

Literature Review

We have reviewed the following documents previously prepared for another planned development at the subject site:

“Level II Hydrogeologic Report, Proposed Redmond Town Center Condominiums, Redmond, King County, Washington”, Terracon Project No. 81077006, Zipper Zeman Associates, Inc., April 6, 2007.

“Draft Geotechnical Report, Proposed Multi-Family Development, 8502 166th Ave NE and 16933 NE 85th St, Redmond, Washington”, Job No. 81065239, Zipper Zeman Associates, Inc., January 5, 2006.

Hydrogeologic Assessments

The following list documents our evaluation of the site with regard to the City of Redmond Hydrogeologic Assessment criteria listed in the Critical Areas Reporting Requirements. For each item we note the requirement followed by our response.

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Level One Hydrogeologic Assessment shall include:

- a. Available information regarding the 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.

Response:

As noted above and corroborated in the referenced hydrogeologic report by Zipper Zeman Associates (ZZA) the observed site soils consist of very silty SAND with gravel and gravelly silty SAND. These soils are consistent with the nearby mapped Vashon Till deposits. These soils are in general relatively impermeable and are not suitable for infiltration.

We observed groundwater seepage at a depth of 30-inches below ground surface at the HA-2 boring location. We assume that this is perched water within the till deposit and it is not part of the deeper underlying aquifer.

The previous investigation by Zipper Zeman Associates (ZZA) reportedly found perched groundwater seepage at depths of 6-feet and 16.5-feet below ground surface at their two boring locations. ZZA opined that due to the presence of glacial till near the surface direct recharge of the underlying aquifers due to infiltration at the subject site is minimal.

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

Response:

The depths of observed groundwater seepage at the site are noted above. The scope of work by GEO Group Northwest, Inc., and apparently also, ZZA was not designed to determine groundwater flow direction. However, perched groundwater generally consists of precipitation which has slowly over-time built up within a sandy soil lense. It generally has very little flow direction or gradient as it comes to an equilibrium within the lateral and vertical extent of the sandy soil zones.

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Based upon records provided by the City of Redmond the closest monitoring wells to the subject site are labeled MW006, MW007 and MW340 as shown on the attached **Plate 6 - Monitoring Wells**. The City of Redmond monitoring wells located close to the subject site but also downhill from the site most recently reported groundwater elevation levels on 1/30/14 at 25.31-feet for MW006, 25.34-feet for MW007 and 28.24-feet for MW340.

We could find no groundwater information for points located topographically uphill from the subject site.

The groundwater gradient at the site is non known. We have attached a image of the City of Redmond Depth to Groundwater Elevation Contour Map as **Plate 7 - Groundwater Elevations** to show the City's known groundwater contours.

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

Response:

Based upon our site visit observations we are not aware of any production wells or monitoring wells located at the subject site. The subject site is located within 1,300 feet of the City of Redmond monitoring wells MW006, MW007, MW331 and MW340. We have previously noted the groundwater elevation data for several of these monitoring wells. In addition, we have reviewed City of Redmond data and found that the most recent groundwater elevation measurement for the monitoring well MW331 is 26.36-feet on 1/30/14.

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

Response:

Based upon our review of City of Redmond provided information we are not aware of any critical areas, including surface waters, within 1,300 feet of the project site.

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

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Response:

There is no known water quality data for the subject site. Water quality data for the water collected at the City's production wells which are outside of the 1,300 foot area is attached as **Appendix A - Redmond Water Quality Report - Summer 2014.**

- f. Best management practices proposed to be utilized.

Response:

We recommend that the following Best Management Practices be utilized during and following construction in order to mitigate the risk of degradation of the groundwater supplies. More specific recommendations and plans are provided later in this report to meet the requirements of the Level 2 Assessment.

1. Proper care should be taken to prevent spills or leaks of hazardous materials. This should include using secondary containment methods if fueling or equipment repair is anticipated for construction work.
2. If spills or leaks of hazardous materials occur then soil and groundwater should be removed and/or mitigated in accordance with legal guidelines.
3. Hazardous materials should be disposed of in accordance with legal requirements. We recommend consulting online information such as provided at:
 - a. kingcounty.gov/solidwaste/facilities/hazwaste
 - b. www.ecy.wa.gov/waste
4. Appropriate signs and/or documentation should be provided to future property owners informing them of the site location within a Critical Aquifer Recharge Area including the aforementioned BMP recommendations.

Level Two Hydrogeologic Assessment shall include:

- a. 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.

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Response:

We have provided all available information for the water and elevation quality data for the site vicinity in the Level One Assessment noted above. Due to the known historic use of the site as residential and no known hazardous waste release/spill at the site this requirement is not applicable to the site. This requirement is applicable to land uses such as typically involved with gas stations and dry-cleaning facilities.

- b. Groundwater monitoring plan provisions.

Response:

Because the proposed use is residential, there are no plans for hazardous material storage or use , there are no plans for stormwater infiltration and because the site soils are relatively impermeable and unlikely to allow for significant aquifer recharge it is our opinion that no groundwater monitoring is necessary.

- c. Discussion of the effects of the proposed project on the groundwater quality and quantity, including:
- (i) Predictive evaluation of groundwater withdrawal effects on nearby wells and surface water features.
 - (ii) Predictive evaluation of contaminant transport based on potential releases to groundwater.
 - (iii) Predictive evaluation of groundwater (recharge, elevation, dewatering feasibility, constructability, discharge permitting, etc.) on the proposed project.

Response:

The currently proposed project has a greater impervious area (19,000 sq. ft) than the existing roof and pavement impervious area. However, it is important to note that the existing surficial soils at the site are relatively impervious. Therefore, it is our opinion that the current groundwater recharge from the project site to the primary aquifer is currently low and the majority of precipitation at the site either flows off-site via runoff or flows into the perched groundwater seepage zones which may eventually allow for lateral transport off-site. Consequently, the addition of impervious surfacing at the subject site will have little or negligible effect on the

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groundwater recharge from the subject site. Accordingly we anticipate no measurable effect on nearby groundwater wells and surface water features as a result of the proposed development.

GEO Group Northwest, Inc., does not anticipate contaminant transport from the proposed project since no hazardous materials are anticipated at the subject site and because there is very little likely groundwater recharge from the site.

Based upon our understanding of the proposed project the development will require shallow excavations for the new improvements. According to Mr. Dan Umbach the deepest anticipated excavation may be around 8-feet below ground surface near the northeastern corner of the property. It is possible that a perched area of groundwater seepage may be encountered at some of the shallow excavations. If that is the case then we anticipate that the seepage will likely be transitory; an emptying of the sandy perched soil layer at the excavation. This water can then be collected and potentially discharged to the stormwater system. Any perched seepage zones which intercept the development such as at footing drains can be collected and discharged to the stormwater system. We recommend that if water seepage is encountered at temporary excavation slopes areas than the slopes should have an inclination of no steeper than 1H:1V for the construction time period.

- d. 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.

Response:

The proposed development is to be multi-family residential and no elevators are proposed. Consequently, we anticipate no significant use or storage of hazardous materials beyond that normally encountered at residential units. There is the possibility for future homeowners to use and/or store automotive related products and craft related products such as solvents and various petroleum products, however, we assume that these will be small quantities and that these products will be properly stored, used and disposed of in accordance with laws and regulations. In addition, any leakage or spills from vehicles if not properly collected and disposed of by the vehicle owner, will be collected at the stormwater collection system.

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At the time of construction we anticipate that construction equipment such as excavators and other machinery may be used which present a risk of contamination to the site soils if a spill or fuel/oil discharge were to occur. Because of the impermeability of site soils we do not anticipate significant risks to the primary aquifer as result of accidental fuel/oil discharge. We have prepared a spill plan which is included below and we recommend that Protection Standards be implemented in accordance with our response to section f, below, in order to mitigate these risks.

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

Response:

In general terms we recommend that hazardous materials stored on-site be stored in sealed and closed containers protected from weather and separated from the ground surface by slabs or pavements.

During construction we recommend that the contractor take care to adequately maintain their equipment such that leaks or accidental discharges of hazardous materials do not take place. Additionally, the contractor should follow the Protection Standards and Spill Plan presented below.

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

Response:

We recommend that the Redmond Protection Standards During Construction be added to the project plans in its entirety and shall serve as the plan for mitigating risks of hazardous materials release during the project. We have reproduced below the Protection Standards which should be added to the plans:

RZC 21.64.050(D)(3)(f):

Protection Standards During Construction. The following standards shall apply to construction activities occurring where construction vehicles will be refueled on-site and/or the quantity of

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hazardous materials that will be stored, dispensed, used, or handled on the construction site is in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid, exclusive of the quantity of hazardous materials contained in fuel or fluid reservoirs of construction vehicles. As part of the City's project permitting process, the City may require any or all of the following items:

1. A development agreement;
2. Detailed monitoring and construction standards;
3. Designation of a person on-site during operating hours who is responsible for supervising the use, storage, and handling of hazardous materials and who has appropriate knowledge and training to take mitigating actions necessary in the event of fire or spill;
4. Hazardous material storage, dispensing, refueling areas, and use and handling areas shall be provided with secondary containment adequate to contain the maximum release from the largest volume container of hazardous substances stored at the construction site;
5. Practices and procedures to ensure that hazardous materials left on-site when the site is unsupervised are inaccessible to the public. Locked storage sheds, locked fencing, locked fuel tanks on construction vehicles, or other techniques may be used if they will preclude access;
6. Practices and procedures to ensure that construction vehicles and stationary equipment that are found to be leaking fuel, hydraulic fluid, and/or other hazardous materials will be removed immediately or repaired on-site immediately. The vehicle or equipment may be repaired in place, provided the leakage is completely contained;
7. Practices and procedures to ensure that storage and dispensing of flammable and combustible liquids from tanks, containers, and tank trucks into the fuel and fluid reservoirs of construction vehicles or stationary equipment on the construction site are in accordance with the Redmond Fire Code, RMC Chapter 15.06; and
8. Practices and procedures, and/or on-site materials adequate to ensure the immediate containment and cleanup of any release of hazardous substances stored at the construction site. On-site cleanup materials may suffice for smaller spills whereas cleanup of larger spills may require a subcontract with a qualified cleanup contractor. Releases shall immediately be contained, cleaned up, and reported if required under RMC Chapter 13.07.120. Contaminated soil, water, and other materials shall be disposed of according to state and local requirements.

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- g. 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.

Response:

For the permanent condition GEO Group Northwest, Inc., is not aware of any equipment or structures which if they failed would result in a hazardous impact. For the construction conditions we recommend that the aforementioned Protection Standards serve as a spill plan.

- h. 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. Attached copies of all historical and current reports and sampling results.

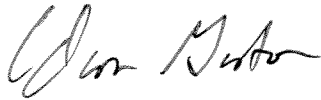
Response:

GEO Group Northwest, Inc., is not aware of any past environmental investigations, sampling, spills or incidents involving contaminated soil or groundwater at the site. As far as we know the site has only been used as residential property so it is unlikely that there are any historical records regarding these sorts of incidents.

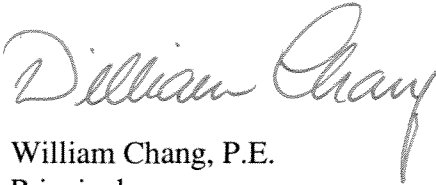
We appreciate this opportunity to have been of service to you on this project. We look forward to working with you as this project progresses. Should you have any questions regarding this report or need additional consultation, please feel free to call us.

Sincerely,

GEO Group Northwest, Inc.



Adam Gaston
Project Engineer



William Chang, P.E.
Principal

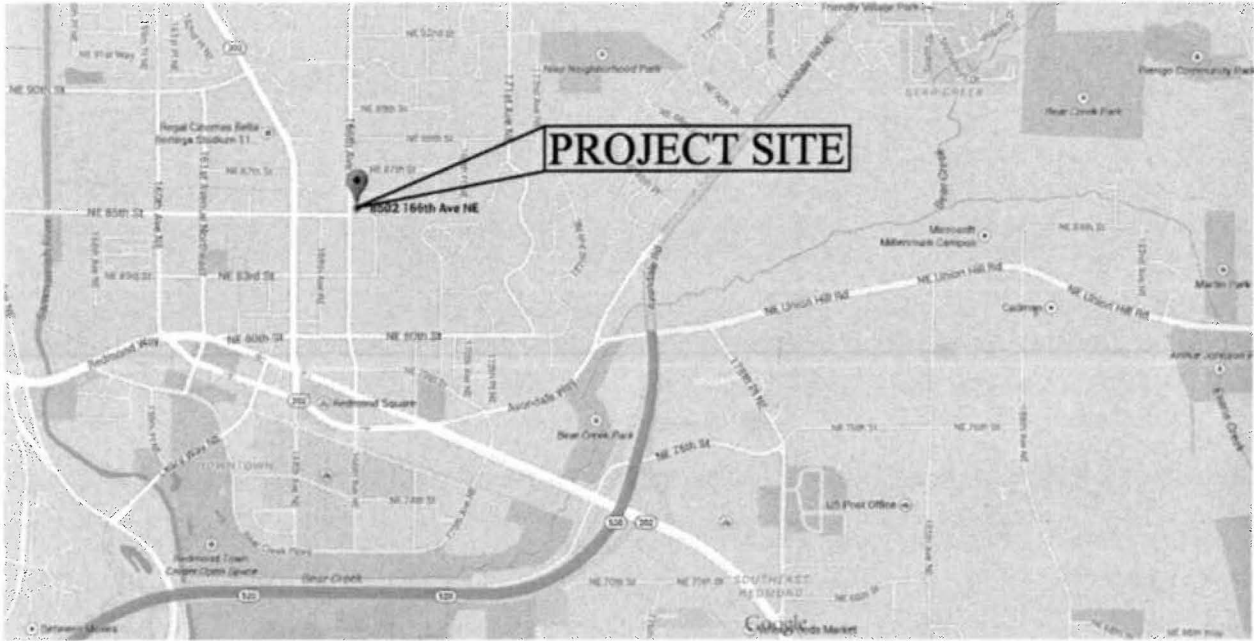


GEO Group Northwest, Inc.

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attachments: Plate 1 - Vicinity Map
 Plate 2 - Existing Site Plan
 Plate 3 - Proposed Site Plan
 Plate 4 - Gradational Analysis
 Plate 5 - Wellhead Zones
 Plate 6 - Monitoring Wells
 Plate 7 - Groundwater Elevations
 Appendix A - Redmond Water Quality Report - Summer 2014.



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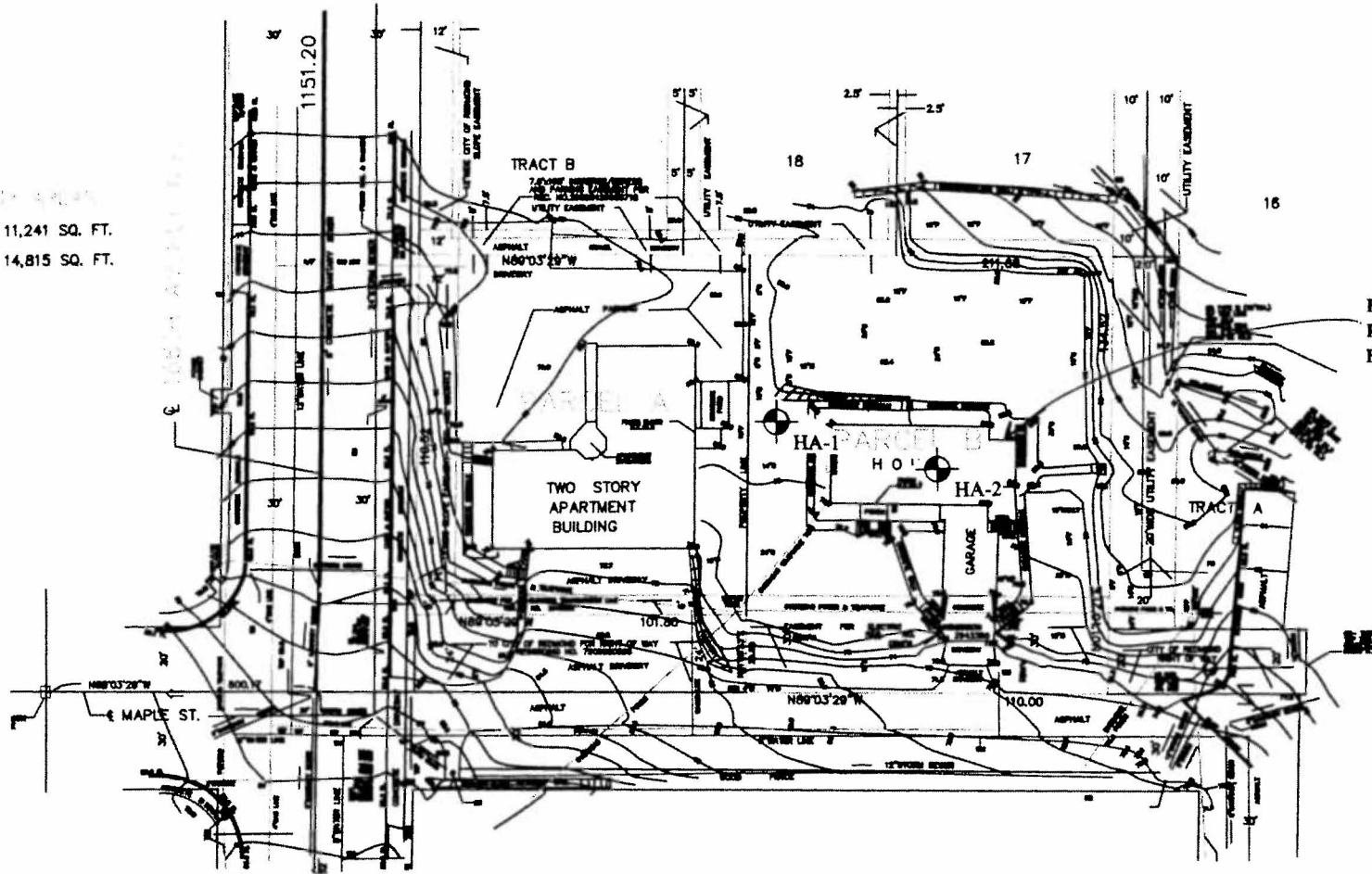
13240 NE 20th Street, Suite 10, Bellevue, WA 98005
Phone 425/649-8757 FAX 425/649-8758
Email info@geogroupnw.com

VICINITY MAP

8502 - 166TH AVE NE & 16640 NE 85TH ST
SEATTLE, WASHINGTON

SCALE: NTS	DATE: 3-4-15	MADE: AG	JOB NO.: G-3821	PLATE: 1
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PARCEL A 11,241 SQ. FT.
 PARCEL B 14,815 SQ. FT.




HOUSE AND GARAGE
 REMOVED PRIOR TO
 FEB. 2015

BASED UPON THE SURVEY BY
 HARSTAD CONSULTANTS, NOV.
 2008 AND MODIFIED BASED ON
 GEO GROUP NW OBSERVATIONS,
 FEB. 2015.

LEGEND

 = BORING NUMBER AND APPROXIMATE LOCATION

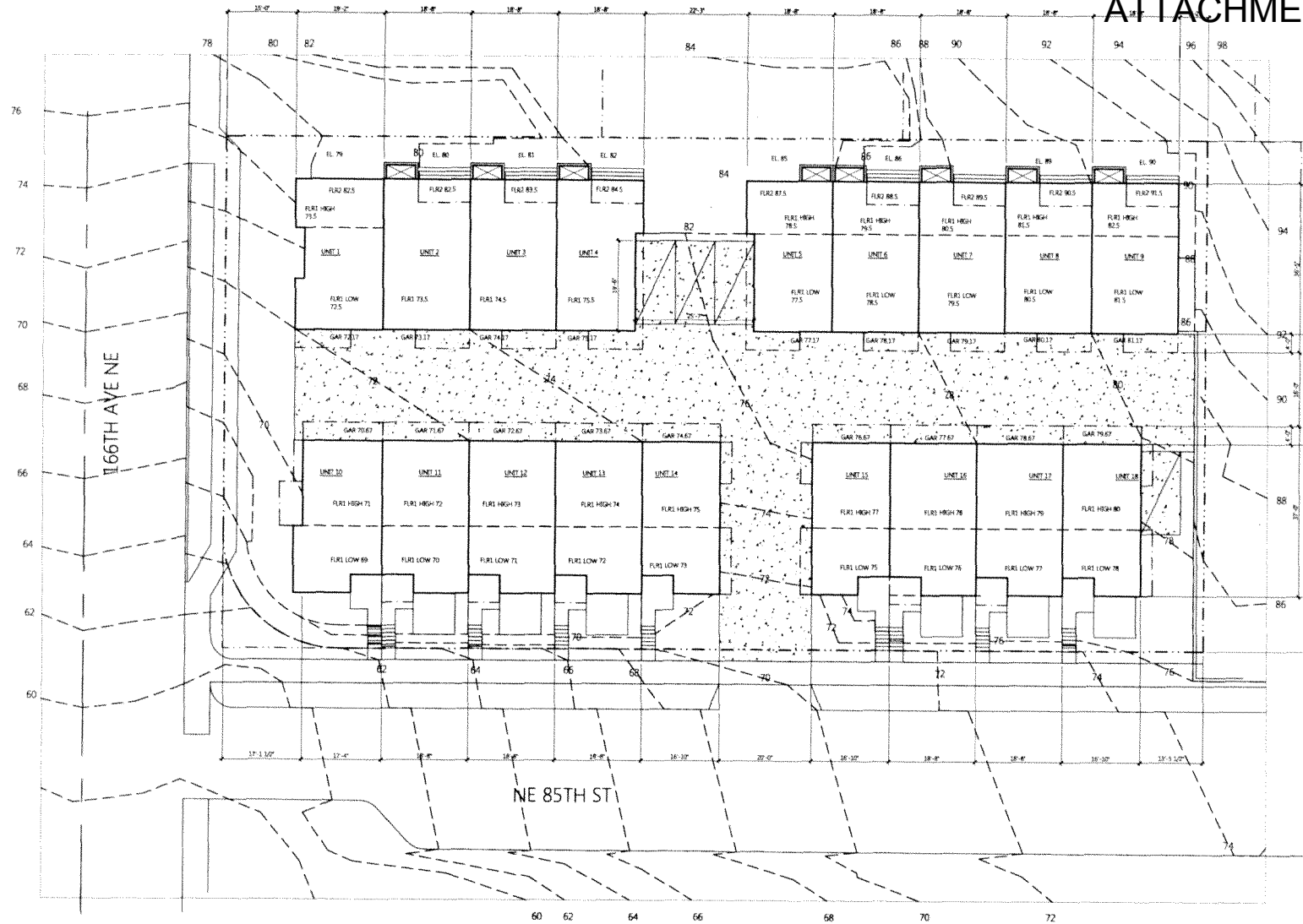
HA-1

 **Group Northwest, Inc.**

13240 NE 20th Street, Suite 10, Bellevue, WA 98005
 Phone 425/649-8757 FAX 425/649-8758
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EXISTING SITE PLAN
 PROPOSED TOWNHOMES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON

PROJECT #: G-3821
 DATE: 3-4-15
 DRAWN: AG
 CHECKED: WC
 SCALE: NTS
 PLATE: 2



BASED UPON THE PRELIMINARY PLAN BY DANIEL UMBACH, 2-9-15.



Group Northwest, Inc.

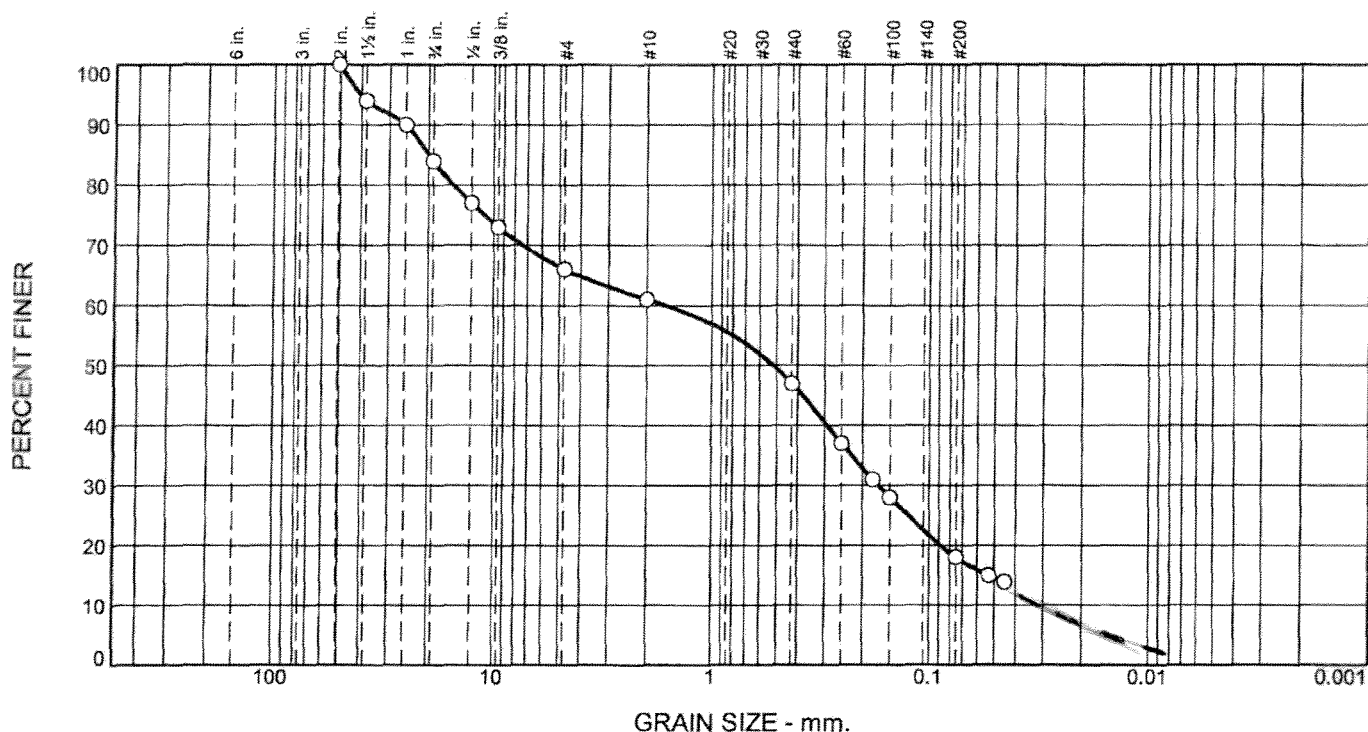
13280 NE 20th Street, Suite 10, Bellevue, WA 98005
 Phone 425/649-8757 FAX 425/649-8758
 Email info@geogroupnw.com

PROPOSED SITE PLAN
 PROPOSED TOWNHOMES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON

PROJECT #: G-3821
 DATE: 3-4-15
 DRAWN: AG
 CHECKED: WC
 SCALE: NTS

PLATE: 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.0	18.0	5.0	14.0	29.0	18.0	

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1.5"	94.0		
1"	90.0		
3/4"	84.0		
1/2"	77.0		
3/8"	73.0		
#4	66.0		
#10	61.0		
#40	47.0		
#60	37.0		
#80	31.0		
#100	28.0		
#200	18.0		
#270	15.0		
#325	13.9		

* (no specification provided)

Material Description
Brn, V Silty Sand with gravel

Atterberg Limits (ASTM D 4318)
PL= NP LL= NV PI=

Classification
USCS (D 2487)= SM AASHTO (M 145)= A-1-b

Coefficients
 D₉₀= 25.4000 D₈₅= 19.9317 D₆₀= 1.6451
 D₅₀= 0.5169 D₃₀= 0.1696 D₁₅= 0.0530
 D₁₀= C_u= C_c=

Remarks
Equipment: 53, 58, 66, 141

Date Received: 2/13/15 Date Tested: 2/17/15
 Tested By: M. Blackwell
 Checked By: M. Blackwell
 Title: Quality Manager

Source of Sample: G-3821 166th Townhomes
 Sample Number: S-2

Depth: 30" - 39"

Date Sampled: 2/13/15



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GRADATIONAL ANALYSIS

8502 - 166TH AVE NE & 16640 NE 85TH ST
 SEATTLE, WASHINGTON

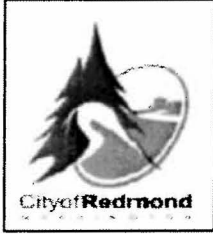
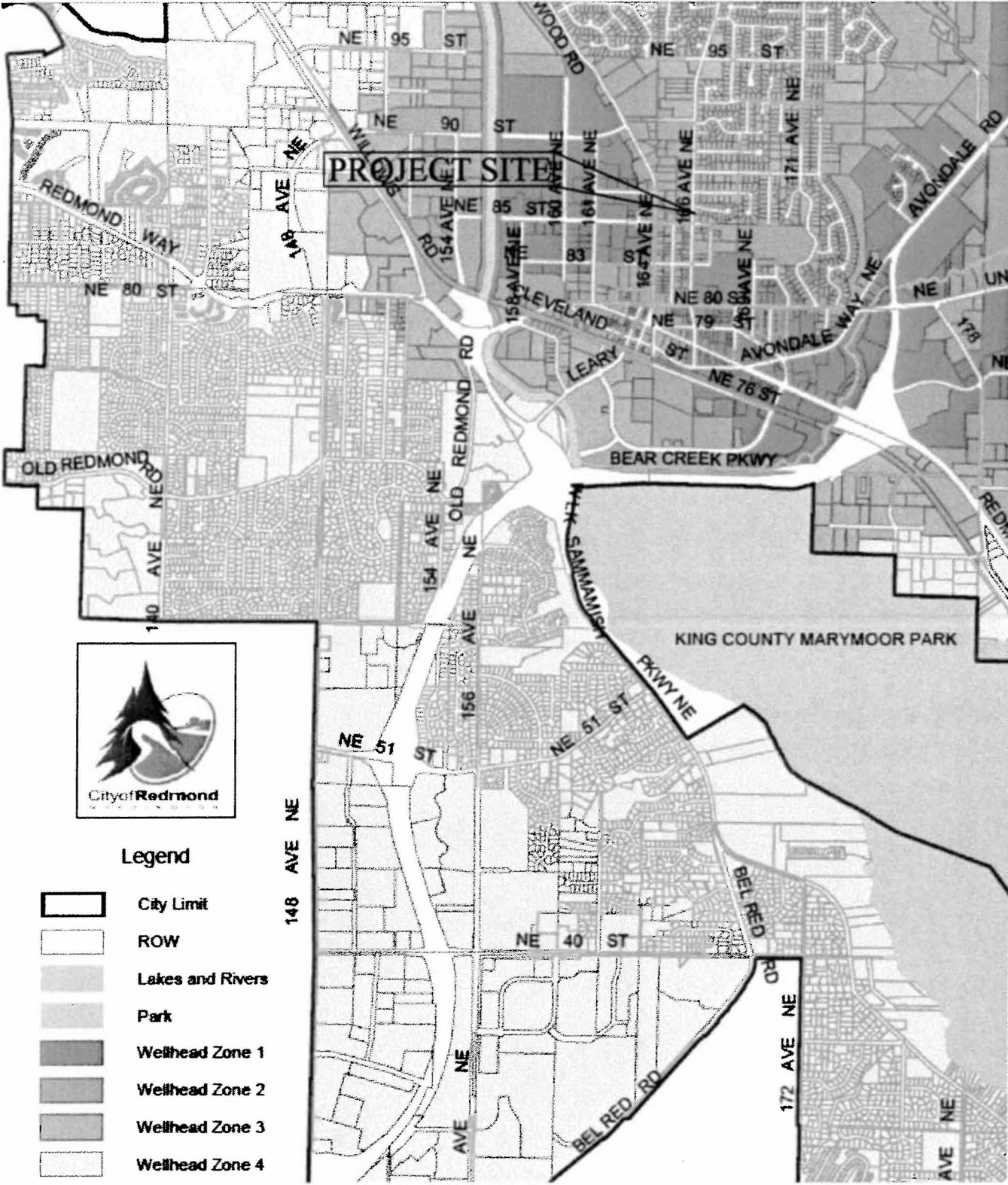
SCALE: NTS

DATE: 3-4-15

MADE: AG

JOB NO.: G-3821

PLATE: 4



- Legend**
- City Limit
 - ROW
 - Lakes and Rivers
 - Park
 - Wellhead Zone 1
 - Wellhead Zone 2
 - Wellhead Zone 3
 - Wellhead Zone 4

BASED UPON ONLINE WELLHEAD ZONE MAP BY CITY OF REDMOND.



Group Northwest, Inc.

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Phone 425/649-8757 FAX 425/649-8758
Email info@geogroupnw.com

WELLHEAD ZONES

8502 - 166TH AVE NE & 16640 NE 85TH ST
SEATTLE, WASHINGTON

SCALE: NTS	DATE: 3-4-15	MADE: AG	JOB NO.: G-3821	PLATE: 5
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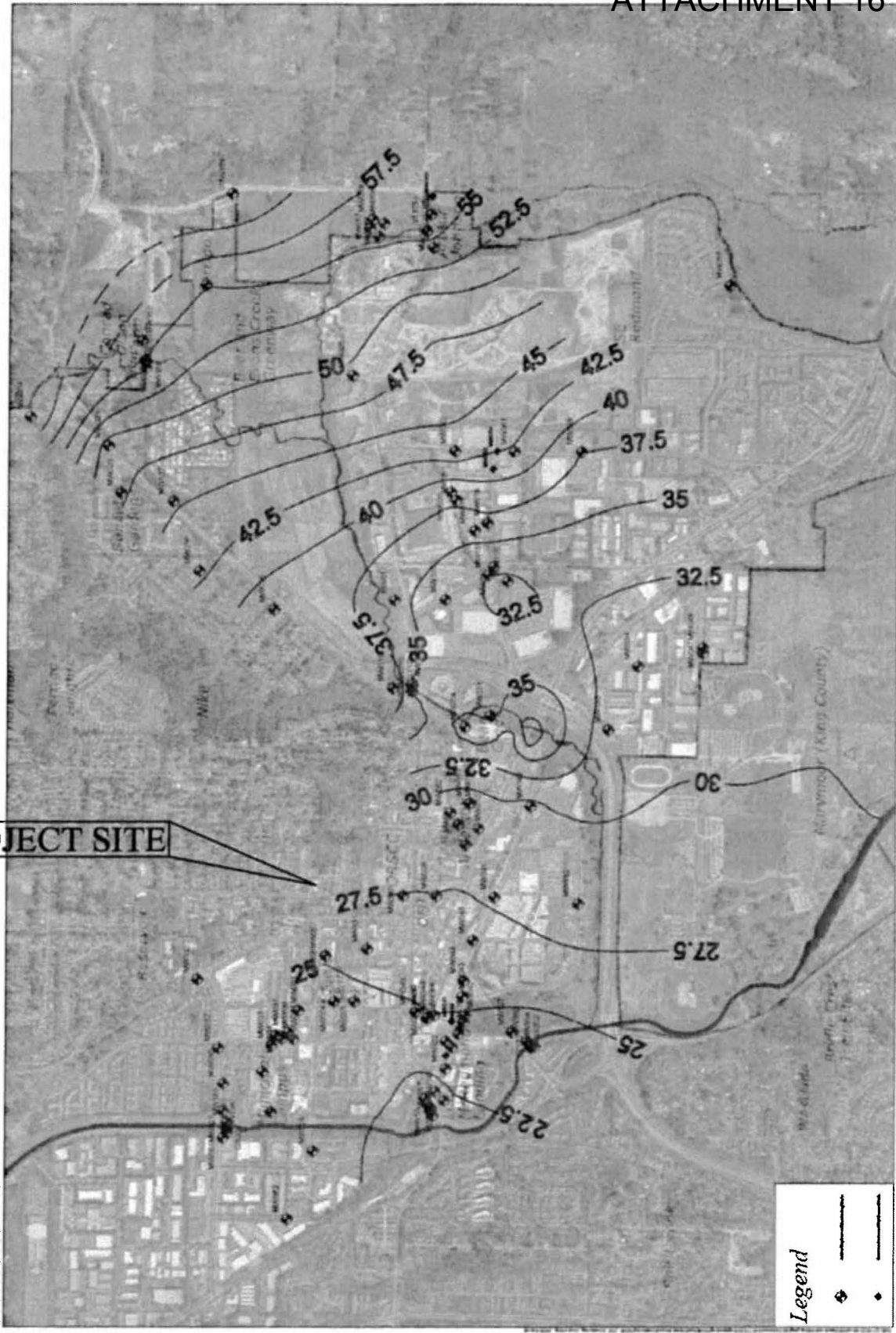
Groundwater Elevation Contour Map - July 29, 2014 City of Redmond, Washington



City of Redmond
Draft Date 03/02/15



PROJECT SITE



Disclaimer: This map is created and maintained by the NR DIVISION, PW DEPARTMENT, of the City of Redmond, Washington. For reference purposes only. The City makes no guarantee as to the accuracy or completeness of the data shown on this map.

BASED UPON GROUNDWATER ELEVATION CONTOUR MAP - JULY 29, 2014 BY CITY OF REDMOND.



Group Northwest, Inc.

13240 NE 20th Street, Suite 10, Bellevue, WA 98005
Phone 425/649-8757 FAX 425/649-8758
Email info@geogroupnw.com

GROUNDWATER ELEVATIONS

8502 - 166TH AVE NE & 16640 NE 85TH ST
SEATTLE, WASHINGTON

SCALE: NTS

DATE: 3-4-15

MADE: AG

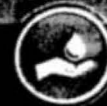
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APPENDIX A:
REDMOND WATER QUALITY REPORT
SUMMER 2014
G-3821

City of Redmond
WATER QUALITY REPORT

YOUR DRINKING WATER



SUMMER 2014 PWS ID: 71650B



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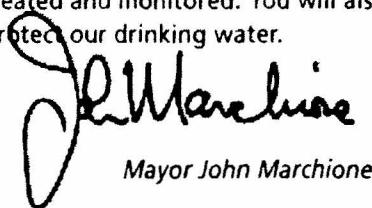
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CITY OF REDMOND

all about your drinking water

Safe public drinking water is something we all expect and deserve. In Redmond our sources of supply continue to be pure and plentiful, but they are also vulnerable to contamination and depletion. Our Wellhead Protection Program and the Source Improvement Project, as well as facility and security upgrades, are examples of our commitment to preserving the quality and quantity of this precious resource.

In this annual report you will learn where your drinking water comes from. You'll learn what is in it, and how it is protected, treated and monitored. You will also learn about ways we all can help to conserve and protect our drinking water.



Mayor John Marchione



INFORMATION FROM THE EPA

The sources of drinking water (both tap and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals, and can pick up substances resulting from the presence of animal or human activity.

Substances and contaminants that could be present in source water include:

Microbes such as viruses and bacteria, which may come from septic systems, livestock, and wildlife.

Inorganic chemicals such as salts and metals, which may be naturally-occurring or result from urban stormwater runoff, wastewater discharges, and farming.

Pesticides and herbicides from agriculture, urban stormwater runoff, and residential uses.

Organic chemicals both synthetic and volatile, which are by-products of industry and can also come from gas stations, dry cleaners, urban stormwater runoff, and septic systems.

Radioactive contaminants, which can be naturally-occurring or result from petroleum production or mining activities.

In order to ensure the safety of tap water, the EPA regulates the amount of contaminants allowed in public drinking water. The FDA regulates the contaminants in bottled water, which must provide a similar degree of safety.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 800-426-4791.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at 800-426-4791.

DID YOU KNOW...

There is NO DETECTABLE lead or copper in any of the sources of Redmond drinking water.

The water system is **tested daily** for safety and purity



The City of Redmond incorporated in 1912 after a devastating fire. Incorporation allowed the city to tax business and build a water system.

The average household in Redmond uses roughly

177
gallons

of water per day.

Redmond's daytime population doubles. The water system is required to account for this increase.



WHERE DOES MY WATER COME FROM?

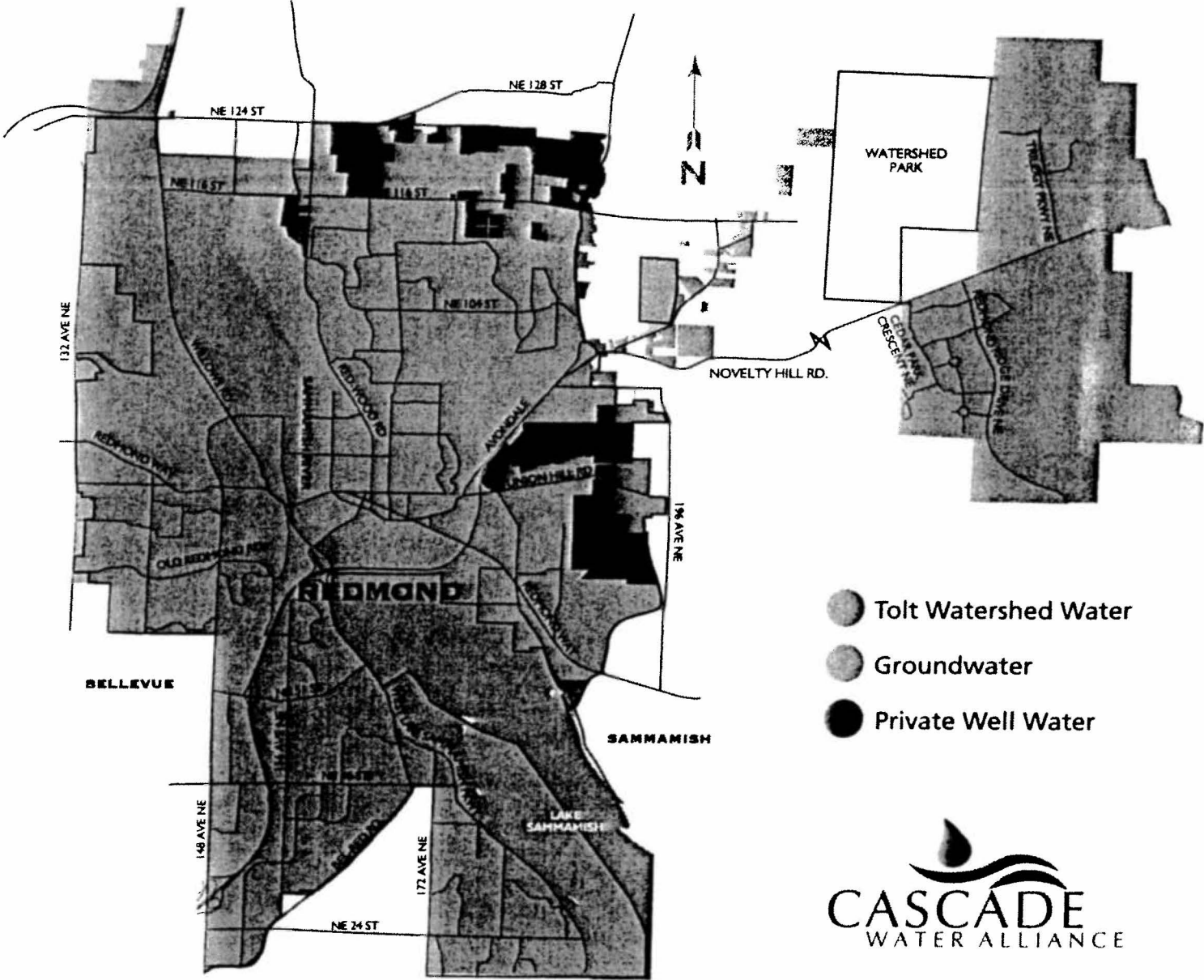
The City of Redmond has a hybrid water system. You may drink water from the Cascade Mountains or well water from an aquifer, depending on where you live.




THE TOLT WATERSHED

Residents on the west side of Lake Sammamish and the Sammamish River, and those who live in Redmond Ridge and Trilogy are served water that comes from the Tolt Watershed in the Cascade Mountains.

THE GROUNDWATER SYSTEM

Residents east of Lake Sammamish and the Sammamish River drink well water from our aquifers. During the summer, water from the Tolt will be blended with the groundwater to help meet peak summer demand.



-  Tolt Watershed Water
-  Groundwater
-  Private Well Water



THE TOLT WATERSHED

From the Cascade Mountains to your tap

The Tolt Reservoir and Watershed are located 15 miles east of Redmond in the Cascade Mountains. Rivers, streams, and snowmelt are impounded here to make up the reservoir supply. The water is filtered and treated and then travels through a supply pipeline to Redmond and other eastside water districts on its way to Seattle. The City of Seattle owns the Watershed and pipeline. Redmond, as a member of the Cascade Water Alliance, buys this water and both Seattle and Redmond monitor and test it to maintain quality.

Watershed Protection

The Tolt Watershed covers nearly 14,000 acres and is closed to public access. Seattle's aggressive watershed protection plan safeguards the water supply from degradation

and human intrusion. However, according to the State Department of Health, all surface waters in Washington State are given a susceptibility rating of "high" whether or not contaminants have been detected. Contamination that might occur would most likely be from soil erosion or animal activity.

Treatment

Water treatment of the Tolt supply consists of filtration, ozonation, chlorine disinfection, and fluoridation. Calcium oxide and CO₂ are added to help reduce the water's natural corrosive effect on plumbing. Filtration removes organic material and makes the water cleaner and clearer. Ozone kills tough potential pathogens like giardia and cryptosporidium.

2013 WATER QUALITY DATA—TOLT SYSTEM

Detected Compounds	Units	Levels		EPA Limits		Typical Sources
		Average	Range	MCLG	MCL	
FLUORIDE	ppm	0.8	0.7 - 0.9	4	4	Additive for dental health
TURBIDITY	NTU	0.06	0.04 - 0.38	NA	TT	Soil runoff
TTHM	ppb	27.3	15.1 - 39.2	NA	80	Chlorination by-products
HAA5	ppb	29.7	15.3 - 44.6	NA	60	Chlorination by-products
CHLORINE	ppm	0.89	0.14 - 1.49	NA	4 MRDL	Additive that kills germs
BARIUM	ppb	1.9	(one sample)	2000	2000	Erosion of natural deposits
NITRATE	ppm	0.13	(one sample)	10	10	Erosion of natural deposits
CADMIUM	ppb	0.35	(one sample)	5	5	Erosion of natural deposits
Untreated Water						
TOTAL ORGANIC CARBON	ppm	1.2	1.1 - 1.4	NA	TT	Naturally present in the environment
CRYPTOSPORIDIUM	#/100L	ND	ND	NA	NA	Naturally present in the environment

MCLG: (maximum contaminant level goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLG's allow for a margin of safety.

MRDL: (maximum residual disinfectant level)

MCL: (maximum contaminant level): The highest level of a contaminant that is allowed in drinking water. MCL's are set as close to the MCLG as feasible using the best available treatment technology.

NTU: A measurement of water clarity. High turbidity can interfere with disinfection.

PPM: (Parts Per Million): 1 ppm = 1 mg/L

PPB: (Parts Per Billion): 1 ppb = 1 ug/L

TT: (treatment technique): A required process intended to reduce the level of a contaminant in drinking water.

NA: Not Applicable

OTHER USEFUL TOLT DATA

• Water Hardness = 27.7 mg/L or 1.6 grains per gallon. *This water is soft.* • pH = 8.1 – 8.6 • Alkalinity 17.7 mg/L

A list of other contaminants that were not detected, are secondary or unregulated, is available upon request.

THE GROUNDWATER SYSTEM

Redmond's renewable resource

In Redmond, east of the Sammamish River, there are underground, water-bearing formations called aquifers. For 60 years the aquifers have supplied 35% of Redmond's drinking water. In 2013, the City's wells pumped 907 million gallons from the aquifers. This resource is considered to have a high vulnerability to potential contamination because the aquifers are extremely shallow.

Groundwater Protection

In 2003, Redmond established a Wellhead Protection Program as a way to help protect our groundwater from contamination and depletion. The Wellhead Protection staff is responsible for:

- Gathering hazardous materials data and visiting businesses to help identify and eliminate sources of pollution that could contaminate groundwater.
- Reviewing development proposals to ensure that groundwater will not be adversely impacted.

- Collecting groundwater levels and samples from monitoring wells throughout the City.

As a result of the Wellhead Protection Program, Redmond is in compliance with the three components of the State's Source Water Assessment Program: Protection Area Delineation, Contaminant Source Inventory, and Susceptibility Assessment. To learn more, contact Amanda Balzer at abalzer@redmond.gov or call 425-556-2753.

Treatment

Our groundwater is treated for safety and dental health with two common drinking water additives: sodium fluoride and chlorine. Chlorine acts as a safety net against disease causing germs. The well water is adjusted for optimum pH. At most wells we use air stripping towers which release CO2 from the water as a way of raising the pH. At Well #4, sodium hydroxide is used. Increasing the pH makes the water less corrosive to household plumbing.

2013 WATER QUALITY DATA – GROUNDWATER SYSTEM

Detected Compounds	Units	Levels		EPA Limits		Typical Sources
		Average	Range	MCLG	MCL	
FLUORIDE	ppm	0.80	0.50 - .98	4	4	Additive to promote dental health
NITRATE	ppm	0.75	0 - 1.6	10	10	Erosion of natural deposits
TTHM	ppb	17.8	10 - 25	NA	80	Chlorination by-products
HAA5	ppb	11.8	0 - 20	NA	60	Chlorination by-products
CHLORINE	ppm	0.81	0.23 - 1.27	NA	4MRDL	Additive that kills germs
PERCHLOROETHYLENE	ppb	0.60	0 - 1.2	NA	5	Discharge from dry cleaners
TOTAL COLIFORM	% positive	< 1%	1 out of 650	0	5%	Naturally present in environment
BARIUM	ppb	1.25	0 - 5	2000	2000	Naturally present in environment
CHROMIUM	ppb	.5	0 - 2	100	100	Naturally present in environment

MCLG: (maximum contaminant level goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLG's allow for a margin of safety.

MRDL: (maximum residual disinfectant level)

MCL: (maximum contaminant level): The highest level of a contaminant that is allowed in drinking water. MCL's are set as close to the MCLG's as feasible using the best available treatment technology.

NA: Not Applicable

NTU: A measurement of water clarity. High turbidity can interfere with disinfection.

PPB: (Parts Per Billion): 1 ppb = 1 ug/l

PPM: (Parts Per Million): 1 ppm = 1 mg/l

TT: (treatment technique): A required process intended to reduce the level of a contaminant in drinking water.

TTHM: (total trihalomethane): Disinfection by-products

HAA5: (Haloacetic acid): Disinfection by-products

OTHER USEFUL GROUNDWATER DATA

• Hardness = 60-90 mg/l (4-5 grains per gallon) This water is moderately hard. • pH = 7.5 - 7.9 • Alkalinity = 85-90mg/l

A list of other contaminants that were not detected, are secondary or unregulated, is available upon request.

KEEPING THE LEAD OUT

What you can do to help

There is no detectable lead or copper in any of the sources of Redmond drinking water. However, lead is a serious contaminant and can be found in the water of some homes due to older plumbing.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing.

The City of Redmond is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your cold water tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline, 800-426-4791, or www.epa.gov/safewater/lead. You can also get information from the Redmond Water Quality Office at 425-556-2800.



2013 LEAD AND COPPER CITYWIDE MONITORING PROGRAM

Compounds & Units	MCLG	90th Percentile Action Level*	90th Percentile Residential Level	# of Homes Exceeding Action Level*	Sources
LEAD (ppb)	0	15 ppb	3 ppb	1 out of 36	Corrosion of household plumbing
COPPER (ppm)	1.3 ppm	1.3 ppm	Not Detected	0 out of 36	Corrosion of household plumbing

* ACTION LEVEL: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

Since 1983, Redmond's drinking water has been treated to minimize corrosion in the home. A citywide monitoring program began in 1992, which tested water in homes most likely to have plumbing components with lead. Since that time, only 10 of 398 samples have exceeded the action level (15ppb) for lead. The next monitoring program will begin in June of 2015.

CROSS CONNECTION CONTROL PROGRAM

Redmond's Water Quality Office maintains a database of assemblies installed throughout the City. We monitor all testing and send customers an annual reminder notice. Your efforts in performing required testing is essential in protecting your drinking water.

Backflow Testing

If you have an irrigation system for your yard, fire suppression sprinkler system, boiler, pool/spa, or water feature, state law requires that you have a backflow prevention assembly installed to prevent contaminated water from flowing back into your drinking water—a serious health hazard.

Backflow assemblies fail for a variety of reasons. That's why state law requires them to be tested annually by a certified tester—to ensure that the assemblies will function if there is a backflow event.



Garden hoses can be hazardous to the water quality in your home.

To prevent backflow and keep your water safe DO NOT:

- Submerge a garden hose into anything that you would not want to drink.
- Use hose-end applicators to apply garden chemicals to your yard. When not in use, keep the hose bibs on the house in the "off" position. The spray nozzle at the end of the hose is not a safe shut off.

Protecting against potentially harmful backflow incidents is an important part in providing high quality drinking water. Redmond strives to provide the highest quality water to our customers, and protecting against potentially harmful backflow is a very important part of this effort. If you have any questions about the Cross Connection Control Program and testing of backflow assemblies, call Kathy Caldwell at 425-556-2847.



2013 ANNUAL WATER USE

Efficiency performance report

This report, which is required by the Washington State Department of Health (DOH) Water Use Efficiency Rule (WUE), includes information about our metering status, our distribution system leakage, and progress made towards our water conservation goals.

Metering and Distribution Leakage Summary

The Redmond water system is fully metered. The state requires that water suppliers maintain their distribution system leakage at 10% or less for a rolling 3-year average. The state recognizes that a certain amount of leakage is expected and unavoidable. The leakage is based on the total water produced by the wells and purchased from Cascade Water, less the amount of water sold to customers and used for other system purposes like flushing and fire fighting. The estimated total leakage for Redmond for 2013 was 5.45% and the rolling 3-year average is 4.87%, well within the state DOH leakage standard.

The City of Redmond has exceeded its original water conservation goal of saving of 178,000 gallons of water a day on an average day and 245,000 gallons of water per day during the peak season by the end of 2013 for existing customers. This goal was established on October 16, 2007 via a public hearing and was in effect from January 1, 2008 to December 31, 2013. A new water conservation goal, which must be updated every six years, was established on November 19, 2013 for years 2014 through 2019.

2013 Redmond Conservation Program Savings With Cascade

In addition to rebates and unit number savings, Cascade worked with Redmond to provide outreach to residents which included:

- Bringing the Cascade Conservation Road Show to Derby Days and Sustain Fest.
- Bringing the Sawy Gardener Program to residents to teach gardeners how to have beautiful landscapes without excessive water or chemicals.
- Providing thousands of conservation items to residents, businesses, apartment complexes and home owners associations.
- Providing irrigation efficiency training to businesses and other organizations to help them become better water managers.
- Developing presentations on rainwater harvesting and drip irrigation for classroom education programs.
- Participated in developing Washington State's new ecoPRO Sustainable Landscapes Certification Program.

For information about water conservation programs, please visit www.cascadewater.org.

2013 WATER CONSERVATION PROGRAM RESULTS

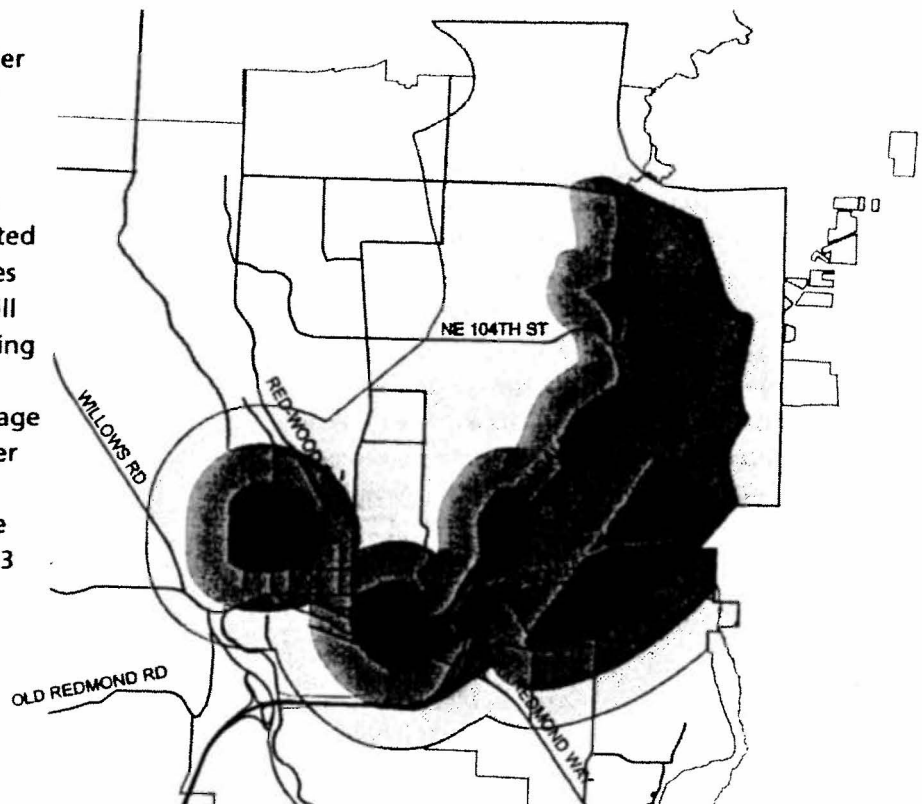
PROGRAM	ELIGIBLE CUSTOMER SECTORS			SAVINGS (GPD)
	Single Family	Multi-Family	Commercial	
Leak Detection Mailer/Check	X	X	X	18,571
Pre-Rinse Spray Valve Installations			X	822
Showerhead and Aerator Replacements			X	27,143
Web Page & Road Show Items	X			894
EST 2013 SAVINGS (Gallons Per Day)				47,430

WELLHEAD PROTECTION ZONES

Keep your drinking water safe

A primary source of Redmond's drinking water is groundwater. The Wellhead Protection Program works to protect our drinking water by managing areas around the City's water supply wells to prevent contamination.

The groundwater aquifer that provides the City with 35% of our drinking water is located beneath downtown Redmond and continues north up Avondale and east along Union Hill Road. Rainwater refills the aquifer by draining into streams and seeping down into the ground. The area where seepage and drainage has the most significant effect on the aquifer is known as the Critical Aquifer Recharge Area (CARA). The CARA is divided into three Wellhead Protection Zones (Zones 1, 2, and 3 shown on the map).



The zones are based on the time it takes a drop of water to travel from the point where it enters the aquifer to the point where it enters the nearest drinking water well. In Zone 1, groundwater takes six months or less to travel to the nearest drinking water well. In Zone 2, it takes one year or less, and in Zone 3 it takes up to 10 years. It is important to keep the water that gets to the aquifer clean as it becomes our drinking water.

- Zone 1 (6-month time of travel)
- Zone 2 (1-year time of travel)
- Zone 3 (10-year time of travel)

PROTECTING OUR GROUNDWATER

What you can do to protect your drinking water

The best way to protect our drinking water is to make sure pollution does not get into the environment around us, especially in the Critical Aquifer Recharge Areas (CARA).



Dispose of Hazardous Products Properly

Items such as used motor oil, oil-based paint, cleaning solvents, fuels, antifreeze, transmission and brake fluid, and pesticides and herbicides should never be dumped on the ground or into a stormwater drain on the street. For more information on proper disposal of hazardous materials visit King County's Local Hazardous Waste Management Program website at www.lhwmp.org.



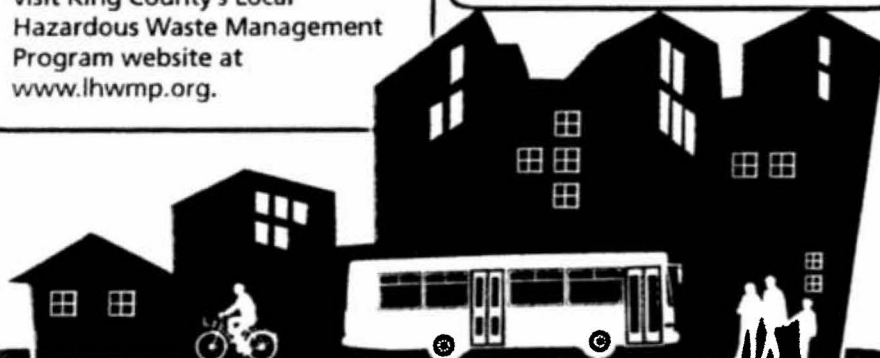
Limit your use of chemicals, fertilizers, pesticides, and other hazardous products

Use the least toxic products or methods available. Over application or misuse can cause these chemicals to make their way into surface water and groundwater. For more information, visit King County's website on Natural Yard Care www.lhwmp.org/home/gsgs.



Properly Maintain Your Septic System

If you have a septic system, pump it out on a regular basis (every three years depending on the tank and family size). Household hazardous wastes should never be flushed or put down the drain. This includes strong acids or bases, petroleum products, solvents, heavy metals and pesticides. For more information contact Public Health - Seattle & King County District Office at 206-296-4932.



If you own or operate a business in Redmond, evaluate your hazardous materials handling process:

- Properly store products and waste, both indoors and outdoors, utilizing secondary containment (a container to catch spills or leaks from the original container).
- Be prepared for spills. Have a spill kit and spill procedures in place and train employees how to use them.
- Keep lids on dumpsters and waste bins stored outside.
- Minimize use of toxic cleaning solvents, such as chlorinated solvents, and other toxic chemicals.
- For additional information on hazardous materials storage and handling or environmentally safer alternatives, contact our Wellhead Protection Pollution Prevention Specialist staff at 425-556-2714.



BE VIGILANT

If spills occur, clean them up immediately. Call Redmond's 24-hour Spill Hotline at 425-556-2868 to report spills.

wellhead protection



ADDITIONAL INFORMATION

**Redmond Public Works
Water Quality Office**
www.redmond.gov/environment/
drinkingwater
425-556-2800

Washington Department of Health
www.doh.wa.gov/ehp/dw
800-521-0323

Environmental Protection Agency
www.epa.gov/safewater
Safe Drinking Water Hotline
800-426-4791

American Water Works Association
www.drinktap.org
www.awwa.org

Redmond Wellhead Protection Program
www.redmond.gov/environment
425-556-2701

GET INVOLVED

It's your drinking water and your input is important. Attend and comment at City Council meetings on the first and third Tuesday of the month at 7:30 pm in the Council Chambers, located at 15670 NE 85th Street. Agendas for the meetings can be found on the City's website (www.redmond.gov) or posted in the lobbies of City Hall and the Public Safety Building.

WATER QUALITY REPORT TEAM

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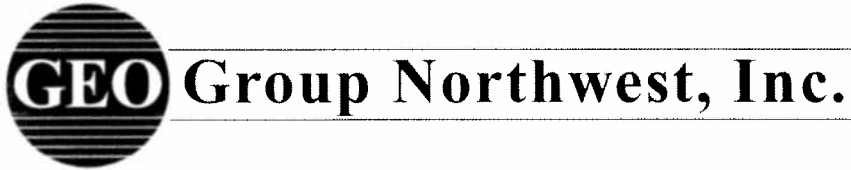
If you have questions about this report or about your drinking water, please contact Redmond's Drinking Water Quality section at kcaldwell@redmond.gov or lmward@redmond.gov.

Este informe contiene información muy importante sobre su agua de beber. Tradúzcalo o hable con alguien que lo entienda bien.

“本報告含有飲用水問題的重要信息，請人翻譯或與懂英文的人交談一下。”

이 보고서에는 식수에 관한 중요한 정보가 있습니다.





May 5, 2015

G-3821

Mr. Erich Armbruster
Ashworth Homes LLC
14419 Greenwood Ave N #A179
Seattle, WA 98133

**Subject: RESPONSE TO CITY OF REDMOND COMMENTS - 3/23/15
 PROPOSED TOWNHOUSES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON**

Ref: "Critical Areas Recharge Report, Proposed Townhouses, 8502 - 166th Ave NE & 16640
 NE 85th St, Redmond, Washington, G-3821", GEO Group Northwest, March 6, 2015.

Dear Mr. Armbruster:

Per the request of Dan Umbach, the project architect, we have prepared the following responses to the following City of Redmond comments with regard to the referenced Critical Areas Recharge Report.

We have reproduced the City's comments below and provided our responses:

Comment #1:

Provide date of exploration.

Response #1:

We excavated two hand-augered borings at the site on February 13, 2015.

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Comment #2

The aquifer is recharged downgradient by runoff from the site. Estimate the impact to runoff and groundwater recharge from the project intercepting runoff and interflow with a calculation (ex. water balance).

Response #2:

Based upon our review of the project's storm drainage analysis by PacLand (4-28-15) the existing site drainage basin is noted as discharging 0.28 cfs from the site during the 10 year 24-hour storm event. Following the proposed development the increase of impervious area is projected to discharge 0.51 cfs during the same storm event which indicates that the proposed development may theoretically decrease the potential infiltration and interflow in near surface soils by 0.23 cfs during the design storm event. Theoretically this calculation indicates a potential decrease in groundwater recharge due to the site development of up to 82 percent. This number is the maximum anticipated reduction in groundwater recharge. It is important to note that in actuality some of the precipitation at the site will also be lost to evapotranspiration. Also, it is our opinion that the existing underlying impervious soils likely already result in a greater proportion runoff/precipitation than estimated by the stormwater analysis presented by PacLand. Please note that a previous Level II Hydrogeologic Report was prepared for the project site by Zipper-Zeman Associates in 2007 (references below on pages 6-7). This report was also used as the reference in the PacLand report. In the Zipper-Zeman report from 2007 it is noted that in the opinion of Zipper-Zeman (now Terracon) direct recharge of the underlying aquifers due to site infiltration is minimal. GEO Group Northwest, Inc., agrees with this assessment based upon our confirmation that the underlying site soils consist of dense and relatively impervious glacial till.

Comment #3:

The project is located in zones 2 and 3, however, Wellhead Protection Zone 2 performance standards apply to the entire project.

GEO Group Northwest, Inc.

May 5, 2015
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Response #3:

GEO Group Northwest, Inc., concurs with this statement. Our report incorrectly stated the site is located in Wellhead Protection Zone 1. We hereby revise that to state Wellhead Protection Zones 2 and 3. Our referenced report noted performance standards which apply to the project and recommended that they be added to the project plans. To insure completeness we have attached a copy of the Wellhead Protection Zone Performance Standards.

Comment #4:

If building will have any masonry work, include or reference a plan for management of Masonry Cleaning wastewater management in this report. Also note the requirement for Protection Standards During Construction will be particularly important. Use only clean certified fill material for import to the site.

Response #4:

Based upon our discussions with the project architect, Mr. Dan Umbach, we are not aware of any masonry products proposed for the new development. The current design review plans indicate that cementboard is proposed for siding. It is our understanding that cementboard products do not generally require a washing process similar to masonry which has the potential to impact site stormwater. If masonry products are used at the site then we recommend that all water used for washing the product should be collected and treated prior to discharge or removed from the site and taken to an approved treatment facility. Masonry wash wastewater shall not be infiltrated or discharged to the stormwater system without first being treated in accordance with the City of Redmond requirements.

If fills are to be imported to the site than these fills should be from a WSDOT approved source site or should be approved by an engineer or geologist has having come from a clean site in accordance with the attached City of Redmond Fill Material Acceptance Guidance.

GEO Group Northwest, Inc.

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Comment #5:

Add a discussion about how groundwater should be managed on-site for this project, both during construction and long term. Show a cross-section of project with subsurface structures and seasonal high groundwater elevation.

Structures that are built within water table shall be of watertight construction as no permanent dewatering is permitted in Wellhead Protection Zones 1 and 2.

Response #5:

Currently, the project plans have not been developed with floor elevations. So it is not possible to provide an accurate cross-section of the development. However, we have attached Elevation Model Views V-7 and V-10 by Daniel Umbach which show how the project has been designed to step down the hillside thereby minimizing the amount of excavation which will occur. Based upon discussions with Mr. Umbach we understand that the deepest excavation below existing grade may have a depth of around 8-feet near the northeastern corner of the property.

Our subsurface investigation encountered groundwater seepage at a depth of 30-inches below grade at the area where the previous house was constructed at the 16640 NE 85th St lot. We described this seepage as being perched seepage within a sand lense within the underlying glacial till. It is important to note that this sand lense may be the same one encountered at a depth of 6-feet below ground surface at one of the Zipper-Zeman (Terracon) borings in 2007. It may also be a different non-continuous sand lense. In both cases it is critical to understand that the sand lenses within glacial till often are limited in areal extent and thickness and there is no simple and economical way to map the extent, thickness and water holding capacity of these water-holding layers without excavating the majority of the site and potentially many of the adjacent properties. In addition, there is no known connection between the perched seepage zones and the water-bearing aquifers. Precipitation which falls on the ground at the site or on adjacent properties may eventually migrate vertically into one of these sandy soil zones eventually filling it unless there is

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seepage at the ground surface with a continuous flow pathway or unless the seepage zone encounters subsurface development in which case the water may continue to follow the path of least resistance. It is also possible that these zones are very limited in size and they have filled over time and the water within has never migrated anywhere. The Zipper-Zeman borings also indicated that a perched seepage zone was located within a sandy lense at a depth of 16.5-feet at one of the borings. GEO Group Northwest is not aware of a natural linking of the perched seepage zones within the glacial till to the underlying aquifer. It is possible for non-natural (man-made subsurface structures) to create links between the perched seepage zones and the underlying aquifer such as at an underground utility line or poorly constructed water well, however, we are not aware that such structures exist at the subject site.

If at the time of construction groundwater seepage is encountered at the building pad or related development excavations then we recommend that the water be properly treated to remove suspended sediment as required and then discharged into the approved stormwater or sewer system.

If the perched seepage zones are encountered above the base of the building foundations then we anticipate that the permanent building dewatering system will capture this water for discharge to the stormwater system. There is no practical way of capturing this water and re-injecting it into the overlying glacial till since the underlying soils are relatively impermeable and this sort of discharge presents risks of damage to on-site and off-site structures such as pavements and retaining walls.

It is important to note that permanent dewatering by the building footing drains for localized perched seepage zones is not the same as permanent dewatering below the water table (within the underlying aquifer). As described above we have no evidence that permanent dewatering of perched seepage zones will have any adverse effect on the underlying aquifer.

May 5, 2015
8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington

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Comment #6:

A detailed Spill Plan will be required before construction. It can be included in the CAR or in the SWPPP.

Response #6:

The referenced Storm Drainage Analysis by Pacland (4-28-15) indicates that SWPPP will be prepared and provided with the construction drawings. GEO Group Northwest, Inc., has previously provided some documentation in our C.A.R. report from March 6, 2015 as to spill response procedures. We have reproduced and added to that information in preparing the attached Spill Plan. We recommend that this information be used in the preparation of the SWPPP and included with the construction documents.

Comment #7:

Provide a bibliography that includes study reports, maps, plans and other references used.

Response #7:

Our referenced C.A.R. indicates Literature Review on page 4. We have reproduced that list here and added additional information to this list:

Bibliography:

“Level II Hydrogeologic Report, Proposed Redmond Town Center Condominiums, Redmond, King County, Washington”, Terracon Project No. 81077006, Zipper Zeman Associates, Inc., April 6, 2007.

May 5, 2015
 8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington

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“Draft Geotechnical Report, Proposed Multi-Family Development, 8502 166th Ave NE and 16933 NE 85th St, Redmond, Washington”, Job No. 81065239, Zipper Zeman Associates, Inc., January 5, 2006.

“Geotechnical Report Update Letter, 166th Avenue Townhomes, 8502 166th Ave NE & 16640 NE 85th St, Redmond, King County, Washington, Terracon Project No. 81155022”, Terracon, April 29, 2015.

“Storm Drainage Analysis, The 166th Ave Townhomes”, PacLand, April 28, 2015.

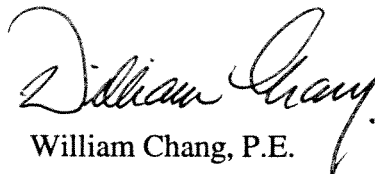
“Design Review Board Materials”, Daniel Umbach, including sheets: S-1, S-2, S-3, S-4, S-5, P-1, P-2, CV-1, C1.0, L-1, L-2, V-1, V-2, V-3, V-4, V-5, V-6, V-7, V-8, V-9, V-10, E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, E-9, E-10, E-11, E-12, E-13, E-14, A-1, A-2, A-3, A-4, A-5, Design Checklist, 03-30-15.

If you have any questions please feel free to call us.

Sincerely,
 GEO GROUP NORTHWEST, INC.



Adam Gaston
 Project Engineer



William Chang, P.E.
 Principal



Attachments: Copy of Wellhead Protection Zone Performance Standards (RZC)
 City of Redmond Fill Material Acceptance Guidelines
 Spill Plan
 Design Review Board sheets V-7 and V-10 - Elevation Views

cc: Dan Umbach

GEO Group Northwest, Inc.

B. Alteration of Critical Aquifer Recharge Areas. Alteration of critical aquifer recharge areas may only be permitted subject to the criteria in RZC 21.64.020.D, RZC 21.64.020.E, RZC 21.64.030.C, RZC 21.64.040.B, RZC 21.64.050.B, and RZC 21.64.060.D.

C. 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.

D. Wellhead Protection Zone Performance Standards.

1. Any uses or activities locating in the City of Redmond which involve storing, handling, treating, using, producing, recycling, or disposing of hazardous materials or other deleterious substances shall comply with the following standards that apply to the zone in which they are located. Residential uses of hazardous materials or deleterious substances are exempt from the following standards.
2. If a property is located in more than one wellhead protection zone, the Director of Public Works shall determine which standards shall apply based on an assessment evaluation of the risk posed by the facility or activity. The assessment evaluation shall include, but not be limited to: (a) the location, type, and quantity of the hazardous materials or deleterious substances on the property; (b) the geographic and geologic characteristics of the site; and (c) the type and location of infiltration on the site.

3. Development within Wellhead Protection Zones 1 or 2, and any facility or activity per RMC Chapter 13.07.100(A), shall implement the following performance standards:
- a. Secondary Containment.
 - i. The owner or operator of any facility or activity shall provide secondary containment for hazardous materials or other deleterious substances in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid or in quantities specified in the Redmond Fire Code, RMC Chapter 15.06, whichever is smaller.
 - ii. Hazardous materials stored in tanks that are subject to regulation by the Washington State Department of Ecology under WAC Chapter 173-360, Underground Storage Tank Regulations, are exempt from the secondary containment requirements of this section, provided that documentation is provided to demonstrate compliance with those regulations.
 - b. Vehicle Fueling, Maintenance, and Storage Areas. Fleet and automotive service station fueling, equipment maintenance, and vehicle washing 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 fluids into soil, surface water, or groundwater. Appropriate emergency response equipment and spill kits shall be kept on-site during transfer, handling, treatment, use, production, recycling, or disposal of hazardous materials or other deleterious substances.
 - c. Loading and Unloading Areas. Secondary containment or equivalent best management practices, as approved by the Director of Public Works, shall be required at loading and unloading areas that store, handle, treat, use, produce, recycle, or dispose of hazardous materials or other deleterious substances in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid.
 - d. Stormwater Infiltration Systems. Design and construction of new stormwater infiltration systems must address site-specific risks of releases posed by all hazardous materials on-site. These risks may be mitigated by physical design means or equivalent best management practices in accordance with an approved Hazardous Materials Management Plan. Design and construction of said stormwater infiltration systems shall also be in accordance with RMC Chapter 15.24.020 and the City of Redmond Clearing, Grading and Stormwater Technical Notebook, and shall be certified for compliance with the requirements of this section by a professional engineer or engineering geologist registered in the State of Washington.
 - e. Well construction and operation shall comply with the standards in RMC Chapter 15.24.095.
 - f. Protection Standards During Construction. The following standards shall apply to construction activities occurring where construction vehicles will be refueled on-site and/or the quantity of hazardous materials that will be stored, dispensed, used, or handled on the construction site is in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid, exclusive of the quantity of hazardous materials contained in fuel or fluid reservoirs of construction vehicles. As part of the City's project permitting process, the City may require any or all of the following items:
 - i. A development agreement;
 - ii. Detailed monitoring and construction standards;
 - iii. Designation of a person on-site during operating hours who is responsible for supervising the use, storage, and handling of hazardous materials and who has appropriate knowledge and training to take mitigating actions necessary in the event of fire or spill;
 - iv. Hazardous material storage, dispensing, refueling areas, and use and handling areas shall be provided with secondary containment adequate to contain the maximum release from the largest volume container of hazardous substances stored at the construction site;
 - v. Practices and procedures to ensure that hazardous materials left on-site when the site is unsupervised are inaccessible to the public. Locked storage sheds, locked fencing, locked fuel tanks on construction vehicles, or other techniques may be used if they will preclude access;

- vi. Practices and procedures to ensure that construction vehicles and stationary equipment that are found to be leaking fuel, hydraulic fluid, and/or other hazardous materials will be removed immediately or repaired on-site immediately. The vehicle or equipment may be repaired in place, provided the leakage is completely contained;
 - vii. Practices and procedures to ensure that storage and dispensing of flammable and combustible liquids from tanks, containers, and tank trucks into the fuel and fluid reservoirs of construction vehicles or stationary equipment on the construction site are in accordance with the Redmond Fire Code, RMC Chapter 15.06; and
 - viii. Practices and procedures, and/or on-site materials adequate to ensure the immediate containment and cleanup of any release of hazardous substances stored at the construction site. On-site cleanup materials may suffice for smaller spills whereas cleanup of larger spills may require a subcontract with a qualified cleanup contractor. Releases shall immediately be contained, cleaned up, and reported if required under RMC Chapter 13.07.120. Contaminated soil, water, and other materials shall be disposed of according to state and local requirements.
- g. **Fill Materials.** Fill material shall comply with the standards in RMC Chapters 15.24.080 and 15.24.095.
 - h. **Cathodic Protection Wells.** Cathodic protection wells shall be constructed following the standards in RMC Chapter 15.24.095.
 - i. **Underground Hydraulic Elevator Cylinders.** All underground hydraulic elevator pressure cylinders shall be constructed following the standards in RMC Chapter 15.24.095.
 - j. **Best Management Practices.** All development or redevelopment shall implement Best Management Practices (BMPs) for water quality and quantity, as approved by the Technical Committee, such as biofiltration swales and use of oil-water separators, BMPs appropriate to the particular use proposed, clustered development, and limited impervious surfaces.
4. **Development Within Wellhead Protection Zone 3 shall implement the following performance measures:**
- a. Compliance with the performance standards for vehicle fueling, maintenance and storage areas; loading and unloading areas; well construction and operation; fill materials; cathodic protection wells; underground hydraulic elevator cylinders, and best management practices in subsections D.3.b, D.3.c, D.3.e, D.3.h, D.3.i, and D.3.j of this section; and
 - b. Development Within Wellhead Protection Zone 4 shall implement best management practices (BMPs) for water quality and quantity as approved by the Committee.
5. **An incremental environmental improvement to a system protective of groundwater may proceed as follows:**
- a. Except as provided in subsection (b) below, the construction or location of an incremental improvement to a system protective of groundwater shall not be permitted to alter, expand, or intensify any legal nonconforming use or structure in a manner that increases the degree of nonconformity. However, upon the Technical Committee's approval of an incremental improvement to a system protective of groundwater, the improvement may be constructed without the property owner having to meet the following City codes:
 - i. The provisions of RZC 21.64 regarding critical areas buffers, if the footprint of the original system protective of groundwater is located within the same critical area buffer, and it can be demonstrated through the best available science that there will be no significant adverse impacts to the critical area and its buffer;
 - ii. The provisions of RZC 21.76.100.F.9.b and F.9.c requiring nonconforming structures, landscaping, and pedestrian system areas to be brought into compliance with current building, fire, or land use codes, to the extent that the requirement is triggered by the value or design of the incremental environmental improvement to a system protective of groundwater; and

ATTACHMENT 16

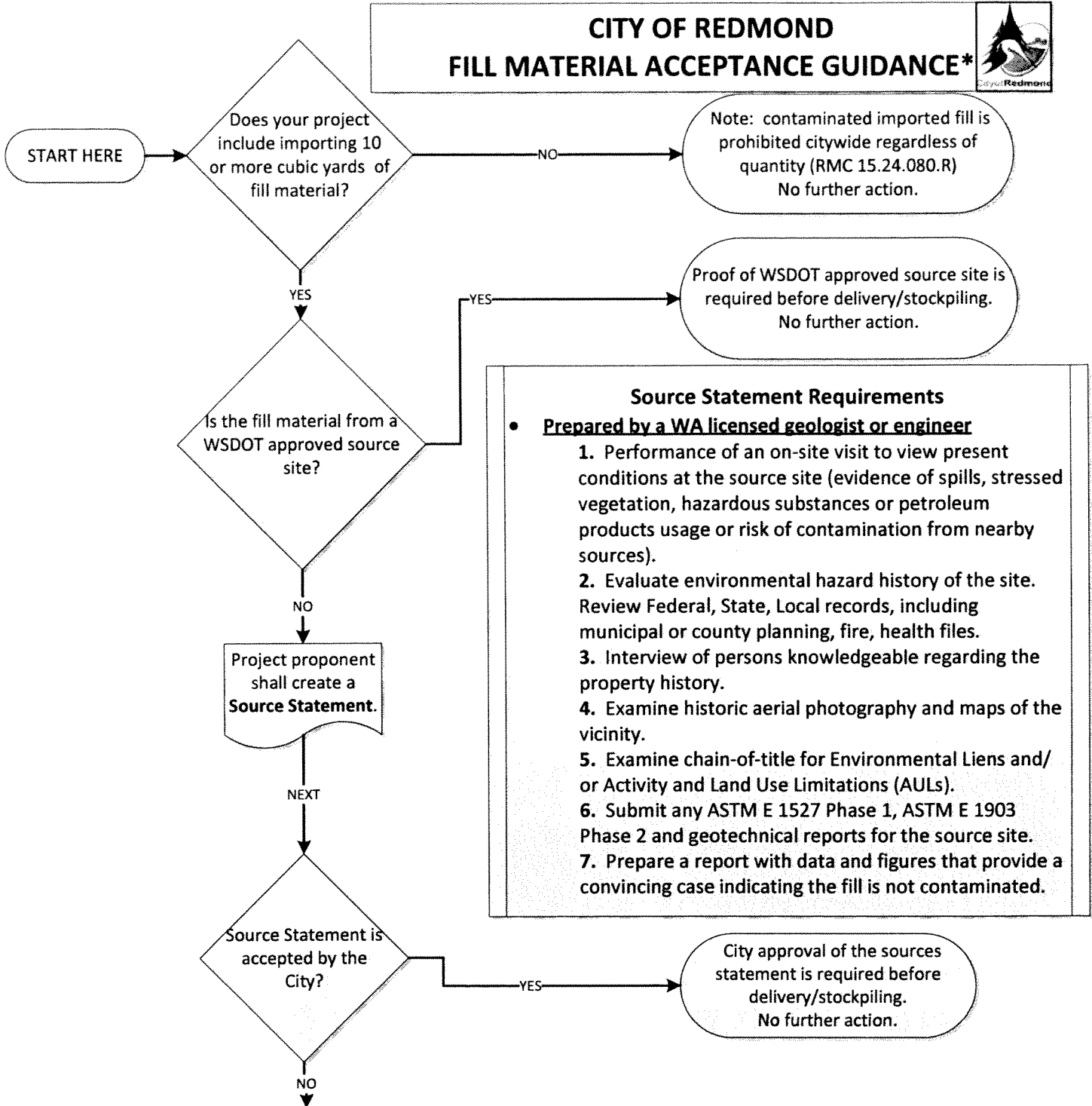
- iii. The provisions of RZC 21.64.050.C.1 prohibiting the redevelopment of certain land uses and activities in wellhead protection zones 1 and 2.

- b. Improvements required through the groundwater protection incentive program in order to mitigate potential stormwater impacts to groundwater may alter, expand, or intensify existing legal nonconforming uses and structures in a way that increases the degree of nonconformity where the Technical Committee determines that no economically, technologically, and environmentally reasonable alternative exists that meets the requirement to protect groundwater and fulfills the operational needs of the existing development served by the improvements. By way of example and not by way of limitation, groundwater protection incentive program improvements may alter, expand, or intensify the degree of nonconformity of existing landscaping, parking, and covered storage structures that are legally nonconforming, as long as the requirements of this subsection are met.

(Ord. 2704)

Effective on: 8/31/2013

**CITY OF REDMOND
FILL MATERIAL ACCEPTANCE GUIDANCE***



Source Statement Requirements

- **Prepared by a WA licensed geologist or engineer**
 1. Performance of an on-site visit to view present conditions at the source site (evidence of spills, stressed vegetation, hazardous substances or petroleum products usage or risk of contamination from nearby sources).
 2. Evaluate environmental hazard history of the site. Review Federal, State, Local records, including municipal or county planning, fire, health files.
 3. Interview of persons knowledgeable regarding the property history.
 4. Examine historic aerial photography and maps of the vicinity.
 5. Examine chain-of-title for Environmental Liens and/or Activity and Land Use Limitations (AULs).
 6. Submit any ASTM E 1527 Phase 1, ASTM E 1903 Phase 2 and geotechnical reports for the source site.
 7. Prepare a report with data and figures that provide a convincing case indicating the fill is not contaminated.

If the project proponent still wishes to use the source site, the following needs to occur:

- ✓ The project proponent will develop for City approval a sampling and analysis plan, to characterize the source material. The City will approve only sampling plans that will produce representative sampling and confirmation that the source material is not contaminated (see MTCA guidance).
- ✓ Sample analysis will include the parameters listed to the right.
- ✓ The City will determine based on sample results and project proponent sample analysis if the source material can be imported into the City.

* Guidance for compliance with RMC 15.24.080(r) and 15.24.095, refer to full code for all local requirements. Version 1, drafted 6/2011

Analyte	Method	Reporting Limit
Gasoline	NWTPH-Gx	1/2 the cleanup level
Diesel and Oil	NWTPH-Dx	"
Volatile Organic Compounds (full list)	EPA 8260B	"
SemiVolatile Organic Compounds	EPA 8270D	"
Total Metals (13 priority pollutant metals list)	EPA 6010B or EPA 6020	"
Mercury	EPA 7471A	"
PCB's	EPA 8082	"
Total Organic Carbon (TOC)	EPA 9060	"

SPILL PLAN

166th Ave Townhomes
8502 166th Ave NE & 16640 NE 85th St
Redmond, WA

1. Proper care should be taken to prevent spills or leaks of hazardous materials. This should include secondary containment methods if fueling or equipment repair is anticipated for construction work.
2. If spills or leaks of hazardous materials occur than soil and groundwater should be removed and/or mitigated in accordance with legal guidelines.
3. Hazardous materials should be disposed of in accordance with legal requirements. We recommend calling the Redmond Spill Hotline at 425-556-2868 and also consulting the following online information:
 - a. kingcounty.gov/solidwaste/facilities/hazwaste
 - b. www.ecy.wa.gov/waste
4. Appropriate signs and/or documentation should be provided to future property owners informing them of the site location within a Critical Aquifer Recharge Area including the aforementioned BMP recommendations.

V-7

85TH STREET ELEVATION



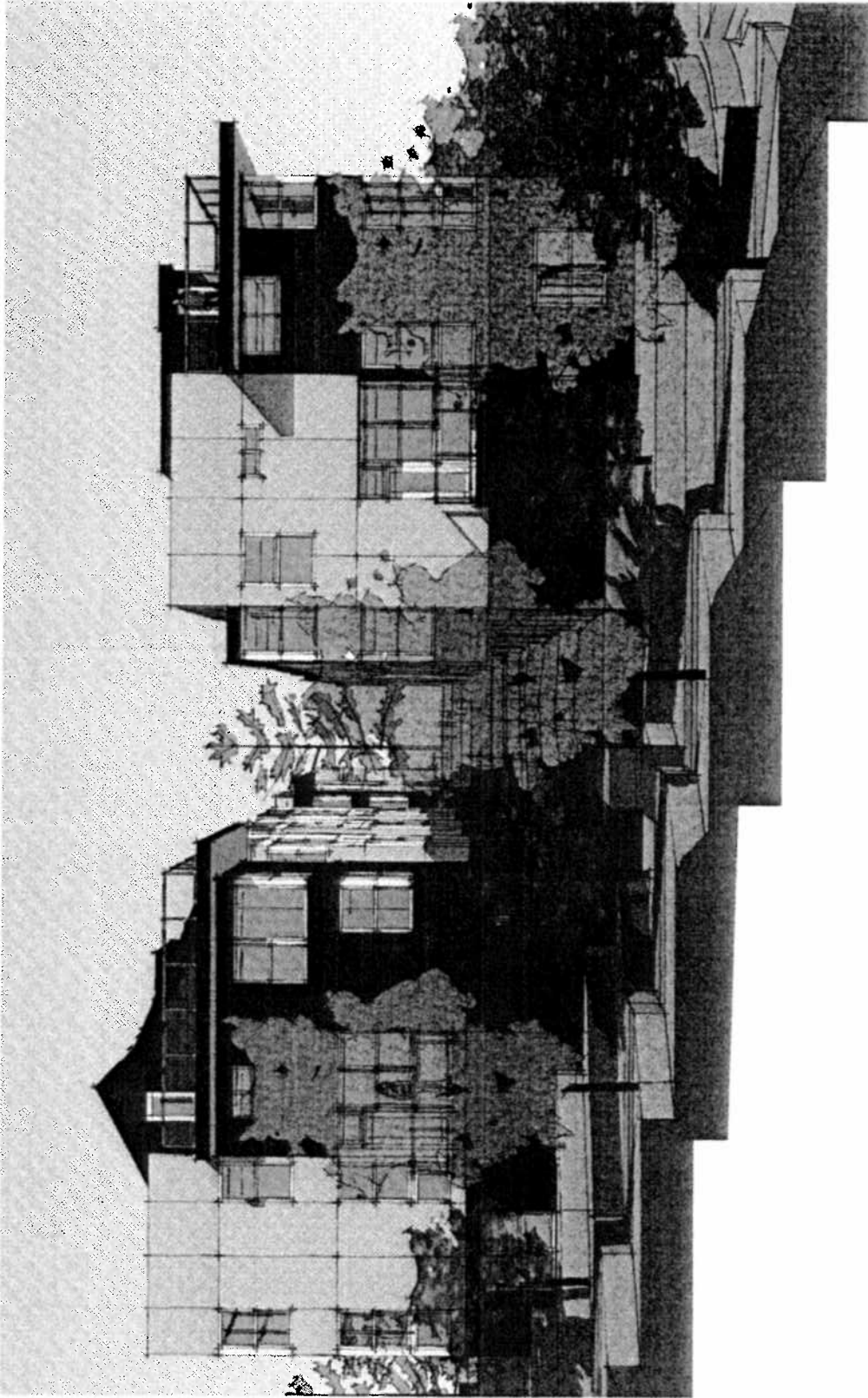
Daniel
UMBACH
Architect
7711 16th Ave NW
Seattle, WA 98117
Ph: 206 427-2871
dumbach@comcast.net

16th Avenue Townhomes
8502 16th Ave NE & 16640 NE 85th St
60% 03.30.15
DESIGN REVIEW
TF 16th Ave Townhomes, LLC
2801 Alaskan Way Ste 107
Seattle, WA 98121

Daniel
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166th Avenue Townhomes
8502 166th Ave NE & 16640 NE 85th St
2801 Alaskan Way Ste 107,
Seattle, WA 98121
60% 03.30.15
DESIGN REVIEW

V-10



166TH AVE ELEVATION



June 8, 2015

G-3821

Mr. Erich Armbruster
Ashworth Homes LLC
14419 Greenwood Ave N #A179
Seattle, WA 98133

**Subject: RESPONSE TO CITY OF REDMOND COMMENTS - ADDENDUM
 PROPOSED TOWNHOUSES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON**

Ref: "Response to City of Redmond Comments - 3/23/15", GEO Group Northwest, Inc., May 5, 2015.

"Critical Areas Recharge Report, Proposed Townhouses, 8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington, G-3821", GEO Group Northwest, March 6, 2015.

Dear Mr. Armbruster:

Per the request of Dan Umbach, the project architect, we have prepared the following responses to the following City of Redmond comments with regard to the referenced Critical Areas Recharge Report and our previous response to comments dated May 5, 2015.

The City of Redmond has accepted our responses to some of the comments discussed in our letter of May 5, 2015. We have reproduced the City's "correction required" comments below and provided our responses:

Comment #5:

Add a discussion about how groundwater should be managed on-site for this project, both during construction and long term. Show a cross-section of project with subsurface structures and seasonal high groundwater elevation. Further characterization of soils and groundwater is

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8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington

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Page 2

needed to understand the potential impact to recharge of the aquifer, appropriate building design such that permanent dewatering is not used and potential for infiltration. Results of the HA-2 site gradational analysis was said to have an infiltration rate of 1.3 in/hr.

A feasibility study may be required for temporary construction dewatering. See Draft Interim Construction Dewatering Policy and provide either a feasibility study or justification for not needing a study (5/21/15).

Structures that are built within water table shall be of watertight construction as no permanent dewatering is permitted in Wellhead Protection Zones 1 and 2.

Response #5:

We have prepared the attached **Plate 1 - Grading Plan, Plate 2 - X-Section A - West/East and Plate 3 - X-Section B - North/South** to address the reviewer's comment. As shown the amount of excavation for the proposed development will not encounter the underlying aquifer and there is the possibility that excavations for the building pads will not encounter perched groundwater seepage either, as these sand lenses within the glacial till may not be connected. Based upon the cross-sections the maximum depth below existing surface for the proposed building pads is around 8-feet. We estimate that the average depth for building pad preparation is more like around 4-feet. Please note that the water seepage levels noted on the cross-sections are depths where perched water seepage was observed at the time of the borings. This water seepage is not indicative of a "water table" or the level of the underlying aquifer. In fact, it is important to note that the boring B-3 located at the high point at the site did not encounter any water seepage down to a depth of 51.5-feet below ground surface. The observed seepage zones signify that for a limited extent and depth and also for a likely limited time period a likely relatively small amount of water has collected within a sandier layer within the glacial till soils or at the interface between the medium dense and very dense glacial till soils. As previously noted in our referenced report and as also noted in the hydrogeologic report by ZZA / Terracon there is no known quantifiable connection between the perched seepage zones and the underlying water-bearing aquifers. These perched seepage zones may fill during the wetter periods of the year and

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are not hydraulically connected to the aquifer. Some portion of this seepage may eventually discharge at the ground surface downslope from the site or enter existing subsurface collection systems downslope from the site. It is our opinion that the subsurface conditions at the site have been properly characterized. There is little anticipated value added by installing monitoring wells at the site as perched seepage zones may fill during some years and not others and the extent of these zones is often very limited, not extending far either laterally or vertically. The likely amount of groundwater seepage present within the sandier lenses of glacial till is relatively small, on the order of 600 gallons, and would likely drain out of the soil when an excavation is made to intercept these areas within one day. Normally this relatively small amount of water could be properly treated and then legally discharged to the stormwater system.

The reported infiltration rate was developed based upon gradational analysis of one soil sample. This rate does not take into account the relative impermeability of the underlying very dense glacial till soils. Any attempt to infiltrate at the overlying medium dense glacial till soils may achieve the reported infiltration rate for relatively small amounts of water as the water will likely flow laterally and fill void spaces within the sandier zones of the overlying medium dense, weathered, till deposit. Infiltration through the underlying very dense glacial till will be very slow, if at all, and we anticipate will have very little if any affect on the underlying aquifer. We do not recommend planning for infiltration at the site.

Based upon our review of the City of Redmond Draft Interim Temporary Construction Dewatering Policy we understand that projects which will require construction dewatering at or above a rate of 500 gallons/minute shall submit a project specific Temporary Dewatering Feasibility study. Based upon our investigation and review of the investigations by ZZA / Terracon at the subject site it is our opinion that if any temporary construction dewatering is necessary it will not meet or exceed the 500 gallons/minute threshold. As previously noted we expect that if any perched seepage zones are encountered that the water will drain into the excavation within about a day at an anticipated rate of less than 10 gallons per minute. The estimated maximum temporary dewatering anticipated is around 600 gallons. Since this is not draining from the aquifer it is not a reduction in the aquifer, per se, but potentially a temporary reduction in the long-term recharge for the aquifer. This reduction would only occur during the

June 8, 2015
8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington

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Page 4

period of temporary construction dewatering and would have no measurable long-term adverse impact to the aquifer.

Based upon the grading plan (attached) and our discussions with the developer, Mr. Erich Armbruster, we understand that at the building locations there will be partial basement retaining walls at some of the sides of the new buildings. Separate, stand-alone, conventional retaining walls will be constructed between the northwestern and northeastern buildings and between the northeastern and southeastern buildings. It is anticipated that typical footing drains and drainage mat systems will be constructed with the lowest point of subsurface drainage collection being at or just above the building pad grading elevations which are illustrated on the attached Cross-Sections. It is likely, as discussed above, that if any perched seepage is encountered at these excavations that it will quickly drain out immediately following the excavation. The permanent footing drainage systems will provide collection capability and reduce the chances of hydrostatic pressure build-up on below-grade walls for the unlikely possibility that seepage develops above the proposed building floor and adjacent parking lot grades. It is not considered likely that seepage will occur for the permanent condition at these elevations, however, it is standard engineering practice to plan for potential subsurface drainage concerns by installing footing and wall drainage systems. The intent of these drainage measures is not to collect subsurface water from the entire site but to insure that if seepage develops above the elevation of living spaces and adjacent hardscaping (pavements) that this water can be collected so that damage will not occur to the development. It is our opinion that the City's requirement that structure's built within the water table be watertight does not apply in this case since the proposed development is not below the water table. Based upon the City's 2014 mapping of the water table as presented in our referenced Critical Areas Recharge Report (3/6/15) the anticipated groundwater "water table" elevation is around an elevation of 27.5-feet. No excavation or development at the site is anticipated to go deeper than an elevation of 70.9-feet which is over 40-feet above the reported water table depth. Exploratory borings completed for this development as described in our report and in the previous reports by ZZA / Terracon did not encounter the underlying aquifer, even though they were drilled with depths of up to 51.5-feet below the ground surface.

June 8, 2015
8502 - 166th Ave NE & 16640 NE 85th St, Redmond, Washington

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Page 5

Comment #8:

Include a cross-section of subsurface structures and seasonal high groundwater elevation in plans.

Response #8:

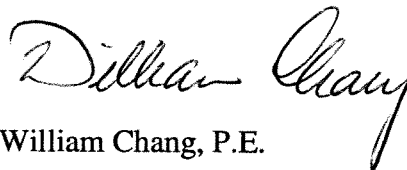
We have prepared the attached cross-sections as previously noted in our Response #5. At the time of our previous response to the reviewer's comments (letter, 5/5/15) finish floor elevations were not available. Additionally, if the cross-sections are required on the plans, than the designer or civil engineer will need to add them to the plan documents.

If you have any questions please feel free to call us.

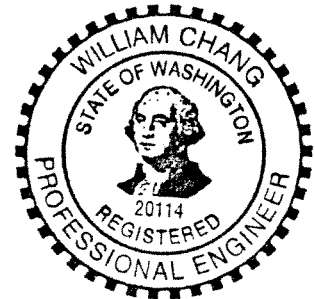
Sincerely,
GEO GROUP NORTHWEST, INC.



Adam Gaston
Project Engineer



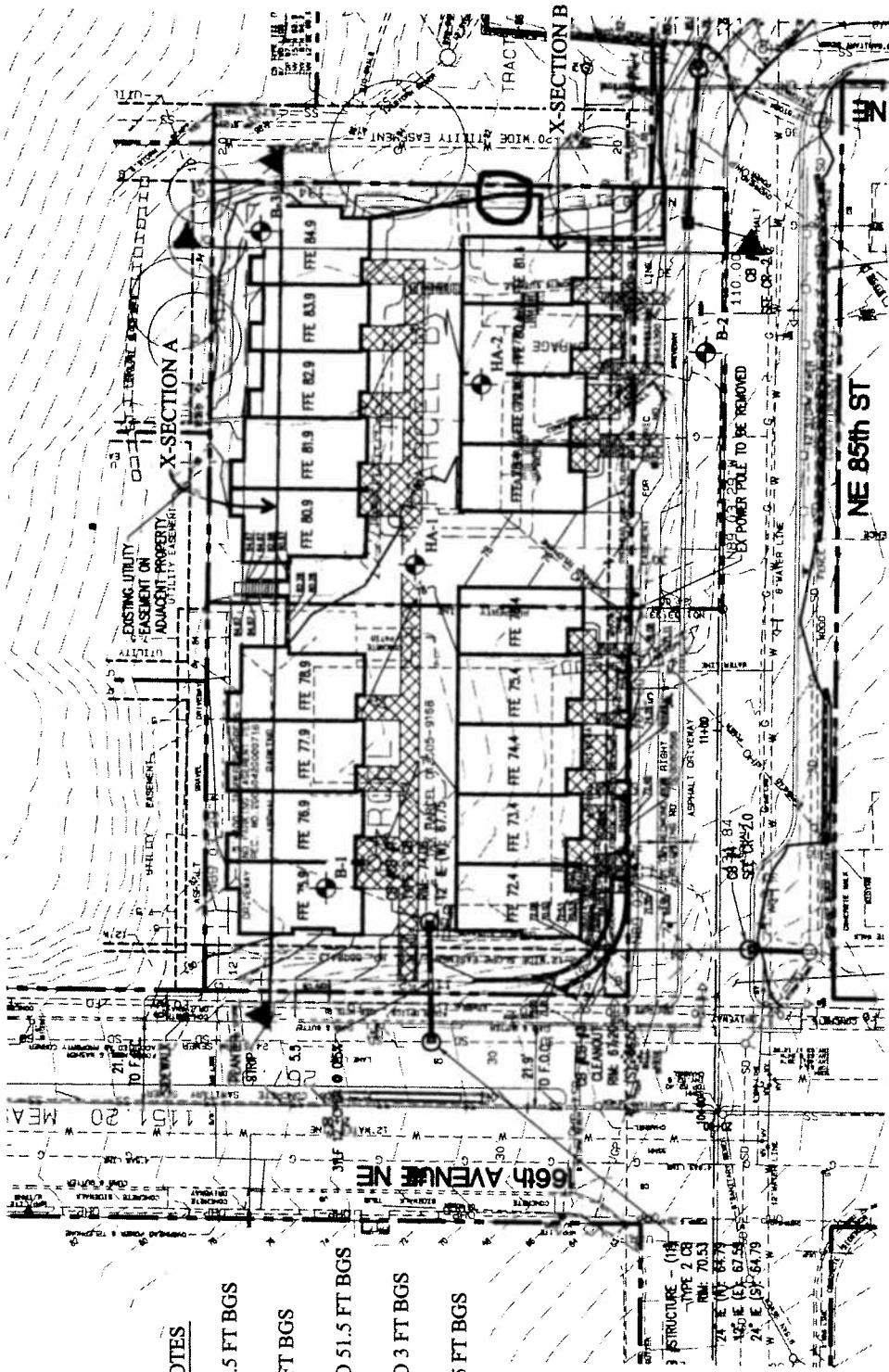
William Chang, P.E.
Principal



Attachments: Plate 1 - Grading Plan
Plate 2 - X-Section A - West/East
Plate 3 - X-Section B - North/South

cc: Dan Umbach

GEO Group Northwest, Inc.



BORING SEEPAGE NOTES

- B-1 SEEPAGE AT 16.5 FT BGS
- B-2 SEEPAGE AT 6 FT BGS
- B-3 NO SEEPAGE TO 51.5 FT BGS
- HA-1 NO SEEPAGE TO 3 FT BGS
- HA-2 SEEPAGE AT 2.5 FT BGS

PROJECT # G-3821
 DATE: 5-29-15
 DRAWN: AG
 CHECKED: WC
 SCALE: 1" = 30'
 PLATE: 1

GRADING PLAN
 PROPOSED TOWNHOMES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON

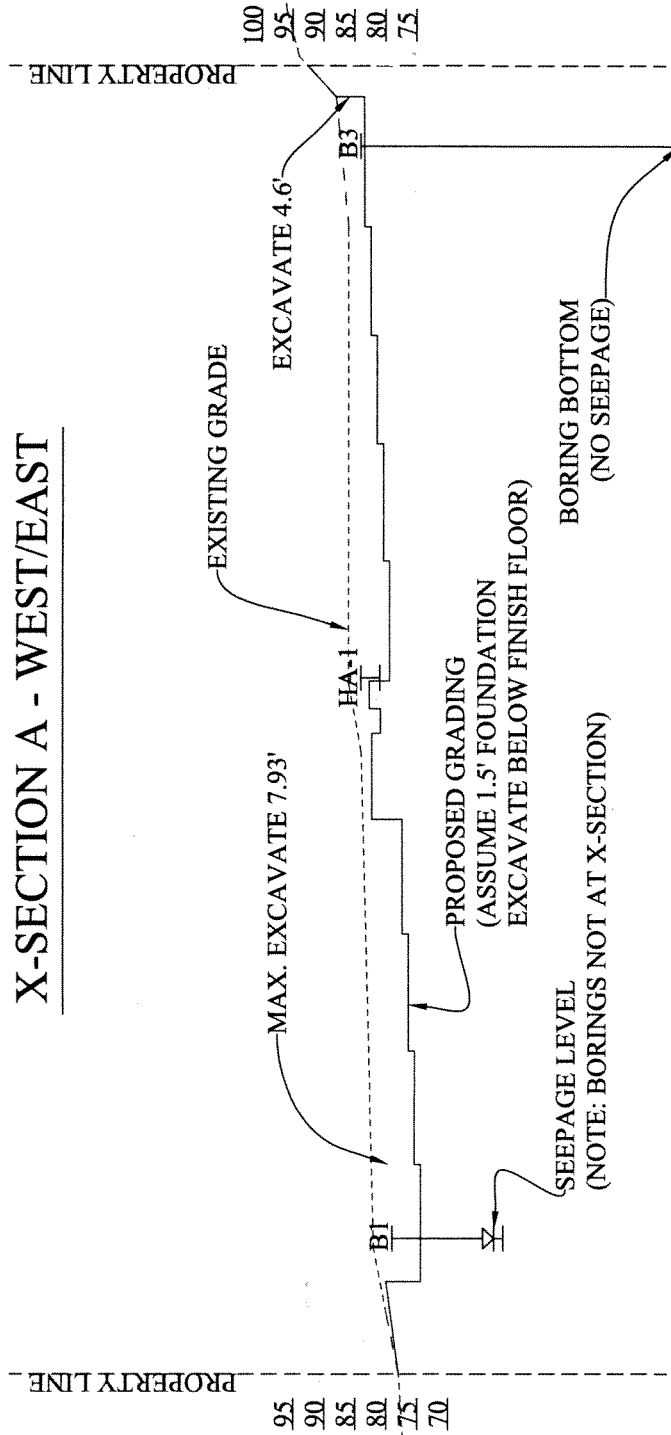
Group Northwest, Inc.
 15100 NE 80th Street, Suite 100, Redmond, WA 98052
 Phone: 425.949.4757 FAX: 425.949.4758
 Email: info@grouppnw.com



LEGEND
 ● = BORINGS AND APPROX LOC.
 (B-1, B-2 & B-3 BY TERRACON,
 HA-1 & HA-2 BY GGNW)

BASED UPON THE GRADING PLAN,
 C-12, BY PACLAND, 4/30/15.

X-SECTION A - WEST/EAST



BASED UPON GRADING PLAN, C-12, PACLAND, 4/30/15.



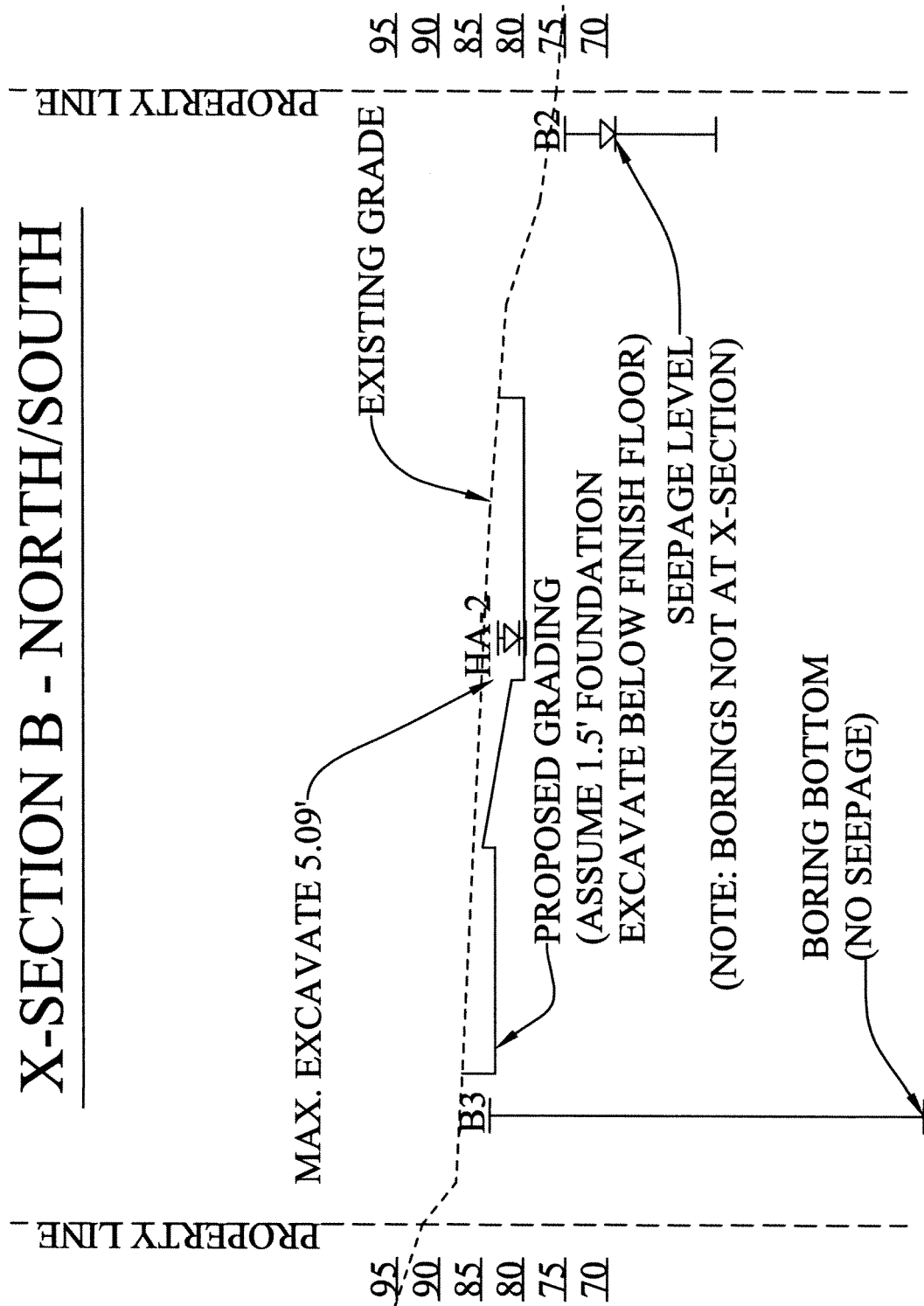
Group Northwest, Inc.

11240 NE 20th Street, Suite 10, Bellevue, WA 98005
 Phone: 425.452.8738
 Email: info@gfonw.com

X-SECTION A - WEST/EAST
 PROPOSED TOWNHOMES
 8502 - 166TH AVE NE & 16640 NE 85TH ST
 REDMOND, WASHINGTON

PROJECT #: G-3821
 DATE: 5-29-15
 DRAWN: AG
 CHECKED: WC
 SCALE: 1" = 20'
 PLATE: 2

X-SECTION B - NORTH/SOUTH



BASED UPON GRADING PLAN, C-12, PACLAND, 4/30/15.



Group Northwest, Inc.

13240 NE 20th Street, Suite 10, Bellevue, WA 98005
 Phone 425/649-8757 FAX 425/649-8758
 Email info@geogroupnw.com

X-SECTION B - NORTH/SOUTH

8502 - 166TH AVE NE & 16640 NE 85TH ST
 SEATTLE, WASHINGTON

SCALE: 1" = 20'

DATE: 5-29-15

MADE: AG

JOB NO.: G-3821

PLATE: 3