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Engineering Geologic Report
Riverside Estates Subdivision
Ridgeline Park
34512 NW Pacific Highway
La Center, Washington

CGT Project Number G2005322

Prepared for

Peter Ettro
Ettro Capital
340 Oswego Point Drive #208
Lake Oswego, Oregon 97034

July 22, 2020

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Dear Mr. Ettro:

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this engineering geologic report for the proposed Ridgeline Park project at the Riverside Estates Subdivision. The site is located at 34512 NW Pacific Highway in La Center, Washington. We performed our work in general accordance with CGT Proposal GP9004, dated July 8, 2020. Written authorization for our services was received on July 17, 2020.

We appreciate the opportunity to work with you on this project. Please contact us at 503.601.8250 if you have any questions regarding this report.

Respectfully Submitted,
CARLSON GEOTECHNICAL

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Doc ID: G:\GEOTECH\PROJECTS\2020 Projects\G2005322 - Ridgeline Park - Geologic Hazard\G2005322 - GEO\008 - Deliverables\Report\Engineering Geologic Report.docx

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TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

Carlson Geotechnical (CGT), a division of Carlson Testing, Inc. (CTI), is pleased to submit this engineering geologic report for the proposed Ridgeline Park project at the Riverside Estates Subdivision. The site is located at 34512 NW Pacific Highway in La Center, Washington, as shown on the attached Site Location, Figure 1.

1.1 Project Information

CGT developed an understanding of the proposed project based on our correspondence with you and the following project documents provided to us:

- “Geotechnical Site Investigation, Goode Property, La Center, Washington,” prepared by Columbia West Engineering, Inc., (CWE), dated January 31, 2008.
- “Site Plan for Ridgeline Park,” prepared by PLS Engineering, not dated.

CGT was previously retained to prepare the following report:

- “Report of Site-Specific Pavement Design Services, Riverside Estates Subdivision, NW Pacific Highway & NW Larson Drive, La Center, Washington,” CGT Project Number G1804931.A

In addition, CGT performed construction observations during the mass grading of the subdivision in 2018.

Based on our review of the site plan, we understand this portion of the project will include development of a new park at the north end of the residential subdivision. Ridgeline Park will include:

- Construction of an access road and parking area to serve the new park. We assume new pavements will be surfaced with asphalt concrete (AC).
- A new sports court.
- A new, 8-foot-wide, ADA-compliant path.
- The site plan indicates stormwater collected from new hardscaped areas will be disposed of in on-site biofiltration facilities and through the use of level spreaders. Design of infiltration facilities rests with others.
- The site plan indicates grading will include the placement of up to about 7 feet of structural fill in the area of the proposed roadway and ADA path to reach finished grades. New fill slopes will have finished gradients up to 2 horizontal to 1 vertical (2H:1V).

We understand that the site is located in a landslide hazard overlay zone, indicating it contains slopes in excess of 15 percent, and that the City of La Center requires an engineering geologic report be completed for the project prior to issuance of a building permit.

1.2 Scope of Services

The purpose of our work will be to identify geologic hazards that may affect the property. Our specific scope of services will include the following:

- Review available literature for geologic hazards in the vicinity of the site. Specific hazards to be addressed by this study include:
    - Erosion potential
    - Landslide potential / Slope stability
    - Seismic potential
    - Flood potential
    - Volcanic hazards potential
- Review readily available historical aerial photographs of the site.
- Review available topographic, geologic, and geologic hazard maps for the area.
- Perform a surface reconnaissance of the site.
- Explore subsurface conditions at the site by advancing three hand auger borings to depths of up to about 5½ feet below ground surface (bgs). Details of the subsurface investigation are presented in Appendix A.
- Provide **qualitative** conclusions regarding the potential impacts of geologic hazards on the proposed development, and vice versa.
- Provide a written report summarizing the results of our study in general accordance with Clark County Code Chapter 40.430.030(C)(5) and the 2006 Washington State Geologist Licensing Board Guidelines for Preparing Engineering Geology Reports in Washington.

2.0 GEOLOGY

2.1 Regional Geology

The project site is located within the eastern edge of the Portland-Vancouver Basin. Regional geologic maps indicate that the majority of the basin is underlain by Pleistocene Missoula Lake flood deposits. Approximately 18,000 to 15,000 years ago[1], large periodic glacial flooding occurred in the Portland-Vancouver Basin, depositing boulders, sands, and silts throughout the area.

2.2 Site Geology

The geologic map[2] for the area indicates that the site is primarily mapped as underlain by Pleistocene catastrophic flood deposits (Qfs) originating from glacial outburst floods of Lake Missoula (Figure 2) and Pleistocene and/or Pliocene conglomerate (QTc). The flood deposits (Qfs) are mapped along the southern portion of the site and were produced by the periodic failure of glacial ice dams that impounded Lake Missoula in present day Montana between 18,000 to 15,000 years ago[3]. Floodwaters raged through Idaho, eastern Washington, and through the Columbia River Gorge. Near Rainier, Oregon, the river channel was restricted, causing floodwaters to back up the Willamette Valley as far south as Eugene. Floodwaters throughout the quadrangle mantle low-relief surfaces below 300 feet in elevation with deposit thickness greater than 100 feet. The flood deposits are typically split into three different facies: the coarse-grained facies, the fine-grained facies, and the channel facies. The southern portion of the site is mapped as fine-grained Missoula flood deposits, which typically consist of silt, clay, and fine-grained sand. Beds are generally poorly defined and thin (less than 3 feet thick).

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[1] Allen, John Eliot, Burns, Marjorie, and Burns, Scott, 2009. Cataclysms on the Columbia, The Great Missoula Floods, Revised Second Edition: Ooligan Press, Portland State University.

[2] Evarts, R.C, Philip Dinterman, and Jessica Block, 2004, Geologic Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington, SIM-2844.

[3] Allen, John Eliot, et al., 2009. Cataclysms on the Columbia, The Great Missoula Floods, Revised Second Edition: Ooligan Press, Portland State University.

The northern half of the site is mapped as underlain by Pleistocene and/or Pliocene conglomerate (QTc) that consist of semi-consolidated pebble, cobble, and gravel. This unit is well exposed in scattered outcrops that demonstrate the unit forms a continuous stratum of 65 to 130 feet in thickness beneath the cataclysmic flood deposits (Qfs) mapped throughout the area.

3.0 SEISMICITY

The site is located in a tectonically and seismically active area that may be affected by earthquakes generated by crustal and subduction zone sources.

3.1 Earthquake Sources

3.1.1 Crustal Sources

Crustal earthquakes typically occur at depths ranging from 15 to 40 kilometers bgs[4]. According to the United States Geological Survey Quaternary fault and fold database[5], nearby seismic sources capable of producing damaging earthquakes in this region include Portland Hills fault and the Lacamas Lake fault (Figure 3). Distances from the site to the nearest mapped strands of these known active or potentially active faults are summarized in the following table.

Table 1 Known Active or Potentially Active Crustal Faults in the Vicinity of the Site

USGS Fault No.	Fault Name	Distance and Direction from Site	USGS Fault Class[1]
877	Portland Hills fault	20 km SW	A
880	Lacamas Lake fault	25 km SE	A

1 USGS Fault Classes from USGS Earthquake Hazards Program, 2008 National Seismic Hazard Maps
Class A: Fault with convincing evidence of Quaternary activity (ACTIVE)
Class B: Fault that requires further study in order to confidently define their potential as possible sources of earthquake-induced ground motion (POTENTIALLY ACTIVE)
Class C: Fault with insufficient evidence for Quaternary activity (LOW POTENTIAL FOR ACTIVITY)

3.1.1.1 Portland Hills fault (USGS 877)

The Portland Hills fault zone is a series of northwest-trending faults forming the northeastern margin of the Tualatin Mountains. The faults associated with this structural zone vertically displace the Columbia River Basalt Group by 1,130 feet, and appear to control thickness changes in late Pleistocene sediment[6]. Geomorphic lineaments suggestive of Pleistocene deformation have been identified within the fault zone, but none of the fault segments has been shown to cut Holocene deposits[7,8]. The fact that the faults do not cut Holocene sediments is most likely a result of the faulting being related to a time of intense uplift of the Oregon Coast Range during the Miocene, and little to no movement along the faults during the Holocene.

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[4] Geomatrix Consultants, 1995. Seismic Design Mapping, State of Oregon: unpublished report prepared for Oregon Department of Transportation, Personal Services Contract 11688, January 1995.

[5] U.S. Geological Survey, 2020. Quaternary fault and fold database for the United States, *accessed July 2020*, from USGS web site: http://earthquakes.usgs.gov/regional/qfaults/.

[6] Mabey, M.A., Madin, I.P., Youd, T.L., Jones, C.F., 1993, Earthquake hazard maps of the Portland quadrangle, Multnomah and Washington Counties, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-79, Plate 2, 1:24,000.

[7] Conforth and Geomatrix Consultants, 1992. Seismic hazard evaluation, Bull Run dam sites near Sandy, Oregon: unpublished report to City of Portland Bureau of Water Works.

[8] Balsillie, J.J. and Benson, G.T., 1971. Evidence for the Portland Hills fault: The Ore Bin, Oregon Dept. of Geology and Mineral Industries, v. 33, p. 109-118.

3.1.1.2 Lacamas Lake fault (USGS 880)

The Lacamas Lake fault is a northwest-trending structure located in the vicinity of Lacamas Lake, near Camas, Washington, at the northeastern margin of the Portland basin. This fault was originally identified by well-expressed lineaments defined by the relatively steep linear valley margins along both sides of Lacamas Lake[9]. Although recent activity on the Lacamas Lake fault is uncertain, the fault is considered active based on possible displacement of Troutdale sediments, prominent topographic lineaments associated with the fault, and possible associated seismicity. The fault is buried by Pleistocene Missoula flood deposits, suggesting a long recurrence interval.

3.1.2 Cascadia Subduction Zone Seismic Sources

The Cascadia Subduction Zone (CSZ) is a 1,100-kilometer-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continental plate at a rate of about 3 to 4 centimeters per year[10]. The fault trace is located off of the coast of southern British Columbia, Washington, Oregon, and northern California; approximately 229 kilometers west of the site (see attached Figure 4).

Two primary sources of seismicity are associated with the CSZ: relatively shallow earthquakes that occur on the interface between the two plates (Subduction Zone earthquakes), and deep earthquakes that occur along faults within the subducting Juan de Fuca plate (intraplate earthquakes).

3.1.2.1 Subduction Zone Earthquakes

Large subduction zone (megathrust) earthquakes occur within the upper approximate 30 kilometers of the contact between the two plates[11]. As the Juan de Fuca Plate subducts beneath the North American Plate through this zone, the plates are locked together by friction[12]. Stress slowly builds as the plates converge until the frictional resistance is exceeded, and the plates rapidly slip past each other resulting in a “megathrust” earthquake. The United States Geologic Survey estimates megathrust earthquakes on the CSZ may have magnitudes up to M9.2.

Geologic evidence indicates a recurrence interval for major subduction zone earthquakes of 250 to 650 years, with the last major event occurring in 1700[13,14]. The eastern margin of the seismogenic portion of the Cascadia Subduction zone is located approximately 90 kilometers west of the site, as shown on Figure 4.

3.1.2.2 Intraplate Earthquakes

Below about 30 kilometers, the plate interface does not appear to be locked by friction, and the plates slowly slide past each other. The curvature of the subducted plate increases as the advancing edge moves east, creating extensional forces within the plate. Normal faulting occurs in response to these extensional forces.

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[9] Madin and Hemphill-Haley, 2001: The Portland Hills Fault at Rowe Middle School. Oregon Geology V63 p47.

[10] DeMets, C., Gordon, R.G., Argus, D.F., Stein, S., 1990. Current plate motions: Geophysical Journal International, v. 101, p. 425-478.

[11] Pacific Northwest Seismic Network, 2020. Pacific Northwest Earthquake Sources Overview, *accessed July 2020,* from PNSN web site, http://pnsn.org/outreach/earthquakesources/.

[12] Pacific Northwest Seismic Network, 2020. Pacific Northwest Earthquake Sources Overview, *accessed July 2020,* from PNSN web site, http://pnsn.org/outreach/earthquakesources/.

13 Atwater, B.F., 1992. Geologic evidence for earthquakes during the past 2,000 years along the Copalis River, southern coastal Washington: Journal of Geophysical Research, v. 97, p. 1901-1919.

[14] Peterson, C.D., Darienzo, M.E., Burns, S.F., and Burris, W.K., 1993. Field trip guide to Cascadia paleoseismic evidence along the northern California coast: evidence of subduction zone seismicity in the central Cascadia margin. Oregon Department of Geology and Mineral Industries, Oregon Geology, Vol. 55, p. 99-144.

This region of maximum curvature and faulting of the subducting plate is where large intraplate earthquakes are expected to occur, and is located at depths ranging from 30 to 60 kilometers[15,16,17]. Intraplate earthquakes within the Juan de Fuca plate generally have magnitudes less than M7.5[18].

The 2001 M6.8 Nisqually earthquake near Olympia, Washington, occurred within this seismogenic zone at a depth of 52 kilometers. The site is located within the intraplate seismogenic zone, as shown on Figure 4.

3.2 Historic Seismicity

The Pacific Northwest is a seismically active area. Epicenters for historic earthquakes[19] in western Washington from 1904 to 2020 are shown on Figure 5. The majority of these earthquakes are shallow (crustal) in nature, with a lesser amount of intraplate sources. No large-scale subduction-zone earthquakes occurred during this period.

4.0 LOCAL TOPOGRAPHY

Topography in the vicinity of the site is shown on the attached Figures 1 and 6. The site is located along a dissected high terrace above the East Fork Lewis River Valley located approximately 0.40 mile to the southwest. The terrace is bisected by NW Pacific Highway, which borders the site to the north-northeast. North of the highway the topography ascends to the northeast at a gradient of 9½ horizontal to 1 vertical (9½H:1V). To the south of the site, the terrain consists of a relatively level bench that steepens near the East Fork Lewis River to a gradient of about 4½H:1V.

5.0 HAZARDS

5.1 Flooding

The Federal Emergency Management Agency (FEMA) publishes the Flood Insurance Rate Maps (FIRM) for flood insurance purposes[20]. The mapping indicates that the site is not located within a regulatory flood hazard zone.

5.2 Landslides

Landsliding is a common hazard in the Pacific Northwest that can be initiated on marginally stable slopes by human disturbances such as grading and deforestation, and by natural processes including earthquake shaking, volcanism, heavy rainfalls, and rapid snow melt. Recent studies indicate that the most common causes for slope failures are intense rainfall and human alteration, including the placement of building loads on slopes, excavating or over-steepening slopes, and the infiltration or diversion of storm water runoff. For example, excavation into the base of marginally stable slopes may reduce forces resisting failure on those

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[15] Geomatrix Consultants, 1995. Seismic Design Mapping, State of Oregon: unpublished report prepared for Oregon Department of Transportation, Personal Services Contract 11688, January 1995.

[16] Geomatrix Consultants, 1993. Seismic margin Earthquake For the Trojan Site: Final Unpublished Report For Portland General Electric Trojan Nuclear Plant, Rainier, Oregon, May 1993.

[17] Kirby, Stephen H., Wang, Kelin, Dunlop, Susan, 2002, The Cascadia Subduction Zone and Related Subduction Systems—Seismic Structure, Intraslab Earthquakes and Processes, and Earthquake Hazards: U.S. Geological Survey Open-File Report 02-328, 182 pp.

[18] Cascadia Region Earthquake Workshop, 2008. Cascadia Deep Earthquakes. Washington Division of Geology and Earth Resources, Open File Report 2008-1.

[19] Niewendorp, Clark A., and Neuhaus, Mark E. , Map of Selected Earthquakes for Oregon,1841 through 2002 by Oregon Department of Geology and Mineral Industries, OFR O-03-02.

[20] Federal Emergency Management Agency, 2020. FEMA Map Service Center, *accessed July 2020,* from FEMA web site: https://msc.fema.gov/portal.

slopes, thus causing movement. Adding fill and/or a structure to the top or mid portion of a slope increases the driving forces on a slope and may contribute to failure. Redirecting water onto or into slopes may exploit existing planes of weakness within those slopes, causing failure.

5.2.1 Regional Mapping

The Clark Regional Emergency Services Agency (CRESA)[21] shows a small portion of the northeast portion of the site within a landslide hazard area (Figure 7). Another landslide hazard area is mapped northwest of the site alongside NW Pacific Highway. This map is based on topography, and indicates areas with slope gradients in excess of 15 percent.

Review of the Washington State Geologic Information Portal[22], indicates that no landslides are mapped on the site or in the immediate vicinity of the site. Two small landslide masses are located about 1½ miles and ¾ mile to the northwest and southeast, respectively. These landslide masses are located on slopes adjacent to the North Fork Lewis River.

We also reviewed Light Detection and Ranging (lidar) data and imagery available from the Washington State Department of Natural Resources Division of Geology and Earth Resources on the Washington Lidar Portal (WLP). WLP provides contours and bare earth imagery, which has been filtered to remove foliage and buildings. The lidar data portray the topography at a much greater level of detail than traditional mapping methods, and can reveal features that are otherwise difficult to ascertain. In areas where human activity has modified the topography extensively, such as through road-building and general grading, the resulting "background noise" can mask features that might otherwise be apparent. Based on our review of the lidar data, we did not observe any obvious signs of previous landslides at or in the immediate vicinity of the site. A portion of the lidar map showing the area of the site is presented as Figure 6.

5.3 Seismic Hazards

5.3.1 Liquefaction

A wide variety of slope and ground failures can occur in response to intense seismic shaking during large magnitude earthquakes. These failures are often related to the phenomenon of liquefaction, the process by which water-saturated sediment changes from a solid to a liquid state. Since liquefied sediment may not support the overlying ground, or any structure built thereon, a variety of failures may occur, including lateral spreading, landslides, ground settlement and cracking, sand boils, oscillation lurching, etc. The conditions necessary for liquefaction to occur are: (1) the presence of poorly consolidated, generally cohesionless sediment; (2) saturation of the sediment by groundwater; and (3) an earthquake that produces intense seismic shaking (generally a moment magnitude greater than M5.0). In general, older, more consolidated sediment, and sediment above the water table will not liquefy[23]. Field performance data and laboratory tests

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[21] Clark Regional Emergency Services Agency, *2020*, Hazard Maps, Clark County, Washington, *accessed July 2020*, from CRESA website: http://cresa911.org/emergency-management/mitigation/hazard-maps/

[22] Washington State Department of Natural Resources, 2020. Washington State Geologic Information Portal, *accessed July 2020,* from Washington State DNR website: https://geologyportal-qa.dnr.wa.gov/.

[23] Youd, T.L. and Hoose, S.N. 1978. Historic ground failures in Northern California triggered by earthquakes: U.S. Geological Survey Professional Paper 993, p.117.

indicate that liquefaction occurs predominantly in well-sorted, loose to medium dense sand or silty sand, but can also occur in lean clays and silts[24].

The liquefaction hazard mapping available via WPL[25] indicates the site has a very low susceptibility for liquefaction.

5.3.2 Expected Ground Shaking

The CRESA[26] website includes a map indicating the expected earthquake shaking felt at a site for a magnitude 9.0 Cascadia Subduction Zone earthquake. The map indicates a "light potential damage, strong perceived shaking" level anticipated at the site during a design-level earthquake.

5.3.3 Surface Rupture

5.3.3.1 Faulting

As discussed above, the site is situated in a region of the country characterized by extensive faulting and known for seismic activity. However, no known faults are mapped on or immediately adjacent to the site, the risk of surface rupture impacting the proposed development at the site due to faulting is considered very low.

5.3.3.2 Lateral Spread

Surface rupture due to lateral spread can occur on sites underlain by liquefiable soils that are located on or immediately adjacent to slopes steeper than about 3 degrees (20H:1V), and/or adjacent to a free face, such as a stream bank or the shore of an open body of water. During lateral spread, the materials overlying the liquefied soils are subject to lateral movement downslope or toward the free face. Recognizing the lack of liquefiable soils, we characterize the risk of lateral spread to be negligible.

6.0 SITE RECONNAISSANCE

Melissa Lehman, GIT, under supervision of CGT Senior Engineering Geologist Ryan Houser, LG, LEG, performed a reconnaissance of the site on July 16, 2020.

6.1 Surface Conditions

6.1.1 On Site

The proposed site layout and site conditions during our reconnaissance are shown on the attached Site Plan (Figure 8) and Site Photographs (Figure 9). The existing topography shown on the Site Plan is consistent with that observed during the reconnaissance.

The approximate 5.19-acre irregular-shaped site was bordered by a rural residential property to the east, NW Pacific Highway to the northeast, the Riverside Estates subdivision to the south, and undeveloped land to the northwest. The site descended to the southwest below NW Pacific Highway at gradients up to about 3H:1V with an average gradient of about 6H:1V. A wetland area occupied the southern approximate half of the site. Total relief across the site was about 50 feet.

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[24] Seed, R.B., et al. 2003. Recent Advances In Soil Liquefaction Engineering: A Unified And Consistent Framework. Earthquake Engineering Research Center College Of Engineering University Of California, Berkeley.

[25] Washington State Department of Natural Resources, 2020. Washington State Geologic Information Portal, *accessed July 2020,* from Washington State DNR website: https://geologyportal-qa.dnr.wa.gov/.

[26] Clark Regional Emergency Services Agency, 2020, Hazard Maps, Clark County, Washington, *accessed July 2020*, from CRESA website: https:// http://cresa911.org/emergency-management/mitigation/hazard-maps/

Development on the site consisted of a partially graveled driveway that provided access to the site from NW Pacific Highway. An approximate 10-foot tall, 100-foot long berm of undocumented fill paralleled south side of the gravel access road (see Figure 8). An agricultural pond/reservoir was located on the southwest corner of the site. The site was vegetated with tall grasses and sparse stands of coniferous and deciduous trees that were located around the pond.

No indicators of recent or ongoing slope instability were observed on the site during the reconnaissance.

6.1.2 Area Conditions

The areas to the north and northeast of the site beyond NW Pacific Highway were densely wooded with overstory, and in terms of terrain, moderately ascended to the northeast. The area to the immediate south of the site was relatively flat and was undergoing active development (residential subdivision) at the time of the investigation. The area to the west of the site exhibited similar topography and consisted of an open grassy field.

6.2 Site Subsurface Conditions

6.2.1 Subsurface Investigation & Laboratory Testing

Our subsurface investigation consisted of three hand auger borings (HA-1 through HA-3) completed on July 16, 2020. The approximate exploration locations are shown on the Site Plan, attached as Figure 8. In summary, the borings were advanced to depths ranging from about 5 to 5½ feet bgs. Details regarding the subsurface investigation, logs of the explorations, and results of laboratory testing are presented in Appendix A. Subsurface conditions encountered during our investigation are summarized below.

6.2.2 Subsurface Materials

Logs of the explorations are presented in Appendix A. The following describes each of the subsurface materials encountered at the site.

Organic Soil (OL)
Organic soil was encountered at the surface of all three hand auger borings and extended to depths of ¼ to 1 foot bgs. This soil was generally dark brown, moist, exhibited low plasticity, and included abundant rootlets.

Lean Clay (CL)
Underlying the organic soil was native, lean clay that extended to the full depths explored in all three hand auger borings, approximately 5 to 5½ feet bgs. This soil was generally medium stiff to stiff, dark brown to brown, moist, and exhibited low plasticity.

The soils encountered during our subsurface investigation were consistent with the fine-grained catastrophic flood deposits described in Section 2.2 above, and are consistent to soils documented in the referenced reports.

6.2.3 Groundwater

We did not encounter groundwater within the depths explored at the site on July 16, 2020. To determine approximate regional groundwater levels in the area, we researched well logs available on the Washington

Department of Ecology (WDE)[27] website for wells located within 1 mile of the site. Our review indicated that groundwater levels in the area generally ranged from about 30 to 65 feet bgs. It should be noted that groundwater levels vary with local topography. In addition, the groundwater levels reported on the WDE logs often reflect the purpose of the well, so water well logs may only report deeper, confined groundwater, while geotechnical or environmental borings will often report any groundwater encountered, including shallow, unconfined groundwater. Therefore, the levels reported on the WDE well logs referenced above are considered generally indicative of local water levels and may not reflect actual groundwater levels at the site. We anticipate that groundwater levels will fluctuate due to seasonal and annual variations in precipitation, changes in site utilization, or other factors. Additionally, the on-site, lean clay is conducive to formation of perched groundwater.

7.0 FINDINGS & RECOMMENDATIONS

The primary geologic hazards that may affect the site are potential for slope instability and seismic shaking. We anticipate that with proper construction control, the geology and topography of the site and the surrounding area will not adversely affect the proposed project, and the project will have no geologic impact on adjacent properties or the risk of slope instability. It is our opinion that, with the use of generally accepted construction techniques and by strictly following the recommendations contained in this report and in the building code, the site is geologically suitable for the proposed development.

7.1 Slope Considerations

Any construction within hillside areas inherently bears greater risk of slope instability. The on-site and off-site slopes may be susceptible to slope instability resulting from factors beyond the owner's control, such as off-site grading, erosion and other ground disturbance, a major earthquake, or heavy precipitation. The owners must recognize and accept the risk of potential slope instability from causes beyond their control or as yet unrecognized.

The Clark Regional Emergency Services Agency (CRESA)[28] shows a small portion of the northeast portion of the site within a landslide hazard area. Another landslide hazard area is mapped northwest of the site alongside NW Pacific Highway. We did not observe signs of previous or ongoing instability during our reconnaissance. As described in Section 1.1, the proposed development will include the placement of up to about 7 feet of structural fill in the area of the proposed roadway and ADA path to reach finished grades. New fill slopes will have finished gradients up to 2 horizontal to 1 vertical (2H:1V). We conclude the proposed development will have no significant impact on the potential for large-scale slope instability.

In no case should surface runoff or discharge from drains be directed onto the site slopes. The ground surface adjacent to the building should be sloped to drain away from the building and surface runoff should be collected and routed to a suitable discharge point. Surface water should not be directed into foundation drains. Surface and any subsurface drains should be connected to the nearest storm drain or other suitable discharge point.

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[27] Washington State Department of Ecology, 2020. Well Log Records, *accessed July 2020*, from web site: https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/textsearch.aspx

[28] Clark Regional Emergency Services Agency, *2020*, Hazard Maps, Clark County, Washington, *accessed July 2020*, from CRESA website: https:// http://cresa911.org/emergency-management/mitigation/hazard-maps/

The established vegetation observed at the site should generally provide protection from excessive erosion and no remedial measures are warranted at this time. Any areas of exposed soils, should, at a minimum, be monitored for erosion and preferably be vegetated or otherwise protected from erosion.

7.2 Seismic Shaking

To minimize the risk that this hazard will adversely impact the proposed development should be designed and constructed in accordance with current building codes. The proposed development will have no impact on this hazard.

7.3 Other Hazards

Other geologic hazards identified in the Clark County Code Chapter 40.430.030(C)(5) and the 2006 Washington State Geologist Licensing Board Guidelines for Preparing Engineering Geology Reports in Washington include:

- Subsidence
- Erosion
- Fault Rupture
- Expansive Soils
- Volcanic Hazards

Based on our research, field reconnaissance, and previous experience in the area, none of these hazards are present at the site.

8.0 LIMITATIONS

The scope of this assignment did not include services related to geotechnical engineering for the proposed development such as bearing capacity evaluation, settlement estimates, recommendations regarding stripping and filling, or the use of footing/floor slab drains, etc. Additionally, quantitative soil or rock slope stability analyses was not performed. Our recommendations are not intended to indicate that all geologic hazards can be mitigated by proper engineering. They are provided in order to assist the project engineer in evaluating site conditions based on geologic research and preliminary, site specific, surface and shallow subsurface exploration. If you would like CGT to provide geotechnical recommendations or geotechnical construction observations during site construction, we can prepare a geotechnical report for the site for an additional fee.

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed as, a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

This site evaluation consisted of visual examinations of exposed soil conditions within shallow excavations and a review of readily available geologic resources judged pertinent to the evaluation. Accordingly, the limitations of the site evaluation must be recognized. An exploration of subsurface conditions at depth was not conducted for this evaluation. An investigation to explore subsurface conditions at depth using deeper soil borings or excavations could be conducted at additional cost to the owner to further define the risk of unforeseen, adverse geological issues on this site. However, based on our observations and the information available, the risk of unforeseen adverse geological issues on this site appear to be small and could, in our opinion, be assumed by the owner.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between or away from the explorations. If subsurface conditions vary from those encountered in our site exploration, CGT should be alerted to the change in conditions so that we may provide additional recommendations, if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process. The owner/developer is responsible for insuring that the project designers and contractors implement our recommendations.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood. This report is subject to review and should not be relied upon after a period of three years.

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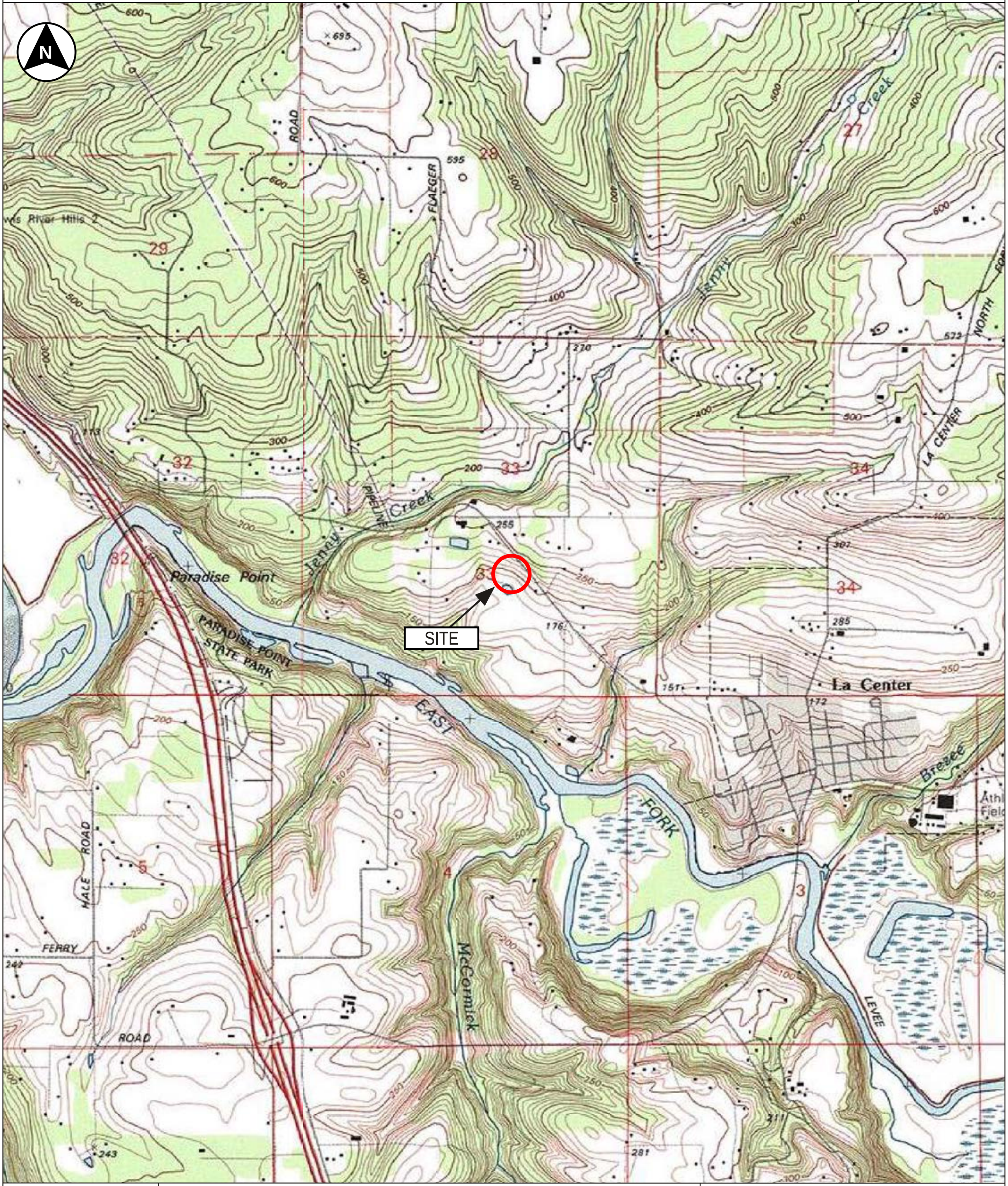
Project Number G2005322

FIGURE 1

Site Location



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Drafted by: MMS

Map created with TOPO!™, © 2006 National Geographic Holdings
USGS 7.5 Minute Topographic Map Series, Ridgefield, Washington Quadrangle, 1990.
Township 5 North, Range 1 East, Section 33 Willamette Meridian

Latitude: 45.870877° North
Longitude: 122.688732° West

1 Inch = 2,000 feet

0 2000 4000

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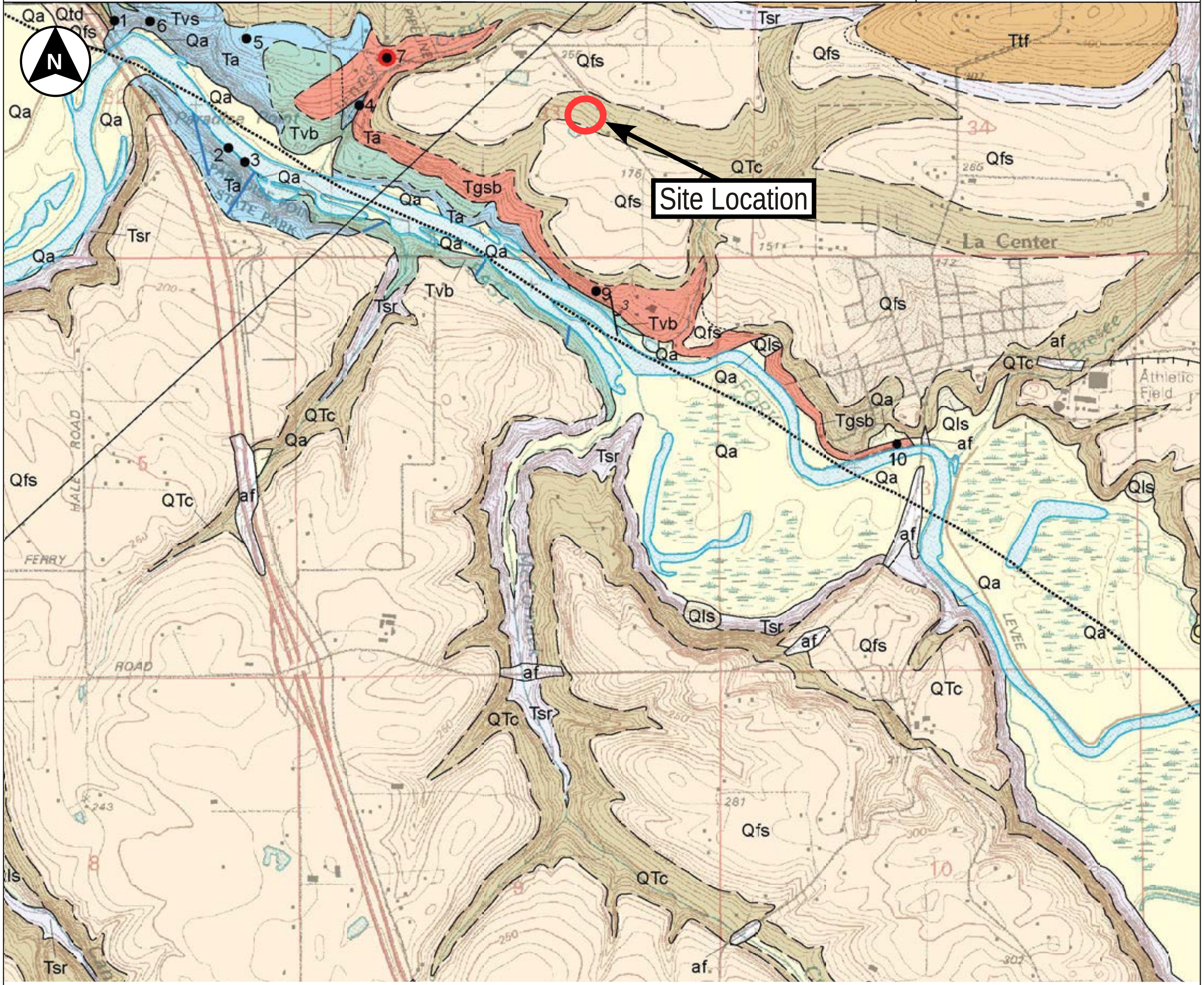
Project Number G2005322

FIGURE 2

Geologic Map



Surficial Deposits

af	Artificial fill
Qa	Alluvium deposits
Qoa	Older alluvium deposits
Qls	Landslide deposits
Ql	Lake deposits
Qfs	Cataclysmic-flood deposits
Qtd	Terrace deposits

Basin-Fill Deposits

QTc	Conglomerate
Ttf	Troutdale formation
Tsr	Sandy River Mudstone

Columbia River Basalt Group

Tgsb	Member of Sentinel Bluffs

Bedrock

Ta	Andesite
Tvb	Volcanic breccia

Contact—Dashed where approximately located; short-dashed where inferred; dotted where concealed

Fault—Dashed where inferred; dotted where concealed

Anticline—Dashed where inferred; dotted where concealed

Strike and dip of beds
10 **Inclined**
⊕ **Horizontal**

Terrace scarp

●33 **Sample locality for chemical analysis**—See table 1

▲ **Glacial erratic**

◇ **Oil well**

●7 **Sample locality for paleomagnetic measurement**

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Map adapted from Evarts, R.C., 2004, Geologic Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington: U.S. Geological Survey, Scientific Investigation Map SIM-2844

Township 5 North, Range 1 East, Section 33 Willamette Meridian

Latitude: 45.870877° North
Longitude: 122.688732° West

1 Inch = 2,000 feet

0 2000 4000

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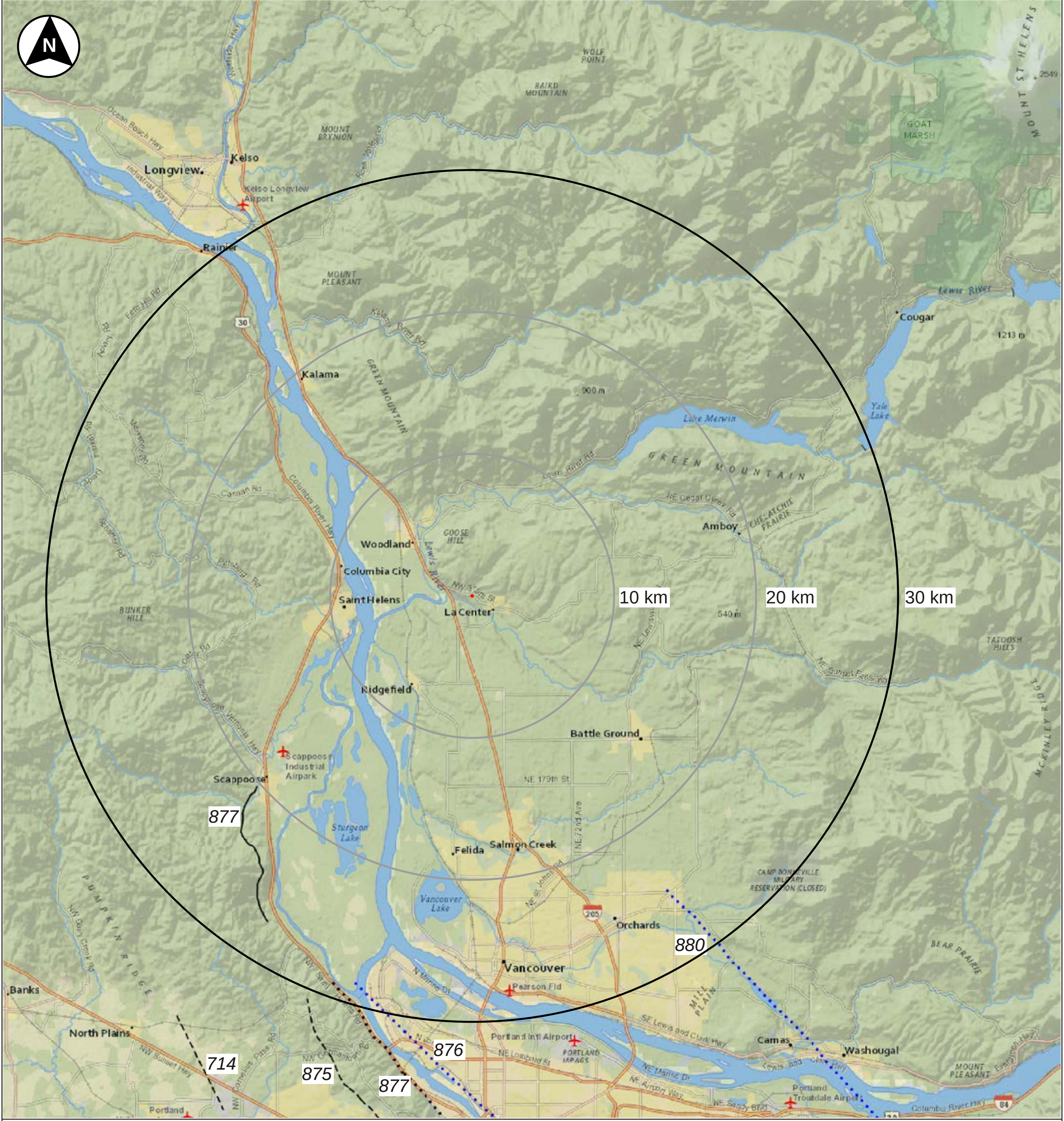
Project Number G2005322

FIGURE 3

USGS Quaternary Faults



LEGEND

🟥 Historic (< 150 years)
🟧 Latest Quaternary (< 15,000 years)
🟩 Late Quaternary (< 130,000 years)
🟦 Middle and late Quaternary (< 750,000 years)
⬛ Undifferentiated Quaternary (< 1.6 million years)
🟨 Unspecified Age
⬜ Class B (age varies)

—— Well constrained location (solid line)
— — Moderately constrained location (dashed line)
· · · Inferred location (dotted line)

716 USGS Fault Number

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NOTES: Data from USGS Quaternary Fault and Fold Database, accessed July 2020, at website: https://earthquake.usgs.gov/cfusion/qfault/.

1 Inch = 10 Kilometers

0 10 20

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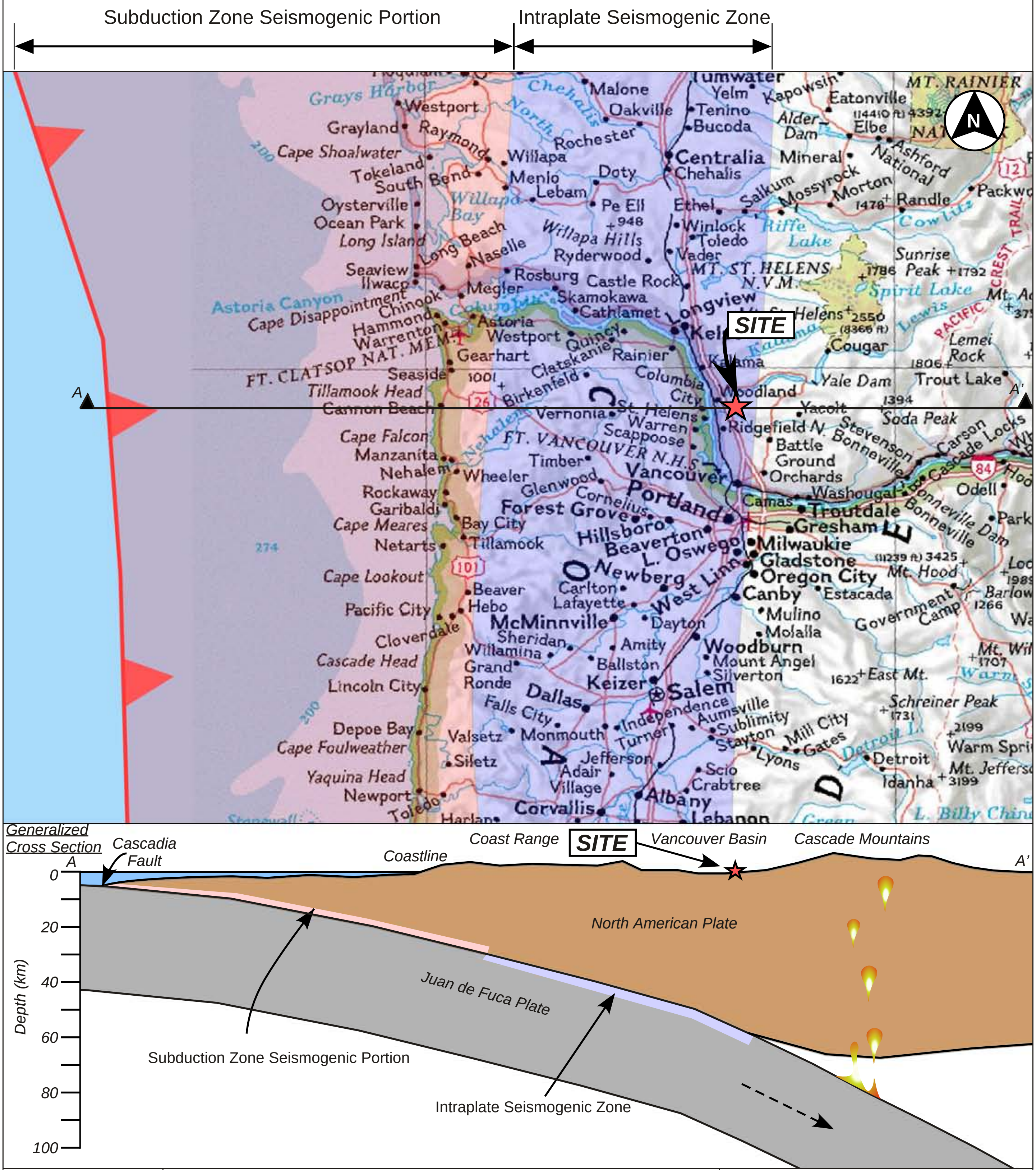
FIGURE 4
Cascadia Subduction Zone



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McCrory, Blair, Oppenheimer, and Walter, 2004. Depth to the Juan de Fuca slab beneath the Cascadia subduction margin - A 3-D model for storing earthquakes: U.S. Geological Survey Data Series 91.

Scale 1 Inch = 50 kilometers
0 50 100

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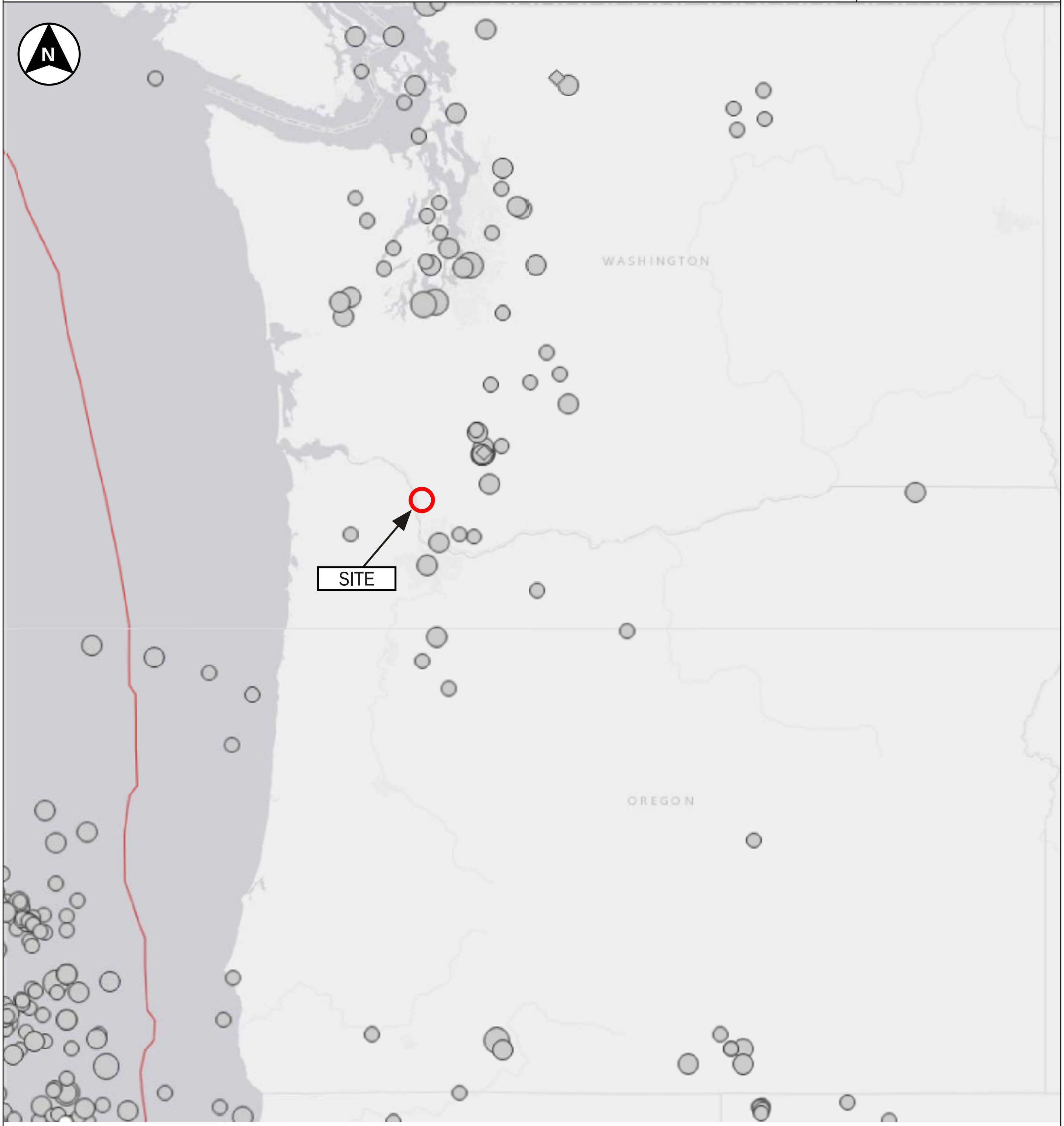
FIGURE 5

Vicinity Earthquakes



1904 - 2020 Earthquakes with Magnitude above M4.5

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Map created from USGS Earthquake Catalog at https://earthquake.usgs.gov/earthquakes/.

Latitude: 45.870877° North
Longitude: 122.688732° West

1 Inch = 100 kilometers

0 100 200

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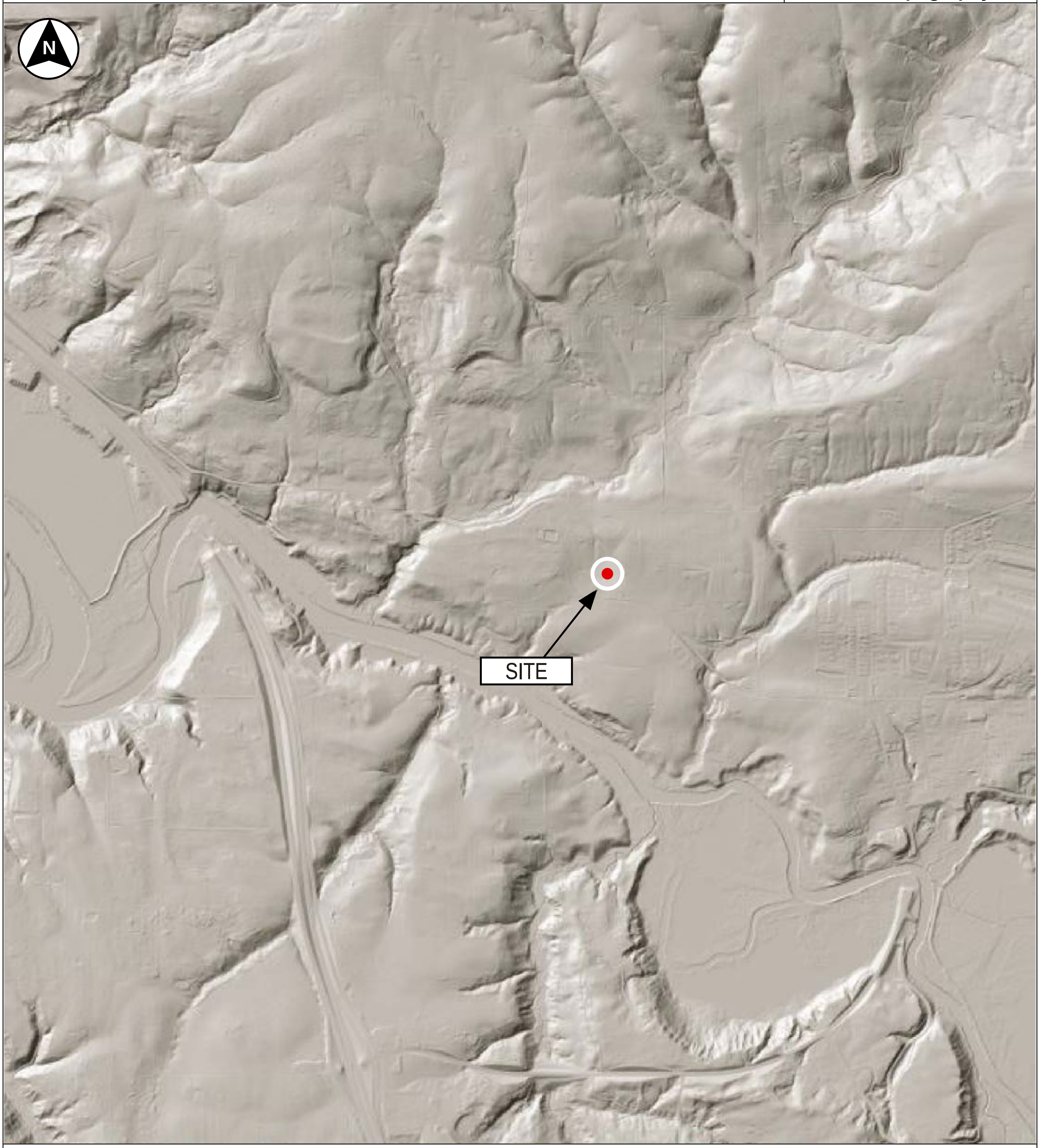
Project Number G2005322

FIGURE 6

Local Topography



NOTES: Bare Earth Lidar Hillshade mapping obtained from Washington State Department of Natural Resources, 2020. Washington State Geologic Information Portal, accessed July 2020, from Washington State DNR website: https://geologyportal-qa.dnr.wa.gov/

Latitude: 45.870877° North
Longitude: 122.688732° West

1 Inch = 2,000 Feet

0 2,000 4,000

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FIGURE 7

Geologic Hazard Overlay

LEGEND

🟪 Landslide Hazard Areas

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Map adapted from Clark County Landslide Areas from the Clark Regional Emergency Services Agency (CRESA), accessed July 2020, http://cresa911.org/emergency-management/mitigation/hazard-maps/

Latitude: 45.870877° North
Longitude: 122.688732° West

1 Inch = 500 feet
0 500 1000

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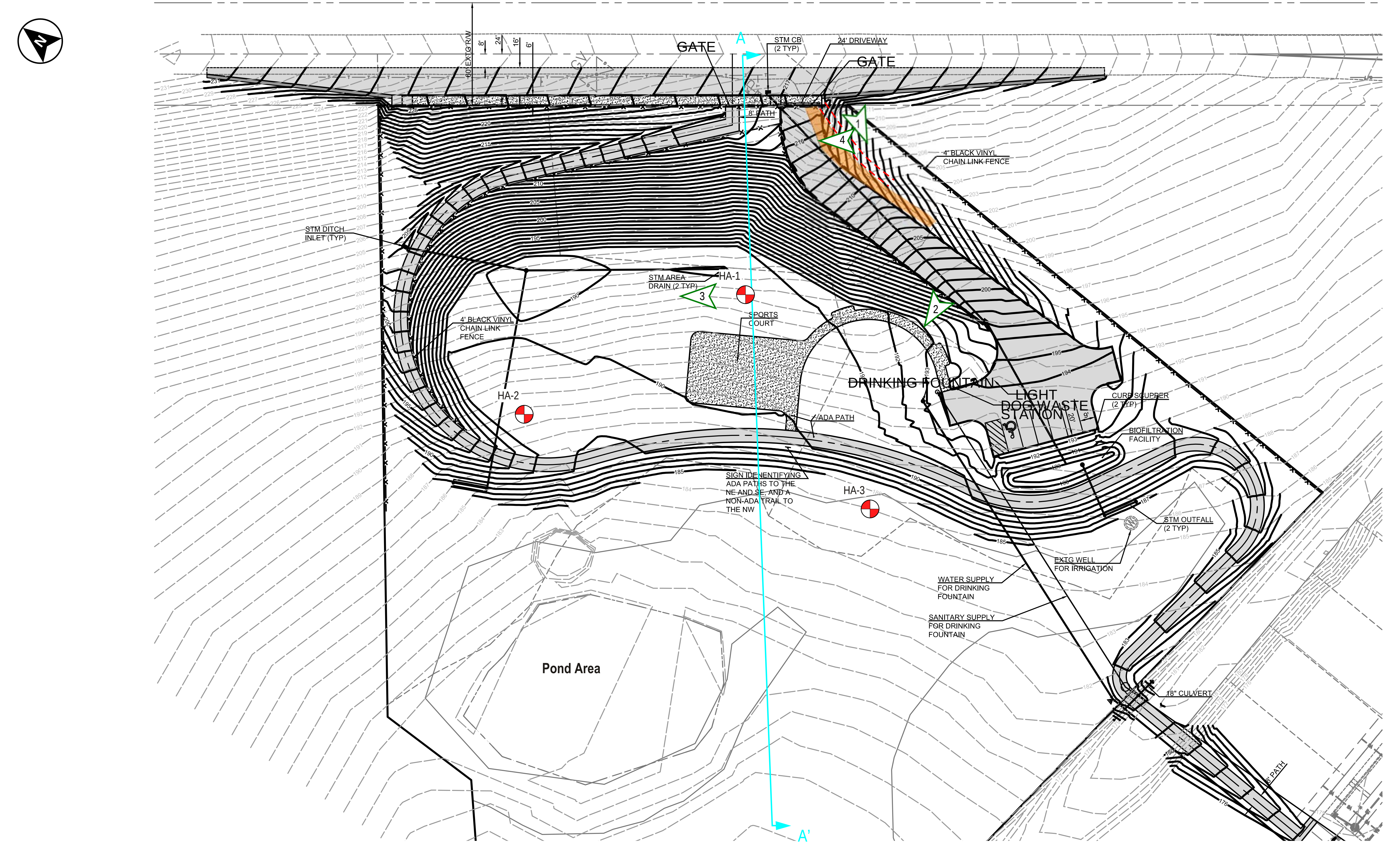
FIGURE 8

Site Plan



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LEGEND

HA-1
● Hand auger boring

A A' Location of cross section shown on Figure 10

🟧 Approximate location of berm

1 Orientation of site photographs shown on Figure 9

- - - Existing Gravel Path

1 Inch = 60 Feet
0 60 120

NOTES: Drawing based on Sheet 1, "Site Plan", produced by PLS Engineering, undated, and modified by CGT. All locations are approximate.

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FIGURE 9

Site Photographs

Photograph 1

Photograph 2

Photograph 3

Photograph 4

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See Figure 8 for approximate photograph locations and directions. Photographs were taken at the time of our fieldwork.

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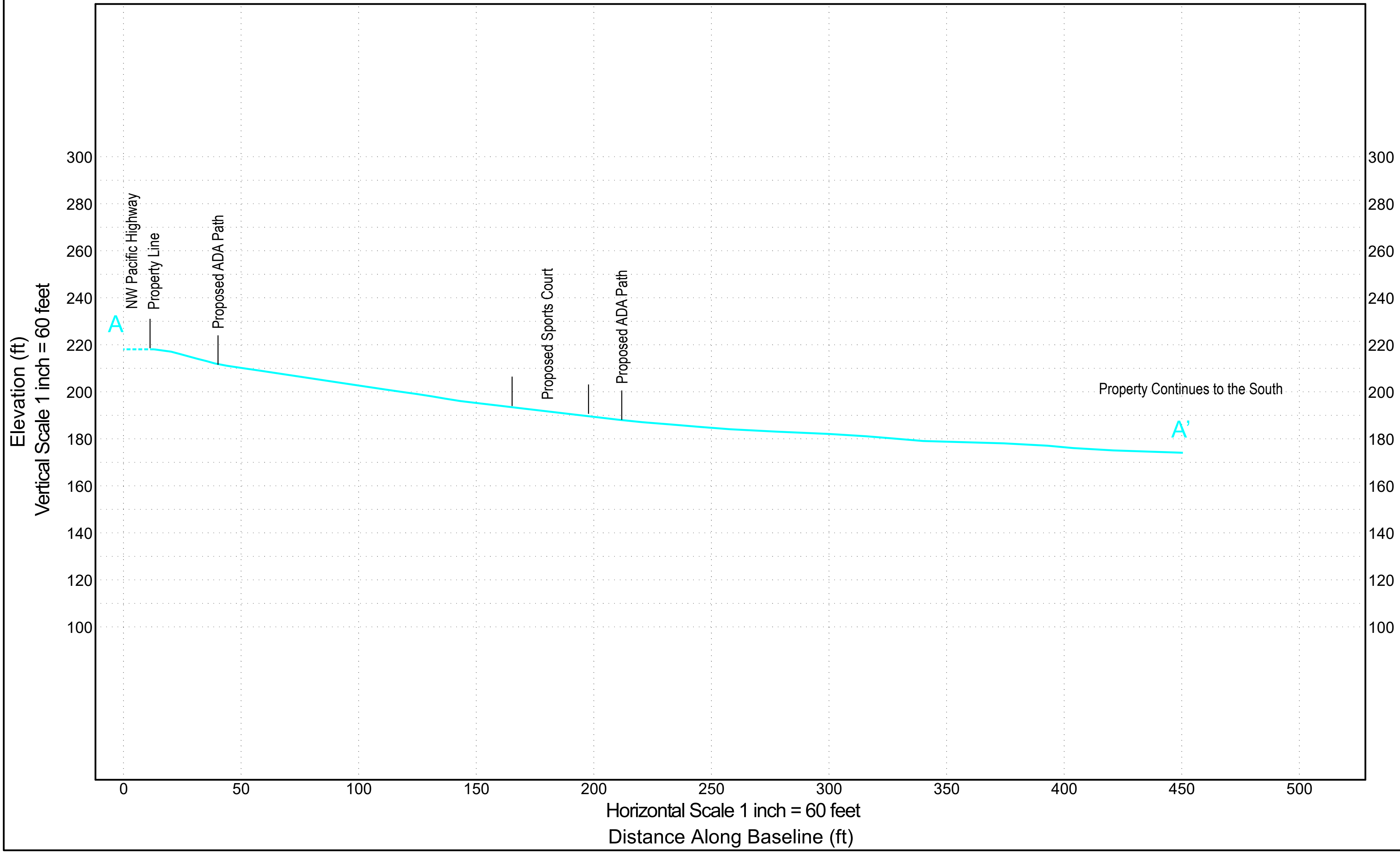
FIGURE 10 - Topographic Profile A-A'

CLIENT Peter Ettro - Ettro Capital
PROJECT NUMBER G2005233
PROJECT NAME Ridgeline Park
PROJECT LOCATION 34512 NW Pacific Highway, La Center, Washington



STRATIGRAPHY & GW - A SIZE W LEGEND LOGS.GPJ 7/11/20 DRAFTED BY: MMS

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Salem Office **(503) 589-1252**
Tigard Office **(503) 684-3460**

Appendix A: Subsurface Investigation

Ridgeline Park
34512 NW Pacific Highway
La Center, Washington

CGT Project Number G2005233

July 22, 2020

Prepared For:

Peter Ettro
Ettro Capital
340 Oswego Point Drive #208
Lake Oswego, Oregon 97034

Prepared by
Carlson Geotechnical

A.1.0 SUBSURFACE INVESTIGATION

Our field investigation consisted of three hand auger borings completed in July 2020. The boring locations are shown on the Site Plan, attached to the main report as Figure 2. The boring locations shown therein were recorded in the office using desktop GIS software and located in the field using handheld a GPS device, and are approximate (+/- 30 feet horizontally). Surface elevations indicated on the logs were estimated based on the topographic contours shown on the referenced Site Plan and are approximate. The attached figures detail the exploration methods (Figure A1), soil classification criteria (Figure A2), and present detailed logs of the explorations (Figures A3 through A5), as discussed below.

A.1.1 Hand Auger Borings

CGT advanced three hand auger borings (HA-1 through HA-3) at the site on July 16, 2020, to depths of up to about 5½ feet bgs using equipment provided and operated by CGT. The hand auger borings were loosely backfilled with the excavated materials upon completion.

A.1.2 Material Classification & Sampling

Representative grab samples of the soils encountered were obtained at select intervals within the hand auger borings. A qualified member of CGT’s geological staff collected the samples and logged the soils in general accordance with the Visual-Manual Procedure (ASTM D2488). An explanation of this classification system is attached as Figure A2. The grab samples were stored in sealable plastic bags and transported to our soils laboratory for further examination. Our geotechnical staff visually examined all samples in order to refine the initial field classifications.

A.1.3 Subsurface Conditions

Subsurface conditions are summarized in Section 6.2 of the main report. Detailed logs of the explorations are presented on the attached exploration logs, Figures A3 through A5.

RIDGELINE PARK -LA CENTER, WASHINGTON
Project Number G2005233

FIGURE A1

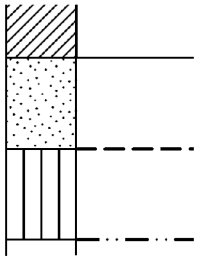
Exploration Key

PL ──●── LL MC	Atterberg limits (plasticity) test results (ASTM D4318): PL = Plastic Limit, LL = Liquid Limit, and MC= Moisture Content (ASTM D2216)
☐ FINES CONTENT (%)	Percentage passing the U.S. Standard No. 200 Sieve (ASTM D1140)

SAMPLING

GRAB	Grab sample
BULK	Bulk sample
☒ SPT	**Standard Penetration Test** (SPT) consists of driving a 2-inch, outside-diameter, split-spoon sampler into the undisturbed formation with repeated blows of a 140-pound, hammer falling a vertical distance of 30 inches (ASTM D1586). The number of blows (N-value) required to drive the sampler the last 12 inches of an 18-inch sample interval is used to characterize the soil consistency or relative density. The drill rig was equipped with an cat-head or automatic hammer to conduct the SPTs. The observed N-values, hammer efficiency, and N_{60} are noted on the boring logs.
⧗ MC	**Modified California** sampling consists of 3-inch, outside-diameter, split-spoon sampler (ASTM G3550) driven similarly to the SPT sampling method described above. A sampler diameter correction factor of 0.44 is applied to calculate the equivalent SPT N_{60} value per Lacroix and Horn, 1973.
▯ CORE	**Rock Coring** interval
▮ SH	**Shelby Tube** is a 3-inch, inner-diameter, thin-walled, steel tube push sampler (ASTM D1587) used to collect relatively undisturbed samples of fine-grained soils.
WDCP	**Wildcat Dynamic Cone Penetrometer** (WDCP) test consists of driving 1.1-inch diameter, steel rods with a 1.4-inch diameter, cone tip into the ground using a 35-pound drop hammer with a 15-inch free-fall height. The number of blows required to drive the steel rods is recorded for each 10 centimeters (3.94 inches) of penetration. The blow count for each interval is then converted to the corresponding SPT N_{60} values.
DCP	**Dynamic Cone Penetrometer** (DCP) test consists of driving a 20-millimeter diameter, hardened steel cone on 16-millimeter diameter steel rods into the ground using a 10-kilogram drop hammer with a 460-millimeter free-fall height. The depth of penetration in millimeters is recorded for each drop of the hammer.
POCKET PEN. (tsf)	**Pocket Penetrometer** test is a hand-held instrument that provides an approximation of the unconfined compressive strength in tons per square foot (tsf) of cohesive, fine-grained soils.

CONTACTS



Observed (measured) contact between soil or rock units.

Inferred (approximate) contact between soil or rock units.

Transitional (gradational) contact between soil or rock units.

ADDITIONAL NOTATIONS

Italics	Notes drilling action or digging effort
{ Braces }	Interpretation of material origin/geologic formation (e.g. { Base Rock } or { Columbia River Basalt })

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All measurements are approximate.

RIDGELINE PARK - LA CENTER, WASHINGTON
Project Number G2005233

FIGURE A2
Soil Classification

Classification of Terms and Content

NAME:
- Group Name and Symbol
- Relative Density or Consistency
- Color
- Moisture Content
- Plasticity
- Other Constituents
- Other: Grain Shape, Approximate Gradation
- Organics, Cement, Structure, Odor, etc.
- Geologic Name or Formation

Grain Size

		U.S. Standard Sieve
Fines		<#200 (0.075 mm)
Sand	Fine	#200 - #40 (0.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
Gravel	Fine	#4 - 0.75 inch
	Coarse	0.75 inch - 3 inches
Cobbles		3 to 12 inches
Boulders		> 12 inches

Coarse-Grained (Granular) Soils

Relative Density

SPT N_{60}-Value	Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
>50	Very Dense

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace silt"
5 - 15%	"With" as part of group name	"**POORLY GRADED SAND WITH SILT**"
15 - 49%	Modifier to group name	"**SILTY SAND**"

Fine-Grained (Cohesive) Soils

SPT N_{60}-Value	Torvane tsf Shear Strength	Pocket Pen tsf Unconfined	Consistency	Manual Penetration Test
<2	<0.13	<0.25	Very Soft	Thumb penetrates more than 1 inch
2 - 4	0.13 - 0.25	0.25 - 0.50	Soft	Thumb penetrates about 1 inch
4 - 8	0.25 - 0.50	0.50 - 1.00	Medium Stiff	Thumb penetrates about ¼ inch
8 - 15	0.50 - 1.00	1.00 - 2.00	Stiff	Thumb penetrates less than ¼ inch
15 - 30	1.00 - 2.00	2.00 - 4.00	Very Stiff	Readily indented by thumbnail
>30	>2.00	>4.00	Hard	Difficult to indent by thumbnail

Minor Constituents

Percent by Volume	Descriptor	Example
0 - 5%	"Trace" as part of soil description	"trace fine-grained sand"
5 - 15%	"Some" as part of soil description	"some fine-grained sand"
15 - 30%	"With" as part of group name	"**SILT WITH SAND**"
30 - 49%	Modifier to group name	"**SANDY SILT**"

Moisture Content

Dry: Absence of moisture, dusty, dry to the touch

Moist: Leaves moisture on hand

Wet: Visible free water, likely from below water table

	Plasticity	Dry Strength	Dilatancy	Toughness
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Medium	Medium to High	None to Slow	Medium
MH	Medium to High	Low to Medium	None to Slow	Low to Medium
CH	Medium to High	High to Very High	None	High

Structure

Stratified: Alternating layers of material or color >6 mm thick

Laminated: Alternating layers < 6 mm thick

Fissured: Breaks along definite fracture planes

Slickensided: Striated, polished, or glossy fracture planes

Blocky: Cohesive soil that can be broken down into small angular lumps which resist further breakdown

Lenses: Has small pockets of different soils, note thickness

Homogeneous: Same color and appearance throughout

Visual-Manual Classification

Major Divisions			Group Symbols	Typical Names
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: 50% or more *retained* on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel/sand mixtures, little or no fines
			GP	Poorly-graded gravels and gravel/sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel/sand/silt mixtures
			GC	Clayey gravels, gravel/sand/clay mixtures
	Sands: More than 50% *passing* the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand/silt mixtures
			SC	Clayey sands, sand/clay mixtures
Fine-Grained Soils: 50% or more Passes No. 200 Sieve	Silt and Clays Low Plasticity Fines		ML	Inorganic silts, rock flour, clayey silts
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
			OL	Organic soil of low plasticity
	Silt and Clays High Plasticity Fines		MH	Inorganic silts, clayey silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic soil of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

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References:

ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

Terzaghi, K., and Peck, R.B., 1948, Soil Mechanics in Engineering Practice, John Wiley & Sons.

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FIGURE A3

Boring HA-1

PAGE 1 OF 1

CLIENT Peter Ettro - Ettro Capital
PROJECT NAME Ridgeline Park
PROJECT NUMBER G2005233
PROJECT LOCATION 34512 NW Pacific Highway, La Center, Washington

DATE STARTED 7/16/20
GROUND ELEVATION 200 ft
ELEVATION DATUM Topographic Contours - Site Plan
WEATHER cloudy, ~65 degrees
SURFACE grass
LOGGED BY MLL
REVIEWED BY RTH
DRILLING CONTRACTOR CGT
SEEPAGE ---
EQUIPMENT 3-inch diameter hand auger
GROUNDWATER DURING DRILLING ---
DRILLING METHOD Manual Hand Auger
GROUNDWATER AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Dark brown, moist, low plasticiy, abundant rootlets.		0						
			LEAN CLAY: *Stiff*, light brown, moist, low plasticity, trace rootlets.								
198					2	GRAB 1					
		CL	Brown, trace fine-grained sand below 3 feet bgs.								
196					4						
194											
192											
190											

- Hand auger boring terminated at 5½ feet bgs.
- No groundwater or caving encountered.
- Boring loosely backfilled with excavated material upon completion.

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FIGURE A4

Boring HA-2

CLIENT Peter Ettro - Ettro Capital
PROJECT NAME Ridgeline Park
PROJECT NUMBER G2005233
PROJECT LOCATION 34512 NW Pacific Highway, La Center, Washington
DATE STARTED 7/16/20
GROUND ELEVATION 190 ft
ELEVATION DATUM Topographic Contours - Site Plan
WEATHER cloudy, ~65 degrees
SURFACE grass
LOGGED BY MLL
REVIEWED BY RTH
DRILLING CONTRACTOR CGT
SEEPAGE ---
EQUIPMENT 3-inch diameter hand auger
GROUNDWATER DURING DRILLING ---
DRILLING METHOD Manual Hand Auger
GROUNDWATER AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Dark brown, moist, low plasticiy, abundant rootlets.		0						
	▨	CL	**LEAN CLAY:** *Stiff*, brown, moist, low plasticity, trace rootlets.								
188	▨				2						
186	▨				4						

- Hand auger boring terminated at 5 feet bgs.
- No groundwater or caving encountered.
- Boring loosely backfilled with excavated material upon completion.

ELEVATION (ft)
184
182
180

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FIGURE A5

Boring HA-3

CLIENT Peter Ettro - Ettro Capital
PROJECT NAME Ridgeline Park
PROJECT NUMBER G2005233
PROJECT LOCATION 34512 NW Pacific Highway, La Center, Washington
DATE STARTED 7/16/20
GROUND ELEVATION 184 ft
ELEVATION DATUM Topographic Contours - Site Plan
WEATHER cloudy, ~65 degrees
SURFACE grass
LOGGED BY MLL
REVIEWED BY RTH
DRILLING CONTRACTOR CGT
SEEPAGE ---
EQUIPMENT 3-inch diameter hand auger
GROUNDWATER DURING DRILLING ---
DRILLING METHOD Manual Hand Auger
GROUNDWATER AFTER DRILLING ---

ELEVATION (ft)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION	GROUNDWATER	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	WDCP N_{60} VALUE	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ WDCP N_{60} VALUE ▲ PL MC LL ☐ FINES CONTENT (%) ☐ 0 20 40 60 80 100
		OL	**ORGANIC SOIL:** Dark brown, moist, low plasiticy, abundant rootlets.		0						
		CL	**LEAN CLAY:** *Medium stiff*, dark brown to brown, moist, low plasticity, trace rootlets.								
182					2						
			Stiff, brown below 2 feet bgs.			GRAB 1					
180					4						
178			• Hand auger boring terminated at 5 feet bgs. • No groundwater or caving encountered. • Boring loosely backfilled with excavated material upon completion.								
176											
174											