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6334 PRELIMINARY GEOTECHNICAL CONSULTATION

North Clackamas Parks and Recreation District
150 Beavercreek Road
Oregon City, OR 97045

Attention: Kathryn Krygier, Planning & Development Manager

**SUBJECT: Preliminary Geotechnical Consultation Services**
**Oak Lodge Community Project**
**3811 SE Concord Road**
**Milwaukie, Oregon**

At your request, GRI completed preliminary geotechnical consultation services for the above-referenced property in Milwaukie, Oregon. The Vicinity Map, Figure 1, shows the general location of the site. The evaluation was conducted to provide information regarding the subsurface conditions at the site and discuss pertinent geotechnical and geologic issues to assist the project team during the predesign stage and scoping phase of the project. GRI understands a full geotechnical investigation, including subsurface explorations, engineering, and report, will be completed at a later date. This letter describes the work accomplished and provides our preliminary evaluation of the site with respect to geotechnical considerations to assist with predesign and scoping of the project.

## SITE DESCRIPTION

The proposed community center site is currently occupied by North Clackamas Parks and Recreation District, located at 3811 SE Concord Road in unincorporated Oak Grove, Oregon, and is bordered commercial properties to the west; SE Concord Road to the south; and residential housing to the north and east. The site is partially bisected by SE Spaulding Avenue. Based on satellite and street view imagery, the southern portion of the site is occupied by an existing building, with grass fields on the northern portion of the property and play areas to the west. Mature trees surround the building and site perimeter, and an approximately 4 to 6 ft high retaining wall surrounds the north and east side of the existing building. Portland cement concrete (PCC) sidewalks and asphalt concrete (AC) pavement roadways are located along the south, central, and west portions of the property. Figure 2 shows the existing site.

All elevations listed in this letter reference the North American Vertical Datum of 1988 (NAVD 88). A review of the U.S. Geological Survey (USGS) Gladstone Quadrangle (2017) indicates the maximum elevation at the site is along the northeast edge of the property at about elevation 235 ft. The property slopes gently downward to the southwest to about elevation 215 ft along the southwest edge of the property.

## PROJECT DESCRIPTION

We understand the project consists of a renovation of the existing North Clackamas Parks and Recreation District building to construct a new community center and park for North Clackamas Parks and Recreation

District. A new library for Oak Lodge is also being considered on the site. We understand Catena Consulting Engineers (Catena) is the structural engineer for the project.

## SUBSURFACE CONDITIONS

Subsurface materials and conditions at the site were evaluated based on our review of available geotechnical and geologic information. Based on our experience in the project vicinity, fill soils consisting of silt, clay, sand, and gravels are likely locally present near the ground surface within the project area. Native soils in the area consist of alluvial deposits of silt, sand, and clay, often containing layers of gravels and cobbles.

Published geologic mapping indicates the site is mantled with Quaternary catastrophic flood deposits of coarse-grained and fine-grained facies. In general, the catastrophic flood deposits are composed of unconsolidated silt, sand, and gravel deposits. Immediately east of the project site, mapping indicates the area is mantled with Miocene-era flows of the Columbia River Basalt Group (Madin, 2004). Figure 3 shows the major geologic formations that mantle the site and surrounding area.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey identifies the soil at the project site, within approximately 80 in. of the surface, consists of Aloha silt loam and Woodburn silt loam. Aloha silt loam and Woodburn silt loam consist primarily of silt, sand, and clay, have a low plasticity, and have a slow infiltration rate when thoroughly wet (USDA, 2019). Figure 4 shows the mapped soil units within the immediate vicinity of the project site.

### Groundwater

Information available through the U.S. Geological Survey (USGS, 2019) indicates the regional groundwater level in this area may be in the range of 40 ft below the ground surface. Review of nearby wells through the Oregon Water Resources Department well report query mapping tool (OWRD, 2019) indicates the local groundwater level in this area may range from about 5 to 10 ft below the ground surface. However, we anticipate perched groundwater in the low-permeability fine-grained soil mantling the site during periods of heavy and prolonged rain and the wet winter season could approach the ground surface. The perched groundwater will be the lowest during the normally dry late summer and early fall months.

## GEOLOGIC HAZARDS

The Oregon Department of Geology and Mineral Industries (DOGAMI) has a Statewide Landslide Information Database for Oregon (SLIDO), which compiles landslides that have been identified on published maps. A review of the SLIDO website indicates no landslides have been documented within or adjacent to the project site. One landslide has been mapped approximately one-half mile southeast of the project site, as shown on Figure 5. These landslides are typically within drainages, over-steepened natural slopes, or poorly compacted fill slopes.

The USGS maps the Oatfield fault across the southwestern corner of the project site; however, the USGS does not consider the Oatfield fault to be an active contributing source in their current Probabilistic Seismic Hazard Analysis (PSHA). The USGS considers the Portland Hills fault located about 1.2 miles (1.9 km) east of the project site and the Bolton fault located approximately 1.9 miles (3.0 km) southwest of the site to be the closest crustal fault sources contributing to the overall seismic hazard at the site. The nearby Quaternary faults are shown on the Local Fault Map, Figure 6. The Cascadia Subduction Zone is mapped approximately

100 km west of the site (Petersen et al., 2014). The risk of damage by tsunami and/or seiche at the site is absent.

### Oatfield Fault

The Oatfield fault is mapped across the southwestern corner of the project site, as shown on Figure 7. Southeast of the site, the fault location is depicted as moderately well constrained, whereas within and adjacent to the project site, the fault location is shown as "inferred", meaning the fault location is approximately located (USGS, 2020). The Oatfield fault strikes northwest, has an approximately 70° northeast dip, and is estimated to be on the order of 40 km in length (Horst, 2019). The fault offsets Miocene-age Wanapum Basalt, part of the Columbia River Basalt Group volcanic rocks (Wells et al., 2018). The Portland Hills fault zone includes the Oatfield fault as well as the Portland Hills fault (located approximately 1.2 miles east of the project site) and is interpreted as potentially seismogenic (capable of generating earthquakes) (Wong et al., 2001). The USGS Quaternary Fold and Fault Database characterizes the Oatfield fault's age of most recent activity as undifferentiated Quaternary, which indicates evidence of activity within the last 1.6 million years exists, but timing of fault activity (such as recurrence and the most recent earthquake event) is unconstrained (Personius et al., 2002). Fault motion is believed to be reverse and right-lateral strike-slip (Wells et al., 2018; Personius et al., 2002). The Oatfield fault is believed to be capable of generating up to a moment magnitude ($M_W$) 7.0 (reverse) to $M_W$ 7.1 (strike-slip) earthquakes (Horst, 2019). In addition to the poorly constrained timing of fault activity, uncertainty exists about the precise location of the Oatfield fault. Heavy vegetation, urbanization, and thick alluvial sediments mantling the ground surface associated with the Missoula Floods (12,000 to 15,000 years ago) obscure potential surface exposures of potentially active faults in the Portland area (Wong et al., 2001).

Given the poorly constrained Quaternary deformation history, uncertainty about the precise location of the Oatfield fault, and lack of historical earthquake activity, in our opinion, the risk of hazard presented by surface fault rupture of the Oatfield fault at the site during the design life of the proposed structures is low. However, given the proposed public use of the new improvements, in our opinion, a program of field investigation to evaluate the potential presence of subsurface structures consistent with a Quaternary fault should be completed. We recommend a phased program of geophysical explorations followed by test pits to evaluate potential fault structures if deemed appropriate. The test pits may assist in evaluating the location and offset information regarding the Oatfield fault and, additionally, will provide opportunity to collect geotechnical information for building design. Conversely, the geophysical work and test pits would also provide a means to document the absence of potential fault structure in areas of new improvements. It should be noted that the effectiveness of test pits may be limited by thickness of overlying soil units and possible shallow groundwater.

## SUMMARY OF FINDINGS

### General

Our review of available geologic and geotechnical literature indicates the site is likely mantled with variable thickness of local fill soils primarily consisting of silt, clay, sand, and gravel. The fill soils are underlain by alluvial deposits of silt, sand, and clay, often containing layers of gravels and cobbles, over the Columbia River Basalt Formation at depth. Fill soils, where present, may not be suitable for the support of on-grade structures depending on the fill composition, magnitude of foundation loads, and settlement sensitivity. The fine-grained fill and alluvial soils are extremely sensitive to moisture content and easily disturbed by construction activities when wet. Careful working procedures and the use of imported granular fill material may be necessary if site preparation and grading are undertaken during wet-weather and wet-ground conditions.

Excavations that encounter rock may require additional effort to remove. Areas of highly fractured or weathered rock may be able to be excavated with a large dozer and/or hydraulic excavator equipped with a rock bucket and rock teeth. More specialized rock excavation techniques, such as chipping, splitting, or expansive grout, may be necessary if zones of less-weathered, less-fractured rock are encountered.

**Foundations**

The foundation design for the proposed structure will depend on the building type and finished grade elevation. One- or two-story structures with a finished floor at existing grade may be able to be supported on conventional spread and wall footings if the foundation loads are relatively light. Fill soils encountered beneath proposed structures will likely need to be recompacted and/or replaced with compacted structural fill or reinforced with ground improvement. Buildings that have moderate to high foundation loads and are constructed at existing grade need to be supported on firm native soils, ground improvement, or pile foundations extending into the underlying native soils.

Buildings that are designed with below-grade levels may be supported on shallow footings, ground improvement, or piles based on their foundation loads, depth of excavation, and subgrade soil and rock materials. We anticipate foundation support for buildings with below-grade levels extending into formational materials can be provided by spread footings or a mat foundation. It may be cost effective to support perimeter wall loads on soldier piles that are a part of an excavation shoring system. The soldier piles will likely need to extend into the underlying formational material at least 15 ft below the bottom of the excavation. If these piles are incorporated into the foundation system, it is likely that this depth will be increased.

**Excavation Support**

Below-grade excavations in the Portland metropolitan area are usually supported with shoring consisting of cast-in-place soldier piles and lagging with soil anchors (tieback anchors). Soil-nail methods can also be used to support excavations. Soldier piles can also be designed and constructed to support perimeter wall loads. Soldier pile shoring systems are usually more appropriate where underpinning of adjacent structures is necessary. It may also be feasible to use internal braces and struts in lieu of soil anchors. The most appropriate shoring method will depend on soil type and depth, the foundation system, performance (deformation) criteria, easement considerations for soil anchors or soil nails, schedule, and cost.

**Groundwater**

Groundwater or perched groundwater may be encountered in the bottom of below-grade excavations, depending on the excavation depth and time of year. Dewatering of below-grade excavations with sump pumps and/or wells may be required. Below-slab groundwater-control measures may consist of perforated PVC pipes installed below the basement floor slab and connected to sump pumps that remove groundwater below the slab. The sump pumps should be connected to the sanitary sewer system. Alternatively, the basement slab and retaining walls may be designed for hydrostatic pressure.

**Seismic Considerations**

We anticipate the building design of new structures will be performed per the American Society of Civil Engineers (ASCE) 7-16 document with 2019 Oregon Structural Specialty Code (OSSC) modifications. The ASCE 7-16 design methodology uses two mapped bedrock acceleration parameters, $S_S$ and $S_1$, corresponding to periods of 0.2 and 1.0 second to develop the Risk-Targeted Maximum Considered Earthquake ($MCE_R$) response spectrum. The mapped acceleration parameters are based on a target risk of structural collapse equal to 1% in 50 years, which is based on generic structural fragility, and include 5% critical damping. The ground-surface $MCE_R$ spectral response acceleration parameters for short periods ($S_{MS}$) and 1.0 second ($S_{M1}$) are determined by application of site coefficients for the short-period ($F_a$) and long-period ($F_v$), to the mapped acceleration parameters. The short- and long-period site coefficients are established based on the site class and geologic hazards at the site. The $MCE_R$ incorporates both deterministic and probabilistic analysis of potential seismic sources. A site-specific geotechnical investigation will be required to determine the site class. The design-level response spectrum for short periods ($S_{DS}$) and 1.0-second period ($S_{D1}$) are calculated as two-thirds of the ground-surface $MCE_R$ spectrum.

The bedrock (Site Class B/C) mapped acceleration parameters were obtained from the USGS design map web service for the coordinates of 45.4109° N latitude and 122.6243° W longitude. The $S_S$ and $S_1$ acceleration parameters identified for the site are 0.87 g and 0.39 g, respectively. A site-specific geotechnical investigation will be required to determine the site class, site coefficients, and design-level response spectrum.

**Liquefaction/Cyclic Softening**

Liquefaction is the process by which loose, saturated granular materials, such as clean sand and, to a somewhat lesser degree, non-plastic and low-plasticity silts, temporarily lose stiffness and strength during and immediately after a seismic event. "Cyclic softening" is a term that describes a relatively gradual and progressive increase in shear strain with load cycles and is more common within fine-grained soils. Alluvial soil deposits of sand, silt, gravel, and cobbles and potentially shallow groundwater are likely present at the site. A site-specific geotechnical investigation with soil sample collection and testing will be needed to establish soil properties to evaluate the potential for liquefaction and cyclic softening at the site.

**Slope Stability**

Based on information available from the DOGAMI SLIDO website, no landslides have been documented within or adjacent to the project site. Lidar data available from the SLIDO website indicate the most significant slopes are associated with the retaining walls along the north and east side of the existing building. Based on the final grading plans once site improvements are more developed, a site-specific slope stability analysis may need to be performed to evaluate the long-term stability of the proposed slopes. A site-specific geotechnical investigation with soil sample collection and testing will be needed to establish soil strength properties for slope stability analysis.

## LIMITATIONS

This letter has been prepared to aid in preliminary evaluation of the property. The scope is limited to the specific location described herein, and our description of the project represents our understanding of the existing site improvement and conditions. A site-specific geotechnical investigation, including field explorations, laboratory testing, and an engineering analysis should be performed when site-development plans become available.

Submitted for GRI,

Expires 06/2020

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This document has been submitted electronically.

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