Exhibit 12

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

Revised December 3, 2014
Project No. 13-3186

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SUBJECT: PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
GREEN MOUNTAIN - PHASE 1
NE INGLE ROAD & NE 28TH STREET
CAMAS, WASHINGTON

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Proposal No. P-4836, dated April 30, 2014, and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*. This report is considered Preliminary because a final grading plan has not been developed.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The Green Mountain site is located on the north side of NE Goodwin Road and east of NE Ingle Road in the City of Camas, Clark County, Washington. The property includes several tax lots that total approximately 281.6 acres. Topography on the southern portion of the site is flat to gently sloping with grades of about 5 to 10 percent. Steeper slopes (up to 35 percent grade) are present on Green Mountain, which is a basalt cinder cone, located in the northern portion of the site. Near vertical slopes are present at the base of Green Mountain where basalt bedrock is exposed.

Phase 1 is approximately 51 acres and located in the southern portion of the site, which is part of the Green Mountain Golf Course. Topography is flat to gently sloping with grades generally about 5 to 20 percent. Improvements include several structures, parking areas and driveways, cart tracks, manmade ponds, and fairways. Vegetation consists of short grasses and sparse trees.

It is our understanding that the proposed development will consist of a subdivision for single family homes, new streets, and associated underground utilities. A grading plan has not been provided for our review; however, we anticipate maximum cuts and fills will be on the order of about 12 feet due to the sloping topography and filling of existing ponds.

REGIONAL AND LOCAL GEOLOGIC SETTING

Regionally, the subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins.

The low-lying portion of the site is underlain by the Quaternary aged (last 1.6 million years) Willamette Formation, a catastrophic flood deposits associated with repeated glacial outburst flooding of the Willamette Valley (Trimble, 1963; Yeats et al., 1996; Phillips, 1987). The last of these outburst floods occurred about 10,000 years ago. These deposits typically consist of horizontally layered, micaceous, silty sand with gravel that is underlain by medium dense to dense gravel.

The Willamette Formation is underlain by a gravel conglomerate interbedded with siltstone and sandstone. Evarts (2006) indicates the age of the conglomerate is poorly constrained but is likely Pliocene to Pleistocene in age (10,000 to 5.3 million years ago). The conglomerate is partially cemented with the upper portion moderately weathered.

The northern portion of the Green Mountain site is underlain by Basaltic Andesite of Green Mountain (Evarts, 2006). The gray basaltic andesite lava flows erupted from a cinder cone on Green Mountain during the Pleistocene (2.6 to 5.3 million years ago). The basalt contains weathered ash, trace quartzite pebbles, and fine grained xenoliths (Evarts, 2006).

A portion of the site is underlain by Miocene to Pleistocene age (16 to 0.5 million years ago) terrigenous sedimentary rocks belonging to the Troutdale Formation (Evarts, 2006). The Troutdale Formation is informally divided into an upper and lower member. Lithologies in the upper member include lenticular layers of volcaniclastic (vitric) sand, quartzite-bearing gravel, fine-grained sand, silt and clay, micaceous quartz-rich sand, and conglomerate with a cumulative average thickness of 100 to 150 feet. The lower member consists primarily of laminated silty clay and sand with reported thicknesses in water well logs of up to 800 feet. These sediments vary from weakly-consolidated to well-indurated.

REGIONAL SEISMIC SETTING

At least four potential source zones capable of generating damaging earthquakes are thought to exist in the region. These include the Lacamas Creek-Sandy River Fault, Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone, as discussed below.

Lacamas Creek-Sandy River Fault

The Lacamas Creek Fault is recognized based on a fault shear contact between Oligocene (30 million years old) volcanic rocks and the Troutdale Formation, and a series of prominent geomorphic lineaments with a cumulative length of 24 miles (Mundorff, 1964; Beeson et al., 1989). The Sandy River Fault, interpreted from gravity and borehole data, forms a possible right stepping, 7-mile-long extension of the Lacamas Creek Fault that vertically displaces the Columbia River Basalt by 1,300 feet (Beeson et al., 1989; Geomatrix Consultants, 1995). A 1989, M3.9 earthquake in the vicinity may have occurred on the Lacamas Creek Fault. A comprehensive seismic hazard study commissioned by the Oregon Department of Transportation concluded that the Lacamas Creek-Sandy River Fault Zone is potentially active with a possible rupture length of greater than 25 miles. The Lacamas Creek Fault is mapped as being ½ mile southwest of the subject site (Figure 1).

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills, and is about 13 miles southwest of the site. The Oatfield Fault occurs along the western side of the Portland Hills, and is about 16 miles southwest of the site. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000). No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies about 36 miles southwest of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault or Newberg Fault; however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies approximately 50 miles west of the Portland Basin at depths of between 20 and 40 kilometers below the surface.

FIELD EXPLORATION

Our site-specific exploration for Phase 1 was conducted on May 23rd, 2014. A total of 13 exploratory test pits were excavated with a medium sized trackhoe to depths ranging between 5 and 9 feet at the approximate locations shown on Figure 2. Test pits TP-1 and TP-12 are outside of the Phase 1 boundary due to a reconfiguration of the layout and are not presented. The previous investigation for the entire Green Mountain site consisted of 25 exploratory test pits excavated November 5th through 7th, 2013. Five test pits from the previous investigation are located within Phase 1 – test pits TP-1, TP-10, TP-13, TP-15, and TP-16. Test pits from the 2013 investigation for the entire Green Mountain site will be referred to as TP-1 (2013), TP-10 (2013), TP-13 (2013), TP-15 (2013), and TP-16 (2013). It should be noted that exploration locations were located in the field by pacing or taping distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate.

A GeoPacific geologist continuously monitored the field exploration program and logged the borings. Soils observed in the explorations were classified in general accordance with the Unified Soil Classification System. During exploration, our geologist also noted geotechnical conditions such as soil consistency, moisture and groundwater conditions. Logs of test pits are attached to this report. The following report sections are based on the exploration program and summarize subsurface conditions encountered at the site.

Undocumented Fill – Undocumented fill was encountered directly at the ground surface in test pits TP-2, TP-3, TP-4, TP-7, TP-8, TP-10, TP-11, and TP-13. The fill generally consisted of brown, medium stiff to stiff, silt (ML) with gravel, clay, and sand and medium dense, silty sand (SM). The fill extended to a depth of 1.5 to 3.5 feet. It is likely that other areas of undocumented fill exist in the vicinity of the existing structures, driveways, and the throughout the golf course.

Topsoil Horizon – The ground surface in test pits TP-5, TP-6, TP-9, TP-1 (2013), TP-10 (2013), TP-13 (2013), TP-15 (2013), and TP-16 (2013) was directly underlain by a low to highly organic topsoil horizon. The dark brown silt (OL-ML) contained trace amounts of sand and contained fine roots throughout. The topsoil horizon was loose and extended to a depth of 6 to 18 inches.

Colluvial Soil – Colluvial soil, formed by downward migration of material under gravitational forces, was encountered beneath the topsoil horizon in test pit TP-15. These soils generally consisted of stiff to very stiff, silty clay (CL) to clayey silt (ML) with weathered basalt that displayed strong orange and gray mottling. In explorations, the colluvial soil extended to a depth of 3 feet in test pit TP-15.

Buried Topsoil Horizon – A low organic, buried topsoil horizon was encountered beneath the fill in test pit TP-8. The buried topsoil horizon was on the order of 6 inches in thickness - extending to a depth of 3 feet.

Fine Grained Catastrophic Flood Deposits (Willamette Formation) – Underlying the topsoil horizon in test pits TP-5, TP-6, TP-9, TP-1 (2013), TP-10 (2013), and TP-13 (2013); the buried topsoil horizon in test pit TP-8; and the fill in test pits TP-2, TP-4, TP-7, TP-10, and TP-13 was fine grained catastrophic flood deposits. These soils generally consisted of stiff to very stiff, light brown, clayey silt (ML) with trace sand that displayed subtle to strong orange and gray mottling. Where encountered, the flood deposits generally extended to a depth of 3 to 7 feet and beyond the maximum depth of exploration in test pits TP-4, TP-7, TP-8, and TP-1 (2013) excavated to a maximum depth of 8.5 feet.

Conglomerate – Underlying the topsoil horizon in test pits TP-15 (2013) and TP-16 (2013); the fill in test pit TP-3, and the fine grained catastrophic flood deposits in test pits TP-2, TP-5, TP-6, TP-9, TP-10, TP-13, TP-10 (2013), and TP-13 (2013) was dense to very dense subrounded gravel (GM) with sandy, clayey silt matrix; dense, silty sand (SM); and stiff silt (ML) with subrounded gravel. The conglomerate was partially cemented and extended beyond the maximum depth of exploration (6 to 10.5 feet).

Soil Moisture and Groundwater

On May 23, 2014 and November 5 through 7, 2013, soils encountered in test pits were moist to wet. Groundwater seepage was encountered in test pits TP-2, TP-5 through TP-9, TP-13, TP-1 (2013), TP-13 (2013), TP-15 (2013) and TP-16 (2013) at depths of 2 to 8.5 feet. Discharge was visually estimated at ¼ to 2 gallons per minute. In test pit TP-1 (2013), the static groundwater level rose to a depth of 2 feet after the test pit had been left open for a time period of several hours. Experience has shown that temporary perched storm-related groundwater conditions often occur within the surface soils over fine-grained native deposits such as those beneath the site, particularly during the wet season. It is anticipated that groundwater conditions will vary depending on the season, local subsurface conditions, changes in site utilization, and other factors.

SLOPE STABILITY

For the purpose of evaluating slope stability, we: (1) reviewed regional 1:24,000 scale topography by the U.S. Geological Survey and published geologic mapping, (2) reviewed 1:150 scale topographic survey mapping of the site by Olson Engineering, Inc., (3) performed a geological reconnaissance of the site, and (4) evaluated subsurface soil conditions in exploratory test pits. Regional slope stability mapping of Clark County, Washington published by the Washington Department of Natural Resources Division of Geology identifies an area of potential instability on the southwest side of Green Mountain (Fiksdal, 1975). This area roughly correlates with the near vertical rock exposures at the base of Green Mountain that is north of the Phase 1 area. No mapped landslides are indicated in the Phase 1 study area on more recent geologic mapping conducted by Evarts (2006).

Based on the data review, field reconnaissance and site exploration, the slope instability hazard for the Phase 1 portion of the Green Mountain property is considered to be low. Slopes in the Phase 1 area are on the order of 5 to 20 percent. Slope geomorphology at the site is generally smooth and uniform - consistent with relative stability. Subsurface explorations indicate the site is generally underlain by stiff to very-stiff, clayey silt (ML) loess underlain by dense to very dense, silty gravel (GM). These materials are generally characterized by moderate to high shear strength and a relatively high resistance to slope instability on gentle slopes. The Phase 1 area is considered generally suitable for development.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Our investigation indicates that the proposed development is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. The primary geotechnical constraint to development is the presence of fill throughout the site. Up to 5 feet of fill was encountered in the exploratory test pits. It is anticipated that fill is prevalent throughout the fairway areas of the golf course where sand traps, ponds, and sculpted topography have been created.

Stormwater Disposal

Soil conditions at the site generally consist of fine grained flood deposits (consisting of clayey silt with sand) underlain by coarse grained, partially cemented conglomerate consisting of subrounded gravel with a clayey silt matrix and trace sand. Orange and gray mottling was observed in near surface soils in all explorations. Soil moisture conditions were moist to wet and perched groundwater seepage was encountered in test pits TP-2, TP-5 through TP-9, TP-13, TP-1 (2013), TP-13 (2013), TP-15 (2013) and TP-16 (2013) at depths of 2 to 8.5 feet. Static groundwater was measured at a depth of 2 feet below the ground surface in test pit TP-1 (2013). Soil mottling, the presence of clay soils, and the prevalent groundwater seepage indicates the soils will likely accept little runoff – if any. Soils with moderate permeability are already saturated with perched groundwater. We would expect soil conditions to behave more as Soil Group 4 soils than Soil Group 3 soils outlined in the Western Washington Continuous Simulation Hydrology Model.

Site Preparation

Due to the presence of fill through the site, areas of proposed construction and areas to receive fill should be cleared of vegetation and existing fill soils should then be removed to stiff or dense native soils. Organic soils are likely present at the bottom of the ponds and should be removed to stiff, native soils. Inorganic debris and organic materials from clearing should be removed from the site. It is likely that the existing fill may be reused as engineered fill provided that they are properly moisture conditioned and free of organic or inorganic debris. Organic-rich root zones should then be stripped from construction areas of the site or where engineered fill is to be placed. Depth of stripping is estimated to average 8+ inches. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/ excavation has been performed. Stripped topsoil should preferably be removed from the site. Any remaining topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative.

Remaining undocumented fills and any subsurface structures (dry wells, basements, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be removed and the excavations backfilled with engineered fill. Fill in excess of 5 feet was encountered directly at the ground surface in test pits for this investigation. Sculpted topography in the vicinity of the fairways indicates the presence of fill. We anticipate that other areas of fill may exist in the vicinity of the existing structures, parking lots, and driveways.

Engineered Fill

All grading for the proposed construction should be performed as engineered grading in accordance with the applicable building code at time of construction with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 90% of the maximum dry density determined by ASTM D1557 (Modified Proctor) or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Site earthwork will be impacted by soil moisture and shallow groundwater conditions. Earthwork in wet weather would likely require extensive use of cement or lime treatment, or other special measures, at considerable additional cost compared to earthwork performed under dry-weather conditions.

Excavating Conditions and Utility Trenches

We anticipate that on-site soils can be excavated using conventional heavy equipment such as trackhoes to a depth of 9 feet. All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1926), or be shored. The existing native soil is classified as Type B Soil and temporary excavation side slope inclinations as steep as 1H:1V may be assumed for planning purposes. This cut slope inclination is applicable to excavations above the water table only. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions.

Soft, saturated soils and groundwater may be encountered in utility trenches, particularly during the wet season. We anticipate that dewatering systems consisting of ditches, sumps and pumps would be adequate for control of perched groundwater. Regardless of the dewatering system used, it should be installed and operated such that in-place soils are prevented from being removed along with the groundwater. Trench bottom stabilization, such as one to two feet of compacted crushed aggregate base, may be necessary in deeper trenches.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that trench backfill be compacted to at least 95% of the maximum dry density obtained by Modified Proctor ASTM D1557 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench.

Erosion Control Considerations

During our field exploration program, we did not observe soil types that would be considered highly susceptible to erosion, except in areas of steeply sloping topography. In our opinion, the primary concern regarding erosion potential will occur during construction, in areas that have been stripped of vegetation. Erosion at the site during construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw bales and silt fences. If used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

Erosion and sedimentation of exposed soils can also be minimized by quickly re-vegetating exposed areas of soil, and by staging construction such that large areas of the project site are not denuded and exposed at the same time. Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture.

Wet Weather Earthwork

Soils underlying the site are likely to be moisture sensitive and may be difficult to handle or traverse with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact fill to the recommended engineering specifications. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean engineered fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic;
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water;
- Material used as engineered fill should consist of clean, granular soil containing less than 5 percent fines. The fines should be non-plastic. Alternatively, cement treatment of on-site soils may be performed to facilitate wet weather placement;
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials;
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and
- Bales of straw and/or geotextile silt fences should be strategically located to control erosion.

If cement or lime treatment is used to facilitate wet weather construction, GeoPacific should be contacted to provide additional recommendations and field monitoring.

Anticipated Foundations

The proposed residential structures may be supported on shallow foundations bearing on competent undisturbed, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. Foundation design, construction, and setback requirements should conform to the applicable building code at the time of construction. For maximization of bearing strength and protection against frost heave, spread footings should be embedded at a minimum depth of 18 inches below exterior grade. The recommended minimum widths for continuous footings supporting wood-framed walls without masonry are 12 inches for single-story, 15 inches for two-story, and 18 inches for three-story structures. Minimum foundation reinforcement should consist of a No. 4 bar at the top of the stem walls, and a No. 4 bar at the bottom of the footings. Concrete slab-on-grade reinforcement should consist of No. 4 bars placed on 24-inch centers in a grid pattern.

The anticipated allowable soil bearing pressure is 1,500 lbs/ft^2 for footings bearing on competent, native soil and/or engineered fill. A maximum chimney and column load of 30 kips is recommended for the site. The recommended maximum allowable bearing pressure may be increased by 1/3 for short-term transient conditions such as wind and seismic loading. For heavier loads, the geotechnical engineer should be consulted. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.40, which includes no factor of safety. The maximum anticipated total and differential footing movements (generally from soil expansion and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

Footing excavations should penetrate through topsoil and any loose soil to competent subgrade that is suitable for bearing support. All footing excavations should be trimmed neat, and all loose or softened soil should be removed from the excavation bottom prior to placing reinforcing steel bars. Due to the moisture sensitivity of on-site native soils, foundations constructed during the wet weather season may require overexcavation of footings and backfill with compacted, crushed aggregate.

Our recommendations are for house construction incorporating raised wood floors and conventional spread footing foundations. If living space of the structures will incorporate basements, a geotechnical engineer should be consulted to make additional recommendations for retaining walls, water-proofing, underslab drainage and wall subdrains. After site development, a Final Soil Engineer's Report should either confirm or modify the above recommendations.

Pavement Design

For design purposes, we used an estimated resilient modulus of 9,000 for compacted native soil. Table 1 presents our recommended minimum pavement section for dry weather construction.

Table 1. Recommended Minimum Dry-Weather Pavement Section

Material Layer	Light-duty Public Streets	Compaction Standard
Asphaltic Concrete (AC)	3 in.	92%/ 92% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2 in.	95% of Modified Proctor AASHTO T-180
Crushed Aggregate Base 1½"-0	8 in.	95% of Modified Proctor AASHTO T-180
Subgrade	12 in.	95% of Modified Proctor AASHTO T-180 or equivalent

Any pockets of organic debris or loose fill encountered during ripping or tilling should be removed and replaced with engineered fill (see *Site Preparation* Section). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving. If pavement areas are to be constructed during wet weather, the subgrade and construction plan should be reviewed by the project geotechnical engineer at the time of construction so that condition specific recommendations can be provided. The moisture sensitive subgrade soils make the site a difficult wet weather construction project.

During placement of pavement section materials, density testing should be performed to verify compliance with project specifications. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

Seismic Design

Structures should be designed to resist earthquake loading in accordance with the methodology described in the 2010 ASCE-7 Standard. We recommend Site Class D be used for design. Design values determined for the site using the USGS (United States Geological Survey) *U.S. Seismic Design Maps* tool (Version 3.1.0) are summarized in Table 2, presented on the following page.

Table 2. Recommended Earthquake Ground Motion Parameters (2010 ASCE-7)

Parameter	Value
Location (Lat, Long), degrees	45.646, -122.457
Mapped Spectral Acceleration Values (MCE):	
Peak Ground Acceleration	0.374
Short Period, S_s	0.880 g
1.0 Sec Period, S_1	0.375 g
Soil Factors for Site Class D:	
F_a	1.148
F_v	1.650
Residential Site Value = 2/3 x F_a x S_s	0.673 g
Residential Seismic Design Category	D_0

Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to earthquake shaking. Soil liquefaction is generally limited to loose, granular soils located below the water table. Following development, on-site soils will consist predominantly of engineered fill or native fine-grained soils above the water table, which are not considered susceptible to liquefaction. Therefore, it is our opinion that special design or construction measures are not required to mitigate the effects of liquefaction.

Drainage

The upslope side of retaining walls and perimeter footings should be provided with a drainage system consisting of 3-inch diameter, slotted, flexible plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining gravel or 1 1/2" - 3/4" drain rock. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. Water collected from the footing drains should be directed into the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. Down spouts and roof drains should not be connected to the foundation drains in order to reduce the potential for clogging. The footing drains should include clean-outs to allow periodic maintenance and inspection. Grades around the proposed structure should be sloped such that surface water drains away from the building. Footing drains are recommended to prevent detrimental effects of groundwater on foundations, and should not be expected to eliminate all potential sources of water entering a crawlspace or beneath a slab-on-grade. An adequate grade to a low point outlet drain in any crawlspace areas is required by code. Underslab drains are sometimes added beneath the slab when placed over soils of low permeability and shallow, perched groundwater.

UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and their consultants for use in design of this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. The checklist attached to this report outlines recommended geotechnical observations and testing for the project. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, expressed or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

JAMES D. IMBRIE
STATE OF WASHINGTON
27177
REGISTERED
PROFESSIONAL ENGINEER
Exp 3-31-16

Beth K. Rapp
Senior Geotechnical Staff

James D. Imbrie, P.E.
Principal Geotechnical Engineer

Attachments: References
Figure 1 – Vicinity Map
Figure 2 – Site and Exploration Plan
Test Pit Logs – TP-2 through TP-11, & TP-13
Test Pit Logs from Previous Study – TP-1 (2013), TP-10 (2013), TP-13 (2013), TP-15 (2013) & TP-16 (2013)

REFERENCES

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.

Beeson, M.H., Tolan, T.L., and Anderson, J.L., 1989, The Columbia River Basalt Group in western Oregon; Geologic structures and other factors that controlled flow emplacement patterns: Geological Society of America Special Paper 239, in Volcanism and tectonicism in the Columbia River flood-basalt province published by the Geological Society of America, p. 223-246.

Carver, G.A., 1992, Late Cenozoic tectonics of coastal northern California: American Association of Petroleum Geologists-SEPM Field Trip Guidebook, May, 1992.

Evarts, R.C., 2006, Geologic Map of the Lacamas Creek Quadrangle, Clark County, Washington: U.S. Geological Survey Scientific Investigations Map 2924.

Fiksdal, A., 1975, Slope stability of Clark County, Washington: Washington Division of Geology and Natural Resources, Open File Report 75-10, map scale 1:63,360.

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

Goldfinger, C., Kulm, L.D., Yeats, R.S., Appelgate, B, MacKay, M.E., and Cochrane, G.R., 1996, Active strike-slip faulting and folding of the Cascadia Subduction-Zone plate boundary and forearc in central and northern Oregon: in Assessing earthquake hazards and reducing risk in the Pacific Northwest, v. 1: U.S. Geological Survey Professional Paper 1560, P. 223-256.

Madin, I.P., 1990, Earthquake hazard geology maps of the Portland metropolitan area, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-90-2, scale 1:24,000, 22 p.

Mundorff, M.J., 1964, Geology and ground-water conditions of Clark County, Washington, with a description of a major alluvial aquifer along the Columbia River: U.S. Geological Survey Water-Supply Paper 1600, 268 p., 3 pls.

Peterson, C.D., Darioenzo, 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 Geology, v. 55, p. 99-144.

Phillips W. M., 1987, Geologic map of the Vancouver Quadrangle, Washington and Oregon: Washington Division of Geology and Natural Resources, Open File Report 87-10, 32 p., map scale 1:100,000.

Trimble, D.E., 1963, Geology of Portland, Oregon and adjacent areas: U.S. Geological Survey Bulletin 1119, 119p., 1 plate, scale 1:62,500.

United States Geologic Survey, 2014, U.S. Seismic Design Maps Online Tool, http://earthquake.usgs.gov/designmaps/us/application.php

Unruh, J.R., Wong, I.G., Bott, J.D., Silva, W.J., and Lettis, W.R., 1994, Seismotectonic evaluation: Scoggins Dam, Tualatin Project, Northwest Oregon: unpublished report by William Lettis and Associates and Woodward Clyde Federal Services, Oakland, CA, for U. S. Bureau of Reclamation, Denver CO (in Geomatrix Consultants, 1995).

Werner, K.S., Nabelek, J., Yeats, R.S., Malone, S., 1992, The Mount Angel fault: implications of seismic-reflection data and the Woodburn, Oregon, earthquake sequence of August, 1990: Oregon Geology, v. 54, p. 112-117.

Wong, I. Silva, W., Bott, J., Wright, D., Thomas, P., Gregor, N., Li., S., Mabey, M., Sojourner, A., and Wang, Y., 2000, Earthquake Scenario and Probabilistic Ground Shaking Maps for the Portland, Oregon, Metropolitan Area; State of Oregon Department of Geology and Mineral Industries; Interpretative Map Series IMS-16.

Yeats, R.S., Graven, E.P., Werner, K.S., Goldfinger, C., and Popowski, T., 1996, Tectonics of the Willamette Valley, Oregon: in Assessing earthquake hazards and reducing risk in the Pacific Northwest, v. 1: U.S. Geological Survey Professional Paper 1560, P. 183-222, 5 plates, scale 1:100,000.

Yelin, T.S., 1992, An earthquake swarm in the north Portland Hills (Oregon): More speculations on the seismotectonics of the Portland Basin: Geological Society of America, Programs with Abstracts, v. 24, no. 5, p. 92.

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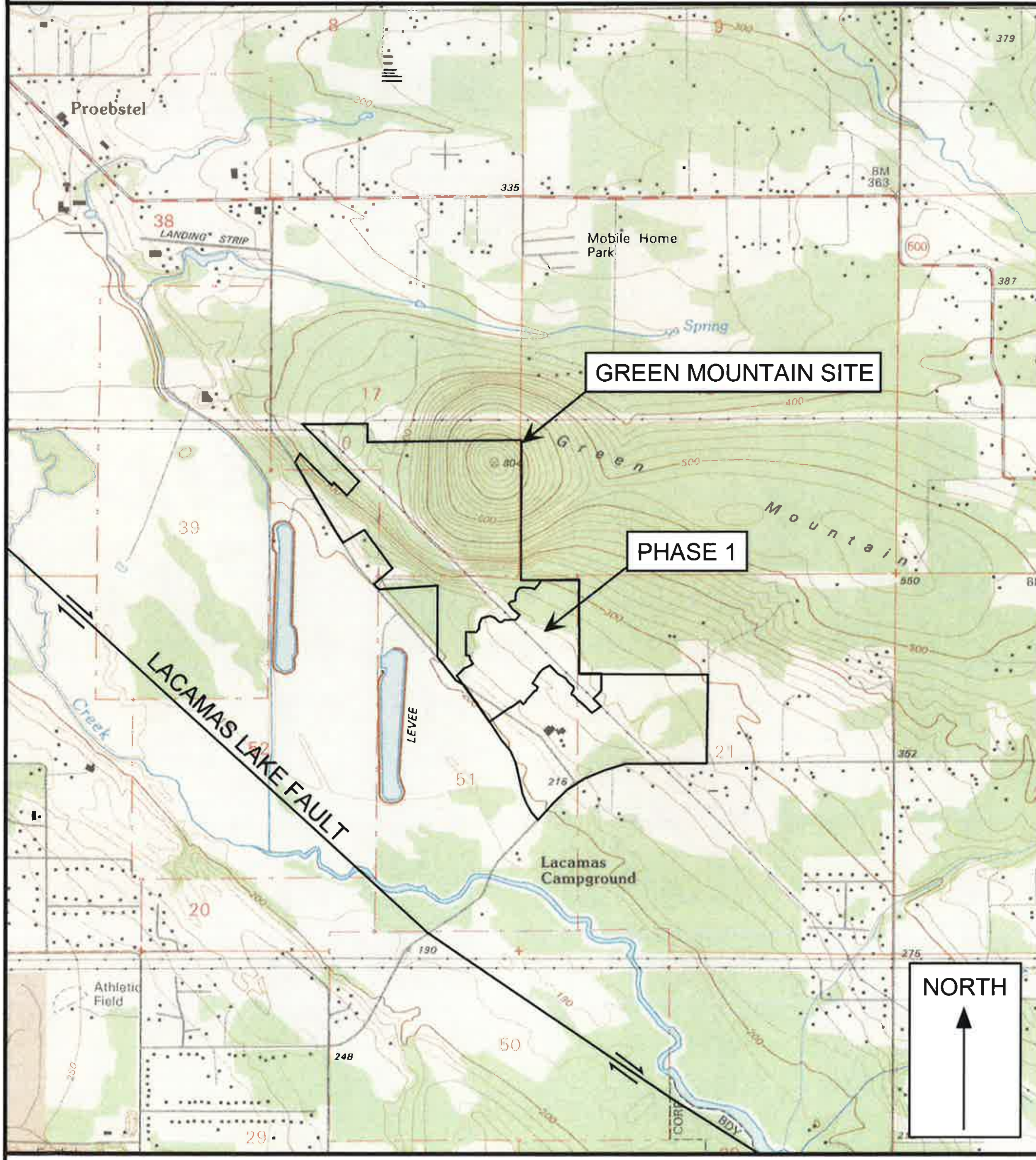
VICINITY MAP



Legend

Approximate Scale 1 in = 2,000 ft

Date: 11/25/2014
Drawn by: EKR

Base map: U.S. Geological Survey 7.5 minute Topographic Map Series, Lacamas Creek, Washington Quadrangle, 1990.

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	FIGURE 1

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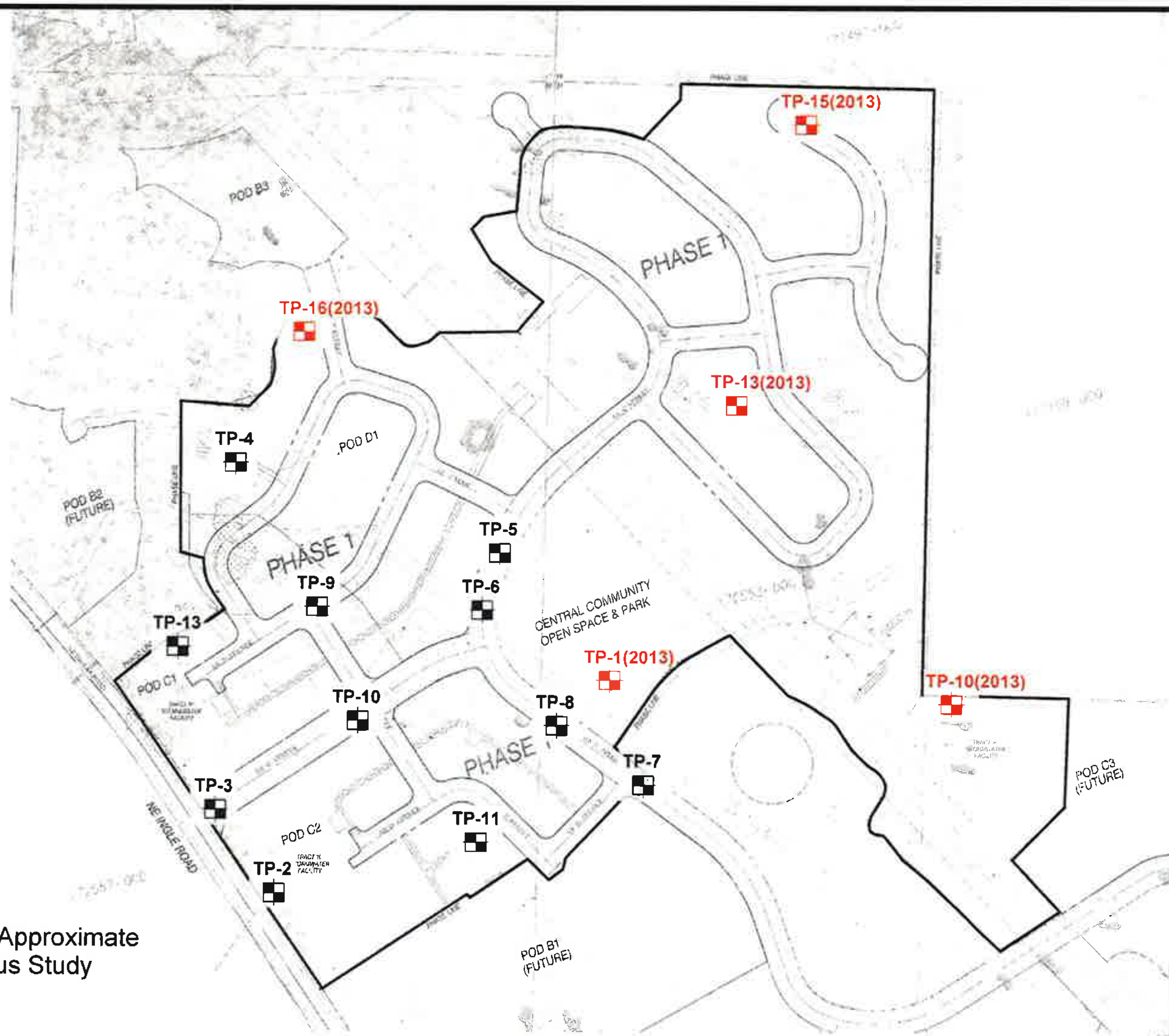
SITE PLAN AND EXPLORATION LOCATIONS



Legend

TP-2 Test Pit Designation and Approximate Location

TP-16(2013) Test Pit Designation and Approximate Location-from Previous Study

0 400'

APPROXIMATE SCALE 1"=400'

Base map provided by Olson Engineering Dated November 2014.

North

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Date: 10/2/2014 Drawn by: EKR	FIGURE 2

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TEST PIT LOG

Project: Green Mountain Phase 1
Camas, Washington

Project No. 13-3186

Test Pit No. **TP-2**

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
1	3.0					Stiff to very stiff, SILT (ML), trace sand, brown, moderately organic, trace roots throughout, 6 inch topsoil developed at surface, strong orange and gray mottling, trace black staining, moist (Fill)
2	1.5					Stiff to very stiff, clayey SILT (ML), trace sand, brown, micaceous, subtle orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
3	4.5					
4	3.5					
5						
6						Dense, subrounded GRAVEL (GM), trace clayey silt matrix, trace sand, brown to gray, trace black staining, partially cemented, strong orange and gray mottling, gravel is up to 9 inches in diameter, well graded, moist to wet (Conglomerate)
7					Seepage	
8					Seepage	
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 7 - 8 feet. Discharge visually estimated at 1/2 gallon per minute.
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Stiff to very stiff, SILT (ML), trace subrounded gravel, brown, with inorganic debris (asphalt), trace roots throughout, 6 inch thick topsoil developed at surface, strong orange and gray mottling, trace black staining, moist (Fill)
2	4.5					
3	4.5					
4	3.5					Stiff to very stiff, sandy SILT (ML), trace subrounded gravel, brown, micaceous, subtle to strong orange and gray mottling, trace black staining, moist (Conglomerate)
5						
6						
7						Dense, subrounded GRAVEL (GM), trace clayey silt matrix, trace sand, brown to gray, trace black staining, partially cemented, strong orange and gray mottling, gravel is up to 9 inches in diameter, well graded, moist to wet (Conglomerate)
8						
9						Test Pit Terminated at 8.5 Feet. Note: No seepage or groundwater encountered.
10						
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal. Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-4**

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Stiff to very stiff, sandy SILT (ML), trace subrounded gravel, gray, trace organic debris, trace roots throughout, 6 inch thick topsoil developed at surface, subtle to strong orange and gray mottling, trace black staining, moist (Fill)
2	4.0					
3	3.5					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
4	3.0					
5						
6						
7						
8						Test Pit Terminated at 8 Feet.
9						
10						Note: No seepage or groundwater encountered.
11						
12						

LEGEND

100 to 1,000 g Bag Sample | 5 Gal Bucket Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-5**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0–1						Low to moderately organic, SILT (OL-ML), dark brown, fine roots throughout, loose, moist (Topsoil)
1	4.5					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, subtle to strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
2	2.0					
3	2.5					
4	2.5					
5						
6						Medium dense to dense, silty SAND (SM), brown to blue gray below 8.5 feet, subtle to strong orange and gray mottling, sand is fine to medium grained, partially lithified, trace black staining, moist (Conglomerate)
7					Seepage (7.5)	
8						
9						Test Pit Terminated at 9 Feet.
10						
11						Note: Groundwater seepage encountered at 7.5 feet. Discharge visually estimated at 1/4 gallon per minute.
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal. Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-6**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0–0.5						Low organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil)
1	2.5					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, subtle to strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
2	4.5					
3	3.5					
4	4.0				Seepage	
5						
6						Medium dense to dense, silty SAND (SM), trace subrounded gravel, brown, strong orange and gray mottling, sand is fine to medium grained, partially lithified, trace black staining, moist (Conglomerate)
7						
8						
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 4.5 feet. Discharge visually estimated at 1/4 gallon per minute.
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-7**

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.0					Stiff to very stiff, sandy SILT (ML), trace subrounded gravel, light brown, trace roots throughout, 6 inch thick topsoil developed at surface, strong orange and gray mottling, trace black staining, moist (Fill)
2	4.0					
3	2.0					
4	2.5					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
5						
6					Seepage (5.5 - 6.5)	
7						
8						
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 5.5 - 6.5 feet. Discharge visually estimated at 1/4 gallon per minute.
11						
12						

LEGEND

100 to 1,000 g — Bag Sample | 5 Gal Bucket — Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-8**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.0					Stiff to very stiff, sandy SILT (ML), light brown, trace roots throughout, 6 inch thick topsoil developed at surface, strong orange and gray mottling, moist (Fill)
2	2.5					Low organic, SILT (OL-ML), gray, trace fine roots throughout, loose, moist (Buried Topsoil)
3	2.0					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
4	1.5					
5						
6					Seepage	
7					Seepage	
8						
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 5.5 - 7.5 feet. Discharge visually estimated at 1/2 gallon per minute.
11						
12						

LEGEND

100 to 1,000 g — Bag Sample; 5 Gal Bucket — Bucket Sample; Shelby Tube Sample; Seepage; Water Bearing Zone; Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1, Camas, Washington	Project No. 13-3186	Test Pit No. **TP-9**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0–0.8						Moderately organic, SILT (OL-ML), trace gravel fill, dark brown, fine roots throughout, loose, moist (Topsoil)
1	4.0					Stiff to very stiff, clayey SILT (ML), trace sand, brown, micaceous, subtle orange and gray mottling, trace roots to 3 feet, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
2	3.5					
3	4.5					
4	4.5					
5						
6						
7					Seepage	Dense, subrounded GRAVEL (GM), trace clayey silt matrix, trace sand, brown to gray, trace black staining, partially cemented, strong orange and gray mottling, moist to wet (Conglomerate)
8						
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 7.5 feet. Discharge visually estimated at 1/4 gallon per minute.
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1 Camas, Washington	Project No. 13-3186	Test Pit No. **TP-10**

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	**Material Description**
1	4.0					Stiff to very stiff, SILT (ML), trace sand, brown, trace inorganic debris, trace roots throughout, 6 inch topsoil developed at surface, strong orange and gray mottling, moist (Fill)
2	4.0					
3	4.5					Stiff to very stiff, sandy SILT (ML), trace clay, light brown, micaceous, subtle to strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
4	4.5					
5						
6						
7						Dense to very dense, subrounded GRAVEL (GM), trace clayey silt matrix, trace sand, brown to gray, trace black staining, partially cemented, strong orange and gray mottling, gravel is up to 6 inches in diameter, well graded, moist (Conglomerate)
8						
9						Test Pit Terminated at 8.5 Feet.
10						Note: No seepage or groundwater encountered.
11						
12						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1, Camas, Washington	Project No. 13-3186	Test Pit No. TP-11

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.5					Stiff to very stiff, sandy SILT (ML), trace gravel, light brown, trace fine roots throughout, 6 inch thick topsoil developed at surface, moist (Fill)
2	4.5					Low to moderately organic, SILT (OL-ML), brown, trace fine roots throughout, moist (Buried Topsoil)
3	3.5					Stiff to very stiff, sandy SILT (ML), light brown, subtle to strong orange and gray mottling, moist (Fill)
4	3.0					
5						Test Pit Terminated at 5 Feet due to Buried Water Line Tape.
6						Note: No groundwater or seepage encountered.
7						
8						
9						
10						
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1, Camas, Washington	Project No. 13-3186	Test Pit No. **TP-13**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.5					Stiff, sandy SILT (ML), trace clay, light brown, trace roots throughout, 6 inch thick topsoil developed at surface, strong orange and gray mottling, moist (Fill)
2	2.0					
3	2.5					Stiff to very stiff, sandy SILT (ML), light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
4	4.0					
5						
6						
7						Dense to very dense, subrounded GRAVEL (GM), trace silty sand matrix, brown to gray, trace black staining, strong orange and gray mottling, gravel is up to 12 inches in diameter, moist (Conglomerate)
8					Seepage	
9						Test Pit Terminated at 8.5 Feet.
10						Note: Groundwater seepage encountered at 8.5 feet. Discharge visually estimated at 1/4 gallon per minute.
11						
12						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 5/23/2014
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain, Camas, Washington	Project No. 13-3186	Test Pit No. TP-1 (2013)

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5					Moderately organic, sandy SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil)
2	1.0				Water level at abandonment	Medium stiff, sandy SILT (ML), brown, micaceous, strong orange and gray mottling, moist to wet (Fine Grained Catastrophic Flood Deposits)
3	1.0				Seepage	
4	0.5					Test Pit Terminated at 4 Feet for Infiltration Testing.
5						
6						Note: Groundwater seepage encountered at 3 feet. Discharge visually estimated at less than 1 gallon per minute. Static groundwater at 2 Feet at Completion of Infiltration Testing.
7						
8						
9						
10						
11						
12						

LEGEND

100 to 1,000 g Bag Sample | 5 Gal Bucket Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/5-7/2013
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain, Camas, Washington	Project No. 13-3186	Test Pit No. TP-10 (2013)

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
0–0.7						Moderately organic, SILT (OL-ML), dark brown, fine roots throughout, loose, moist (Topsoil)
1	2.0					Stiff to very stiff, sandy SILT (ML), trace clay, light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
2	2.0					
3	1.5					
4	3.5					Dense, subrounded GRAVEL (GM), trace sandy silt matrix, light brown to gray, trace black staining, strong orange and gray mottling, micaceous, moist (Conglomerate)
5						
6						Test Pit Terminated at 6 Feet.
7						
8						Note: No seepage or groundwater encountered.
9						
10						
11						
12						

LEGEND

Bag Sample (100 to 1,000 g) · Bucket Sample (5 Gal Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 11/5-7/2013
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1, Camas, Washington	Project No. 13-3186	Test Pit No. TP-13 (2013)

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0–0.7						Moderately organic, SILT (OL-ML), brown, fine roots throughout, loose, moist (Topsoil)
0.7–3	1.5 (2 ft); 3.0 (3 ft)					Medium stiff to very stiff, sandy SILT (ML), trace clay, light brown, micaceous, strong orange and gray mottling, trace black staining, moist (Fine Grained Catastrophic Flood Deposits)
3–9					Seepage (8 ft)	Dense, subrounded GRAVEL (GM), trace sandy silt matrix, trace clay, light brown to gray, trace black staining, well graded, strong orange and gray mottling, micaceous, moist (Conglomerate)
9–12						Test Pit Terminated at 9 Feet.

Note: Groundwater seepage encountered at 8 feet.
Discharge visually estimated at 1 gallon per minute.

LEGEND

100 to 1,000 g — Bag Sample; 5 Gal Bucket — Bucket Sample; Shelby Tube Sample; Seepage; Water Bearing Zone; Water Level at Abandonment

Date Excavated: 11/5-7/2013
Logged By: B. Rapp
Surface Elevation:

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TEST PIT LOG

Project: Green Mountain Phase 1, Camas, Washington	Project No. 13-3186	Test Pit No. TP-15 (2013)

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0–0.7						Moderately organic, SILT (OL-ML), with basalt fragments, dark brown, fine roots throughout, loose, moist (Topsoil)
1–3	1.5 (1 ft); 3.5 (2 ft)				Seepage (2 ft)	Stiff to very stiff, silty CLAY (CL) to clayey SILT (ML), with gray weathered basalt, light reddish-brown, trace fine roots throughout, strong orange and gray mottling, black staining, moist (Colluvial Soil)
3–10.5						Medium dense, silty SAND (SM) with interbeds of stiff, sandy SILT (ML), light brown, micaceous, sand is fine to medium grained, strong orange and gray mottling, trace black staining, moist (Conglomerate)

Test Pit Terminated at 10.5 Feet.

Note: Groundwater seepage encountered at 2 feet.
Discharge visually estimated at 1 gallon per minute.

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/5-7/2013
Logged By: B. Rapp
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Green Mountain, Camas, Washington	Project No. 13-3186	Test Pit No. TP-16 (2013)

Depth (ft)	Pocket Penetrometer (tons/ft^2)	Sample Type	In-Situ Dry Density (lb/ft^3)	Moisture Content (%)	Water Bearing Zone	Material Description
0–1	0.5					Moderately organic, SILT (OL-ML), dark brown, fine roots throughout, loose, moist (Topsoil)
1–9	2.0 (2 ft); 3.5 (3 ft); 2.0 (4 ft)				Seepage (3.5–6.5 ft)	Medium dense, silty SAND (SM) with interbeds of stiff, sandy SILT (ML), light brown to gray, micaceous, sand is coarse to medium grained, strong orange and gray mottling, trace black staining, moist to wet (Conglomerate)
9–12						Test Pit Terminated at 9 Feet.

Note: Groundwater seepage encountered at 3.5 to 6.5 feet. Discharge visually estimated at 2 gallons per minute.

LEGEND: Bag Sample (100 to 1,000 g), Bucket Sample (5 Gal Bucket), Shelby Tube Sample, Seepage, Water Bearing Zone, Water Level at Abandonment

Date Excavated: 11/5-7/2013
Logged By: B. Rapp
Surface Elevation: