

Geotechnical Engineering Report

Atonement Parking Lot and Building Improvements

Prepared For:

Atonement Free Lutheran Church
328 North Olympic Avenue
Arlington, WA

Attn: Mr. John Furstenwerth



May 28, 2021
Project No. 21-0524

Atonement Free Lutheran Church
328 North Olympic Avenue
Arlington, WA

Attention: Mr. John Furstenwerth

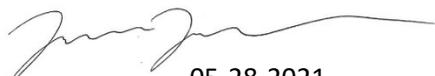
Regarding: Geotechnical Engineering Report
Atonement Parking Lot and Building Improvements
6905 172nd Street NE
Arlington, WA 98223

Dear Mr. Furstenwerth:

As requested, GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our geotechnical engineering investigation for the proposed Atonement Parking Lot and Building Improvements located at 6905 172nd Street NE in Arlington, WA (see Vicinity Map, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated March 17, 2021 and authorized by yourself.

We appreciate the opportunity to provide geotechnical services on this project and look forward to assisting you during the construction phase. Should you have any further questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.



05-28-2021

Tristan A. Coragiulo, G.I.T.
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Enclosure: Infiltration Feasibility and Geotechnical Investigation

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PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation is to establish general subsurface conditions beneath the site from which conclusions and recommendations pertaining to project design can be formulated. Specifically, our scope of services includes the following tasks:

- Exploration of soil and groundwater conditions underlying the project site by excavating 3 test pits to evaluate subsurface conditions and document soil types. The explorations were advanced with a tracked excavator and extended to depths of approximately 8 to 10 feet below ground surface (BGS).
- Perform laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered and to assess on-site infiltration capability.
- Provide a written report containing a description of subsurface conditions and exploration logs. The findings and recommendations in this report pertain to the site preparation and earthwork, fill and compaction, seismic design, foundation recommendations, concrete slab-on-grade construction, foundation and site drainage, utilities, temporary and permanent slopes, geotechnical consultation, and construction monitoring.
- Assess geologically hazardous areas (if present) per the Arlington Municipal Code (AMC) Chapter 20.93.600.

PROJECT DESCRIPTION

The project site contains an existing building with a partial basement. The building has existing parking and drive paths located to the north and east of the building. The drive paths and parking areas consist of both asphalt and gravel surfaces.

GeoTest understands that new parking areas are planned to the south and west of the existing building. The existing drive paths and parking areas to the north and east of the building are likely to be revised to allow for more vehicle capacity. At the time of this report, GeoTest also understands that new floor space in both the upper and lower portions of the building are being considered for the southwestern portion of the existing building. Should new construction occur, it is likely that shallow conventional foundations with slab-on-grade floors will be utilized. GeoTest anticipates that wood frame construction would be used and that structural loads would be relatively light.

The proposed parking lot improvements are expected to require minor amounts of grading. GeoTest expects that the areas that will require the most grading will be in proximity to the western property boundary. It is generally anticipated that less than about 5 vertical feet of cut and/or fill will be needed to establish finished site grades.

GeoTest understands that the infiltration of stormwater will be considered for this project. Stormwater concepts are not currently available, but it is assumed that the use of infiltration trenches, bioretention facilities, and/or subsurface storm chambers are the most likely facilities that will be used for this project.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on the results and review of available information, site reconnaissance, subsurface explorations, laboratory testing, and previous experience in the project vicinity.

Surface Conditions

The trapezoidal shaped, approximately 4.43-acre subject property exists on the northside of 172nd Street NE upslope from a new apartment complex currently in construction to the west. The western perimeter of the parcel is bordered with cedar fencing and a retaining wall maintaining grades between the church's lawn and the adjacent off-property apartments. Previous development on this lot includes the church building near the central portion of the lot, a few portables to the northwest, and an illuminated parking lot comprised of both pavement and gravel. The frontage of the church, as well as some perimeter portions of the parking lot, have been landscaped with a variety of perennials and trees. Mowed grass lawn surrounds the existing buildings in the southwest, west, and northwestern portions of the property. A bio-retention pond or a potentially historic construction pond that is now vegetated with grass is located northwest of the church building and west of the portables on site.



Images 1 and 2 – Site conditions upon our arrival with mowed lawn west and southwest of the church (left) and the surrounding parking lot to the north and east (right).

Subsurface Soil Conditions

Subsurface conditions were explored by advancing three test pits on May 12, 2021 (TP-1 – TP-3). The explorations were advanced to depths of between 8 and 10 feet below ground surface (BGS) using a subcontracted excavator. The approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figure 2).

The first test pit was advanced near the proposed area of building improvements, in which GeoTest observed approximately 1.5 feet of previously placed fill overlying relict topsoil to approximately 2 feet BGS. Underlying the relict topsoil, GeoTest observed medium dense, brown to tan, silty to poorly graded, gravelly sands with trace cobbles to refusal depth. The second test pit was advanced near the eastern portion of the site, exhibiting approximately 1 foot of topsoil overlying similar, native, gravelly sands, while the third exposed previously placed, crushed aggregate overlying relict topsoil to approximately 1.5 feet BGS within the northern portion of the parking lot. GeoTest interpreted the native soils underlying the topsoil, fill, and relict topsoil to be that of Advance Outwash. Additional explorations within the southwest quadrant of the site were not conducted due to the high concentration of existing utilities in the area. Refer to the attached *Site and Exploration Map* (Figure 2) for approximate locations of our explorations.



Image 3 – Observed subsurface conditions within TP-1, with fill overlying native advance outwash soils at depth.

General Geologic Conditions

Geologic information for the project site was obtained from the geologic map entitled, *Geologic map of the Arlington West 7.5-minute quadrangle, Snohomish County, Washington* (Minard, 1985), published by the U.S. Geological Survey. According to Minard, the subject property is underlain by Transitional Beds (map unit Qtb) and/or Advance Outwash (map unit Qva) from the Fraser glaciation. According to the author, Transitional Beds consist of clay, silt, and fine sand in which were deposited a significant distance in front of an advancing glacier or event. Advance Outwash consists of very gravelly, coarse sand deposited in a glaciofluvial environment in front of an advancing glacier or event.

The near-surface soils consisted of uncontrolled fill soils that were not identified on the regional map. Underlying the fill, the native soils were consistent with Advance Outwash as described by Minard. The mapped geologic materials are consistent with our experience in the vicinity of the project site.

Groundwater

Groundwater seepage was observed within two test pits advanced within the northern half of the site. GeoTest encountered moderate seepage at approximately 6 feet BGS within exploration TP-2 and slight seepage at approximately 8.5 feet BGS within TP-3 to the west.

The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater levels are variable throughout the year and will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use.

GEOLOGIC HAZARDS

As the subject property is located within the City of Arlington, GeoTest reviewed Chapter 20.93.600 (Geologically Hazardous Areas) of the Arlington Municipal Code. The subject property is relatively flat and had been historically graded. Thus, it is GeoTest's opinion that the subject property does not contain erosion or landslide hazards. The subject property is mapped as having a very low to low susceptibility to liquefaction. Thus, no mitigations are required to address erosion, landslide, or liquefaction hazards as no such hazards exist on this property.

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the data collected during this investigation, it is our opinion that the subsurface conditions at the site are suitable for the proposed development, provided the recommendations contained herein are incorporated into the project design.

Our subsurface explorations throughout the proposed area of development encountered between 1 to 2 feet of topsoil, previously placed fill, and relict topsoil overlying native, medium dense to dense, gravelly, Advance Outwash sands with low to moderate silt contents. Firm and unyielding, native, Advance Outwash soils are suitable for the support of conventional foundations and slab-on-grade systems. The foundational elements may also bear directly on properly placed and compacted structural fill atop native, firm and unyielding native soil. Due to the variability in composition and grain size, as well as high organic contents, and an underlying relict topsoil, existing uncontrolled fill should not be re-used as structural fill. The native soils, however, may be re-used for structural fill applications.

The surficial soils overlying the native Advance Outwash are not suitable for foundation(s), floor slabs, pavement and/or sidewalks subgrade. Based on our three test pit explorations, GeoTest anticipates approximately 2 feet of topsoil, uncontrolled fill, and relict topsoil removal to expose mineral soil in building pad and parking lot areas. The project team should also anticipate unexpected depths of relict topsoil and consequently, its complete removal.

The native, Advance Outwash that was encountered below topsoil, fill soil, and relict topsoil is suitable for the conventional infiltration of stormwater. GeoTest generally anticipates that the bottom of stormwater infiltration facilities will extend about 4 to 6 feet below finished site grades, with the bottom of the facilities being established at least 3 feet in Advance Outwash. The bottoms of infiltration facilities are not intended to be placed in uncontrolled fill soils. As such, GeoTest should be present during the excavation of infiltration facilities to confirm that the bottoms of these facilities extend into the intended soil type.

Site Preparation and Earthwork

The portions of the site proposed for foundation(s), floor slabs, pavement and/or sidewalks development should be prepared by removing existing topsoil, relict topsoils, deleterious material, previously placed fill, and significant accumulations of organics. Based on our explorations, GeoTest anticipates approximately 2 feet of topsoil, uncontrolled fill, and relict topsoil removal to expose mineral soil in building pad and parking lot areas.

Prior to placement of any foundation elements or structural fill, the exposed subgrade under all areas to be occupied by soil-supported floor slabs, spread, or continuous foundations should be recompacted to a firm and unyielding condition. Verification of compaction can be accomplished through proof rolling with a loaded dump truck, large self-propelled vibrating roller, or similar piece of equipment applicable to the size of the excavation. The purpose of this effort is to identify loose or soft soil deposits so that, if feasible, the soil distributed during site work can be recompacted.

Proof rolling should be carefully observed by qualified geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be

overexcavated to firm soil. Alternatively, Dynamic Cone Penetrometers or soil probing by a qualified GeoTest representative can confirm firm and unyielding conditions if a proof roll cannot be performed. Overexcavated areas should be backfilled with compacted granular material placed in accordance with subsequent recommendations for structural fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, qualified geotechnical personnel should observe subgrade conditions to determine if proof rolling is feasible.

Fill and Compaction

Structural fill used to obtain final site elevations must be properly placed and compacted. In most cases, suitable, non-organic, predominantly granular soil may be used for fill material provided the material is properly moisture conditioned prior to placement and compaction, and the specified degree of compaction is obtained. Material containing topsoil, wood, trash, organic material, or construction debris is not suitable for reuse as structural fill and should be properly disposed offsite or placed in nonstructural areas.

Soils containing more than approximately 5 percent fines are considered moisture sensitive and are difficult to compact to a firm and unyielding condition when over the optimum moisture content by more than approximately 2 percent. The optimum moisture content is that which allows the greatest dry density to be achieved at a given level of compactive effort.

Reuse of On-Site Soil

Due to excessive silt and organic contents of the previously placed uncontrolled fill soils observed on site, these soils are not recommended for use as structural fill. GeoTest recommends any reuse of these soils be limited to landscape and other non-structural areas.

The native on-site Advance Outwash soils are suitable for reuse as structural fill when placed at or near optimum moisture contents, as determined by ASTM D1557 and if allowed for in the project plans and specifications.

Imported Structural Fill

GeoTest recommends that imported structural fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved naturally occurring granular material (pit run) with at least 30 percent retained on the No. 4 sieve, or a well-graded crushed rock. Structural fill for dry weather construction may contain up to 10 percent fines (that portion passing the U.S. No. 200 sieve) based on the portion passing the U.S. No. 4 sieve. The use of an imported fill having more than 10 percent fines may be feasible, but the use of these soils should generally be reviewed by the design team prior to the start of construction.

Imported structural fill with less than 5 percent fines should be used during wet weather conditions. Due to wet site conditions, soil moisture contents could be high enough that it may be difficult to compact even clean imported select granular fill to a firm and unyielding condition. Soils with an over-optimum moisture content should be scarified and dried back to a suitable moisture content during periods of dry weather or removed and replaced with drier structural fill.

Backfill and Compaction

Structural fill should be placed in horizontal lifts. The structural fill must measure 8 to 10 inches in loose thickness and be thoroughly compacted. All structural fill placed under load bearing areas should be compacted to at least 95 percent of the maximum dry density, as determined using test method ASTM D1557. The top of the compacted structural fill should extend outside all foundations and other structural improvements a minimum distance equal to the thickness of the fill. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

Native soils with elevated silt contents are particularly susceptible to degradation during wet weather. As a result, it may be difficult to control the moisture content of site soils during the wet season. If construction takes place during wet weather, GeoTest recommends that structural fill consist of imported, clean, well-graded sand or sand and gravel as described above. If fill is to be placed or earthwork is to be performed in wet conditions, the contractor may reduce soil disturbance by:

- Limiting the size of areas that are stripped of topsoil and left exposed
- Accomplishing earthwork in small sections
- Limiting construction traffic over unprotected soil
- Sloping excavated surfaces to promote runoff
- Limiting the size and type of construction equipment used
- Providing gravel 'working mats' over areas of prepared subgrade
- Removing wet surficial soil prior to commencing fill placement each day
- Sealing the exposed ground surface by rolling with a smooth drum compactor or rubber-tired roller at the end of each working day
- Providing up-gradient perimeter ditches or low earthen berms and using temporary sumps to collect runoff and prevent water from ponding and damaging exposed subgrades

Seismic Design Considerations

The Pacific Northwest is seismically active, and the site could be subject to movement from a moderate or major earthquake. Consequently, moderate levels of seismic shaking should be

accounted for during the design life of the project, and the proposed structure should be designed to resist earthquake loading using appropriate design methodology.

For structures designed using the seismic design provisions of the 2018 International Building Code, the native Advance Outwash is classified as Site Class D according to ASCE 7-16. The structural engineer should select the appropriate design response spectrum based on Site Class D soil and the geographical location of the proposed construction.

Foundation Support

Continuous or isolated spread footings founded on proof-rolled, undisturbed, medium dense, native soils or on properly compacted structural fill placed directly over undisturbed native soil can provide foundation support for the proposed improvements. We recommend that qualified geotechnical personnel confirm that suitable bearing conditions have been reached prior to placement of structural fill or foundation formwork.

To provide proper foundation support, GeoTest recommends that topsoil, existing fill, relict topsoil, and/or loose/soft upper portions of the native soil be removed from beneath the building foundation area(s) or be replaced with properly compacted structural fill as described in the *Fill and Compaction* section of this report. GeoTest generally anticipates 2 feet of removal to expose suitable soils. Localized overexcavation, if necessary, can be backfilled to the design footing elevation with lean concrete, or foundations may be extended to bear on firm and unyielding native soil. In areas requiring overexcavation to competent native soil, the limits of the overexcavation should extend laterally beyond the edge of each side of the footing a distance equal to the depth of the excavation below the base of the footing. If lean concrete is used to backfill the overexcavation, the limits of the overexcavation need only extend a nominal distance beyond the width of the footing. In addition, GeoTest recommends that foundation elements for the proposed structure(s) bear entirely on similar soil conditions to help prevent differential settlement from occurring.

Continuous and isolated spread footings should be founded 18 inches, minimum, below the lowest adjacent final grade for freeze/thaw protection. The footings should be sized in accordance with the structural engineer's prescribed design criteria and seismic considerations.

Allowable Bearing Capacity

Assuming the above foundation support criteria are satisfied, continuous or isolated spread footings founded directly on medium dense native soils or on compacted structural fill placed directly over firm and unyielding native soils may be proportioned using a net allowable soil bearing pressure of 2,500 pounds per square foot (psf).

The "net allowable bearing pressure" refers to the pressure that can be imposed on the soil at foundation level. This pressure includes all dead loads, live loads, the weight of the footing, and any backfill placed above the footing. The net allowable bearing pressure may be increased by one-third for transient wind or seismic loads.

Foundation Settlement

Settlement of shallow foundations depends on foundation size and bearing pressure, as well as the strength and compressibility characteristics of the underlying soil. If construction is accomplished as recommended and at the maximum allowable soil bearing pressure, GeoTest estimates the total settlement of building foundations to be less than one inch under static conditions. Differential settlement between two adjacent load-bearing components supported on competent soil is estimated to be less than one half the total settlement.

Foundation Surcharge

The western perimeter of the property is bordered by an off-site and engineered retaining wall constructed on the neighboring property to lower site grades. It is our understanding that the proposed development will be constructed approximately 60 to 70 feet east of this retaining wall. GeoTest recommends maintaining a construction set back of at least 15 feet from the top of this wall to avoid the potential for foundational surcharge.

Floor Support

Conventional slab-on-grade floor construction is feasible for the planned site improvements. Floor slabs may be supported on properly prepared, firm and unyielding native subgrade or on properly placed and compacted structural fill placed over properly prepared native soil. GeoTest does not recommend that floor slabs be placed on existing uncontrolled fill or organic soils. Prior to placement of the structural fill, properly prepared subgrade soil should be proof-rolled as recommended in the *Site Preparation and Earthwork* section of this report.

GeoTest recommends that interior concrete slab-on-grade floors be underlain with at least 6 inches of clean, crushed, free-draining gravel. The gravel should contain less than 3 percent passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The purpose of this gravel layer is to provide uniform support for the slab, provide a capillary break, and act as a drainage layer. To help reduce the potential for water vapor migration through floor slabs, a continuous 10-mil minimum thick polyethylene sheet with tape-sealed joints should be installed below the slab to serve as an impermeable vapor barrier. The vapor barrier should be installed and sealed in accordance with the manufacturer's instructions.

The American Concrete Institute (ACI) guidelines suggest that the slab may either be poured directly on the vapor barrier or on a granular curing layer placed over the vapor barrier depending on construction conditions. GeoTest recommends that the architect or structural engineer specify if a curing layer should be used. If moisture control within the building is critical, we recommend a representative of GeoTest observe the vapor barrier to confirm that joints and penetrations have been properly sealed.

Exterior concrete slabs-on-grade, such as sidewalks, may be supported directly on undisturbed native soil or on properly placed and compacted structural fill; however, long-term performance will be enhanced if exterior slabs are placed on a layer of clean, durable, well-draining granular material.

Foundation and Site Drainage

Positive surface gradients should be provided adjacent to the proposed building to direct surface water away from the building and toward suitable drainage facilities. Roof drainage should not be introduced into the perimeter footing drains but should be separately discharged directly to the stormwater collection system or similar municipality-approved outlet. Pavement and sidewalk areas, if present, should be sloped and drainage gradients should be maintained to carry surface water away from the building towards an approved stormwater collection system. Surface water should not be allowed to pond and soak into the ground surface near buildings or paved areas during or after construction. Construction excavations should be sloped to drain to sumps where water from seepage, rainfall, and runoff can be collected and pumped to a suitable discharge facility.

To reduce the potential for groundwater and surface water to seep into interior spaces, GeoTest recommends that an exterior footing drain system be constructed around the perimeter of new building foundations as shown in the Conceptual Footing and Wall Drain Section (Figure 3) of this report. The drain should consist of a perforated pipe measuring 4 inches in diameter at minimum, surrounded by at least 12 inches of filtering media. The pipe should be sloped to carry water to an approved collection system.

The filtering media may consist of open-graded drain rock wrapped in a nonwoven geotextile fabric such as Mirafi 140N (or equivalent) or wrapped with a graded sand and gravel filter. For foundations supporting retaining walls, drainage backfill should be carried up the back of the wall and be at least 12 inches wide. The drainage backfill should extend from the foundation drain to within approximately 1 foot of the finished grade and consist of open-graded drain rock containing less than 3 percent fines by weight passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The invert of the footing drain pipe should be placed at approximately the same elevation as the bottom of the footing or 12 inches below the adjacent floor slab grade, whichever is deeper, so that water will

be contained. This process prevents water from seeping through walls or floor slabs. The drain system should include cleanouts to allow for periodic maintenance and inspection.

Please understand that the above recommendations are intended to assist the design engineer and/or architect in development of foundation and site drainage parameters and are based on our experience with similar projects in the area. The final foundation and site drainage plan that will be incorporated into the project plans is to be determined by the design team.

Resistance to Lateral Loads

The lateral earth pressures that develop against retaining walls will depend on the method of backfill placement, degree of compaction, slope of backfill, type of backfill material, provisions for drainage, magnitude and location of any adjacent surcharge loads, and the degree to which the wall can yield laterally during or after placement of backfill. If the wall is allowed to rotate or yield so the top of the wall moves an amount equal to or greater than about 0.001 to 0.002 times its height (a yielding wall), the soil pressure exerted comprises the active soil pressure. When a wall is restrained against lateral movement or tilting (a nonyielding wall), the soil pressure exerted comprises the at rest soil pressure. Wall restraint may develop if a rigid structural network is constructed prior to backfilling or if the wall is inherently stiff.

GeoTest recommends that yielding walls under drained conditions be designed for an equivalent fluid density of 35 pounds per cubic ft (pcf) for structural fill in active soil conditions. Nonyielding walls under drained conditions should be designed for an equivalent fluid density of 55 pcf for structural fill in at-rest conditions. Design of walls should include appropriate lateral pressures caused by surcharge loads located within a horizontal distance equal to or less than the height of the wall. For uniform surcharge pressures, a uniformly distributed lateral pressure equal to 35 percent and 50 percent of the vertical surcharge pressure should be added to the lateral soil pressures for yielding and nonyielding walls, respectively.

For structures designed using the seismic design provisions of the 2018 International Building Code, GeoTest recommends that retaining walls include a seismic surcharge in addition to the equivalent fluid densities presented above. We recommend that a seismic surcharge of approximately $8H$ (where H is the height of the wall in feet) be used for design purposes.

Passive earth pressures developed against the sides of building foundations, in conjunction with friction developed between the base of the footings and the supporting subgrade, will resist lateral loads transmitted from the structure to its foundation. For design purposes, the passive resistance of well-compacted fill placed against the sides of foundations is equivalent to a fluid with a density of 325 pounds per cubic ft. The recommended value includes a safety factor of about 1.5 and is based on the assumption that the ground surface adjacent to the structure is level in the direction of movement for a distance equal to or greater than twice the embedment depth. The recommended value also assumes drained conditions that will prevent the buildup

of hydrostatic pressure in the compacted fill. Retaining walls should include a drain system constructed in general accordance with the recommendations presented in the *Foundation and Site Drainage* section of this report. In design computations, the upper 12 inches of passive resistance should be neglected if the soil is not covered by floor slabs or pavement. If future plans call for the removal of the soil providing resistance, the passive resistance should not be considered.

An allowable coefficient of base friction of 0.35, applied to vertical dead loads only, may be used between the underlying imported granular structural fill and the base of the footing. If passive and frictional resistance are considered together, one half the recommended passive soil resistance value should be used since larger strains are required to mobilize the passive soil resistance as compared to frictional resistance. A safety factor of about 1.5 is included in the base friction design value. GeoTest does not recommend increasing the coefficient of friction to resist seismic or wind loads.

Temporary and Permanent Slopes

The contractor is responsible for construction slope configurations and maintaining safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored during and after excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring.

Temporary excavations in excess of 4 ft should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403.

Temporary unsupported excavations in medium dense Advance Outwash are classified as a Type B soil according to WAC 296-155-66401 and may be sloped as steep as 1H:1V (Horizontal: Vertical). All soils encountered are classified as Type C soil in the presence of groundwater seepage. Flatter slopes or temporary shoring may be required in areas where groundwater flow is present and unstable conditions develop.

Temporary slopes and excavations should be protected as soon as possible using appropriate methods to prevent erosion from occurring during periods of wet weather.

GeoTest recommends that permanent cut or fill slopes be designed for inclinations of 2H:1V or flatter. Permanent cuts or fills used in detention ponds, retention ponds, or earth slopes intended to hold water should be 3H:1V or flatter. All permanent slopes should be vegetated or otherwise protected to limit the potential for erosion as soon as practical after construction.

Utilities

Utility trenches must be properly backfilled and compacted to reduce cracking or localized loss of foundation, slab, or pavement support. Excavations for new shallow underground utilities are expected to be placed within the medium dense Advance Outwash that was encountered during our field explorations.

Trench backfill in improved areas (beneath structures, pavements, sidewalks, etc.) should consist of structural fill as defined in the *Fill and Compaction* section of this report. Outside of improved areas, trench backfill may consist of reused Advance Outwash provided the backfill can be compacted to the project specifications. It should be noted that some cobbles were observed within these native soils. Prior to re-use, GeoTest recommends selective removal of cobbles greater than 4 inches in diameter to exclude the oversized aggregate observed within this material from utility trench backfill. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the *Fill and Compaction* section of this report and *Typical Utility Trench* section (Figure 4).

Surcharge loads on trench support systems due to construction equipment, stockpiled material, and vehicle traffic should be included in the design of any anticipated shoring system. The contractor should implement measures to prevent surface water runoff from entering trenches and excavations. In addition, vibration as a result of construction activity and traffic may cause caving of the trench walls.

The contractor is responsible for trench configurations. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored by the contractor during excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring. If groundwater or groundwater seepage is present, and the trench is not properly dewatered, the soil within the trench zone may be prone to caving, channeling, and running. Trench widths may be substantially wider than under dewatered conditions.

Pavement Subgrade Preparation

Selection of a pavement section is typically a choice relative to its higher initial cost and lower long-term maintenance, or lower initial cost with more frequent maintenance. For this reason, we recommend that the owner participate in the selection of the proposed pavement sections that are planned for the site. Site grading plans should include provisions for sloping of the subgrade soils in proposed pavement areas so that passive drainage of the pavement section(s) can proceed uninterrupted during the life of the project.

The preparation of pavement subgrades consisting of native Advance Outwash or structural fill overlying Advance Outwash can be performed in general accordance with the *Site Preparation*

and Earthwork of this report. If, however, the intent is to leave existing, uncontrolled fill and underlying relict topsoil below pavement sections, GeoTest recommends the removal of at least 2 feet of uncontrolled fill below the pavement subgrades. The exposed soils should be remedially compacted to a firm and unyielding condition and a geosynthetic, such as Tensar TriAx TX140, should be placed between the underlying fill soils and new structural fill. The geosynthetic is intended to mitigate punching, pumping, and/or yielding of the lower density, lower quality uncontrolled fill materials. It should be noted that although the geosynthetic will improve the performance of the uncontrolled fill, it is our opinion that a full removal of the uncontrolled fill and relict topsoil would present the least amount of risk to the Owner with regard to the function and longevity of the pavement.

GeoTest is available to further consult, review and or/modify our recommendations based on further discussion and/or analysis with the project team/owner. The above pavement subgrade discussion should be considered “preliminary” and may modified by the Civil Engineer and/or design team based on the actual finished site grading elevations and/or the owner’s preferences.

Stormwater Infiltration Potential

At the time of our site visit, the near-surface soils consisted of 1 to 2 feet of topsoil, underlying fill and/or relict topsoil overlying native Advance Outwash. The Advance Outwash is medium dense to dense and is comprised of gravelly sands. Based on the presence of predominantly granular materials, it is our opinion that the on-site infiltration of stormwater is feasible for this project site.

Test Pit Gradation Results

From the explorations excavated in the areas of interest, three representative soil samples were selected and mechanically tested for grain size distribution and calculation according to the soil grain size analysis method per the 2019 Department of Ecology *Stormwater Management Manual for Western Washington* (SMMWW). A summary of these results is reproduced in Table 1 below.

Table 1 Preliminary Infiltration Results Based on Grain Size Analysis			
Test Pit ID & Depth	Geologic Unit	Uncorrected K_{sat} Infiltration Rate [in/hr]	Corrected K_{sat} Infiltration Rate [in/hr]
TP-1 (2.5 ft)	Advance Outwash	19.5	5.6
TP-1 (3.5 ft)	Advance Outwash	63.7	10*
TP-2 (8.0 ft)	Advance Outwash	40.2	10*
Notes: - K_{sat} = Initial Saturated Hydraulic Conductivity -Correction Factors Used: $CF_v = 0.8$, $CF_t = 0.40$, $CF_m = 0.9$, -Total Correction Factor = 0.288 * GeoTest does not recommend using preliminary rates over 10 inches per hour			

The rates presented in Table 1 are representative of loose soil conditions and do not take the relative density of the soil into account.

Stormwater infiltration potential is a function of the relatively permeability of the site soils, and the separation between the base of the proposed stormwater facility and the groundwater table. Based on the results presented in Table 1, and the relative depth to the groundwater table (observed between 6 to 8.5 feet BGS), the on-site infiltration of stormwater is feasible for the project site. For facilities based in the silty weathered Advance Outwash typically encountered in the upper 1 to 2 feet BGS, we recommend a **preliminary design infiltration rate of 5.6 inches per hour**, with the assumption that at least 5 vertical feet of separation exists between the bottom of proposed facilities and seasonal groundwater.

In the event that facilities are designed with less than 5 vertical feet of separation between the bottom of the facility and groundwater, a reduction of the infiltration rate to account for mounding will be required. At the time of this report, GeoTest is not aware of a specific stormwater plan, nor is GeoTest aware of the depths of proposed facilities. The final design is likely to require a collaborative effort between GeoTest and the Civil designer. Should stormwater facilities be designed with less than 5 feet of separation, GeoTest recommends that a preliminary, assumed, mounded rate of 2.5 inches per hour be used. This mounded rate assumes that the facility bottom is in Advance Outwash, that there is at least 3 feet of separation between the facility and groundwater, and that a Pilot Infiltration Test will be performed to confirm the infiltration rate.

The presence of a retaining wall bordering the property to the west should also be considered with the design of the stormwater facility. GeoTest recommends maintaining a set back of at least 30 feet between the western retaining wall and the proposed infiltration facility. This set back limits the potential for infiltrating stormwater to affect the structural integrity of the existing and off-site retaining wall.

Stormwater Treatment

The stormwater facilities on-site may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or offsite discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were also tested to determine possible pollutant treatment suitability.

Cation exchange capacity, organic content, and pH tests were performed by Northwest Agricultural Consultants on three soil samples collected from the explorations shown in Table 2. A summary of the laboratory test results is presented in Table 2 below.

TABLE 2					
Cation Exchange Capacity, Organic Content, and pH Laboratory Test Results					
Test Pit ID	Sample Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content (%)	pH
TP-2	0.8	Topsoil	29.5	13.51	5.5
TP-2	1.6	Advance Outwash	17.4	4.48	5.9
TP-2	3.0	Advance Outwash	10.0	2.63	6.1

Suitability for onsite pollutant treatment is determined in accordance with SSC-6 of the 2019 Washington State Department of Ecology *Stormwater Management Manual for Western Washington*. Soils with an organic content of greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable for stormwater treatment. Based on the results shown in Table 2, topsoil and Advance Outwash on site are suitable for stormwater treatment. However, it should be noted that the near surface Advance Outwash and topsoil have elevated silt contents which should be expected to reduce the overall infiltration potential for these soils.

On-site soils can be amended by mixing higher silt content soils or adding mulch (or other admixtures) to elevate the cation exchange capacity and organic contents. On-site amended soil requires additional testing to confirm compliance with ecological regulations. GeoTest is available to perform additional laboratory testing as part of an expanded scope of services if the soil is to be amended. Alternatively, the owner may elect to import amended soils with the desired properties for planned treatment facilities.

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

We also recommend that geotechnical construction monitoring services be provided. These services should include observation by GeoTest personnel during (infiltration facility construction, structural fill placement, compaction activities and subgrade preparation operations) to confirm that design subgrade conditions are obtained beneath the areas of improvement.

Periodic field density testing should be performed to verify that the appropriate degree of compaction is obtained. The purpose of these services is to observe compliance with the design concepts, specifications, and recommendations of this report. In the event that subsurface conditions differ from those anticipated before the start of construction, GeoTest Services would be pleased to provide revised recommendations appropriate to the conditions revealed during construction.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing and structural steel. These services are supported by our fully accredited materials testing laboratory.

USE OF THIS REPORT

GeoTest Services has prepared this report for the exclusive use of Atonement Free Lutheran Church and their design consultants for specific application to the design of the proposed Atonement Improvements located at 6905 172nd Street NE in Arlington, WA. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published geological information for the site. If variations in subsurface conditions are encountered during construction that differ from those contained within this report, GeoTest should be allowed to review the recommendations and, if necessary,

make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible to perform all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

Attachments: Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Typical Footing and Wall Drain Section
Figure 4	Typical Utility Trench Section
Figure 5	USCS Sheet
Figure 6 – 8	Exploration Logs
Figure 9	Grain Size Analysis Sheet
Attached	Northwest Agricultural Results
Attached	Report Limitations and Guidelines

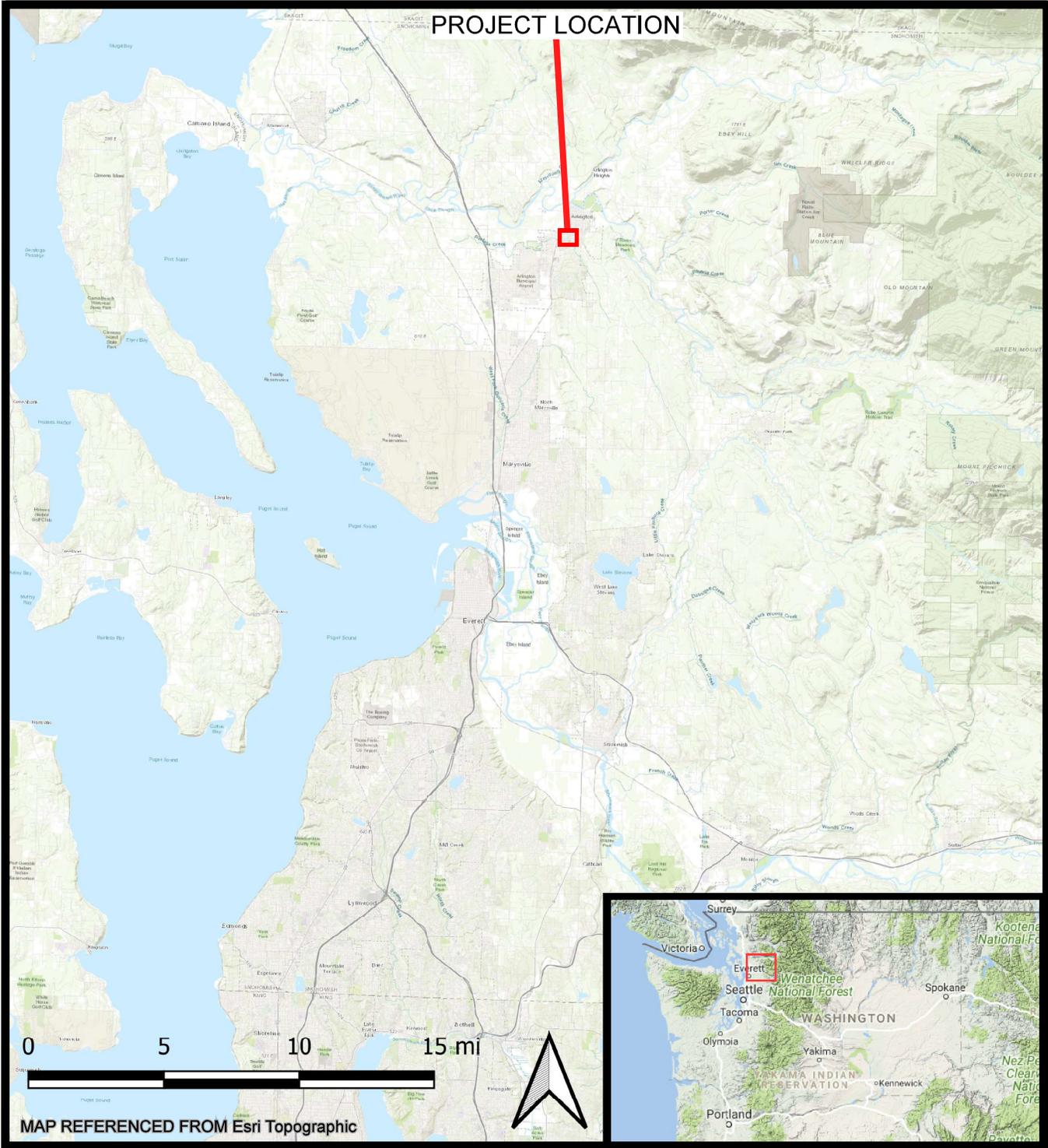
REFERENCES

Gariepy, D., Graul, C., Heye, A., Howie, D., Labib, F., & Song, K. (n.d.), 2019 Stormwater Management Manual for Western Washington (2019 SMMWW) (pp. 1-1108) (United States, Washington State Department of Ecology).

Minard, J.P., 1985. Geologic map of the Arlington West 7.5-minute quadrangle, Snohomish County, Washington [map]. 1:24,000. US Geological Survey MF-1740.

PDS Map Portal. Snohomish County Planning and Development Services - Online Web Services. Retrieved in May 2021

Washington Interactive Geologic Map. Washington State Department of Natural Resources - Online Web Services. Retrieved in May 2021



PROJECT LOCATION

MAP REFERENCED FROM Esri Topographic



Date: 05-14-21

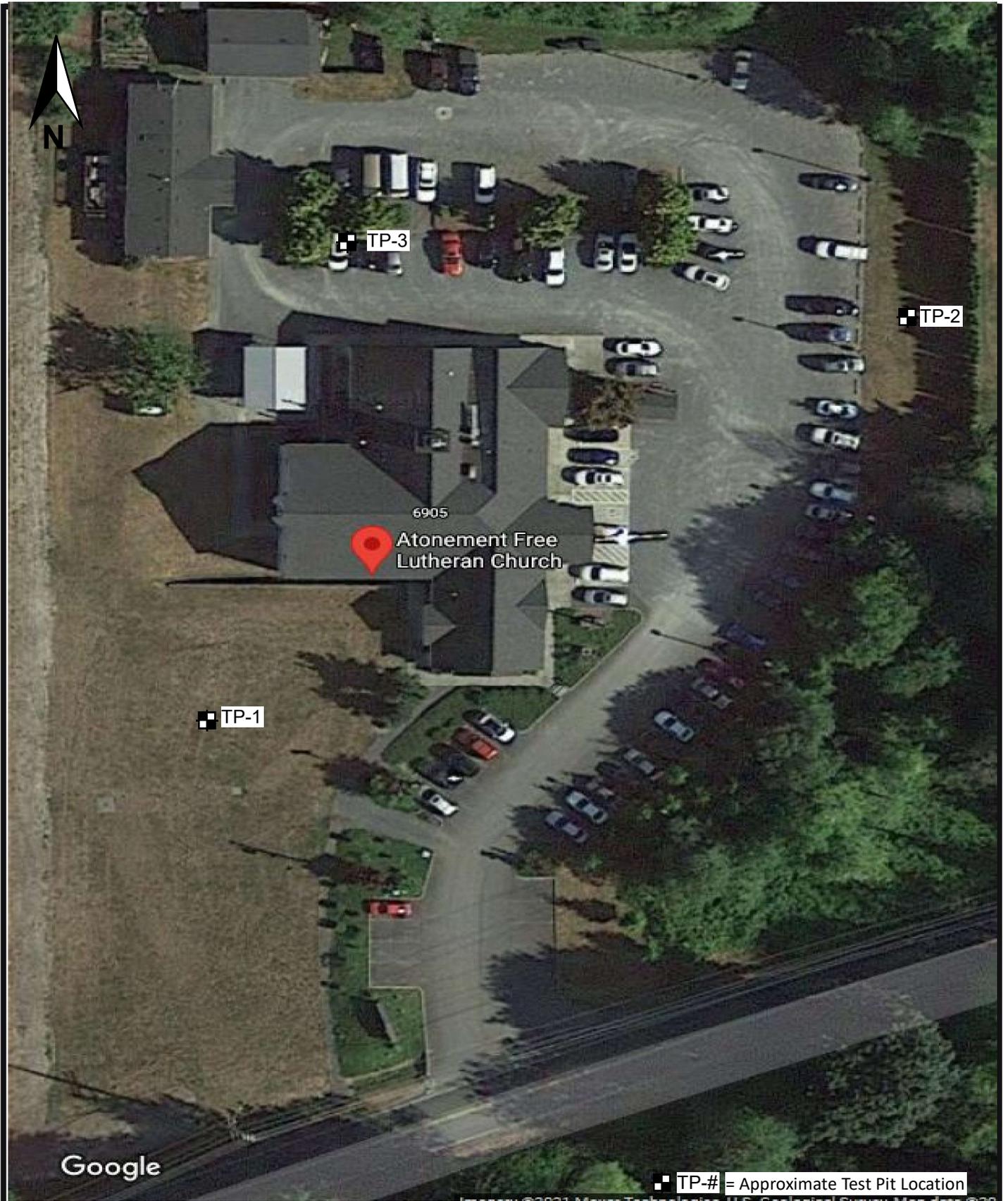
By: SEM

Scale: As Shown

Project
21-0524

VICINITY MAP
ATONEMENT PARKING LOT AND BUILDING IMPROVEMENTS
6905 172ND STREET NE
ARLINGTON WA 98225

Figure
1



Date: 5-14-21

By: SEM

Scale: As Shown

Project

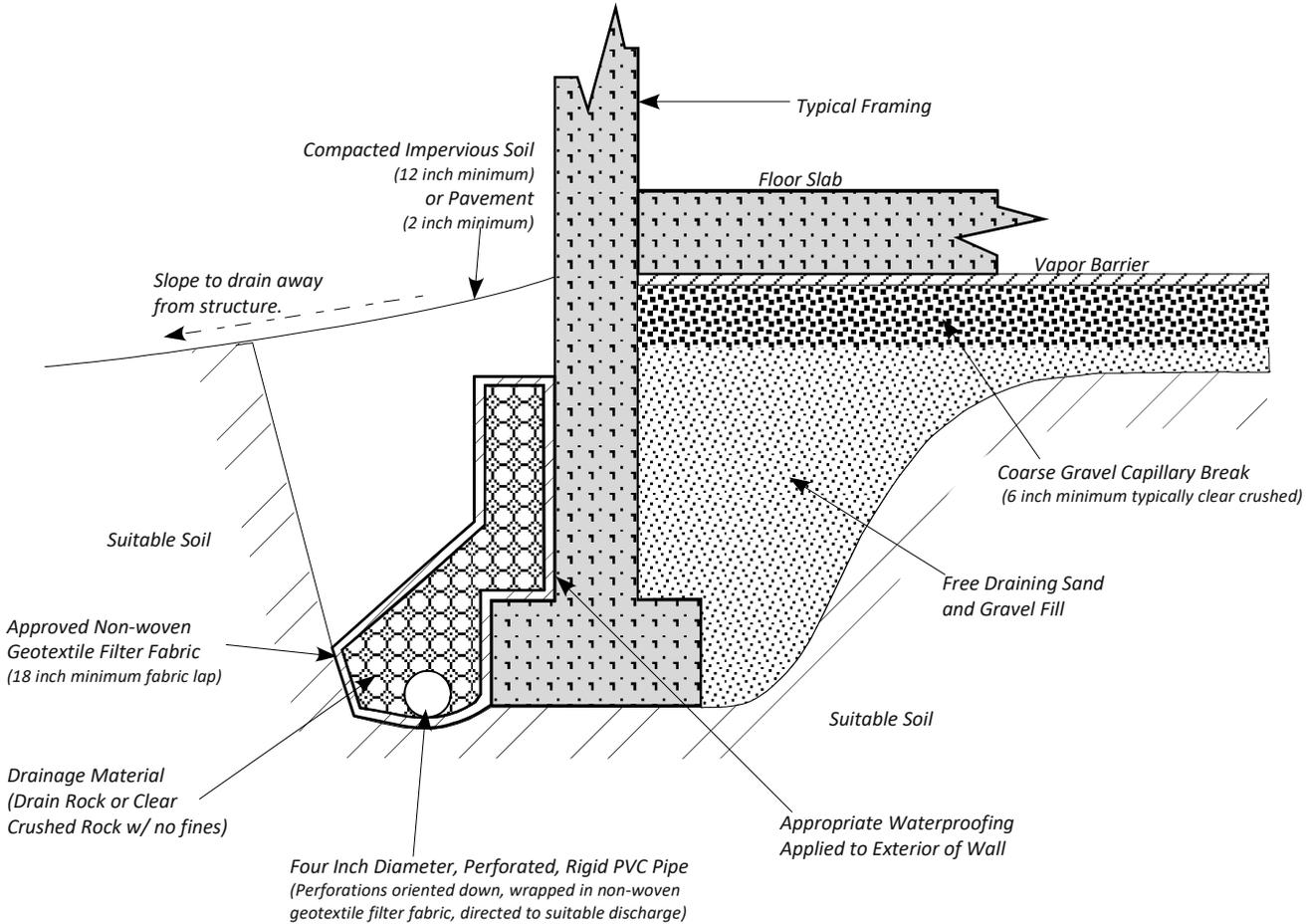
SITE AND EXPLORATION PLAN
ATONEMENT PARKING LOT AND BUILDING IMPROVEMENTS
6905 172ND STREET NE
ARLINGTON, WA 98223

21-0524

Figure

2

SHALLOW FOOTINGS WITH INTERIOR SLAB-ON-GRADE



Notes:

This figure is not intended to be representative of a design. This figure is intended to present concepts that can be incorporated into a functional foundation drain designed by a civil engineer. In all cases, refer to the civil plan sheet for drain details and elevations.

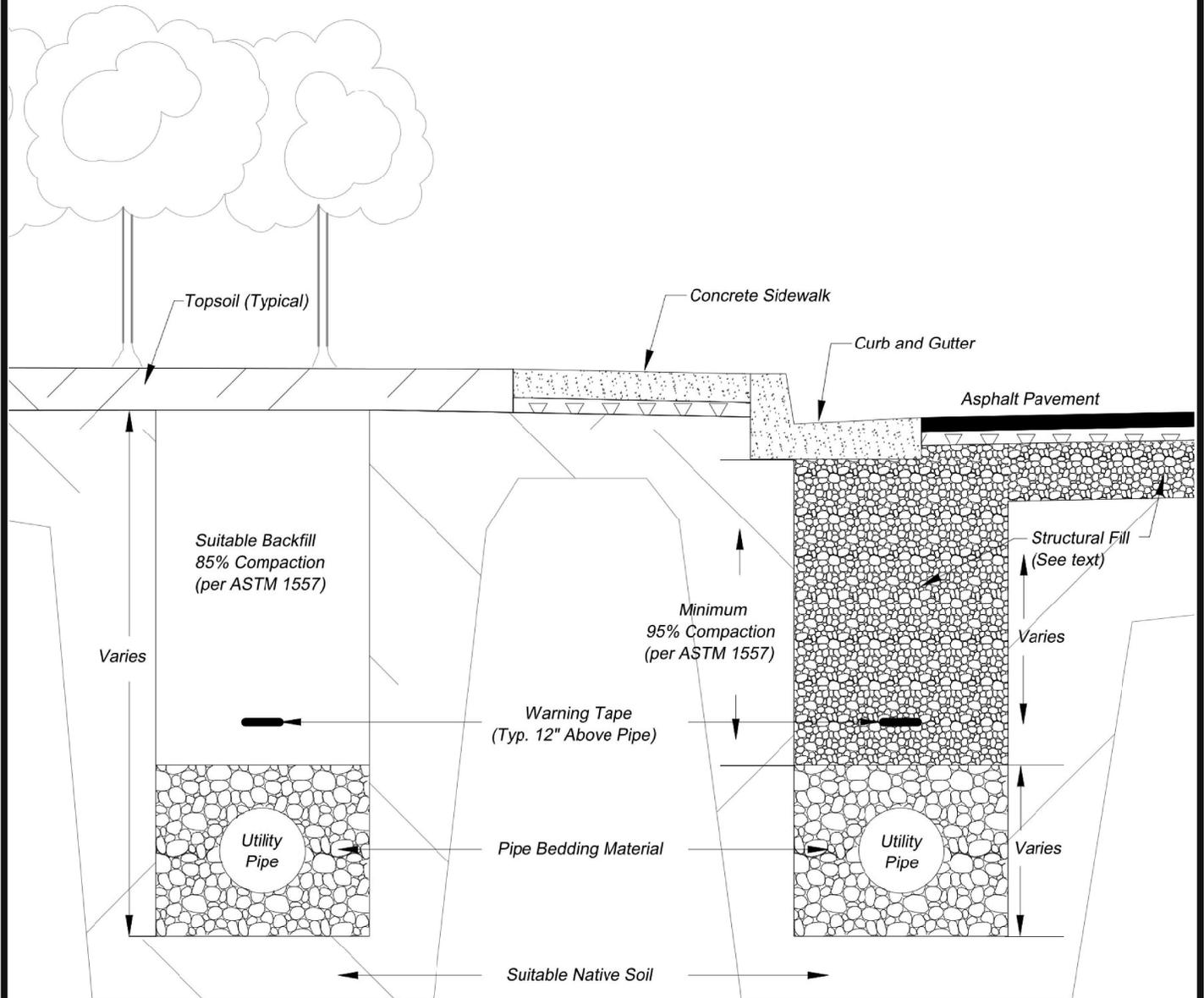
Footings should be properly buried for frost protection in accordance with the International Building Code or local Municipal building codes (typically 18 inches below exterior finished grades).

The footing drain will need to be modified from this typical drawing to fit the dimensions of the planned footing and slab configuration.

	Date: 5/14/21	By: SEM	Scale: None	Project
	TYPICAL FOOTING & WALL DRAIN SECTION ATONEMENT PARKING LOT AND BUILDING IMPROVEMENTS 6905 172ND STREET NE ARLINGTON, WA 98225			21-0524
				Figure 3

LANDSCAPING AREAS

LOAD BEARING AREAS



Date: 5-14-21

By: SEM

Scale: None

Project

21-0524

TYPICAL UTILITY TRENCH SECTION
ATONEMENT PARKING LOT AND BUILDING IMPROVEMENTS
6905 172ND STREET NE
ARLINGTON, WA 98225

Figure

4

Soil Classification System

	MAJOR DIVISIONS	CLEAN GRAVEL (Little or no fines)	GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS ⁽¹⁾⁽²⁾
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SP	Poorly graded sand; gravelly sand; little or no fines
				SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity	
			CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay	
			OL	Organic silt; organic, silty clay of low plasticity	
	SILT AND CLAY (Liquid limit greater than 50)		MH	Inorganic silt; micaceous or diatomaceous fine sand	
			CH	Inorganic clay of high plasticity; fat clay	
			OH	Organic clay of medium to high plasticity; organic silt	
	HIGHLY ORGANIC SOIL		PT	Peat; humus; swamp soil with high organic content	

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.

2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

- Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
- Secondary Constituents: > 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
- > 12% and ≤ 30% - "gravelly," "sandy," "silty," etc.
- Additional Constituents: > 5% and ≤ 12% - "slightly gravelly," "slightly sandy," "slightly silty," etc.
- ≤ 5% - "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key	Field and Lab Test Data																																									
<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">SAMPLE NUMBER & INTERVAL</th> <th style="width: 70%;">SAMPLER TYPE</th> </tr> <tr> <td></td> <td style="text-align: center;">Code Description</td> </tr> <tr> <td rowspan="4"> </td> <td>a 3.25-inch O.D., 2.42-inch I.D. Split Spoon</td> </tr> <tr> <td>b 2.00-inch O.D., 1.50-inch I.D. Split Spoon</td> </tr> <tr> <td>c Shelby Tube</td> </tr> <tr> <td>d Grab Sample</td> </tr> <tr> <td></td> <td style="text-align: center;">e Other - See text if applicable</td> </tr> <tr> <td></td> <td>1 300-lb Hammer, 30-inch Drop</td> </tr> <tr> <td></td> <td>2 140-lb Hammer, 30-inch Drop</td> </tr> <tr> <td></td> <td>3 Pushed</td> </tr> <tr> <td></td> <td>4 Other - See text if applicable</td> </tr> </table>	SAMPLE NUMBER & INTERVAL	SAMPLER TYPE		Code Description		a 3.25-inch O.D., 2.42-inch I.D. Split Spoon	b 2.00-inch O.D., 1.50-inch I.D. Split Spoon	c Shelby Tube	d Grab Sample		e Other - See text if applicable		1 300-lb Hammer, 30-inch Drop		2 140-lb Hammer, 30-inch Drop		3 Pushed		4 Other - See text if applicable	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Code</th> <th style="width: 70%;">Description</th> </tr> <tr> <td>PP = 1.0</td> <td>Pocket Penetrometer, tsf</td> </tr> <tr> <td>TV = 0.5</td> <td>Torvane, tsf</td> </tr> <tr> <td>PID = 100</td> <td>Photoionization Detector VOC screening, ppm</td> </tr> <tr> <td>W = 10</td> <td>Moisture Content, %</td> </tr> <tr> <td>D = 120</td> <td>Dry Density, pcf</td> </tr> <tr> <td>-200 = 60</td> <td>Material smaller than No. 200 sieve, %</td> </tr> <tr> <td>GS</td> <td>Grain Size - See separate figure for data</td> </tr> <tr> <td>AL</td> <td>Atterberg Limits - See separate figure for data</td> </tr> <tr> <td>GT</td> <td>Other Geotechnical Testing</td> </tr> <tr> <td>CA</td> <td>Chemical Analysis</td> </tr> </table>	Code	Description	PP = 1.0	Pocket Penetrometer, tsf	TV = 0.5	Torvane, tsf	PID = 100	Photoionization Detector VOC screening, ppm	W = 10	Moisture Content, %	D = 120	Dry Density, pcf	-200 = 60	Material smaller than No. 200 sieve, %	GS	Grain Size - See separate figure for data	AL	Atterberg Limits - See separate figure for data	GT	Other Geotechnical Testing	CA	Chemical Analysis
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CA	Chemical Analysis																																									
<p>Groundwater</p> <p> Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.</p>																																										



Atonement Improvements
6905 172nd Street SE
Arlington, WA 98225

Soil Classification System and Key

Figure
5



TEST PIT LOG

Test Pit No. TP-1

PROJECT: Atonement Parking Lot and Building Improvements

PROJECT NO.: 21-0524

LOCATION: 6905 172nd Street NE, Arlington, WA 98223

DATE: 5/12/21

EXPLORATION METHOD: Tracked Excavator

ELEVATION: 160'

CONTRACTOR/DRILLER: Kaiser Enterprises

LOGGED BY: SEM

DEPTH TO WATER TABLE: ∇ N/A PERCHED WATER: ∇ N/A CAVING C N/A

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA			USCS SYMBOL	SOIL PROFILE DESCRIPTION
	SAMPLE & TEST DATA				
0				SM	Medium dense, light brown, damp, silty, gravelly SAND, rootlets (Fill) 4" white PVC pipe @ 0.5' BGS
1	1	█ d		SM	Medium dense, dark brown, damp, silty, gravelly, SAND, rootlets (Relict Topsoil)
2	2	█ d	W = 22.0 GS	SM	Medium dense, brown, damp, silty, gravelly, SAND (Advance Outwash) 4" white PVC pipe @ 2.5' BGS
3	3	█ d	W = 20.1 GS		
4	4	█ d	W = 4.7 GS	SP	Medium dense, tan, slightly silty, gravelly SAND (Advance Outwash)
5					
6	5	█ d			
7					
8	6	█ d			
9					
10	7	█ d		SP	Medium dense, gray, moist, slightly silty, gravelly SAND, poorly graded (Advance Outwash)

Reference Notes:

1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for an explanation of the graphics/symbols used.

Test Pit TP-1 was terminated at 10.0 ft below site grades on 5/12/21

Figure:

Notes:

6



TEST PIT LOG

Test Pit No. TP-2

PROJECT: Atonement Parking Lot and Building Improvements

PROJECT NO.: 21-0524

LOCATION: 6905 172nd Street NE, Arlington, WA 98223

DATE: 5/12/21

EXPLORATION METHOD: Tracked Excavator

ELEVATION: 167'

CONTRACTOR/DRILLER: Kaiser Enterprises

LOGGED BY: SEM

DEPTH TO WATER TABLE: ∇ N/A PERCHED WATER: ∇ 6.0 CAVING C N/A

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA			USCS SYMBOL	SOIL PROFILE DESCRIPTION
	SAMPLE & TEST DATA				
0				SM	Loose, dark brown, damp, silty, gravelly SAND, rootlets (Topsoil)
1	8	█ d	GT	SP	Medium dense, light brown, damp, slightly silty, gravelly SAND (Advance Outwash)
2	9	█ d	GT		
3	10	█ d	GT		
4				SP	Dense, gray, moist to wet, gravelly coarse SAND (Advance Outwash) Moderate seepage @ 6' BGS
5					
6	11	█ d			
7					
8	12	█ d	W = 13.3 GS		

Reference Notes:

1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for an explanation of the graphics/symbols used.

Test Pit TP-2 was terminated at 8.0 ft below site grades on 5/12/21

Figure:

Notes:

7



TEST PIT LOG

Test Pit No. TP-3

PROJECT: Atonement Parking Lot and Building Improvements PROJECT NO.: 21-0524
 LOCATION: 6905 172nd Street NE, Arlington, WA 98223 DATE: 5/12/21
 EXPLORATION METHOD: Tracked Excavator ELEVATION: 159'
 CONTRACTOR/DRILLER: Kaiser Enterprises LOGGED BY: SEM
 DEPTH TO WATER TABLE: ∇ N/A PERCHED WATER: ∇ 8.5' CAVING C 9.0'

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA		USCS SYMBOL	SOIL PROFILE DESCRIPTION
	SAMPLE & TEST DATA			
0			GM	Dense, blue gray, damp, silty, sandy GRAVEL, angular,
			SM	(Crushed Surfacing Top Course)
13	█ d		SM	Dense, brown, damp, silty, gravelly, SAND (Fill)
14	█ d		SP	Medium dense, dark brown, damp, silty, gravelly SAND, roots, rootlets (Relict Topsoil)
15	█ d		SP	Medium dense, light brown, damp, slightly silty, gravelly SAND (Advance Outwash)
16	█ d		SP	Medium dense, tan, damp, slightly silty, gravelly SAND (Advance Outwash)
17	█ d		SP	Medium dense, tan, damp to wet, gravelly SAND, poorly graded (Advance Outwash)
18	█ d			Becomes wet @ 7.5' BSG
19	█ d			Minor seepage @ 8.5' BSG Minor caving @ 9.0 BSG

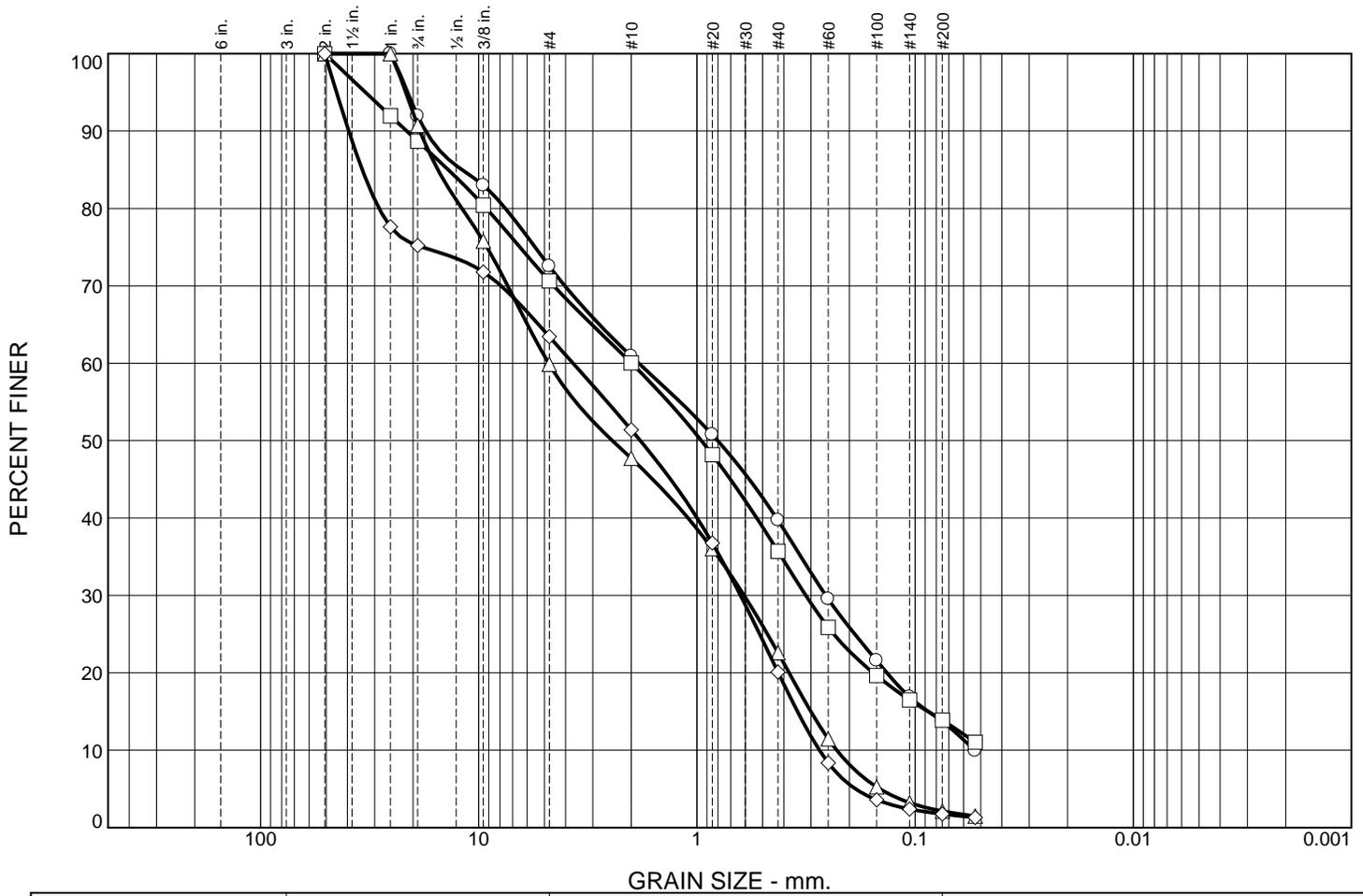
Reference Notes:
 1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for an explanation of the graphics/symbols used.

Test Pit TP-3 was terminated at 9.5' ft below site grades on 5/12/21

Figure:

Notes:

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	8	19	12	21	26	14	
□	0	11	18	11	24	22	14	
△	0	9	31	12	25	21	2	
◇	0	25	12	12	31	18	2	

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	2	1.8	Silty, gravelly SAND	SM
□	TP-1	3	2.5	Silty, gravelly, SAND	SM
△	TP-1	4	3.5	Very gravelly, SAND, trace silt	SP
◇	TP-2	12	8.0	Very gravelly SAND, trace silt	SP

<p style="font-size: small; margin: 0;">1.888.251.5276 Bellingham Arlington Oak Harbor www.geotest-inc.com</p>	<p>Client: Atonement Free Lutheran Church</p> <p>Project: Atonement Parking Lot and Building Improvements</p> <p>Project No.: 21-0524</p>
--	--

Figure 9

Tested By: JC/CD Checked By: SEM



**Northwest Agricultural
Consultants**

2545 W Falls Avenue
Kennewick, WA 99336
509.783.7450
www.nwag.com
lab@nwag.com

PAP-Accredited



GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 55190-1-1
Date: May 15, 2021
Project No: 21-0524
Project Name: Atonement Improvements

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-2 @ 0.8'	5.5	13.51%	29.5 meq/100g
TP-2 @ 1.6'	5.9	4.84%	17.4 meq/100g
TP-2 @ 3.0'	6.1	2.63%	10.0 meq/100g
Method	SM 4500-H⁺ B	ASTM D2974	EPA 9081



REPORT LIMITATIONS AND GUIDELINES FOR ITS USE¹

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report is Based on a Unique Set of Project-Specific Factors

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.



Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.



A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

Our geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors of omissions, the logs included in this report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable; but recognizes that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, consider advising the contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoTest and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.



In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services performed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.