Arlington Phase 2 Natural Gas Improvements

Geotechnical Engineering Evaluation
Arlington, WA 98223

Prepared For:

Cascade Natural Gas Corporation
1520 2nd Street
Mount Vernon, WA 98273

Attn: James L. Hobbs, Jr., P.E.

CC: Rebecca Cushman, P.E
Parametrix

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April 28, 2021
Project No. 21-0323

Cascade Natural Gas Corporation
1520 2nd Street
Mount Vernon, WA 98273

Attention : James Hobbs, Jr., P.E.

CC : Rebecca Cushman, P.E.
Parametrix
719 2nd Avenue, Suite 200
Seattle, WA 98104

Regarding: Geotechnical Engineering Evaluation
Arlington Phase 2 Natural Gas Improvements
Arlington, WA 98223

Dear Mr. Hobbs and Ms. Cushman:

As requested, GeoTest Services, Inc. (GeoTest) is pleased to submit the following report summarizing the results of our geotechnical evaluation for the proposed natural gas line improvements project from 204th Street NE to 207th Street NE in Arlington, Washington (*Vicinity Map*, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement (20-615G) dated January 7, 2021 and authorized by Cascade Natural Gas.

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.

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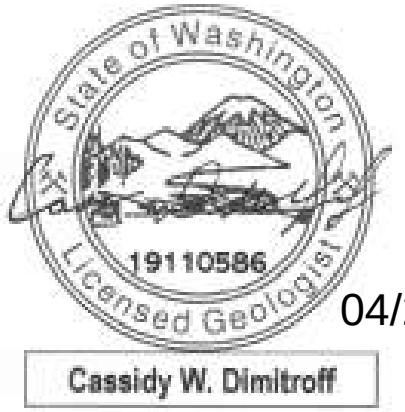

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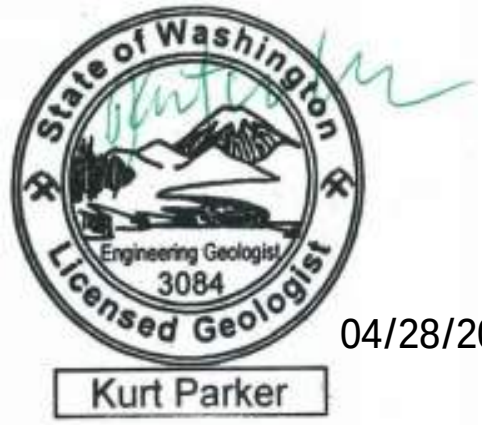

04/28/2021

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Enclosure: Geotechnical Engineering Report

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PURPOSE AND SCOPE OF SERVICES

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

- Exploration of soil and groundwater conditions underlying the site by advancing 17 hollow stem auger borings with a subcontracted drill rig to evaluate subsurface conditions in area expected for new natural gas improvements.

- Laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered.

- To provide a written report containing a description of surface and subsurface conditions, exploration logs, with findings and recommendations for site preparation and feasibility of drilling activities, including soil strength/mechanics, anticipation of dewatering, and areas of obstructions as requested during the initial site meeting. Included will be a discussion of the effects of weather and/or construction equipment on native soils.

PROJECT DESCRIPTION

We understand that the client is in process of planning for the installation of new natural gas lines through open trench and trenchless methods from 204th Street NE to 207th Street NE in Arlington, Washington. We understand trenched installation will occur through the majority of the natural gas line improvements with up to three areas of trenchless borings utilizing Horizontal Directional Drilling (HDD). The new installation is planned to traverse east along 204th Street NE to State Route 9 (SR 9) before trending north and turning east again to intersect Jensen Farm Lane until reaching 207th Street NE. The transect is understood to be approximately 1.18 miles in length in total.

The planned alignment runs east-west along the westbound utility right-of-way along 204th Street NE from approximately 71st Ave NE to 74th Ave NE, where it deviates north then east to avoid existing property development, before splitting north and south along the western margin of SR 9. At SR 9, conventional trenching is planned southward to 204th St NE, where HDD is will continue the utility south of the intersection.

Conventional trenching is planned for the northern alignment running north-south along the western margin of SR 9 for approximately 260 lineal feet, excepting a short section that will require HDD installation below Portage Creek. As the pipeline installation turns east, horizontal directional drilling is planned underneath SR 9 and again below Portage Creek where it then

transitions to conventional trenching and continues east-west along Jensen Farm Lane before trending north-south along 207th Street NE.

The project scope includes providing geotechnical services to explore subsurface conditions in the vicinity of proposed HDD and provide soil characterizations and feasibility commentary for the project. GeoTest met with the client and HDD designer prior to commencing work to discuss scope of the project and to target locations for exploration.

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. A GeoTest Licensed Geologist and Staff Geologist performed field work from March 1st through March 4th, 2021 for this project.

Surface Conditions

The subject section of natural gas improvements occupies approximately 1.18 miles starting on 204th Street NE, traversing north along the west side of SR 9, crossing east along Jensen Farm Lane, and finishing on 207th Street NE in Arlington, Washington. Surface conditions can be categorized by three primary areas that comprise the proposed pipeline alignment: the 204th Street NE corridor, the corridor along SR 9, and the Jensen Farm Lane-207th Street NE corridor.

204th Street NE Corridor

Surface conditions along 204th Street NE include dominantly vacant land on the north side of the roadway and mixed used buildings along the south side of the road. Properties on the north side of the road contain scattered older warehouse buildings and sparsely developed tracts with medium high grasses and brush. Some tree growth is observed on these lots with increased density to the north where the lots intersect the east-west trending Portage Creek. Properties on the south side of 204th Street NE include more modern industrial and commercial buildings, including a new mixed used building that is currently under construction. At the intersection of 204th Street NE and SR 9, urban density increases with retail centers comprising properties at all quadrants of the intersection.

State Route 9 Corridor

Pipeline installation is planned to divert from 204th Street NE and continue along the western side of SR 9, extending approximately 150 feet south of the intersection and approximately 1,200 feet north of the intersection. This area includes the retail properties surrounding the intersection of 204th Street NE and SR 9, specifically the Bartell's Drugstore and Starbucks development on the northwest side of the intersection and a 7-Eleven gas station on the

southwest side of the intersection. Pipeline installation will be conducted within a utility easement, adjacent to the WSDOT ROW for SR 9. This easement transects through short field grasses, native shrubs and crosses the moderately vegetated banks of Portage Creek near the northern extent of the alignment. North of Portage Creek the easement area consists of short grasses and recently brushed terrain adjacent to an industrial warehouse and lumber distribution properties farther west.

Jensen Farm Lane-207th Street NE Corridor

The alignment then trends east toward and under SR 9 and then passes through an empty lot consisting of short field grasses before transitioning into the residential area of Jensen Farm Lane. Surface conditions are composed of paved roadways and concrete flatworks lined with narrow greenways, manicured lawns, and surrounded by single-family residences. Similar developed surfaces continue as the alignment turns northwest along 207th Street NE. On the southeast side of 207th Street NE is the Kent Prairie Elementary School grounds with continued residential development beyond the property boundaries in all cardinal directions.

Commercial, retail, and industrial properties increase in density toward the south and west, while residential housing increases to the north and east. Surface conditions throughout the project area did not have significant standing water during our early March site work. The only exceptions were Portage Creek near the center of the project site and a stormwater detention pond located on the north side of Jensen Farm Lane.

Image 1: Typical surface conditions along Jensen Farm Lane. View facing west of boring B-15 in progress.

Image 2: Surface conditions as seen within vacant lots along the west side of State Route 9. View facing southwest of boring B-6 in progress.

Subsurface Conditions

Subsurface conditions were explored by advancing 17 hollow stem auger borings with split spoon sampling between March 1st and March 4th, 2021 under the direction of a GeoTest Licensed Geologist. The explorations were advanced to depths of between 11.5 to 51.5 feet below ground surface (BGS) at the request of the client. Borings B-5 and B-8 were not advanced due to lack of access to locations of the proposed borings. Boring services were performed by Bortec 1, Inc. of Puyallup, Washington. Approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figures 2A and 2B).

Soil Conditions

Disturbed but representative samples were obtained during drilling by using the Standard Penetration Test (SPT) procedure in accordance with American Society for Testing and Materials (ASTM) D1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular

soils or the relative consistency of cohesive soils; these values are reported on the attached boring logs.

Conditions within the subsurface were generally categorized by three distinct soil types as seen in Table 1. Generally, an overburden unit was observed consisting of either a relatively thin (1-foot) native topsoil, reworked native and topsoil material or imported granular fill depending on the proximity to developed areas or roadways. The thickest section of fill was observed at B-19, along 207th Street NE, and consisted of a gravelly road base, reworked topsoil and native materials to a depth of 7.5 feet BGS. Thickness of fill material typically averaged 2.5 to 5 feet at the remaining exploration locations. Underlying fill materials or topsoil were native recessional glacial outwash deposits.

Table 1: Approximate Upper Contact of Soil Units*

Boring ID:	Arlington Gravel (Feet)	Marysville Sand (Feet)	Groundwater Depth (Feet)	Boring Termination Depth
B-1	2.5	NE	NE	11.5
B-2	2.5	NE	8.0	11.5
B-3	5.0	NE	NE	11.5
B-4	3.5	NE	8.0	11.5
B-5	-	-	-	-
B-6	2.7	12.5	7.5	16.5
B-7	3.0	10	7.5	51.5
B-8	-	-	-	-
B-9	5.5	13	11	41.5
B-10	5.0	9.0	7.5	46.5
B-11	1.0	8.5	7.5	51.5
B-12	5.5	7.5	15	41.5
B-13	1.0	11.3	7.5	46.5
B-14	6.0	8.0	8.8	36.5
B-15	5.0	6.5	5.5	11.5
B-16	1.0	NE	7.2	11.5
B-17	2.5	10	10	11.5
B-18	3.0	10	3.5	11.5
B-19	7.5	NE	7.5	11.5

Note:
* = Depth to top of each unit from existing grade at each location
Material above Arlington Gravel includes topsoil, existing fill, and relict topsoil horizons
NE = Not Encountered

The glacial outwash deposits, underlying the fill materials, consist of the two distinct soil units. These units are the Arlington Gravel Member and the Marysville Sand Member. For the purpose of this geotechnical report, these soil units are referred to as Marysville Sand and Arlington

Gravel. The Arlington Gravel was composed of medium dense to dense, brown, moist, poorly graded to well graded gravel with sand, extending to depths of approximately 6.5 to 12.5 feet BGS. Gravel content in the Arlington Gravel unit typically ranged from 30 to 60 percent with relatively low fines ranging from 5 to 15 percent.

Below the Arlington Gravel, a dominantly medium dense, brown to gray, moist to wet, medium to coarse grained sand with varying silt and gravel content was observed. Fines content in this unit typically ranged from 5 to 10 percent while gravel content was generally less than 5 percent. This unit is interpreted to be the Marysville Sand and extended to the terminal depths of the explorations when encountered.

A *Soil Classification System and Key* is found as Figure 3. Detailed Boring Logs of these explorations can be found as Figures 4 through 20 and Laboratory Testing Results are found in Figures 21 through 32.

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 area is underlain by recessional outwash deposits from the Vashon Stade of the Frasier glaciation. In particular, the Marysville Sand Member (Qvrm) and the Arlington Gravel Member (Qvra) are mapped within the immediate project vicinity. According to Minard, the Marysville Sand unit is generally comprised of well-drained, stratified to massive outwash sand, some gravel, and some areas of silt and clay while the Arlington Gravel unit is generally comprised of mostly well-drained and stratified sand and gravel deposited by meltwater from the receding Vashon glacier.

The soils encountered in our subsurface explorations are generally consistent with the published geological information. We generally encountered a thinner Arlington Gravel unit overlying the Marysville Sand unit that extended throughout maximum exploration depths. Some shallower borings were terminated within the Arlington Gravel unit before intersecting the Marysville Sand below.

One fault system is mapped in near vicinity of the project site by the Washington State Department of Natural Resources (DNR) *Geologic Information Portal.* The site is approximately 10.2 miles southwest of the Devil's Mountain Fault Zone (DMFZ), a left-lateral oblique slip fault system which is considered active by the DNR. According to the published literature, the DMFZ has been active as recent as 100 to 500 years ago and has the potential for a magnitude 7.5 earthquake or greater (Barrie, 2017). Complete engineering mitigation against such an event is generally considered infeasible and is outside the scope of this project.

Groundwater

At the time of our site investigation in late early March 2021, shallow groundwater seepage was observed at depths ranging from 3.5 to 11 feet BGS. Groundwater occurrences were not observed in boring B-1 or B-3. The groundwater seepage observed during the explorations was interpreted as the regional groundwater table. We interpret the varying depth to groundwater to be due to the surface elevation changes across a large site.

A review of the Washington State Department of Ecology *Water Resources* webpage and other GeoTest projects in the near vicinity indicate that a regional groundwater table is present in the area with groundwater elevations ranging from 16 to 30 feet BGS observed in the near vicinity of the project site at the time of study.

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 and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use.

Web Soil Survey

According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) *Web Soil Survey* website, the soils comprising the subject area are classified as Norma Loam for the majority of the site and Everett gravelly sandy loam on the western portion along 204th Street NE. Please reference Table 2 below for general characteristics. Based on their erosion "K" factor assigned by the NRCS, the soils present on-site are considered to have a "low to moderate" susceptibility to erosion. Values of the erosion factor "K" range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Table 2: USDA NRCS Soil Classifications

Map Unit Symbol	39	17
Map Unit Name	Norma Loam	Everett very gravelly sandy loam
Soil Description	Ashy loam (to 10 inches) over sandy loam	Very gravelly sandy loam (to 35 inches) over cobbly coarse sand
Landform	Depressions, drainageways	Eskers, moraines, kames
Parent Material	Alluvium	Sandy and gravelly glacial outwash
Land Capability Classification	5w	4s
Erosion K Factor, Whole Soil	0.28	NA

The soil found throughout the drill locations is considered to have a "low to moderate" susceptibility to erosion based on their K Factor ratings. Additionally, the soil's vulnerability to sheet and rill erosion are considered ***low*** based on the gentle slope inclination that is present at the subject site, in our opinion. Despite the mapped and estimated erosion susceptibility, GeoTest considers that erosion can be managed during construction with typical Best Management Practices (BMPs).

CONCLUSIONS AND RECOMMENDATIONS

Summary of Conclusions

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 traditional trenched pipeline installation and occasional trenchless Horizontal Directional Drilling method for new natural gas lines, provided the recommendations contained herein are incorporated into the project design.

Preliminary plans of pipeline installation were not available at the time of this study. However, we understand that the majority of natural gas line installation will occur within the upper 5 to 10 feet BGS through traditional trenched pipeline methods. We understand that three areas will require HDD installation methods including a section that passes below 204th Street NE at the western side of the intersection of SR 9, below Portage Creek on the west side of SR 9, and below SR 9 and Portage Creek again as the installation path trends east toward Jensen Farm Lane. Although we do not currently know the depth of HDD install, we anticipate depths greater than 10 feet BGS in order to effectively pass below the above mentioned crossings. As such, it is anticipated that the majority of trenchless HDD utility installation will occur within the Marysville Sand member of the glacial outwash while some portions of the drill strings may encounter the Arlington Gravel unit where HDD is shallower and at the terminal ends of each segment. We do not anticipate that trenched or trenchless pipeline installation activities will impact any WSDOT Right-Of-Way or roadway fill prism soils as the installation path is planned within the utility easement that fronts SR 9. Additionally, the HDD crossing below SR 9 is anticipated to be well below the road prism as bore pit locations on both ends (approximately locations of B-12 and B-13) are lower in elevation than the apparent base of the road prism.

The following soil parameters were requested by the Horizontal Direction Drill design team to support design inputs. Requested parameters include soil unit weight, internal friction angle, and cohesion values of the anticipated soils to be intersected during HDD operations. Table 3 outlines the recommended soil parameters for the upper Arlington Gravel unit (GP-SP) and the lower Marysville Sand unit (SP-SM).

Table 3: Recommended Soil Parameters

Soil Unit - USCS	Unit Weight	Internal Friction Angle	Cohesion
Arlington Gravel – GP-SP	125 pcf	32°	0 psf
Marysville Sand – SP-SM	115 pcf	30°	0 psf

The above recommended soil parameters are based on laboratory determination of USCS soil classification, field derived consistency (N – values), relative saturations from field observations and natural moisture readings. We recommend that the project design team review the provided soil parameters. We may be consulted for further soil parameter determination or examination at the request of the project team.

Site Preparation and Earthwork

We understand that a portion of natural gas improvements will be accomplished by trenchless HDD installation, with the remaining installation accomplished by open trenching conditions that will require site preparation and backfill. As such, we provide the following general recommendations for site preparation and earthwork activities common for the soil types observed at the project site.

Prior to backfill of trenches or final preparation below improved areas (pavement, sidewalks, curbs), the exposed subgrade should be recompacted to a firm and unyielding condition. Compaction of existing fill and native soils will likely require a hoe-pack or plate compactor and moisture conditioning, dependent on the season of construction. We recommend that construction occur in the summer months for this reason.

Depending on the application, verification of compaction can be accomplished through nuclear densometer testing or 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 disturbed during site work can be recompacted.

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

Proof rolling may not be feasible for certain locations within trench areas or other difficult access zones when using a full-size dump truck or other large machinery. In this situation, we recommend alternate means of verification such as nuclear densometer, Dynamic Cone Penetrometer (DCP) testing or soil probe methods be employed to verify suitability of field conditions.

Fill and Compaction

Structural fill used to obtain final elevations for areas of trenching or disturbance that may have overlying improved surfaces such as roadways, curbs or sidewalks must be properly placed and compacted. In most cases, any non-organic, predominantly granular soil may be used for fill 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, organics, 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

The on-site, non-organic, native glacial outwash sands and gravels are suitable for reuse as structural fill when placed at or near optimum moisture contents, as determined by ASTM D1557 (Modified Proctor), and if allowed for in the project plans and specifications. The near-surface soils may contain elevated silt contents and may be difficult to use during periods of wet weather. Some of the road base materials seen below asphalt roadways may be suitable for reuse. If elected for reuse, the contractor should stockpile these materials and further evaluation should be conducted. We do not recommend reuse of other reworked native fills or deleterious material within structural backfill zones

We do not recommend reuse of the topsoil, fill or native material with significant organic content or deleterious material within structural areas. Any such material should be reused in non-structural areas only or removed from the site. GeoTest should approve of any existing site soils prior to placement and compaction.

Import Structural Fill

GeoTest recommends that imported structural fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved inorganic, naturally occurring granular material (pit run) or a well-graded crushed rock. We recommend structural fill for dry weather construction be similar

to Washington State Department of Transportation (WSDOT) Standard Specification 9-03.14(2) for "Select Borrow" with the added requirement than 100 percent pass a 4-inch-square sieve.

Soil containing more than about 5 percent fines (that portion passing the U.S. No. 200 sieve) cannot consistently be compacted to a dense, non-yielding condition when the water content is greater than optimum. Accordingly, GeoTest recommends that imported structural fill for wet weather construction be similar to WSDOT Standard Specification 9-03.14(1) for "Gravel Borrow" with the added requirement that no more than 5 percent pass the U.S. No. 200 sieve. Due to wet weather or wet site conditions, soil moisture contents could be high enough that it may be very difficult to compact even 'clean' imported select granular fill to a firm and unyielding condition. Soils with over-optimum moisture contents should be scarified and dried back to more suitable moisture contents during periods of dry weather or removed and replaced with fill soils at a more suitable range of moisture contents.

Based on local availability, the designer may elect to utilize Crushed Surfacing Base Course (CSBC) or Crushed Surfacing Top Course (CSTC) as structural fill. As such, we recommend gradations similar to WSDOT Standard Specification 9-03.9(3) be incorporated into the project plans. Use of quarry spalls may be necessary in deeper excavation areas to manage groundwater concerns. Specifications for this material should be similar to WSDOT 9-13.1(5).

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. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

If construction takes place during wet weather, GeoTest recommends that structural fill consist of imported, clean, sandy gravel or gravelly sand 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

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 feet should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403.

Temporary unsupported excavations in the medium dense to dense, granular outwash soils and upper fill soils, encountered shallowly at the project site are classified as a Type C soil according to WAC 296-155-66401 and may be sloped as steep as 1.5:1 (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 improved areas. Excavations for new shallow underground utilities are likely to encounter the medium dense to dense Arlington Gravel. Deeper utilities may be placed in the medium dense Marysville Sand soils encountered at about 6.5 to 15 feet below present site grades.

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 and may consist of imported fill soils or reused, approved native outwash soils. The selection of soil material for

trench backfill will depend on moisture contents and general seasonal conditions. Outside of improved areas, trench backfill may consist of reused native material or existing fill provided the backfill can be compacted to the project specifications. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the Fill and Compaction section of this report.

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.

Utility Trench and Bore Pit Base Support

The new gas line installation has the potential to intersect the groundwater table at varying depths across the project site, which could result in a “quick” condition. A quick condition develops when the seepage pressure exceeds the resisting pressure. In this case, it would be the upwards vertical flow of water exceeding the unit weight of the soils at the bottom of the trench. The potential for a quick condition to develop is based on the hydraulic head difference between the water table level and the trench bottom and the unit weight of the surrounding soils. It is our understanding that bore pits for HDD will be constructed as relatively shallow trenches (approximately 4 feet BGS) and within the Arlington Gravel unit, therefore a quick condition is not anticipated but should be planned for.

If a quick condition develops within the deeper utility trenches, it may become necessary to add quarry spall rock to the bottom of the trench during the excavation process. The quarry spall rock will add weight to the saturated soils and provide resistance against hydrostatic forces. If quick conditions develop in a lateral direction (i.e., running sand), mitigating the differential forces will be more difficult and will likely require that the water table be lowered to below the depth of the excavation.

Dewatering Considerations

As mentioned above, the groundwater was encountered at depths as shallow as 3.5 feet BGS and commonly at approximately 7.5 feet BGS during our site explorations. Due to these conditions, we recommend that site earthwork and utility trenching excavations occur during late summer or early fall when groundwater levels are historically at their lowest and when precipitation is least likely to occur. If earthwork or utility trenching excavations are performed outside the late summer or early fall, then dewatering using appropriate submersible pumps or a more robust dewatering system is likely to be needed. Some dewatering may still be needed for utility trench excavations performed during the late summer or early fall. It is the contractor's responsibility to develop a dewatering plan based on the expected elevation of site excavations and existing ground and surface water conditions. GeoTest recommends that the design team have an opportunity to review the contractor's dewatering plan prior to the start of construction.

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 stripping, subgrade preparation, structural fill placement and compaction activities as needed for open utility trenching, if performed during project construction.

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 concrete, asphalt, and imported or existing soils. 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 Cascade Natural Gas Corporation, Parametrix and their project team for specific application to the design of the proposed Arlington Phase 2 Natural Gas Improvements located in Arlington, Washington. 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.

REFERENCES

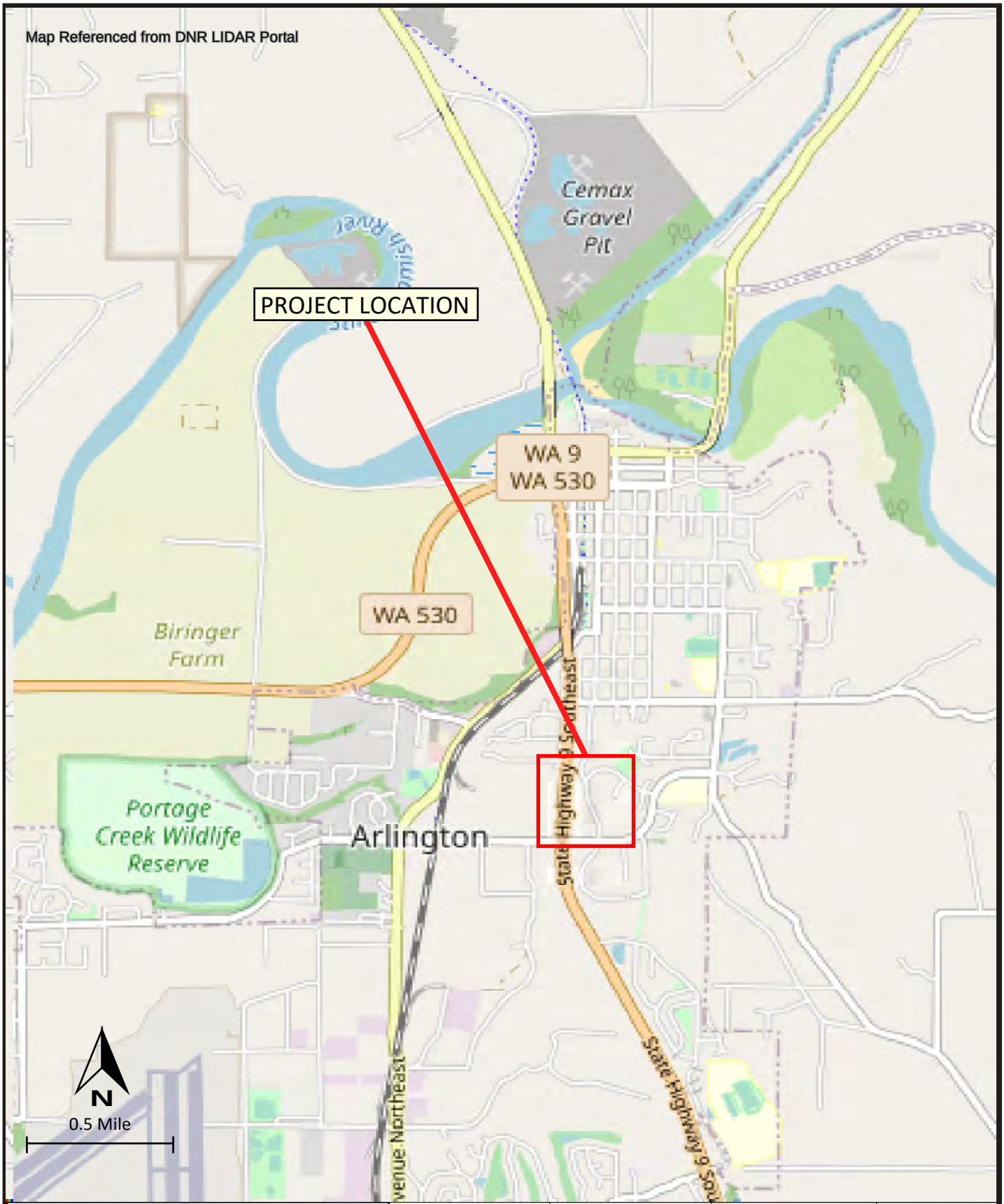
Barrie, J. V. & Greene, H. G. (2017). *The Devils Mountain Fault Zone: An Active Cascadia Upper Plate Zone of Deformation, Pacific Northwest of North America (Master's Thesis, 2017).* Sedimentary Geology. DOI:10.1016

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.

USDA *Web Soil Survey*. (2017, August 21). Retrieved April 2021 from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.

Washington State Department of Ecology. *Well Log Viewer.* Retrieved April 2021 from https://appswr.ecology.wa.gov/wellconstruction/map/WCLSWebMap/.

Washington State Department of Natural Resources. *Geologic Information Portal*. (n.d.). Retrieved April 2021 from https://geologyportal.dnr.wa.gov/.



GEOTEST

Date: 4-5-21	By: DM	Scale: As Shown	Project 21-0323

VICINITY MAP

ARLINGTON PHASE 2 NATURAL GAS IMPROVEMENTS

204TH - 207TH STREET NE

ARLINGTON, WA 98223

Figure 1

B-# = Approximate Boring Location

N

150 Feet

GEOTEST

Date: 4-5-21	By: DM	Scale: As Shown	Project 21-0323

SITE AND EXPLORATION PLAN
ARLINGTON PHASE 2 NATURAL GAS IMPROVEMENTS
204TH - 207TH STREET NE
ARLINGTON, WA 98223

Figure 2A

B-#= Approximate Boring Location

N

150 Feet

GEOTEST

Date: 4-5-21	By: DM	Scale: As Shown	Project 21-0323

SITE AND EXPLORATION PLAN

ARLINGTON PHASE 2 NATURAL GAS IMPROVEMENTS

204TH - 207TH STREET NE

ARLINGTON, WA 98223

Figure 2B

Soil Classification System

MAJOR DIVISIONS			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
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	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
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of 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

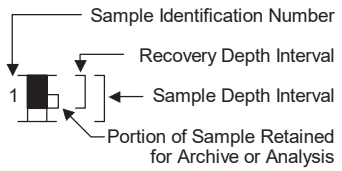
OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

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

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

Groundwater

▽ ATD — Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Field and Lab Test Data

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

GEOTEST

Arlington Phase 2 NGI
204th St. NE - 207th St. NE
Arlington, WA 98223

Soil Classification System and Key

Figure 3

BORING LOG

Boring No. B-1

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-4-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: **PERCHED:** **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Medium dense, dark brown, moist, silty, gravelly SAND (Topsoil)
	1 — 11, 15, 15	30		b2	SP	Medium dense, brown, moist, silty, gravelly SAND (Arlington Gravel)
5	2 — 7, 8, 9	17		b2		- Grading to slightly gravelly
	3 — 9, 16, 14	30		b2	SP	Medium dense, brown, moist, slightly gravelly, slightly silty SAND (Marysville Sand)
10	4 — 11, 12, 14	26		b2	GP	Medium dense, brown, moist to wet, slightly silty, very sandy GRAVEL (Marysville Sand)

W = 5.1 GS

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.

Boring B-1 was terminated at 11.5 feet below existing site grades on 3-4-21

Figure: 4

Notes:

BORING LOG

Boring No. B-2

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-4-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 8.0 **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Medium dense, dark brown, moist, gravelly, silty SAND (Imported Fill)
	5: 10 9 8	17		b2	SP	Medium dense, light brown to brown, moist, very gravelly SAND (Arlington Gravel)
5	6: 47 23 19	42		b2	GP-GM	Dense, slightly silty, very sandy GRAVEL (Arlington Gravel) - pulverized cobbles observed
	7: 27 41 42	83	83 →	b2	SP	Very dense, brown, moist to wet, very gravelly SAND (Arlington Gravel) - Groundwater encountered at 8.0 feet BGS - Minor oxidation banding observed
10	8: 10 10 17	27		b2		

TEST DATA: W = 3.8 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.

Boring B-2 was terminated at 11.5 feet below existing site grades on 3-4-21

Figure: 5

Notes:

BORING LOG

Boring No. B-3

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-4-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Medium dense, brown, moist, gravelly, silty SAND (Imported Fill)
	9 — 12 6 7	13		b2	ML	Stiff, dark brown, moist, gravelly, sandy SILT (Relict Topsoil)
5	10 — 8 21 14	35		b2	SP-SM	Dense, brown, moist, slightly silty, very gravelly SAND (Arlington Gravel)
	11 — 12 9 18	27		b2		- Grading to medium dense, increase in sand from 7.5 to 8.0 feet BGS
10	12 — 18 29 28	57		b2		- Grading to very dense with a slight increase in moisture observed

W = 4.3 GS

W = 4.7 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.

Boring B-3 was terminated at 11.5 feet below existing site grades on 3-4-21

Figure: 6

Notes:

BORING LOG

Boring No. B-4

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-4-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 8.0 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Loose to medium dense, dark brown, moist, gravelly, silty SAND (Imported Fill)
	13 — 6 4 14	18		b2	ML	Very stiff, dark brown, moist, sandy SILT (Relict Topsoil)
5	14 — 31 22 23	45		b2	SW-SM	Dense, light brown, moist, slightly silty, very gravelly SAND (Arlington Gravel)
	15 — 18 19 26	45		b2		- Grading to slightly wet - Groundwater encountered at 8.0 feet BGS
10	16 — 22 14 21	35		b2		- Slight decrease in density

W = 3.9
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.

Boring B-4 was terminated at 11.5 feet below existing site grades on 3-4-21

Figure: 7

Notes:

BORING LOG

Boring No. B-6

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-3-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Medium dense, brown to dark brown, moist to wet, silty, gravelly SAND (Reworked Native Fill)
	17 — 13, 15, 17	32		b2 W = 4.8 GS	SP-SM	Dense, brown, moist, slightly silty, very gravelly SAND (Arlington Gravel) - relict topsoil observed from 2.5 to 2.7 feet BGS - Increase to cobble size clasts at 5.8 feet BGS
5	18 — 20, 21, 17	38		b2		
	19 — 11, 16, 11	27		b2		- Groundwater encountered at 7.5 feet BGS - Grading to medium dense, brown to gray and wet at 8.0 feet BGS
10	20 — 6, 11, 12	23		b2		- Increase in sand observed at 11.3 feet BGS
15	21 — 7, 9, 7	16		b2 W = 14.1 GS	SP-SM	Medium dense, brown, wet, slightly silty, gravelly SAND (Marysville Sand) - decreasing gravel with sample depth

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.

Boring B-6 was terminated at 16.5 feet below existing site grades on 3-3-21

Figure: 8

Notes:

BORING LOG

Boring No. B-7

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-3-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Medium dense, brown, moist, slightly silty, gravelly SAND (Imported Fill)
	22 — 9 18 18	36		b2		- Grading to dense with an increase in silt observed
					SP	Dense, brown to light brown, moist, slightly gravelly SAND with trace silt (Arlington Gravel) - medium to coarse grained sand, slight oxidation on clasts
5	23 — 15 20 25	45		b2		W = 4.6 GS
	24 — 9 14 14	28		b2		- Grading to medium dense with slight oxidation on clasts. Groundwater encountered at 7.5 feet BGS
10	25 — 6 9 13	22		b2	SP-SM	W = 19.7 GS; Medium dense, brown, wet, slighty silty SAND (Marysville Sand) with trace gravel
15	26 — 7 14 14 28	28		b2		- Medium to coarse grained sand with trace silt and a slight increase in gravel
20	27 — 7 9 15	24		b2		W = 21.9 GS; - Grading to slightly silty
25	28 — 5 9 10	19		b2		
30	29 — 7 14 24	41		b2		- Grading to dense with a slight increase in silt observed

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.

Boring B-7 was terminated at 51.5 feet below existing site grades on 3-3-21

Figure: 9

Notes:

BORING LOG

Boring No. B-7

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-3-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** ℄

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	30 — 5 8 23	31		b2	W = 18.5 GS	- Grading to very gravelly
40	31 — 6 6 12	18		b2		- Grading to medium dense sand with trace gravel
45	32 — 4 4 7	11		b2		- Grading to loose to medium dense
50	33 — 8 10 10	20		b2		- Increase in mafic/black sand grains

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.

Boring B-7 was terminated at 51.5 feet below existing site grades on 3-3-21

Figure: 9

Notes:

BORING LOG

Boring No. B-9

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 11 | **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Loose, dark brown, moist, gravelly, silty SAND (Topsoil)
					SM	Medium dense, brown, moist, gravelly, silty SAND (Imported Fill)
	34 — 2 3 9	12		b2	ML	Stiff, light brown to gray, moist, very sandy SILT (Relict Topsoil) to 5.5 feet BGS
5	35 — 13 14 17	31		b2	SW-SM	Very dense, light brown, moist, very gravelly SAND with trace silt (Arlington Gravel)
	36 — 27 41 50	91	91 →	b2		- Grading to very hard with pulverized cobbles observed
10	37 — 10 15 50	65	65 →	b2		- Grading to wet at bottom of sample - Groundwater encountered at 11 feet BGS
15	38 — 14 15 7	22		b2	SP	Medium dense, brown, wet, gravelly SAND with trace silt (Marysville Sand) - 3 to 4 inch thick gravel lens observed at 16 feet BGS with difficult drilling from observed from 15 to 16 feet BGS
20	39 — 5 7 7	14		b2		- Slight decrease in density. Medium to coarse grained sand and an increase in fine grained sand observed from 20.5 to 21.5 feet BGS
25	40 — 5 6 7	13		b2		- Increase in fine grained sand observed from 26 to 26.5 feet BGS
30	41 — 4 6 6	12		b2		

W = 4.7 GS (at 36)
W = 14.7 GS (at 38)
W = 24.7 GS (at 41)

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.

Boring B-9 was terminated at 41.5 feet below existing site grades on 3-1-21

Figure: 10

Notes:

BORING LOG

Boring No. B-9

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323

LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-1-21

EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**

CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff

DEPTH TO WATER TABLE: ▽ 11 **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	42 — 4 7 7	14		b2		- Sand grains fine downwards toward base of sample
40	43 — 3 6 9	15		b2		

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.

Boring B-9 was terminated at 41.5 feet below existing site grades on 3-1-21

Figure: 10

Notes:

BORING LOG

Boring No. B-10

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Loose to medium dense, dark brown, moist, gravelly, very silty SAND (Topsoil)
	44 — 14 18 18	36		b2	SM	Dense, light brown, moist, slightly silty, gravelly SAND (Imported Fill)
5	45 — 25 21 15	36		b2	SW-SM	Dense, brown to light brown, moist, slightly silty, very gravelly SAND (Arlington Gravel) - medium to coarse grained sand with minor oxidation on clasts
	46 — 11 13 11	24		b2		- Grading to medium dense and wet.
					SP	Groundwater encountered at 7.5 feet BGS
10	47 — 5 5 7	12		b2		Medium dense, brown, wet, slightly silty SAND with trace gravel (Marysville Sand)
15	48 — 5 6 6	12		b2		W = 22.1 GS -Slight decrease in silt observed
20	49 — 5 5 7	12		b2		- Increase in fine grained sand and decrease in silt observed
25	50 — 7 8 8	16		b2		W = 20.2 GS - Increase in silt and fine grained sand. 2 inch thick lens of gravel observed at 26.3 feet BGS
30	51 — 5 7 9	16		b2		

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.

Boring B-10 was terminated at 46.5 feet below existing site grades on 3-1-21

Figure: 11

Notes:

BORING LOG

Boring No. B-10

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA		USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	52 — 3 7 9	16		b2	W = 23.5 GS		- Slight heaving observed
40	53 — 4 6 9	15		b2			
45	54 — 2 3 5	7		b2			- Grading from medium dense to loose

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.

Boring B-10 was terminated at 46.5 feet below existing site grades on 3-1-21

Figure: 11

Notes:

BORING LOG

Boring No. B-11

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					SM	Loose, dark brown, moist, gravelly, very silty SAND (Topsoil)
					SM	Loose, brown, moist, silty, very gravelly SAND (Arlington Gravel) to 8.5 feet
	55 — 5 4 3	7		b2		
5	56 — 3 3 3	6		b2		- Gravel plug in sample
	57 — 7 8 7	15		b2		- Grading to medium dense. Groundwater encountered at 7.5 feet BGS
				W = 21.4 GS	SP	Medium dense, reddish brown, wet, slightly silty SAND with trace gravel (Marysville Sand) - slight oxidation observed on clasts
10	58 — 7 7 9	16		b2		- Oxidation banding observed throughout sample
15	59 — 5 8 8	16		b2		- Slight increase in fine grained sand and decrease in silt observed
20	60 — 7 11 11	22		b2		- Grading to brown throughout sample
				W = 22.9 GS		
25	61 — 6 12 9	21		b2		- Increase in coarse grained sand and trace gravel observed
30	62 — 4 6 8	14		b2	SP-SM	Medium dense, brown, wet, slightly silty SAND (Marysville Sand)
				W = 22.9 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.

Boring B-11 was terminated at 51.5 feet below existing site grades on 3-1-21

Figure: 12

Notes:

BORING LOG

Boring No. B-11

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ | **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	63 — 3 4 7	11		b2		- Slight increase in silt observed
40	64 — 3 6 7	13		b2		
45	65 — 4 9 10	19		b2		- Increase in coarse grained sand with slight heaving observed
50	66 — 12 16 18	34		b2		- Grading to dense with a silt pocket observed at 51 feet BGS. Moderate heaving observed

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.

Boring B-11 was terminated at 51.5 feet below existing site grades on 3-1-21

Figure: 12

Notes:

BORING LOG

Boring No. B-12

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 15 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0	67 — 8 8 6	14		b2 W = 13.0 GS	SM	Medium dense, light brown to gray, moist, silty, gravelly SAND (Imported Fill)
5	68 — 4 10 12	22		b2	SM	Medium dense, light brown, moist, slightly silty, gravelly SAND (Arlington Gravel)
	69 — 7 7 6	13		b2	SP	Medium dense, light brown to gray, moist, slightly gravelly SAND with trace silt (Marysville Sand)
10	70 — 6 7 7	14		b2 W = 10.1 GS		- Slight increase in silt observed. Grading to SP-SM
15	71 — 5 5 5	10		b2		- Grading to loose. Slight decrease in silt with scattered oxidation observed
20	72 — 4 9 9	18		b2		- Grading to medium dense
25	73 — 7 12 13	25		b2 W = 18.3 GS		- Slight increase in density
30	74 — 6 9 11	20		b2		- Light heaving observed

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.

Boring B-12 was terminated at 41.5 feet below existing site grades on 3-1-21

Figure: 13

Notes:

BORING LOG

Boring No. B-12

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-1-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 15 **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	75 — 5, 10, 14	24		b2		- Slight increase in density
40	76 — 6, 11, 13	24		b2		

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.

Boring B-12 was terminated at 41.5 feet below existing site grades on 3-1-21

Figure: 13

Notes:

BORING LOG

Boring No. B-13

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					ML	Medium dense, dark brown, moist, sandy SILT (Topsoil)
					SM	Medium dense, light brown, moist, very gravelly SAND with trace silt (Imported Fill) to 5.9 feet BGS - slight oxidation on clasts observed
	77 — 5 11 9	20		b2		
5	78 — 10 10 8	18		b2		- Slight decrease in silt. Grading to SP-SM
	79 — 4 5 7	12		b2	SP	Medium dense, brown to light brown, slightly silty, gravelly SAND (Arlington Gravel)
						- Slight decrease in density. Groundwater encountered at 7.5 feet BGS
10	80 — 10 14 17	31		b2		- Grading to dense. Gravel lens observed from 10.5 to 11.3 feet BGS
					SP	Medium dense, brown, wet SAND with trace silt and gravel (Marysville Sand)
15	81 — 5 6 7	13		b2		
20	82 — 5 8 8	16		b2		
25	83 — 8 9 11	20		b2		- Slight increase in silt towards bottom of sample
30	84 — 3 6 9	15		b2		- Slight decrease in density

W = 10.4 GS

W = 21.7 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.

Boring B-13 was terminated at 46.5 feet below existing site grades on 3-2-21

Figure: 14

Notes:

BORING LOG

Boring No. B-13

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	85 — 5 7 9	16		b2		
40	86 — 3 5 8	13		b2		- Slight decrease in density
45	87 — 8 14 19	33		b2		- Grading to dense. Slight increase in silt observed

W = 22.3 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.

Boring B-13 was terminated at 46.5 feet below existing site grades on 3-2-21

Figure: 14

Notes:

BORING LOG

Boring No. B-14

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 8.8 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	Asphalt paving from 0 to 0.5 feet BGS
					GW	Dense, gray, moist, slightly silty, sandy GRAVEL (Imported Fill)
	88 — 6 5 2	7		b2	SM	Loose, light brown, wet, slightly silty, gravelly SAND (Imported Fill)
5	89 — 15 10 12	22		b2	ML	Medium stiff, dark brown, moist, sandy SILT (Relict Topsoil) from 5.5 to 6.0 feet BGS
	90 — 13 14 15	29		b2	SM	Medium dense, brown, wet, slightly silty, very gravelly SAND (Arlington Gravel)
10	91 — 9 12 13	25		b2 W = 17.6 GS	SP ▽	Medium dense, brown, wet SAND with trace gravel and silt (Marysville Sand) - Groundwater encountered at 8.8 feet BGS
15	92 — 3 6 8	14		b2		- Slight decrease in density
20	93 — 3 7 8	15		b2 W = 21.1 GS		- Grading to slightly silty
25	94 — 4 7 7	14		b2		
30	95 — 4 8 13	21		b2		- Moderate heaving observed

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.

Boring B-14 was terminated at 36.5 feet below existing site grades on 3-2-21

Figure: 15

Notes:

BORING LOG

Boring No. B-14

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 8.8 **PERCHED:** ▽ **CAVING** C

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
35	96 I 5 12 13	25		b2		- Slight increase in density

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.

Boring B-14 was terminated at 36.5 feet below existing site grades on 3-2-21

Figure: 15

Notes:

BORING LOG

Boring No. B-15

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 5.5 **PERCHED:** ▽ **CAVING** ℄

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	Asphalt paving from 0 to 0.6 feet BGS
					GW	Medium dense, brown, moist, slightly silty, sandy GRAVEL (Imported Road Base)
	97 — 12 12 14	26		b2	SM	Medium dense, brown, moist, silty, very gravelly SAND (Imported Fill)
5	98 — 34 13 13	26		b2	SP-SM	Medium dense, light brown, wet, slightly silty, gravelly SAND (Arlington Gravel) - Groundwater encountered at 5.5 feet BGS
	99 — 9 11 12	23		b2	SP	Medium dense, brown to gray, wet, slightly silty, gravelly SAND (Marysville Sand)
10	100 — 10 10 11	21		b2		

W = 9.1
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.

Boring B-15 was terminated at 11.5 feet below existing site grades on 3-2-21

Figure: 16

Notes:

BORING LOG

Boring No. B-16

PROJECT: Arlington Phase 2 Natural Gas Improvements | **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA | **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger | **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec | **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.2 **PERCHED:** ▽ | **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	Asphalt paving from 0 to 0.5 feet BGS
					GW	Medium dense, slighty silty, sandy, GRAVEL (Imported Fill)
					SM	Medium dense, light brown to gray, moist, slightly silty, very gravelly SAND (Arlington Gravel) - pulverized cobbles in sample
5	101 50/3	50		b2		
	102 9 17 13	20		b2		- Slight oxidation observed on clasts
						- Groundwater encountered at 7.2 feet BGS
	103 21 15 12	27		b2	SW-SM	Medium dense, brown, wet, slightly silty, very gravelly SAND (Arlington Gravel)
10	104 50/6	50		b2		- Grading from medium dense to dense
				W = 7 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.

Boring B-16 was terminated at 11.5 feet below existing site grades on 3-2-21

Figure: 17

Notes:

BORING LOG

Boring No. B-17

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 10 **PERCHED:** ▽ **CAVING** ℄

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	
					GW	Asphalt paving from 0 to 0.25 feet BGS
						Medium dense, dark brown, moist, slightly silty, sandy GRAVEL (Imported Fill)
	105 — 29, 28, 28	56		b2	SP-SM	Very dense, brown, moist, slightly silty, very gravelly SAND (Arlington Gravel)
5	106 — 23, 23, 40	63	63	b2		- Slight oxidation on clasts observed
	107 — 14, 11, 5	16		b2		- Grading to medium dense
10	108 — 7, 10, 11	21		b2	SP	Medium dense, brown, moist, slight silty, slightly gravelly SAND (Marysville Sand)

W = 4.5
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.

Boring B-17 was terminated at 11.5 feet below existing site grades on 3-2-21

Figure: 18

Notes:

BORING LOG

Boring No. B-18

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 3.5 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	Asphalt paving from 0 to 0.5 feet BGS
					GW	Medium dense, brown, moist, slightly silty, sandy, GRAVEL (Imported Fill)
	109 — 11, 13, 18	31		b2	SM	Medium dense, brown, moist, slightly gravelly, slightly silty SAND (Imported Fill)
5	110 — 21, 17, 15	32		b2	GW-GM	Dense, brown to gray, wet, slightly silty, very sandy GRAVEL (Imported Fill)
	111 — 6, 7, 4	11		b2	SM	- Perched goundwater encountered at 3.5 feet BGS - Geotextile fabric observed at 3.8 feet BGS Loose to medium dense, brown, wet, slightly silty, very gravelly SAND (Arlington Gravel)
10	112 — 8, 9, 7	16		b2	SM	Medium dense, brown to light brown, wet, slightly silty, gravelly SAND (Marysville Sand) - 3 to 4 inch thick silt lens observed at 10.8 feet BGS

W = 7.3
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.

Boring B-18 was terminated at 11.5 feet below existing site grades on 3-2-21

Figure: 19

Notes:

BORING LOG

Boring No. B-19

PROJECT: Arlington Phase 2 Natural Gas Improvements **PROJECT NO.:** 21-0323
LOCATION: 204th to 207th Street NE, Arlington, WA **DATE:** 3-2-21
EXPLORATION METHOD: Hollow Stem Auger **ELEVATION:**
CONTRACTOR/DRILLER: BoreTec **LOGGED BY:** C. Dimitroff
DEPTH TO WATER TABLE: ▽ 7.5 **PERCHED:** ▽ **CAVING** ☾

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE # INTERVAL	N	N-VALUE CURVE (10 30 50)	TEST DATA	USCS SYMBOL	SOIL PROFILE DESCRIPTION
0					AC	Asphalt paving from 0 to 0.3 feet BGS
	113 — 4 4 3	7		b2	GW	Medium dense, brown, moist, slightly silty, very sandy GRAVEL to 2.7 feet BGS (Imported Fill)
5	114 — 2 2 3	5		b2	ML	Medium stiff, dark brown, moist, very sandy SILT (Relict Topsoil)
	115 — 14 8 17	25		b2	SM	Loose, brown, moist to wet, slightly gravelly, silty SAND (Reworked Native Fill)
10	116 — 44 29 24	53		b2	SM	Medium dense, gray, wet, slightly silty, very gravelly SAND (Arlington Gravel) - Grades from medium dense to hard

W = 12.3
GS

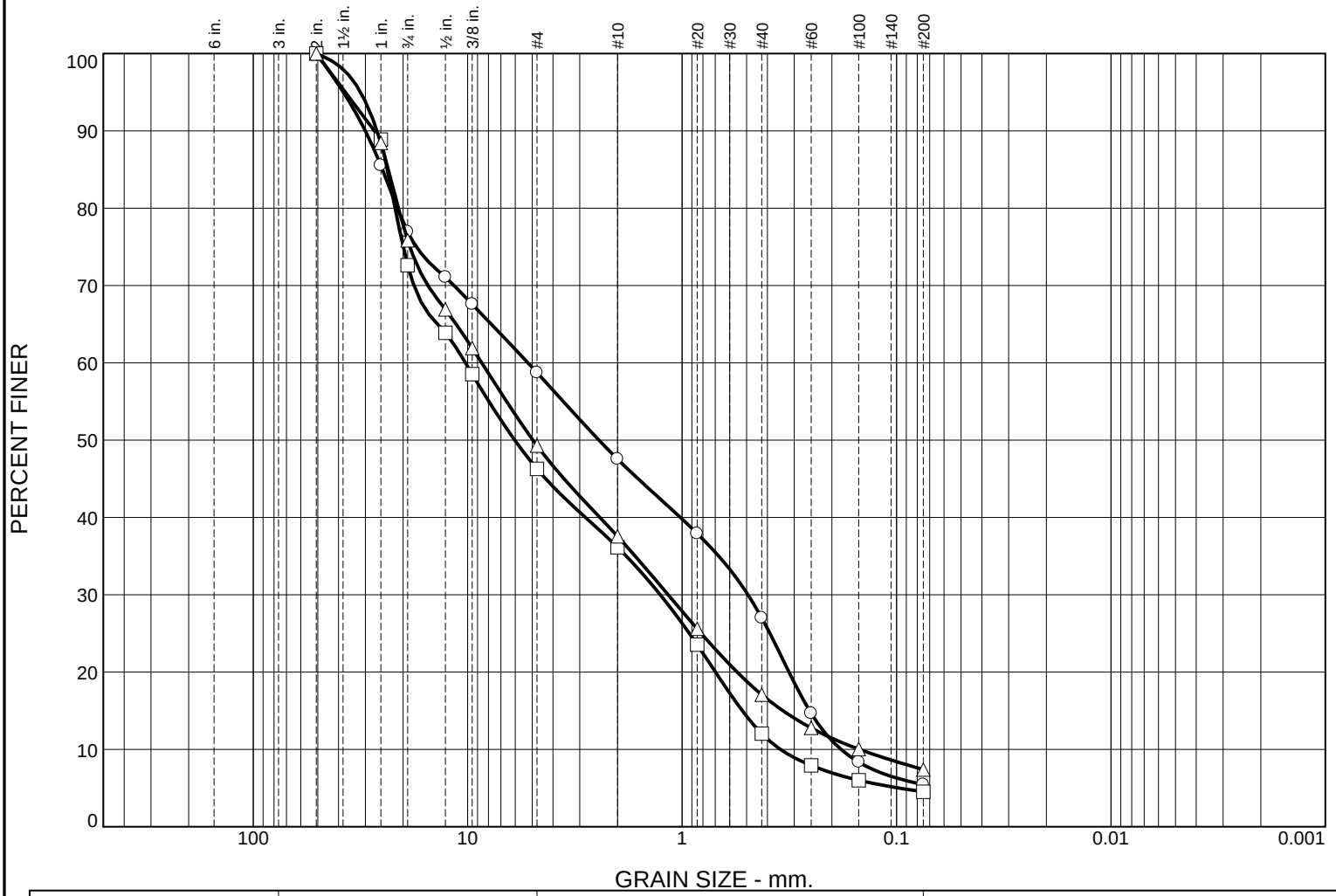
Reference Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key' figure for an explanation of the graphics/symbols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

Boring B-19 was terminated at 11.5 feet below existing site grades on 3-2-21

Figure: 20

Notes:

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	23	18	11	21	22	5	
□	0	27	27	10	24	7	5	
△	0	24	27	11	21	10	7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			24.9679	5.2415	2.4447	0.4926	0.2545	0.1814	0.26	28.89
□			23.6920	10.2386	6.0350	1.2643	0.5236	0.3478	0.45	29.43
△			23.4507	8.5962	4.9628	1.1616	0.3389	0.1490	1.05	57.69

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Slightly silty, very gravelly SAND		SP	5.1
□ Slightly silty, very sandy GRAVEL		GP	
△ Slightly silty, very sandy GRAVEL		GP-GM	3.8

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-1 **Depth:** 2.5

□ **Source of Sample:** B-1 **Depth:** 10

△ **Source of Sample:** B-2 **Depth:** 5

Remarks:

GEOTEST
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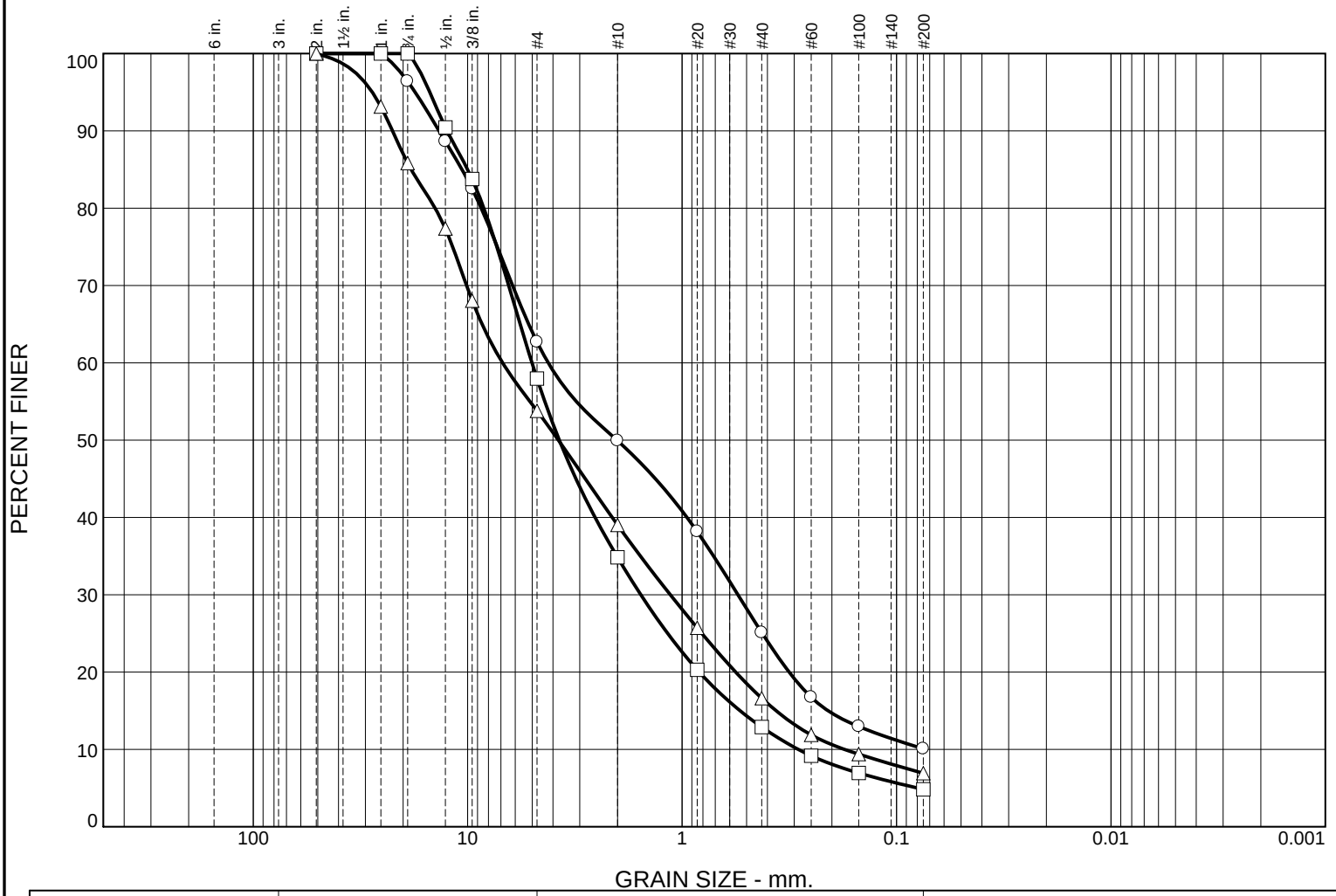
Figure 21

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	4	33	13	25	15	10	
□	0	0	42	23	22	8	5	
△	0	14	32	15	22	10	7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			10.6247	4.2128	2.0140	0.5488	0.2086			
□			10.0002	5.0155	3.7408	1.5575	0.5365	0.2875	1.68	17.44
△			18.3447	6.8764	3.7771	1.1350	0.3646	0.1750	1.07	39.30

	MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○	Slightly silty, very gravelly SAND		SP-SM	4.3
□	Well-graded SAND with gravel		SW	4.7
△	Slightly silty, very gravelly SAND		SW-SM	3.9

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-3 **Depth:** 5

□ **Source of Sample:** B-3 **Depth:** 7.5

△ **Source of Sample:** B-4 **Depth:** 5

Remarks:

GEOTEST
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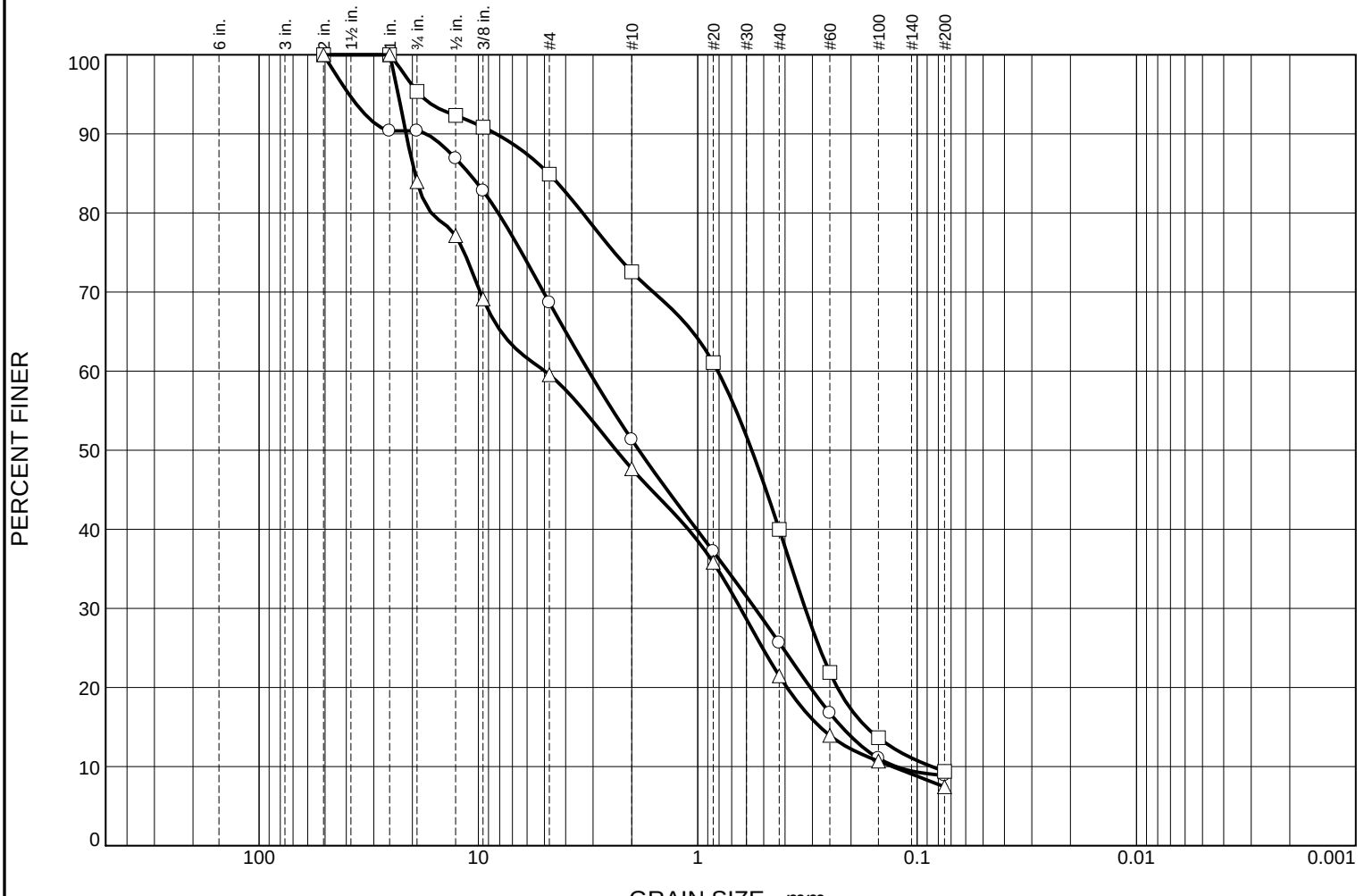
Bellingham | Arlington | Oak Harbor
www.geotest-inc.com

Figure 22

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	10	21	18	25	17	9	
□	0	5	10	12	33	31	9	
△	0	16	24	12	27	14	7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.0201	3.1459	1.8544	0.5480	0.2204	0.1248	0.76	25.20
□			4.7916	0.8100	0.5668	0.3238	0.1706	0.0858	1.51	9.44
△			19.5039	4.9841	2.3560	0.6380	0.2771	0.1297	0.63	38.42

	MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○	Slightly silty, very gravelly SAND		SP-SM	4.8
□	Slightly silty, gravelly SAND		SP-SM	14.1
△	Slightly silty, very gravelly SAND		SP-SM	18.5

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-6 **Depth:** 2.5

□ **Source of Sample:** B-6 **Depth:** 15

△ **Source of Sample:** B-7 **Depth:** 35

Remarks:

GEOTEST
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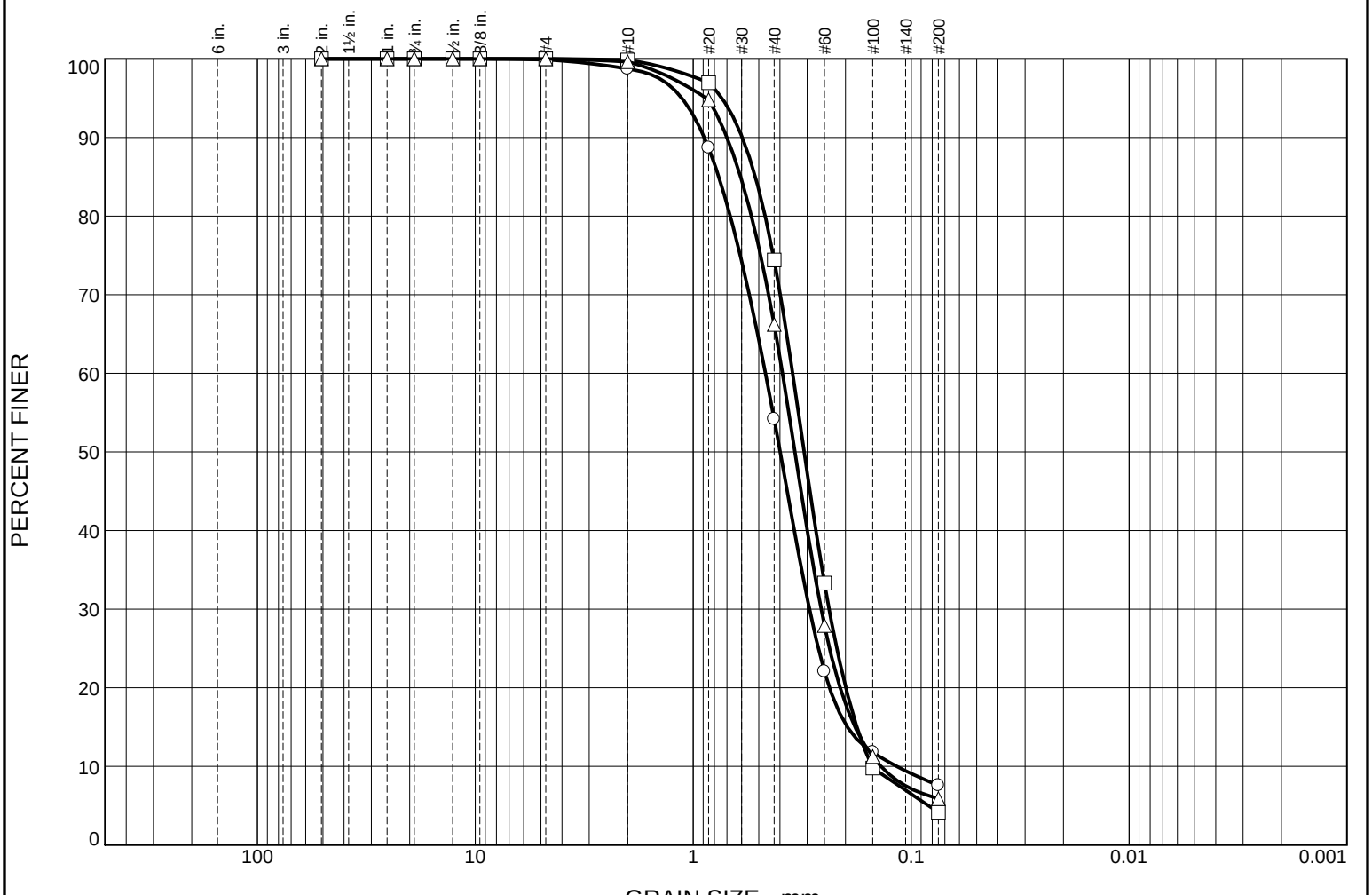
Figure 23

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	45	46	8	
□	0	0	0	0	26	70	4	
△	0	0	0	0	34	60	6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7630	0.4658	0.3991	0.2928	0.1960	0.1167	1.58	3.99
□			0.5186	0.3498	0.3097	0.2380	0.1773	0.1513	1.07	2.31
△			0.6058	0.3894	0.3416	0.2589	0.1808	0.1376	1.25	2.83

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Slightly silty SAND		SP-SM	21.9
□ Poorly graded SAND with trace silt		SP	4.6
△ Slightly silty SAND		SP-SM	19.7

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-7 **Depth:** 20

□ **Source of Sample:** B-7 **Depth:** 5

△ **Source of Sample:** B-7 **Depth:** 10

Remarks:

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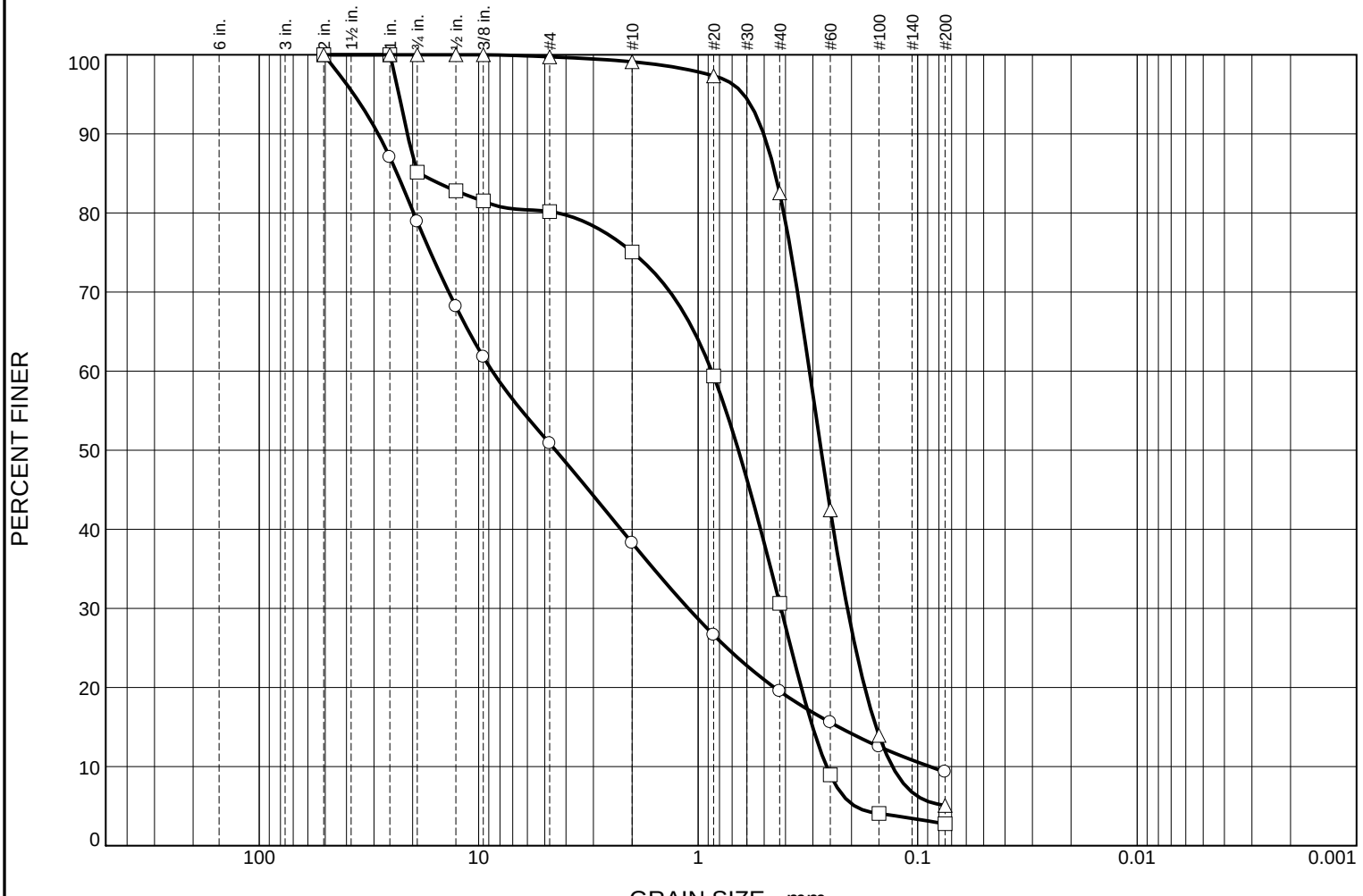
Figure 24

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	21	28	13	18	11	9	
□	0	15	5	5	44	28	3	
△	0	0	0	1	16	78	5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			23.5420	8.6720	4.4695	1.1088	0.2287	0.0880	1.61	98.51
□			18.6131	0.8670	0.6549	0.4194	0.3009	0.2600	0.78	3.33
△			0.4454	0.3110	0.2752	0.2089	0.1546	0.1303	1.08	2.39

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Very gravelly SAND with trace silt		SW-SM	4.7
□ Gravelly SAND with trace silt		SP	14.7
△ Slightly silty SAND		SP	24.7

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-9 **Depth:** 7.5

□ **Source of Sample:** B-9 **Depth:** 15

△ **Source of Sample:** B-9 **Depth:** 30

Remarks:

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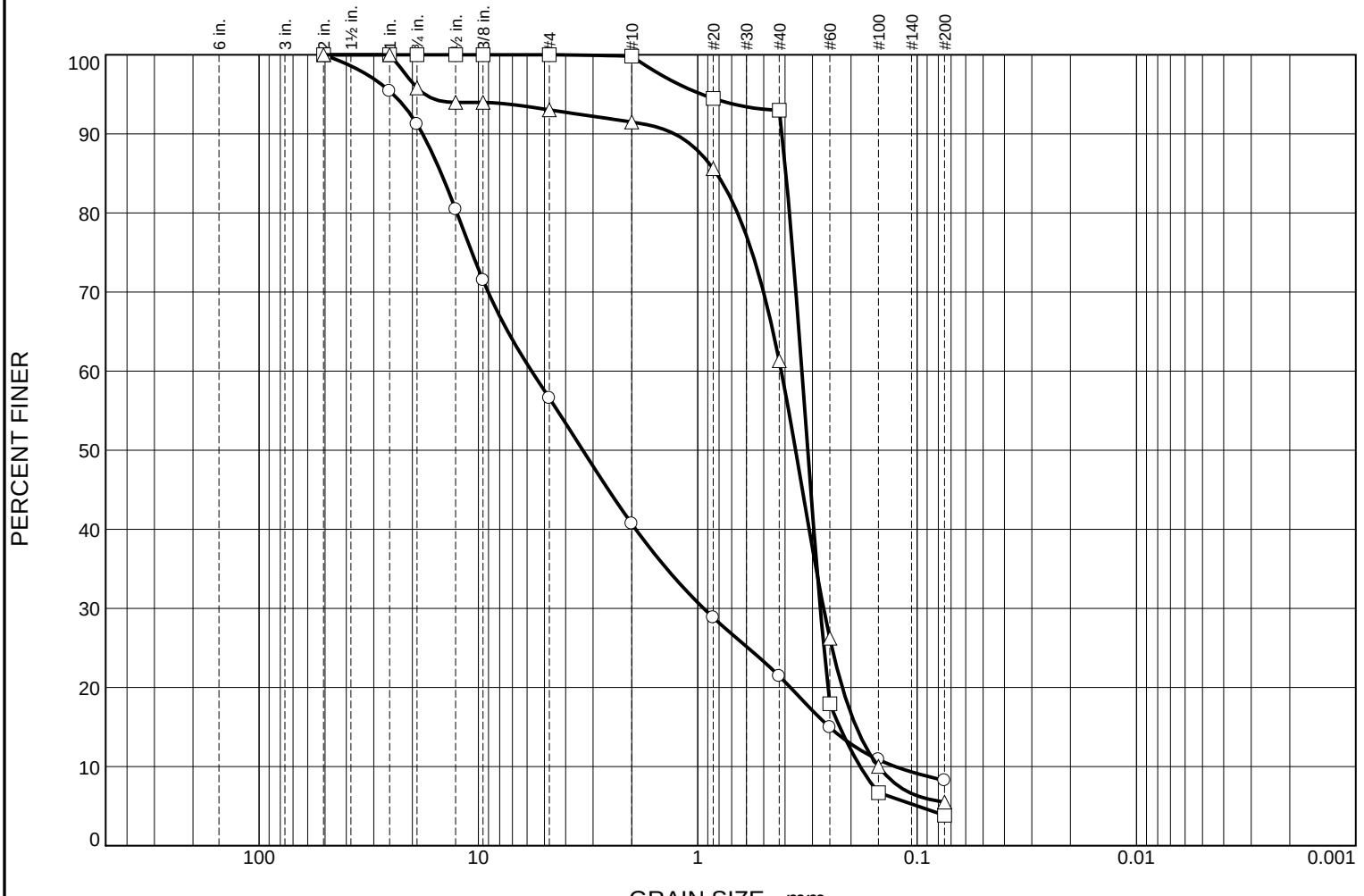
Figure 25

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	9	34	16	20	13	8	
□	0	0	0	0	7	89	4	
△	0	4	3	2	30	56	5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			14.7738	5.7194	3.3438	0.9401	0.2511	0.1259	1.23	45.44
□			0.3963	0.3351	0.3151	0.2764	0.2251	0.1817	1.25	1.84
△			0.8211	0.4160	0.3580	0.2669	0.1894	0.1498	1.14	2.78

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Slightly silty, very gravelly SAND		SW-SM	5.7
□ Poorly graded SAND with trace silt		SP	22.1
△ Slightly silty, slightly gravelly SAND		SP	20.2

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-10 **Depth:** 5

□ **Source of Sample:** B-10 **Depth:** 15

△ **Source of Sample:** B-10 **Depth:** 25

Remarks:

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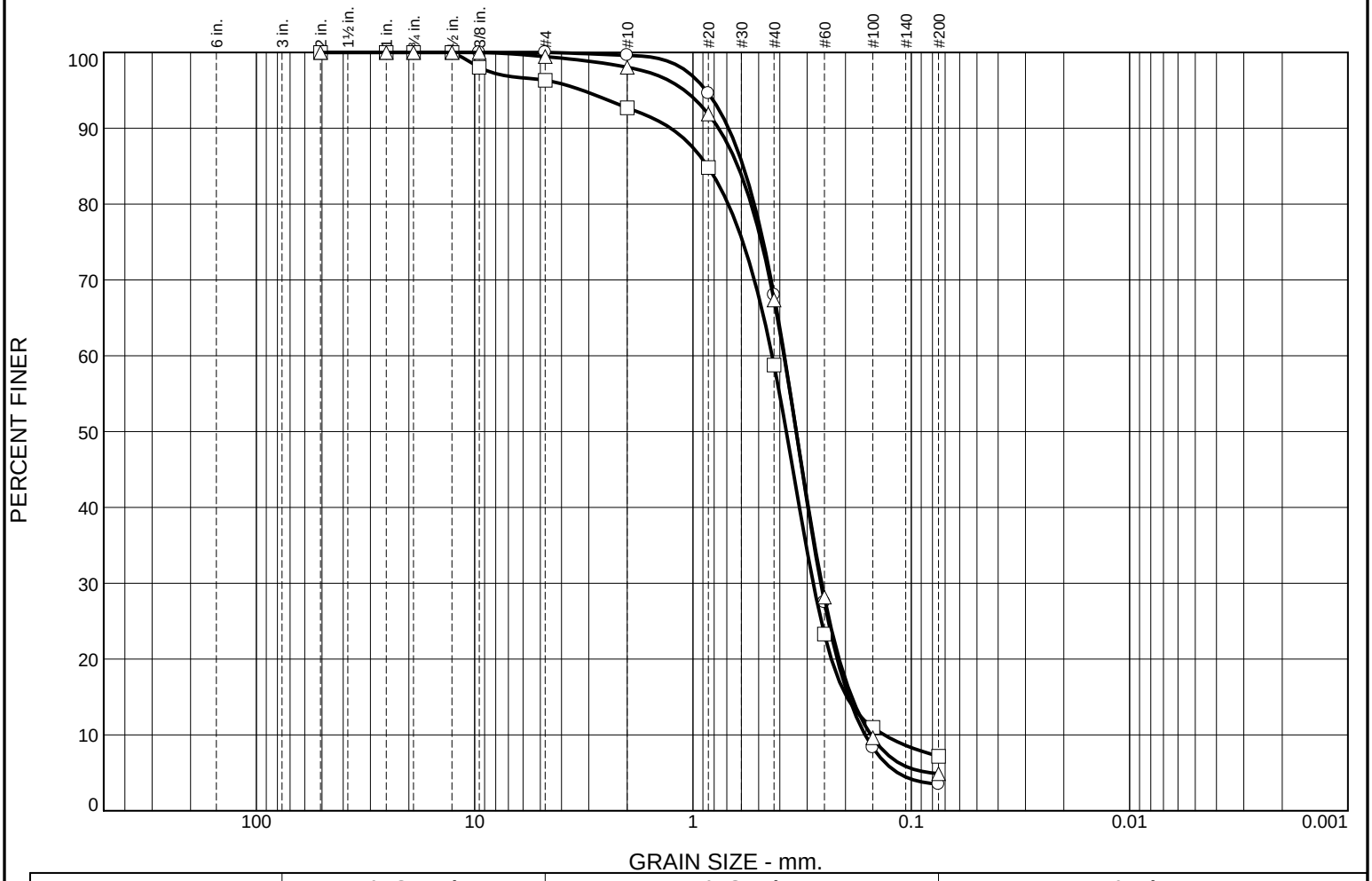
Figure 26

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	32	64	4	
□	0	0	4	3	34	52	7	
△	0	0	1	1	31	62	5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5886	0.3810	0.3363	0.2597	0.1935	0.1628	1.09	2.34
□			0.8575	0.4334	0.3734	0.2811	0.1975	0.1329	1.37	3.26
△			0.6226	0.3826	0.3362	0.2573	0.1875	0.1532	1.13	2.50

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Poorly graded SAND with trace silt		SP	23.5
□ Slightly silty SAND with trace gravel		SP-SM	21.4
△ Slightly silty SAND with trace gravel		SP	22.9

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-10 **Depth:** 35

□ **Source of Sample:** B-11 **Depth:** 7.5

△ **Source of Sample:** B-11 **Depth:** 20

Remarks:

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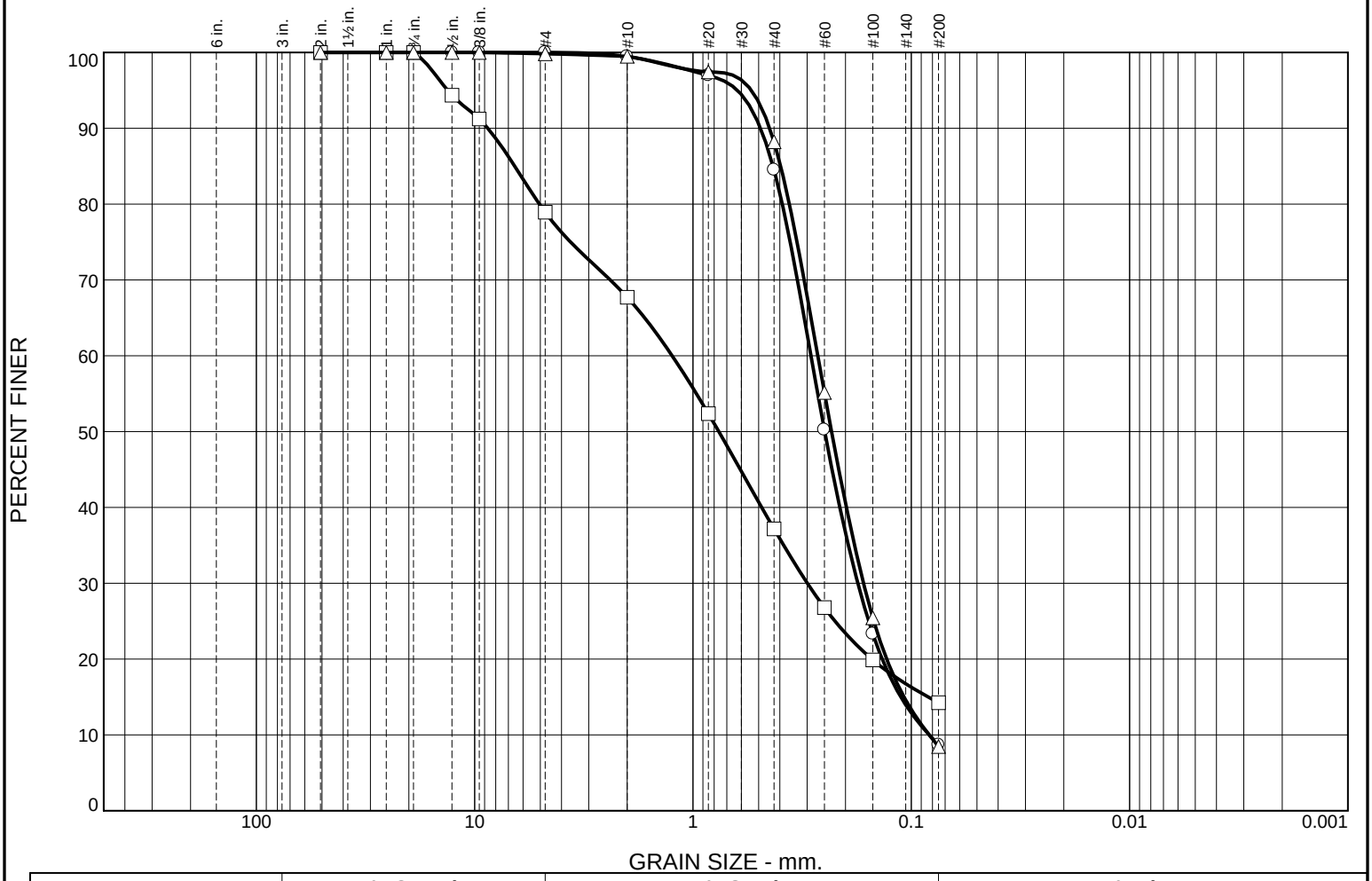
Figure 27

Tested By: DK **Checked By:** DB

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	14	76	9	
□	0	0	21	11	31	23	14	
△	0	0	0	1	11	80	8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.4295	0.2878	0.2491	0.1758	0.1117	0.0827	1.30	3.48
□			6.5532	1.2450	0.7614	0.2990	0.0836			
△			0.3963	0.2679	0.2318	0.1655	0.1080	0.0827	1.24	3.24

	MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○	Slighlty silty SAND		SP-SM	22.9
□	Silty, gravelly SAND		SM	13.0
△	Slightly silty SAND		SP-SM	10.1

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-11 **Depth:** 30

□ **Source of Sample:** B-12 **Depth:** 2.5

△ **Source of Sample:** B-12 **Depth:** 10

Remarks:

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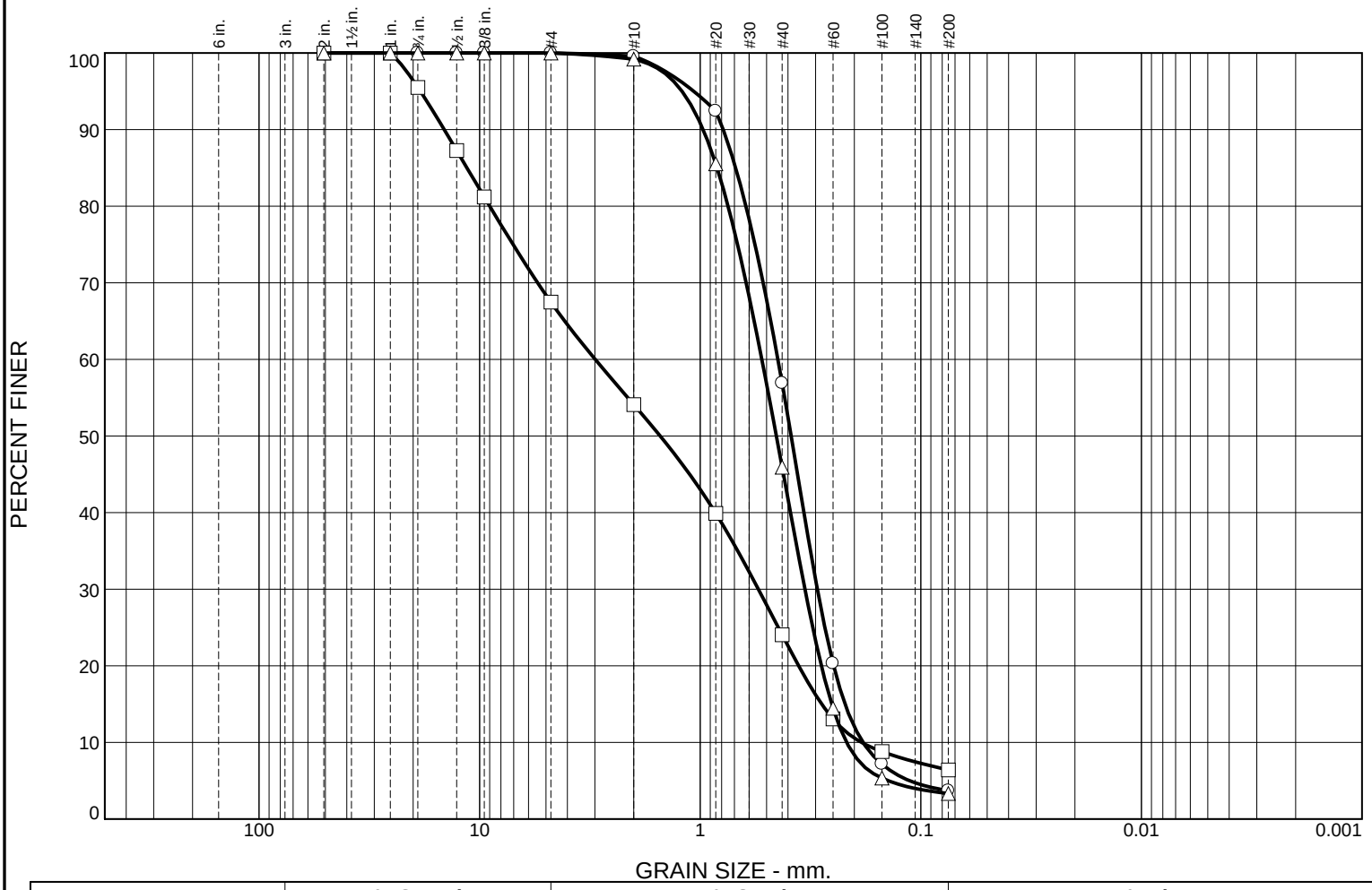
Figure 28

Tested By: DK **Checked By:** DB

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	43	53	4	
□	0	4	29	13	30	18	6	
△	0	0	0	1	53	43	3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.6908	0.4441	0.3869	0.2942	0.2205	0.1829	1.07	2.43
□			11.4040	2.9900	1.5177	0.5449	0.2811	0.1857	0.53	16.10
△			0.8384	0.5254	0.4513	0.3350	0.2534	0.2168	0.99	2.42

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Poorly graded SAND		SP	18.3
□ Slightly silty, very gravelly SAND		SP-SM	10.4
△ Poorly graded SAND with trace silt		SP	21.7

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-12 **Depth:** 25

□ **Source of Sample:** B-13 **Depth:** 5

△ **Source of Sample:** B-13 **Depth:** 20

Remarks:

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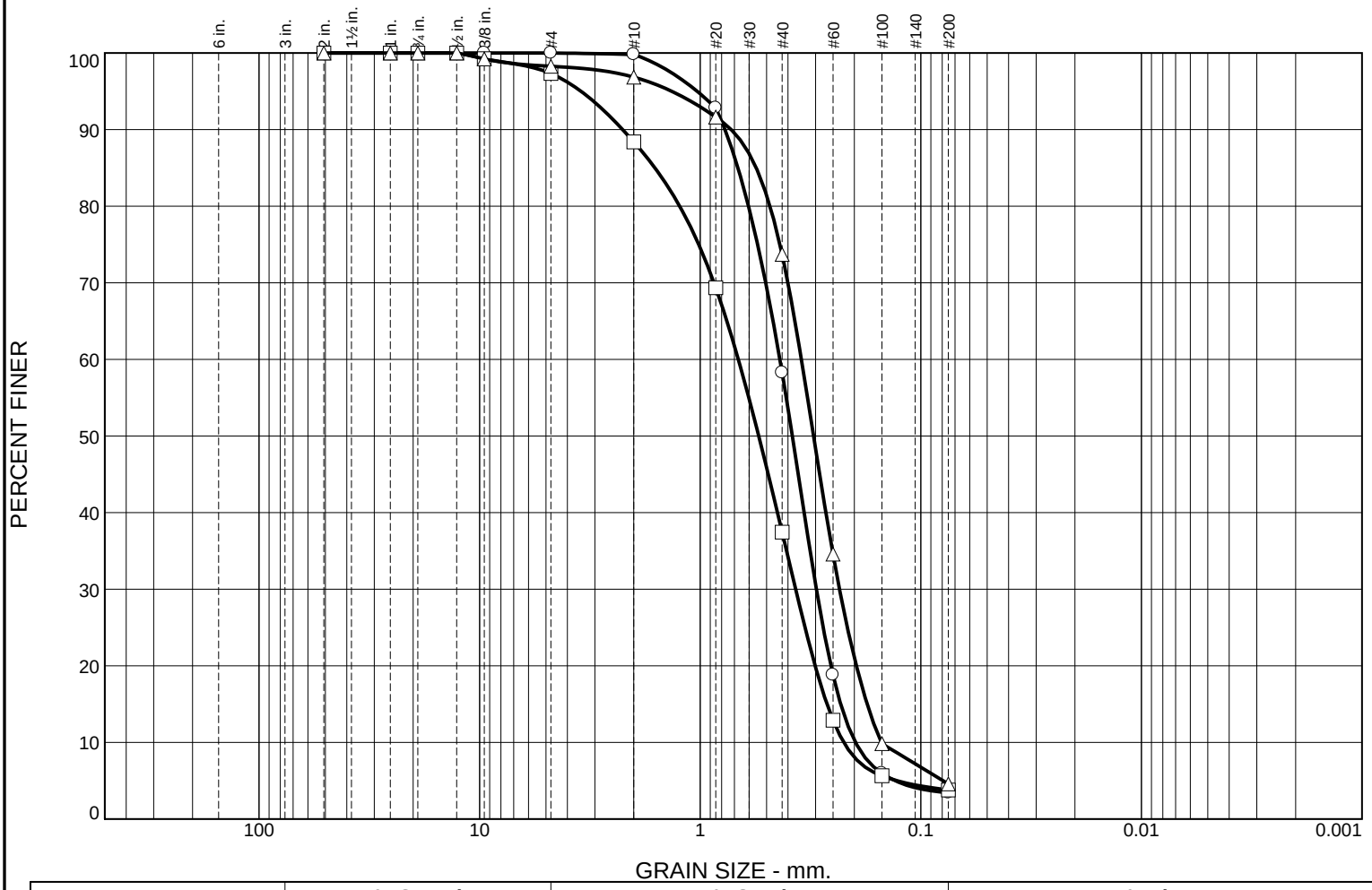
Figure 29

Tested By: DK **Checked By:** DB

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	42	55	3	
□	0	0	3	9	51	33	4	
△	0	0	2	1	23	69	5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.6744	0.4350	0.3822	0.2972	0.2307	0.1977	1.03	2.20
□			1.6036	0.6719	0.5426	0.3692	0.2662	0.2234	0.91	3.01
△			0.5570	0.3477	0.3061	0.2336	0.1751	0.1509	1.04	2.30

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Poorly graded SAND with trace silt		SP	22.3
□ Poorly graded SAND with trace gravel and silt		SP	17.6
△ Slightly silty SAND with trace gravel		SP	21.1

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-13 **Depth:** 40

□ **Source of Sample:** B-14 **Depth:** 10

△ **Source of Sample:** B-14 **Depth:** 20

Remarks:

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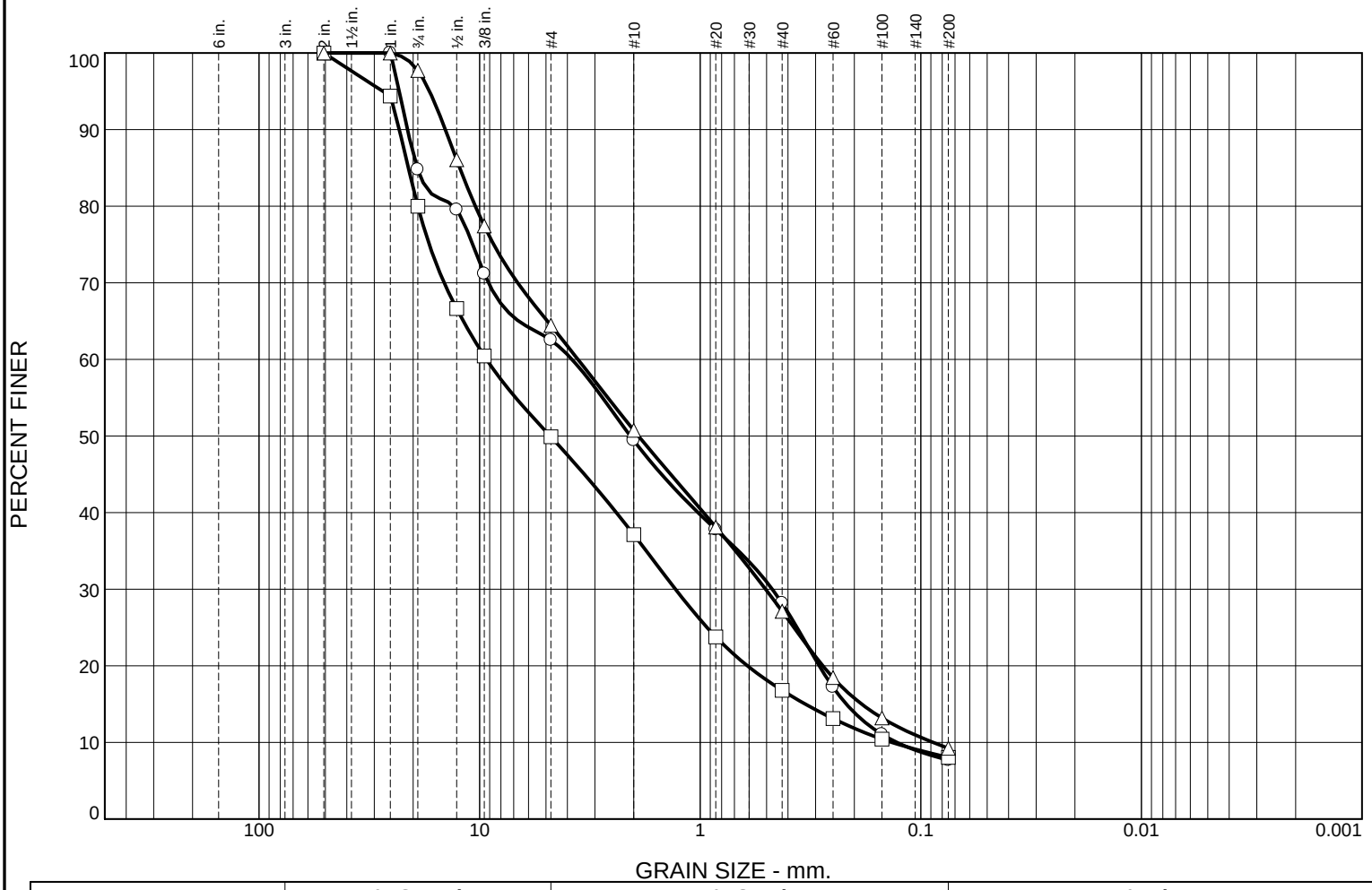
Figure 30

Tested By: DK **Checked By:** DB

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	15	22	14	21	20	8	
□	0	20	30	13	20	9	8	
△	0	2	34	13	24	18	9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			19.1634	3.8092	2.0716	0.4709	0.2176	0.1283	0.45	29.69
□			21.0189	9.3002	4.7844	1.2940	0.3336	0.1350	1.33	68.90
△			12.2955	3.5816	1.9041	0.5050	0.1853	0.0879	0.81	40.77

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Slightly silty, gravelly SAND		SP-SM	9.1
□ Slightly silty, very gravelly SAND		SW-SM	7.1
△ Slightly silty, very gravelly SAND		SP-SM	4.5

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-15 **Depth:** 5

□ **Source of Sample:** B-16 **Depth:** 7.5

△ **Source of Sample:** B-17 **Depth:** 2.5

Remarks:

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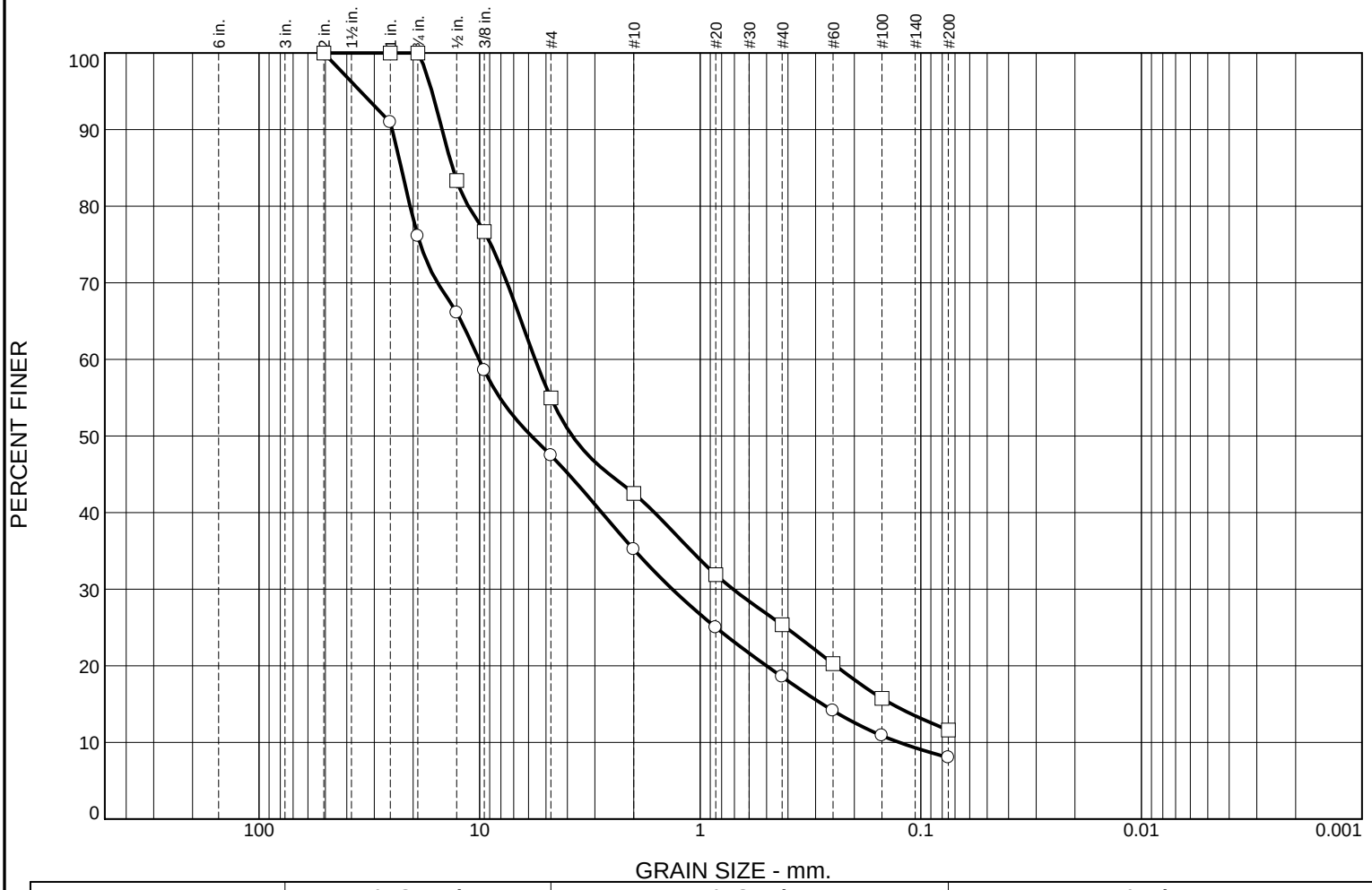
Figure 31

Tested By: DK **Checked By:** DB

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	24	29	12	16	11	8	
□	0	0	45	12	18	13	12	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			22.6430	10.0616	5.8192	1.3361	0.2790	0.1250	1.42	80.52
□			13.2576	5.5987	3.7956	0.7095	0.1351			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Slightly silty, very sandy GRAVEL		GW-GM	7.3
□ Slightly silty, very gravelly SAND		SM	12.3

Project No. 21-0323 **Client:** Parametrix

Project: Arlington Phase 2 Natural Gas Improvements

○ **Source of Sample:** B-18 **Depth:** 5

□ **Source of Sample:** B-19 **Depth:** 7.5

Remarks:

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Figure 32

Tested By: DK **Checked By:** DB

REPORT LIMITATIONS AND GUIDELINES FOR ITS USE[1]

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.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

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.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

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.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

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 preformed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)