October 18, 2016
Project No. 6-917-18096-0

Ms. Sydney Thiel
Project Manager
Central Kitsap School District #401
9102 Dickey Road NW
Silverdale, Washington 98383

Subject: **Preliminary Geotechnical Engineering Report**
Central Kitsap High School and Middle School Campus Redevelopment
10130 Frontier Place NW and 3700 NW Anderson Hill Road
Silverdale, Washington 98311

Dear Ms. Thiel:

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), is pleased to submit this report describing our preliminary geotechnical engineering evaluation for the Central Kitsap High School and Middle School campus redevelopment. Our report also integrates Amec Foster Wheeler's past exploration work at the project site to supplement our recent subsurface findings. The purpose of our evaluation was to derive preliminary conclusions and recommendations concerning earthwork, foundations, floors, retaining walls, utilities, paving, and stormwater infiltration for the planned campus redevelopment.

As outlined in our proposal letter dated July 11, 2016, our scope of work included field exploration, laboratory testing, geotechnical engineering, and report preparation. This report has been prepared for the exclusive use of Central Kitsap School District #401 (CKSD) and their consultants for specific application to this project, in accordance with generally accepted geotechnical engineering practice.

We appreciate the opportunity to be of service on this project. If you have any questions regarding this report, or any aspects of the project, please feel free to contact me.

Sincerely,
Amec Foster Wheeler Environment & Infrastructure, Inc.

Todd Wentworth, P.E.
Associate Geotechnical Engineer

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

Central Kitsap High School and Middle School Campus Redevelopment

10130 Frontier Place NW and 3700 NW Anderson Hill Road

Silverdale, Washington

Prepared for:

Central Kitsap School District #401
9102 Dickey Road NW
Silverdale, Washington 98383

Prepared by:

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11810 North Creek Parkway N
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EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), performed a preliminary geotechnical engineering evaluation for the Central Kitsap High School and Middle School (CKHS/MS) campus redevelopment project on behalf of Central Kitsap School District #401 (CKSD). This summary of project geotechnical engineering considerations is presented for introductory purposes and should be used only in conjunction with the full text of this report.

Project Description: Currently CKSD is considering three different schematic site plans for the new school campus configuration. In general, a combined high school and middle school building will be centrally located. Athletic fields will be reconfigured and/or improved, and new parking and bus access routes around the new school building will be provided off of NW Anderson Hill Road and Frontier Place NW. Stormwater detention facilities will be located within the southwest area of the campus.

Exploratory Methods: We explored subsurface conditions at the site by drilling 15 borings (B-1 thorough B-15) and advancing five hand augers (HB-1 through HB-5) on August 15 and 16, 2016, at strategic locations across the site. Our borings ranged in depth from 16.5 to 26.5 feet below the ground surface (bgs), while our hand borings ranged from 2.75 to 4.3 feet bgs. This report also includes data from 11 borings and four test pit exploration logs from earlier work at the site and two test pit exploration logs previously advanced adjacent to the east side of the school property.

Soil Conditions: Previous development of the site included cuts and fills to create terraces, as confirmed by our recent explorations which encountered 4 to 8 feet of fill in some of our explorations. The fill was medium dense, silty sand, and appears to be derived from on-site cut soils. The native, intact soil consisted of very dense, gravelly silty sand (Glacial Till) and was encountered in most of the explorations. In the southwest portion of the site, very dense sand (Advance Outwash) was encountered in the southwest portion of the site.

Groundwater Conditions: At the time of exploration (August 15 and 16, 2016), boring B-15, advanced in the southwest parking lot, encountered groundwater at approximately 18 feet below the ground surface. None of the other borings encountered groundwater at the time of drilling, however the drilling was done during the driest season of the year, and groundwater is probably higher during the wet season.

Foundations: For planning purposes, conventional spread footings cast atop the existing medium dense silty sand or newly placed structural fill may be designed for an allowable bearing pressure of 2,500 pounds per square foot (psf). Foundations bearing directly on dense to very dense glacial till or advance outwash can be designed with a bearing capacity of 5,000 psf. All footing subgrades should be verified during construction.

Floors: The new structures will be able to use soil-supported, slab-on-grade floors. The floor section should be designed to include a minimum 4-inch layer of washed crushed rock as a capillary break and a vapor barrier placed on top of the capillary break layer.

Pavements: For preliminary design of access drives and parking lots, we recommend a minimum pavement section of 3 inches of asphalt, over 4 inches of base course for car traffic; and 4 inches of asphalt, over 6 inches of base course for access drives with bus and truck traffic.

Stormwater Infiltration: Stormwater infiltration at the site may be feasible in the advance outwash soils, depending on the planned location and depth of infiltration facilities. For preliminary design, we estimate an infiltration rate of 2 inches per hour. Infiltration is less likely in other areas with glacial till. We recommend in situ testing at specific locations and depths where stormwater infiltration is desired, in order to estimate long-term design infiltration rates. Observation wells should be installed in specific locations of infiltration facilities, so that seasonally high groundwater levels can be measured.

On-site Soil Considerations: The on-site soils have a high percentage of fines (silt and clay), which means compaction can be accomplished only within a narrow range of moisture contents. Therefore, the contractor should take precaution to protect any exposed subgrades. Ideally, earthwork would be scheduled for the summer and fall months, when drier weather would maximize the potential to reuse on-site soils.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
Central Kitsap High School and Middle School Campus Redevelopment
Silverdale, Washington

1.0 SITE AND PROJECT DESCRIPTION

Central Kitsap School District (CKSD) plans to redevelop the existing Central Kitsap High School campus, Central Kitsap Middle School campus, bus maintenance facility, and a number of adjacent parcels(collectively abbreviated as CKHSMS). The high school campus is located at 3700 NW Anderson Hill Road, and the middle school campus is located at 10130 Frontier Place NW in Silverdale, Washington (Figure 1) (Latitude 47.65 N, Longitude 122.70 W).

Figure 2 shows the general layout and existing features of the site. The project site boundaries are generally delineated by NW Anderson Hill Road and Frontier Place NW to the west, single-family residences to the north, apartment complexes and single family residences to the east, and the existing Central Kitsap High School building to the south. The Central Kitsap High School building is not part of the current redevelopment project. The property planned for redevelopment encompasses approximately 56 acres. The middle school campus is in the north end of the site directly south of the NW Ballard Lane access road. The bus facility resides in the northeast corner of the site. Athletic fields dominate the central and eastern portions of the project site. Numerous buildings and parking lots are situated along the west side of the project site. The high school athletic track and football field lie along the southern end of the project site. Along the site's eastern boundary are two residential parcels. Vehicle access to and from the site is provided by NW Anderson Hill Road, Frontier Place NW, and NW Ballard Lane.

The redevelopment plan calls for demolition of all existing buildings except for the high school building at the south end of the site. CKSD has developed three alternative schematic site plans addressing the campus layout for buildings, athletic fields, stormwater detention facilities, parking areas, and vehicle access roads. At the time of our report, CKSD had not selected a preferred site layout. In general, all three schematic plans show a centrally located, combined high school and middle school building, athletic fields at the north and south end of the redevelopment area, vehicle access drives and exits on NW Anderson Hill Road and Frontier Place NW, student car drop-off/pick-up areas adjacent to the new school building to the south and west, and bus loading/unloading areas next to the northeast and northwest corners of the new school building. Parking lots will be situated around the outer perimeter of the school building and new bus loading/unloading areas on the north and west sides of the building. Stormwater detention facilities are planned in the southwest corner of the site.

We assume the majority of the existing underground utilities will be replaced to accommodate the planned redevelopment.

The preliminary conclusions and recommendations contained in this report are based on our understanding of the CKHSMS redevelopment, as derived from verbal information and schematic plans provided by CKSD. Because this report has been prepared prior to finalizing the redevelopment plan, additional geotechnical engineering will be needed to provide more specific information in support of final design of foundations, pavement, retaining walls, stormwater management, and other structural features.

2.0 EXPLORATORY METHODS

Oour recent exploration of the surface and subsurface conditions at the project site was conducted on August 15 and 16, 2016. We also reviewed and incorporated into this report our previous explorations at the site. Our explorations and testing consisted of the following elements:

- Visual surface reconnaissance of the site;
- Fifteen borings (designated B-1 through B-15) advanced at strategic locations across the campus redevelopment footprint to depths ranging from 16.5 to 26.5 feet below ground surface (bgs);
- Five hand borings (designated HB-1 through HB-5) advanced to depths of 2.75 to 4.3 feet bgs at strategic locations within the high school football field;
- Laboratory testing consisting of 10 grain-size distribution analyses, 10 fines analyses using the #200 wash procedure, and 14 moisture content determinations performed on selected soil samples;
- Review of boring and test pit logs from previous explorations conducted on the project site by Amec Foster Wheeler (AGRA, 1999; RZA, 1989, 1991; RZA AGRA, 1993, 1994); and
- Review of published geologic maps and seismic information in the vicinity of the site.

Table 1 summarizes the approximate locations, surface elevations, and termination depths of the recent subsurface explorations performed for this investigation. Figure 2 depicts the approximate locations of these explorations and our previous explorations overlain on a topographical survey conducted by AES Consultants, Inc. (AES). Appendix A presents the field exploration procedures and logs, and Appendix B presents geotechnical laboratory testing procedures and results.

Table 1 Recent Exploration Locations, Elevations, and Depths

Exploration	Location Relative to Existing Site Features	Surface Elevation (feet)[1]	Termination Depth (feet)
B-1	New Frontier Junior High building parking lot	183.5	16.5
B-2	CKMS – East end of upper practice field	195.5	16.5
B-3	CKMS – Football field west goal post	184.0	16.5
B-4	CKMS – Top of slope, 65 feet east of baseball field backstop	172.5	16.5
B-5	CKMS – 43 feet east of food service building northeast corner	156.5	16.5
B-6	CKHS – 16 feet north of vacant home in driveway	173.5	16.5
B-7	CKHS – Northeast corner of fenced garden at vacant home	158.0	16.5
B-8	Kitsap Alternative High School building, 34 feet east of doorway	131.0	16.5
B-9	CKHS – Baseball field parking lot, 55 feet west of backstop	157.0	16.5
B-10	CKHS – 41 feet east of baseball field fence, northeast corner	150.0	16.5
B-11	Career & Technical Building, 27 feet southeast of southeast corner	132.0	26.5
B-12	CKHS – Baseball field, 114 feet southeast of first base	153.5	16.5
B-13	CKHS – 70 feet northeast of long jump, east end	134.0	21.5
B-14	Parcel north of middle school – driveway 43 feet west of building	179.5	16.5
B-15	CKHS – Parking lot west of football field	109.0	26.5
HB-1	CKHS – Football field northwest corner at goal line	134.5	2.75
HB-2	CKHS – Football field northeast corner at goal line	134.5	2.75
HB-3	CKHS – Center of football field	136.0	4.3
HB-4	CKHS – Football field southwest corner at goal line	134.5	3.0
HB-5	CKHS – Football field southeast corner at goal line	134.5	3.2

1. Elevations are interpolated based on topographic survey provided by AES, dated June 16, 2016.

We selected the specific number, locations, and depths of explorations with input from the project design team, based on locations of existing and proposed site features, under the constraints of surface access, underground utility conflicts, and budget. We estimated the location of each exploration by measuring their distance from existing features in the field using a tape measure and scaling these measurements onto the topographic survey supplied to us by AES. We then estimated boring ground surface elevations by interpolating between contour lines shown on the topographic survey. Consequently, the data listed in Table 1 and the locations depicted on Figure 2 should be considered accurate only to the degree permitted by our data sources and implied by our measurement methods.

The explorations performed and used for this evaluation reveal subsurface conditions only at discrete locations across the project site, and actual conditions at other locations could vary. Furthermore, the nature and extent of these variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed, we may need to modify the conclusions and recommendations contained in this preliminary report to reflect actual site conditions encountered.

3.0 SITE CONDITIONS

This section presents our observations, measurements, findings, and interpretations regarding development, surface, soil, groundwater, and seismic conditions at the project site.

3.1 Surface Conditions

The surface conditions described below are based on our site reconnaissance on August 15 and 16, 2016, our review of aerial photos, and the topographic survey by AES dated June 16, 2016.

Existing Topography: Topography across the school property primarily slopes down from north to south over a series of graded benches. The slope grades separating the series of benches across the site generally range between 2H:1V to 3H:1V (horizontal: vertical). Cuts appear to have been performed on the upslope section of the ground surface, with fill placed on the downslope sections to raise grade and create the existing benches for the current development topography. Situated along the majority of the eastern property line is a naturally vegetated strip of land that slopes down to the east. The existing topography is shown on Figure 2.

Surface drainage: Drainage across the site is generally from north to south-southwest following the site topography. However, the series of benches across the site appears to retain surface water within the benches, where the surface water appears to infiltrate into the ground or is collected by a series of catch basins. The collected stormwater is then discharged to the City of Silverdale stormwater system on Frontier Place NW and NW Anderson Hill Road. At the time of our site investigations in mid-August 2016, the ground surfaces we encountered were dry except for areas on the athletic fields that appeared to have been irrigated.

Surface cover: The predominant vegetation across open spaces on the site consists primarily of grass. However, mature fir and cedar trees intermixed with shrubbery and grasses grow within the southwest portion of the site surrounding the Alternative High School and Career and Technical Building, on the residential parcel north of the high school athletic field, on the vegetated slopes along the site's eastern property boundary, on the two parcels north of Central Kitsap Middle School, and around the perimeter of the bus facility. The site hardscape consists of asphalt parking lots, roadways, bus loops, and walkways leading from the buildings to parking lots. A combination of concrete or asphalt walkways were noted around the school building perimeter and for pedestrian access to the athletic fields.

3.2 Soil Conditions

According to the published geologic map for the area (Polenz et al. 2013), soil conditions at the site are characterized by Pleistocene Vashon Lodgment Till (Qgt) with Possession Advance Outwash

(Qgap) along the site's western edge following NW Anderson Hill Road to the intersection of NW Anderson Hill Road and Frontier Place NW.

Vashon Lodgment Till (referred to in this report as glacial till) consists of a mixture of clay, silt, sand, gravel, cobbles, and isolated boulders, and can be brown in a weathered condition to gray in an unweathered condition. Glacial till soils tends to be very dense and exhibit high shear strength and low compressibility due to overconsolidation by ice during deposition. Glacial till soils can become soft and unworkable when disturbed by excavation, stockpiling, and backfilling, especially when wet.

Possession Advance Outwash (referred to in this report as advance outwash) consists predominantly of sand with some silt, clay, and pebbles. Occasional interbedded silt/clay layers, may occur. Advance outwash is typically brown in a weathered condition to gray in an unweathered condition. Advance outwash is typically dense with low compressibility due to deposition in front of advancing glaciers that then compressed the sand after deposition. Advance outwash can be reused as structural fill.

During our explorations performed on August 15–16, 2016, we observed the following strata:

- Topsoil and Organics: In general, all explorations advanced in non-paved areas encountered approximately 4 to 6 inches of grass/sod over topsoil at the surface.
- Existing Fill: Fill was encountered in borings B-2, B-3, B-5, B-10, B-12, and B-13. The thickness of fill averaged 4.5 feet, however the fill was 8 feet thick in B-2 and B-13. The fill consisted of medium dense, brown, silty sand with variable gravel content. HB-1 through HB-5 encountered 6 to 12 inches of drainage sand; over loose to medium dense, brown to gray, silty sand to the full extent of the hand borings (2.75 to 4.3 feet bgs), except in HB-1 and HB-3, where we encountered native glacial till below the fill at a depth of approximately 2 feet bgs. The fill soils encountered within all of our explorations appeared to be derived from on-site soils, except for the athletic field drainage sand.
- Glacial Till: Glacial till soils were encountered across the site in borings B-1 through B-14. The glacial till was composed of dense to very dense, silty sand. Glacial till was encountered to the full depth of our borings, ranging from 16.5 feet bgs to 21.5 feet bgs. Glacial till soils extended to 9 feet bgs in boring B-8, and to 23 feet bgs in B-11 until encountering advance outwash sands.
- Advance Outwash: Advance outwash composed of very dense, silty, gravelly sand was encountered underlying the glacial till from 9 feet bgs to the boring extent at 16.5 feet in B-8, from 23 bgs feet to the boring extent at 26.5 feet in B-11, and throughout the full extent of the boring to a depth of 26.5 feet bgs in B-15.

Review of lithologic logs from past explorations across the site show similar soil conditions. Exploration logs are presented in Appendix A for the most recent as well as previous explorations conducted at the site.

Select soil samples from our explorations were submitted for geotechnical laboratory testing. The laboratory testing sheets presented in Appendix B graphically present the results. The geotechnical test results produced the following key findings:

- The fill soils had a fines (silt and clay) content ranging from 18 to 28 percent, with a moisture content ranging from 5 to 13 percent. We interpret the fill soils to be derived from site glacial till soils.
- The glacial till soils have a measured fines content ranging from 14 to 37 percent and a moisture content ranging from 3 to 9 percent. We interpret the moisture content of glacial till soils to be near the optimum values for compaction, but highly sensitive to changes in moisture content.
- The advance outwash had a measured fines content ranging from 4 to 14 percent and a moisture content ranging from 1 to 19 percent. We interpret the lower fines content to be advantageous for stormwater infiltration as well as compaction as new structural fill.

3.3 Groundwater Conditions

At the time of our subsurface explorations (August 15 and 16, 2016), we encountered groundwater only in boring B-15 at 18 feet bgs. However, some mottling and oxidation staining were observed within some of the near-surface soil samples collected, indicating perched groundwater conditions resting on or near the surface of the dense to very dense glacial till soils. Perched water was observed on the high school athletic field at the contact horizon between drainage sand and underlying soil subgrade and also retained in the topsoil directly below the grass surface. It appears the perched water in the high school athletic field is influenced by seepage from the athletic field underdrain and irrigation system.

Because our explorations were performed during a period of dry weather, the groundwater conditions may closely represent the yearly low levels; somewhat higher levels probably occur during the winter and early spring months. Throughout the year, groundwater levels would likely fluctuate in response to changing precipitation patterns, construction activities, irrigation, and site utilization. Observation wells would need to be installed to better understand the seasonal high groundwater levels for design of stormwater infiltration and site drainage facilities.

3.4 Seismic Conditions

The soils underlying the site consist of various thicknesses of medium dense fill placed during previous grading, overlying dense sand(glacial till and advance outwash). Due to the lower density of the previously placed fill, we interpret the site to be Site Class D, as defined in the 2012 International Building Code.

Seismic Design Parameters: The 2012 International Building Code (IBC) requires use of Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Acceleration for design of structures. Based on detailed U.S. Geological Survey (USGS) hazard mapping for this site (USGS 2015), we recommend the following parameters for structural design, based on a design earthquake with a 2 percent probability of occurrence in 50 years (return interval of 2,475 years):

Use IBC Soil Class D with:

- S_S = 1.39 *g*
- S_1 = 0.56 *g*
- S_{DS} = 0.93 *g*
- S_{D1} = 0.56 *g*
- F_a = 1.0
- F_v = 1.5

Where *g* is the acceleration due to gravity.

Liquefaction Evaluation: The soils underlying the site consist mainly of dense to very dense glacial till or advance outwash. Groundwater was encountered only in our boring at the lowest point of the project footprint in the southwest corner of the site at a depth of 18 feet at the time of drilling, in dense sands. We conclude that the risk of soil liquefaction occurring at this site under the IBC 2012 design earthquake is very low.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents our preliminary geotechnical engineering conclusions and recommendations concerning site preparation, foundations, floors, drainage systems, backfilled walls, utilities, stormwater infiltration, pavement, and structural fill. ASTM International (ASTM) specification codes cited herein refer to the most current applicable ASTM manual. Washington State Department of Transportation (WSDOT) specification codes cited herein refer to the current WSDOT publication M41-10, *Standard Specifications for Road, Bridge, and Municipal Construction 2012* (WSDOT, 2012).

4.1 Site Preparation

Preparation of the project site for construction of the combined high school/middle school building will include the following elements:

- Temporary erosion and sedimentation control;
- Removal of existing building;
- Removal or abandonment of utilities within the planned expansion footprint;
- Clearing, stripping, and grading; and
- Subgrade compaction.

The paragraphs below discuss our geotechnical comments and recommendations concerning site preparation.

Erosion Control Measures: Prior to disturbing the ground surface with earthwork, temporary erosion and sedimentation controls should be implemented. The project civil engineer, in conjunction with the Kitsap County Standards, should prepare plans and specifications to prevent erosion and runoff during construction. The contractor will need to understand that design plans and specifications represent the minimum requirements, and additional measures and modifications may be needed that are specific to the construction activities and the weather.

Demolition: One of the first steps in site preparation will likely consist of decommissioning of some utilities, followed by demolition and removal of the existing building structures, as well as the surrounding pavement and curbs. Any associated underground structural elements or utilities, such as old footings, stem walls, and drain pipes, should be exhumed as part of this demolition operation. Excavations created during demolition should be backfilled and compacted with structural fill in accordance with the recommendations contained herein. Pipes more than 2 feet below any future excavations could be filled with lean mix concrete and left in place. However, if any significant structure is planned over an abandoned utility line, the utility trench backfill should be evaluated and possibly replaced to meet the proposed structural needs.

Subgrade Compaction: Exposed subgrades for footings, floors, pavements, and other structures should be compacted to a dense, unyielding state. Any localized zones of loose granular soils observed within a subgrade should be compacted to a density commensurate with the surrounding soils. Any organic, soft, or pumping soils observed within a subgrade should be overexcavated and replaced with a suitable structural fill.

On-site Soils: We offer the following evaluation of the on-site soils relative to potential use as structural fill.

- *Existing Fill Soils*: The loose to medium dense fill soils appear suitable for reuse if the soil is near optimum moisture content, properly placed, and compacted to project specifications. However, fill soils can vary greatly in fines, organic, and moisture content and should be evaluated for suitability prior to use as structural fill. The fill soil will be difficult or impossible to reuse during wet weather due to the high silt content, and aerating activities may need to be performed during warm weather conditions to reduce moisture content to acceptable levels for reuse of these soils as structural fill.
- *Glacial Till*: The glacial till soils underlying the site appears suitable for reuse if the soil is near optimum moisture content, properly placed, and compacted to project specifications. While dense to very dense in the undisturbed state, glacial till contains a high percentage of fines, and is highly sensitive to disturbance and softening in the presence of excessive moisture. Laboratory testing indicates the glacial till soils at the site range from below to over optimum moisture content for compaction, making reuse of these soils as structural fill difficult except under ideal moisture and weather conditions. Soils with moisture content greater than optimum will require aerating activities during warm weather to reduce the moisture content to acceptable levels for use as structural fill, while soils with moisture content less than optimum will require moisture conditioning to bring the moisture content to an acceptable level for use as structural fill. Moisture content for the majority of the glacial till soil tested appeared to be near optimum, and the soils appeared suitable for use as structural fill at the time of our testing. During wet weather, these soils would be difficult or impossible to compact due to their silt content and moisture sensitivity. On the other hand, if any of the soils become too dry, water may need to be added to achieve near optimum moisture content for achieving proper compaction.
- *Advance Outwash*: The sands and gravelly sand advance outwash deposits were only encountered at the low elevation of the site and therefore may not be an available source for structural fill. However, where encountered, the advance outwash has a relatively low fines content and therefore can be used in a broader range of weather conditions than glacial till.

- Wet-Weather Considerations: As discussed above, most of the on-site soils available from site grading will be difficult to use as structural fill during wet weather. Consequently, the project specifications should include provisions for importing clean, granular fill in case site filling must proceed during wet weather. For general structural fill purposes, we recommend using a well-graded sand or gravel, such as “Ballast” or “Gravel Borrow” per WSDOT 9-03.9(1) and 9-03.14, respectively, except that the percent passing the U.S. No. 200 Sieve should be less than 5 percent.

Permanent Slopes: All permanent cut slopes and fill slopes should be adequately inclined to minimize long-term raveling, sloughing, and erosion. We generally recommend that no slopes be steeper than 2H:1V. For all soil types, the use of flatter slopes (such as 3H:1V) would further reduce long-term erosion potential and facilitate vegetation growth.

Slope Protection: We recommend that a permanent berm, swale, or curb be constructed along the top edge of all permanent slopes to intercept surface flow. Also, a hardy vegetative groundcover should be established as soon as feasible to further protect the slopes from erosion due to runoff water.

4.2 Foundations

In our opinion, conventional spread footings will provide adequate support for the proposed building structures if the subgrades are properly prepared. If foundations are located within the previously placed fill, some excavation and recompaction may be necessary. We offer the following comments and recommendations for the purposes of footing design and construction.

Footing Depths and Widths: For frost and erosion protection, the bottoms of all exterior footings should bear at least 18 inches below adjacent outside grades, whereas the bottoms of interior footings need bear only 12 inches below the surrounding slab surface level. To minimize post-construction settlements, continuous (wall) and isolated (column) footings should be at least 18 inches and 24 inches wide, respectively. Greater depths may be considered to achieve higher soil bearing pressure and lateral resistance

Bearing Subgrades: The following types of subgrade soils are anticipated, depending on location and elevation.

1. Previously placed fill. It appears that the previously placed fill was compacted to a medium dense state. Any new footing subgrades within the previously placed fill should be compacted to verify density. Some over-excavation and replacement may be necessary to create a suitable subgrade.

2. Structural fill. Newly placed structural fill that has been properly compacted, as described in the Structural Fill section of this report, will provide a suitable subgrade.

3. Glacially consolidated soils. The intact, native, glacial till and advance outwash soils are in a dense conditions and will support higher bearing pressures than the above described fill.

Bearing Capacities: For preliminary design, we are providing general recommendations based on the subgrade soil type. Once the location, size, and elevation of the foundations have been determined, we could provide more specific bearing pressures for specific footing locations.

1. Previously placed fill. Once suitable subgrade conditions have been confirmed, the foundations can be designed for an allowable bearing pressure of 2,500 psf.

2. Structural fill. Properly placed and compacted structural fill will also provide an allowable bearing pressure of 2,500 psf.

3. Glacial consolidated soils. The undisturbed glacial till and glacial outwash will provide an allowable bearing pressure of 5,000 psf.

For seismic design or other transient live loading, these pressures may be increased by one third.

Subgrade Verification: We recommend footing subgrades be verified by an Amec Foster Wheeler representative before any concrete is placed. Footings should never be cast on loose, soft, or frozen soil; slough; debris; or surfaces covered by standing water.

Footing Settlements: We estimate that total settlements of properly designed footings will be less than 1 inch and differential settlement between two adjacent footings would be less than ¾ inch. Settlements would be reduced if the actual design bearing pressures are lower than our recommended allowable pressures.

Footing and Stemwall Backfill: To provide erosion protection and lateral load resistance, we recommend all footing excavations be backfilled and compacted on both sides of the footings and stemwalls after the concrete has cured. The excavations should be backfilled with structural fill and compacted to a density of at least 90 percent (based on ASTM D-1557).

Lateral Resistance: Footings and stemwalls that have been properly backfilled as described above will resist lateral movements by means of passive earth pressure and base friction. We recommend using the following design values, which incorporate static and seismic safety factors of at least 1.5 and 1.1, respectively.

Design Parameter	Allowable Value
Static passive pressure	300 pcf
Seismic passive pressure	400 pcf
Base friction coefficient	0.4

Note: pcf = pounds per cubic foot

Base friction can be combined with the respective passive pressure to resist static and seismic loads.

4.3 Slab-on-Grade Floors

In our opinion, soil-supported slab-on-grade floors can be used in the proposed buildings if the subgrades are properly prepared. We offer the following comments and recommendations concerning slab-on-grade floors.

Floor Subbase: All soil-supported slab-on-grade floors should bear on at least medium dense soils or structural fill. Localized overexcavation and replacement of loose soils may be needed depending on the location of the floor slabs. The condition of subgrade soils should be evaluated by an Amec Foster Wheeler representative in case overexcavation of unsuitable soils is needed. Subsequent backfilling and compaction of the structural fill should be observed and verified by an Amec Foster Wheeler representative.

Capillary Break: To reduce the upward wicking of groundwater beneath the floor slab, we recommend a capillary break be placed over the subbase. This capillary break should consist of a 4-inch-thick layer of pea gravel or other clean, uniform gravel, such as “Gravel Backfill for Drains” per WSDOT Standard Specification 9-03.12(4).

Vapor Barrier: We recommend a vapor barrier at least 10 mil thick be placed directly between the capillary break and the floor slab to prevent moisture from migrating upward through the slab. During subsequent casting of the concrete slab, the contractor should exercise care to avoid puncturing this vapor barrier.

Vertical Deflections: Soil-supported slab-on-grade floors can deflect downward when vertical loads are applied due to elastic compression of the subgrade. In our opinion, a subgrade reaction modulus of 200 pounds per cubic inch can be used to estimate these deflections.

4.4 Foundation Drains

The building should be provided with permanent drainage systems to minimize the risk of future moisture problems. We offer the following recommendations and comments for drainage design and construction.

Perimeter Drains: We recommend the new building structures be encircled with a perimeter drain system to collect possible seepage water. This drain should consist of a 4-inch-diameter perforated rigid pipe within an envelope of pea gravel or washed rock, extending at least 6 inches on all sides of the pipe. The gravel envelope should be wrapped with filter fabric to reduce the migration of fines from the surrounding soils. Ideally, the drain invert would be installed no more than 8 inches above or below the base of the perimeter footings.

Runoff Water: Roof-runoff and surface-runoff water should *not* be allowed to flow into the foundation drainage systems. Instead, these sources should flow into separate tightline pipes and be routed away from the buildings to an appropriate location. In addition, final site grades should slope downward away from each building so that runoff water will flow by gravity to suitable collection points, rather than ponding near the buildings. Ideally, the area surrounding the buildings would be capped with concrete, asphalt, or low-permeability (silty) soils to minimize surface-water infiltration next to the footings.

Floor Slab Underdrains: Depending on site grading and building locations, floor slab underdrains may need to be considered. For example, where subgrade excavations intersect a contact with underlying dense glacial soils, there may be a need to intercept and drain perched groundwater. The need for underdrains will be assessed once the final grades and structure locations have been determined.

4.5 Backfilled Walls

We offer the following recommendations for relatively short walls supporting grade changes at the site. Underground vaults could also be designed as backfilled walls.

Footing Depths: For frost and erosion protection, concrete retaining wall footings should bear at least 18 inches below the adjacent ground surface. However, greater depths might be necessary to develop adequate passive resistance and/or bearing resistance in certain cases. Flexible gravity walls, such as gabions and modular block walls, should be embedded at least 8 inches below final grades.

Curtain Drains: To preclude development of hydrostatic pressure behind the backfilled retaining wall, we recommend a curtain drain be placed behind the walls. This curtain drain should consist of pea gravel, washed rock, or some other clean, uniform, well-rounded gravel, extending outward a minimum of 12 inches from the wall and extending upward from the footing drain to within about 12 inches of the ground surface. The curtain drain should connect to a 4-inch-diameter perforated drain pipe behind the heel of the wall, and the drain pipe should discharge away from the wall.

Backfill Soil: Ideally, all retaining wall backfill placed behind the curtain drain would consist of clean, free-draining, granular material, such as "Gravel Backfill for Walls," per WSDOT Standard Specification 9-03.12(2). Alternatively, on-site soils could be used as backfill if they are placed at a moisture content near optimum for compaction.

Backfill Compaction: Because soil compactors place significant lateral pressures on retaining walls, we recommend only small, hand-operated compaction equipment be used within 3 feet of a backfilled wall. In addition, all backfill should be compacted to a density as close as possible to 90 percent of the maximum dry density (based on ASTM D-1557); a greater degree of compaction closely behind the wall would increase the lateral earth pressure, whereas a lesser degree of compaction might lead to excessive post-construction settlements.

Applied Loads: Overturning and sliding loads applied to retaining walls can be classified as static pressures and surcharge pressures. We offer the following specific values for design purposes:

- *Static Pressures*: Yielding (cantilever) retaining walls should be designed to withstand an appropriate active lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate at-rest lateral earth pressure. These pressures act over the entire back of the wall and vary with the backslope inclination. Assuming a level backslope, we recommend using active and at-rest pressures of 35 pcf and 55 pcf, respectively.
- *Surcharge Pressures*: Static lateral earth pressures acting on a retaining wall should be increased to account for surcharge loadings resulting from any traffic, construction equipment, material stockpiles, or structures located within a horizontal distance equal to the wall height. For simplicity, a traffic surcharge can be modeled as a uniform horizontal pressure of 75 psf acting against the upper 6 feet of the wall.
- *Seismic Pressures*: Static lateral earth pressures acting on a retaining wall should be increased to account for seismic loadings. These pressures act over the entire back of the wall and vary with the backslope inclination, the seismic acceleration, and the wall height. For preliminary design, we recommend these seismic loadings be modeled as uniform *active* pressure of 6H psf (based on a wall height of "H" feet), assuming a level backslope and allowing some deformation during the earthquake. These pressures could be refined during final design when the retaining wall dimensions and locations are known.

Resisting Forces: Static pressures and surcharge pressures are resisted by a combination of passive lateral earth pressure, base friction, and subgrade bearing capacity. Passive pressure acts over the embedded front of the wall (neglecting the upper 1 foot for paved foreslopes, or the upper 2 feet for soil foreslopes) and varies with the foreslope declination, whereas base friction and bearing capacity act along the bottom of the footings. Assuming a level foreslope beyond the wall, the following design values can be used for preliminary design, which incorporate static and seismic safety factors of at least 1.5 and 1.1, respectively.

Design Parameter	Allowable Value
Static passive pressure	300 pcf
Seismic passive pressure	400 pcf
Base friction coefficient	0.4
Static bearing capacity	2,500 psf

Base friction can be combined with passive pressure to resist the applied loads.

4.6 Underground Utilities

We expect that underground utilities for the high school and middle school campus redevelopment, such as waterlines, storm drains, sewer pipes, manholes, and catch basins, will be included in the site development. Our comments and recommendations concerning the installation of these utilities are presented below.

<u>Temporary Slopes:</u> Configuration and maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. All applicable local, state, and federal safety codes should be followed. Temporary excavations should either be shored or sloped in accordance with *Safety Standards for Construction Work,* Part N, Washington Administrative Code (WAC) 296-155-650 through 66411, when workers will be below the surface. For planning purposes, the soil type classification and maximum inclination based on Part N of the *Safety Standards for Construction Work*, WAC 296-155-66401 and -66403, is provided below.

Soil Type	WAC Soil Type	Maximum Inclination
Existing and new structural fill	C	1½H:1V
Dense advance outwash	B	1H:1V
Dense glacial till	A	3/4H:1V

<u>Bedding Soils</u>: Utility pipes should be bedded on an appropriate material that extends at least 6 inches outward from the pipe in all directions. For level or gently sloping pipes, we recommend

using a clean, uniform, well-rounded material, such as pea gravel or "Gravel Backfill for Pipe Bedding" per WSDOT Standard Specification 9-03.12(3).

Backfill Soils: The on-site soils will be difficult to compact as utility excavation backfill unless the moisture content is kept within a narrow range of the optimum moisture content. During the wet season or during rainy periods, backfill material used for utility trenches and other excavations may need to consist of clean, well-graded granular soils, such as "Gravel Borrow" per WSDOT Standard Specification 9-03.14, except with less than 5 percent passing the U.S. No. 200 sieve. Controlled-density fill (CDF) could be used as a more convenient, but also more expensive, alternative to backfill soil in any weather conditions.

Backfill Compaction: We recommend utility backfill soils be compacted to a density commensurate with surrounding fill or native soils, as well as with the requirements of any overlying structures. CDF backfill does not require compaction but should have a compressive strength commensurate with the application.

4.7 Stormwater Infiltration

We understand it is desired to infiltrate stormwater in the southwest area of the site along the west edge of the property where stormwater detention facilities are shown on the schematic site plans. We reviewed chapter 7.3.4.1 General Requirements for Infiltration Facilities, in the Kitsap County Stormwater Design Manual (Kitsap County 2010), (referred to herein as the Kitsap Stormwater Manual). We have the following comments relative to these criteria:

Permeable soil layer thickness, and separation from the water table: Section 7.3.4.1.A of the Kitsap Stormwater Manual gives a basic requirement of a minimum of 3 feet of permeable soil below the bottom of the infiltration facility and at least 3 feet between the bottom of the facility and the maximum wet-season water table.

Table 2 summarizes the measured depth to groundwater at time of drilling, and the measured thickness of relatively permeable soil encountered above the groundwater table (or above a relatively impervious soil layer).

Table 2 Measured Thickness of Permeable Soil Layers

Exploration	Depth to Groundwater at time of drilling (feet)[1]	Depth to top of permeable layer (feet)	Thickness of permeable layer (feet)	Lower boundary to infiltration (Groundwater or impervious soil)
B-15	18.0	0.5	17.5	Groundwater

1 Groundwater levels at time of drilling: August 16, 2016.

On the basis of these preliminary measurements, the southwest area of the site exhibited the greatest thickness of permeable soil layers above groundwater at this time. However, the groundwater was measured during the dry summer season and is expected to be higher during the wet season. Additional exploration and groundwater monitoring will be needed for final design.

Estimated Infiltration Rate for Preliminary Design: We recommend using a preliminary design infiltration rate of 2 inches per hour for the southwest area of the site. This is based on a soil sample collected 15 feet deep in B-15 drilled in the southwest parking lot. The laboratory grain size distribution of this sample was correlated with Table 5.1 in the Kitsap County Stormwater Manual to estimate this preliminary design rate.

In situ testing: Additional studies will be needed for final design. We recommend installing groundwater observation wells to determine the groundwater table during the wet season. In situ, pilot infiltration testing (PIT) is recommended to provide better estimation of the infiltration rates for final long-term design. Tests should be conducted at the actual planned location of the infiltration facilities and at the infiltrating elevation. These tests should be done once the location and elevation of the facility has been determined, and the testing should be done during the wet season.

4.8 Pavement

We understand new vehicle access roads, parking lots, and bus lanes with student loading/unloading areas will be constructed as part of the campus redevelopment work. Site access will be from NW Anderson Hill Road and Frontier Place NW, with the bus loading/unloading area to the north of the new school, parking lots to the north and west of the new school, and vehicle access roads encompassing the perimeter of the school building. New concrete sidewalks will be constructed across the site for pedestrian access to all school campus amenities. The following comments and recommendations are given for pavement design and construction.

Soil Design Values: Soil design values for subgrade conditions were determined based on field observations, visual classification, laboratory testing, and reference to typical values provided in the WSDOT Pavement Guide, and the Kitsap County Road Standards. Based on grain size analyses performed on representative soil samples, we estimate a California Bearing Ratio (CBR) value of 20 for the underlying subgrade soils. We have interpreted the effective resilient subgrade modulus as 15,000 psi (average to good subgrade).

Traffic Design Values: The calculated pavement sections for the main driveway/bus loop and fire lanes are based on an assumed traffic loading of 35 bus trips per 200 school days over a 20-year design life. Sufficient car traffic volumes are included in the calculations. The calculated pavement section for car and light truck parking areas is based on light to moderate traffic.

Flexible Pavement Sections: A conventional pavement section typically comprises a hot-mix asphalt (HMA) pavement over a crushed rock base (CRB) course, over a suitable subgrade or subbase that consists of granular structural fill. Based on the estimated design values, the following minimum pavement sections are recommended:

	Minimum Thickness (inches)	
Flexible Pavement Section	**Passenger Car Only Areas**	**Heavy Vehicle (Bus) Driveways**
HMA Class ½”	3	4
CRB	4	6

These values represent the recommended minimum thickness of HMA Class ½” asphalt. Other combinations of pavement thickness could be considered upon request.

Rigid Pavement Section: A concrete pavement section typically consists of Portland cement concrete (PCC) pavement over CRB, over a suitable subgrade or subbase that consists of granular structural fill. Based on the estimated design values, a minimum rigid pavement section of 6 inches of PCC over 4 inches CRB is recommended.

Pavement Materials: HMA should conform to WSDOT Standard Specification 5-04. PCC should conform to WSDOT Standard Specification 5-05. CRB should be an imported clean crushed rock meeting the requirements for “Crushed Surfacing Top and Base Course” per WSDOT Standard Specification 9-03.9(3).

Subgrade Preparation: We anticipate minor cuts and/or fills may be needed to achieve pavement design grades. All pavement subgrades should be proof-rolled “wheel-to-wheel” with a loaded dump truck to verify the density, but this is especially important for subgrade above areas where pre-existing fill soils will remain. The proof rolling should be observed by a representative from Amec Foster Wheeler. Any areas of soft, yielding subgrade disclosed during this proof-rolling operation should be overexcavated and replaced with a suitable structural fill, as described subsequently.

Compaction and Verification: Structural fill used to achieve subgrade, subbase material, and base course material should be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557), and all asphalt concrete should be compacted to at least 92 percent of the Rice value (ASTM D-2041). We recommend an Amec Foster Wheeler representative be retained to verify compaction of the subgrade fill and base course before any overlying layer is placed. For the subgrade, compaction is best verified by means of frequent density testing; for the base course, methodology observations and hand-probing are more appropriate than density testing.

Pavement Life and Maintenance: It should be noted that no asphalt pavement is maintenance-free. The above-described pavement sections represent our minimum recommendations for an average level of performance during a 20-year design life; therefore, an average level of maintenance will likely be required. Furthermore, a 20-year pavement life typically assumes that an overlay will be placed after about 10 years. Thicker asphalt, base, and subbase courses would offer better long-term performance, but would cost more initially; thinner courses would be more susceptible to “alligator” cracking and other failure modes. However, pavement design can be considered a compromise between a high initial cost and low maintenance costs, versus a low initial cost and higher maintenance costs.

4.9 Structural Fill

The term *structural fill* refers to any materials used for building pads, as well as materials placed under or against foundations and retaining walls; under slab-on-grade floors, sidewalks, and pavements; and for permanent fill slopes. Our comments, conclusions, and recommendations concerning structural fill are presented in the following paragraphs.

Materials: Typical structural fill materials include sand, gravel, crushed rock, quarry spalls, CDF, lean-mix concrete, well-graded mixtures of sand and gravel (commonly called “gravel borrow” or “pit-run”), and mixtures of silt, sand, and gravel. Soils used for structural fill should not contain any organic matter or debris, or any individual particles greater than approximately 6 inches in diameter, and should have no more than 20 percent fines (silt and clay that passes the U.S. No. 200 sieve).

Fill Placement: Structural fill should be placed in horizontal lifts not exceeding 8 inches in loose thickness, and each lift should be thoroughly compacted with a mechanical vibratory compactor. Other procedures may be appropriate for some materials.

Compaction Criteria: Using the Modified Proctor test (ASTM D1557) as the standard, we recommend structural fill be used for various on-site applications and compacted to the following minimum densities:

Fill Application	Minimum Compaction (percent)
Footing subgrade	95
Footing and stemwall backfill	90
Slab-on-grade floor subgrade	90
Slab on-grade sidewalk subgrade	90
Retaining wall subgrade	90
Retaining wall backfill	90
Asphalt or concrete pavement subgrade	95
Utility trench backfill under pavements/structures	95
Utility trench backfill	90

Subgrade Verification and Compaction Testing: Regardless of material or location, all structural fill should be placed over dense, unyielding subgrades. The condition of all subgrades should be verified by an Amec Foster Wheeler representative before filling or construction begins. In addition, fill soil compaction should be verified by means of in-place density tests performed during fill placement so the adequacy of the soil compaction efforts may be evaluated as earthwork progresses.

Soil Moisture Considerations: The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the “fines” content (the soil fraction passing the U.S. No. 200 sieve) increases, soils become more sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than 2 percentage points above or below optimum. For fill placement during wet-weather site work, we recommend using “clean” fill, which refers to soils that have a fines content of 5 percent or less (by weight) based on the soil fraction passing the U.S. No. 4 sieve.

Import Fill and Wet Weather Fill Considerations: As discussed in Section 4.1 (Site Preparation – On-site Soils), the on-site soils would be difficult to reuse as structural fill during wet weather because of high silt content and moisture sensitivity. Alternatively, we recommend using a well-graded sand and gravel, such as “Ballast” or “Gravel Borrow” per WSDOT9-03.9(1) and 9-03.14, respectively, except that the percent passing the U.S. No. 200 sieve should be less than 5 percent.

Concrete and Pavement Recycling: It is anticipated that the project will produce asphalt and concrete rubble. These materials, or similar imported materials, can be considered for reuse during project construction if they are pulverized to appropriate grain sizes. Recycled asphalt can be uniformly blended with pavement base course materials in accordance with WSDOT Standard Specification 9-

03.21(1)E. Recycled concrete can be substituted for up to 100 percent of base course materials below pavements, including CSBC and gravel base. Recycled concrete should be used in accordance with WSDOT Standard Specification 9-03.21(1)B.

5.0 RECOMMENDED ADDITIONAL SERVICES

Because this preliminary report has been prepared prior to design of the Central Kitsap High School and Middle School campus redevelopment, an additional geotechnical study will be needed to complete the design documents. After the specific locations, architectural layouts, and primary structural details of the buildings and associated structures have been established, we should perform a design-phase geotechnical evaluation. This type of evaluation may include advancing additional borings within the specific building footprint, installing groundwater observations wells, performing in-situ infiltration tests, conducting laboratory tests, performing geotechnical engineering analyses, and preparing a *Geotechnical Engineering Report.* Once this information is available and we have reviewed the design, we will submit a proposal to provide the design-phase study.

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7.0 CLOSURE

The preliminary conclusions and recommendations presented in this report are based, in part, on the explorations Amec Foster Wheeler performed and used for this study and on information provided for the proposed project. An additional geotechnical study will be needed as part of the design process to complete the project design documents. In addition, if variations in the subgrade conditions are observed at a later time, we may need to modify this report to reflect those changes. We are available to provide geotechnical engineering throughout the design process and to perform monitoring services throughout construction.

We appreciate the opportunity to be of service on this project. If you have any questions regarding this report, or any aspects of the project, please feel free to contact our office.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.

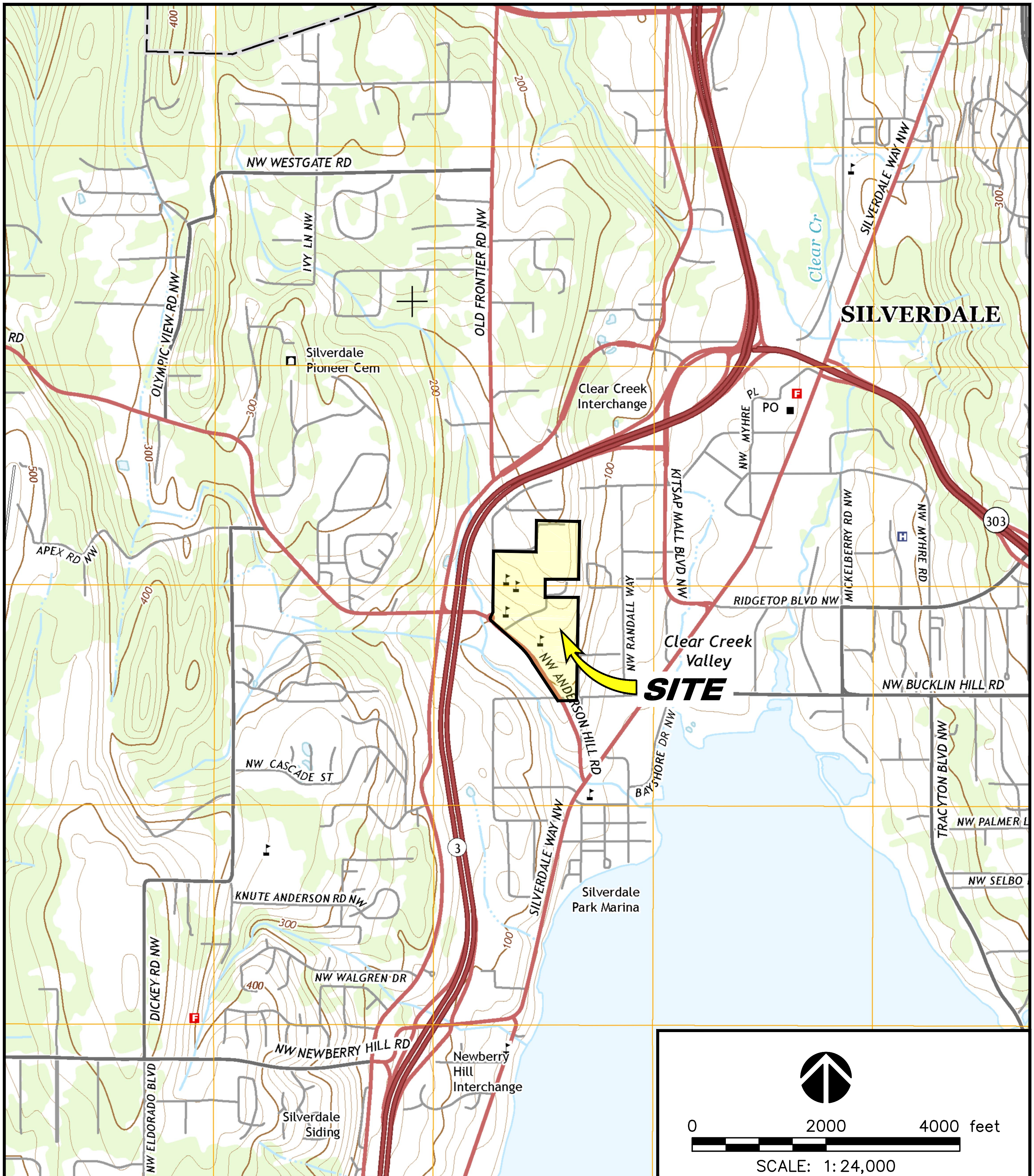
Konrad H. Moeller, L.E.G.
Senior Geologist

Todd D. Wentworth, P.E., L.G.
Associate Engineer

Reviewed by: James S. Dransfield, P.E.
Principal Geotechnical Engineer

amec foster wheeler

FIGURES



CENTRAL KITSAP SCHOOL DISTRICT	amec foster wheeler	CENTRAL KITSAP HIGH SCHOOL AND MIDDLE SCHOOL CAMPUS	DATE SEPTEMBER 2016
			SCALE 1" = 2,000'
Amec Foster Wheeler Environment & Infrastructure, Inc. 11810 North Creek Parkway North Bothell, WA 98011		SITE LOCATION MAP	PROJECT NO. 6-917-18096-0
			FIGURE 1

DRAWN BY: JRS CHECKED BY: KM

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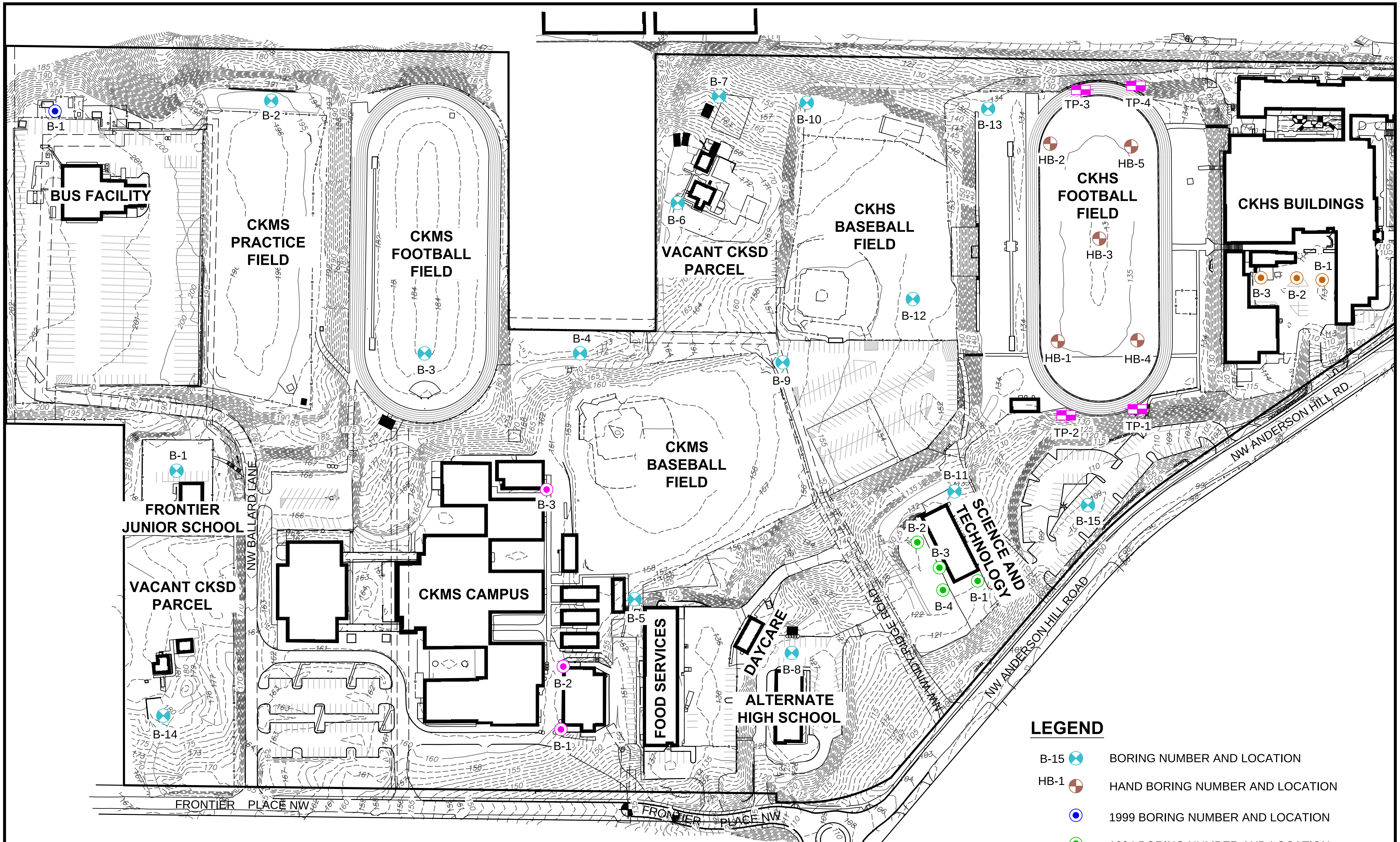


NOTE:

WE ESTIMATED THE RELATIVE LOCATION OF EACH EXPLORATION BY MEASURING FROM EXISTING FEATURES AND SCALING THESE MEASUREMENTS ONTO A LAYOUT PLAN SUPPLIED TO US. THE LOCATIONS DEPICTED ON THIS FIGURE SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE PERMITTED BY OUR DATA SOURCES AND IMPLIED BY OUR MEASURING METHODS.

LEGEND

- B-15 — BORING NUMBER AND LOCATION
- HB-1 — HAND BORING NUMBER AND LOCATION
- 1999 BORING NUMBER AND LOCATION
- 1994 BORING NUMBER AND LOCATION
- 1993 BORING NUMBER AND LOCATION
- 1991 TEST PIT AND LOCATION
- 1989 BORING NUMBER AND LOCATION

NOTE:
SURVEY BASE IS "*TOPOGRAPHY MAP*" BY AES CONSULTANTS, INC., DATED JUNE 16th, 2016.

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG.	APPR.

CENTRAL KITSAP SCHOOL DISTRICT

Amec Foster Wheeler
Environment & Infrastructure, Inc.
11810 North Creek Parkway North
Bothell, WA 98011

amec foster wheeler

CENTRAL KITSAP HIGH SCHOOL AND MIDDLE SCHOOL CAMPUS

SITE AND EXPLORATION PLAN

DATE	SEPTEMBER 2016
SCALE	1" = 120'
PROJECT NO.	6-917-18096-0
FIGURE	2

DRAWN BY: JRS CHECKED BY: TDW

APPENDIX A

Field Exploration Procedures and Logs

APPENDIX A
FIELD EXPLORATION PROCEDURES AND LOGS
Central Kitsap High School and Middle School Campus Redevelopment
Silverdale, Washington

The following paragraphs describe the procedures used for field explorations and field tests that Amec Foster Wheeler conducted for this project. Descriptive logs of our explorations are enclosed in this appendix and locations shown on Figure A-1.

AUGER BORING PROCEDURES

Exploratory borings were advanced with a hollow-stem auger, using a trailer-mounted drill rig operated by an independent drilling firm working under subcontract to Amec Foster Wheeler. An engineering geologist from Amec Foster Wheeler continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to the laboratory for further visual examination and testing. After each boring was completed, the borehole was backfilled with a mixture of bentonite chips and soil cuttings, and the surface was patched with asphalt or concrete (where appropriate).

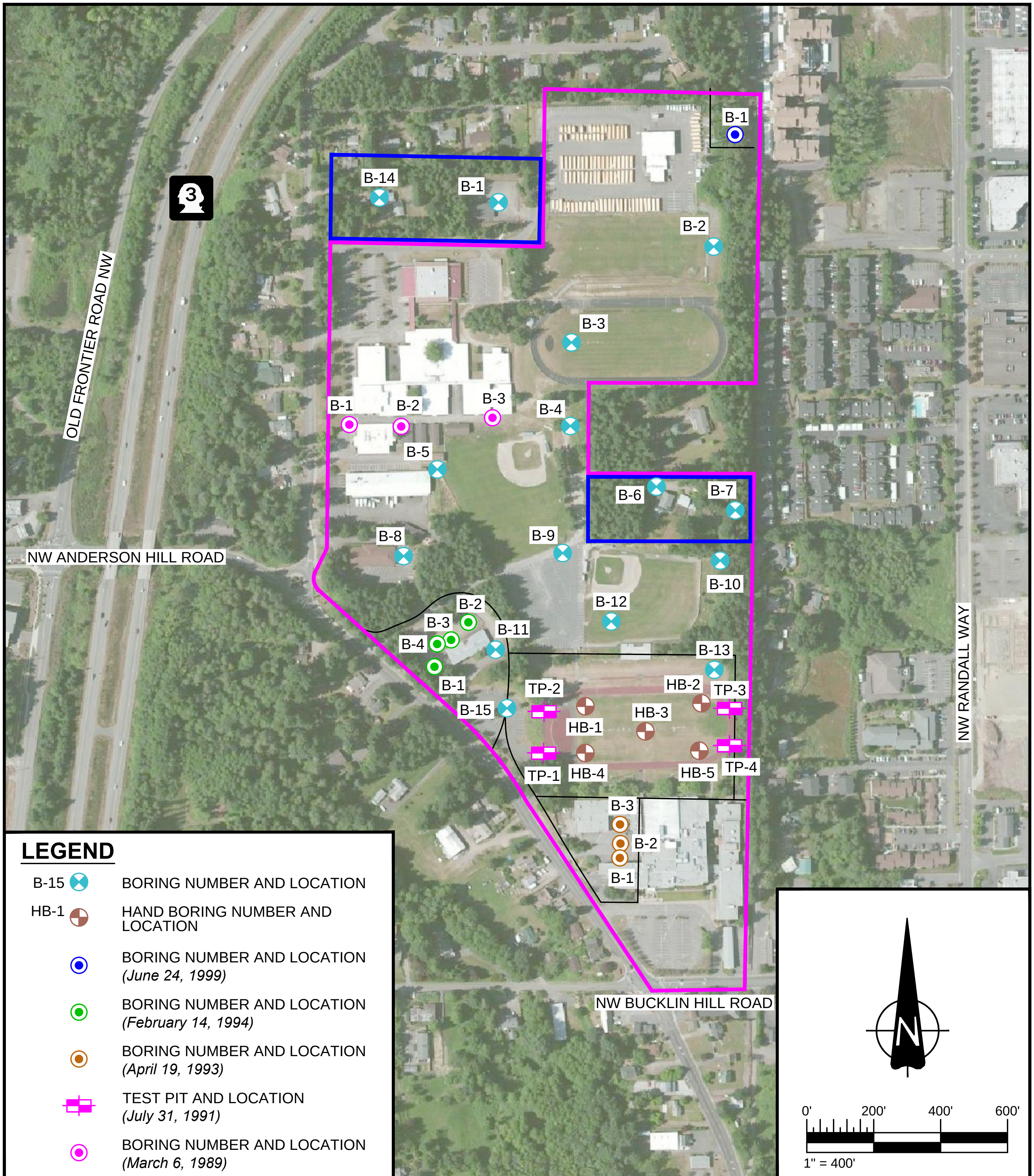
Throughout the drilling operation, soil samples were obtained at 2.5- or 5-foot depth intervals by means of the standard penetration test (SPT) per ASTM D-1586. This testing and sampling procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval was counted, and the total number of blows struck during the final 12 inches was recorded as the standard penetration resistance, or “SPT blow count.” If a total of 50 blows were struck within any 6-inch interval, the driving was stopped and the blow count was recorded as 50 blows for the actual penetration distance. The resulting standard penetration resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The enclosed boring logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on field classifications and supported by subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, boring logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. The boring logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.

HAND BORING PROCEDURES

Our exploratory hand borings were advanced with a 3-inch-diameter hand auger operated by an Amec Foster Wheeler geotechnical specialist, who logged the subsurface conditions and obtained representative soil samples. All samples were stored in watertight containers and later transported to a laboratory for further visual examination and testing. After each hand boring was completed, we backfilled the borehole with soil cuttings and tamped the surface. The relative density of granular soils and relative consistency of cohesive soils were generally estimated according to the drilling resistance encountered in each borehole.

The enclosed Hand Boring Logs describe the vertical sequence of soils and materials encountered in each hand boring, based primarily on our field classifications and supported by subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Our logs also indicate the approximate depth of any groundwater encountered in the boreholes, as well as all sample numbers and sampling locations.



CENTRAL KITSAP SCHOOL DISTRICT	amec foster wheeler	CENTRAL KITSAP HIGH SCHOOL AND MIDDLE SCHOOL CAMPUS	DATE: SEPTEMBER 2016 SCALE: 1" = 400'
Amec Foster Wheeler Environment & Infrastructure, Inc. 11810 North Creek Parkway North Bothell, WA 98011		PROPOSED BORINGS	PROJECT NO.: 6-917-18096-0 FIGURE: A-1

DRAWN BY: JRS CHECKED BY: TDW

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PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *1*

Location: New Frontier JR High Bldg Parking Lot

Approximate ground surface elevation: 183.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	2.5-inches Asphalt			N/E		
	Very dense, moist, brown, gravelly, silty SAND (Qvt - Glacial Till).					
		85%	S-1		50/6"	22
5	Becomes with brown mottling	50%	S-2		50/5"	
	Becomes gray with no mottling					
10		40%	S-3		50/6"	
15		30%	S-4		50/2"	
16.5	Boring terminated at approximately 16.5 feet					

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot: 0 10 20 30 40 50

MOISTURE CONTENT: 0 20 40 60 80 100 — Plastic Limit, Liquid Limit

Page 1 of 1

LEGEND

2.00-inch OD split-spoon sampler

N/E No groundwater encountered

Grain Size Analysis (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Drill*

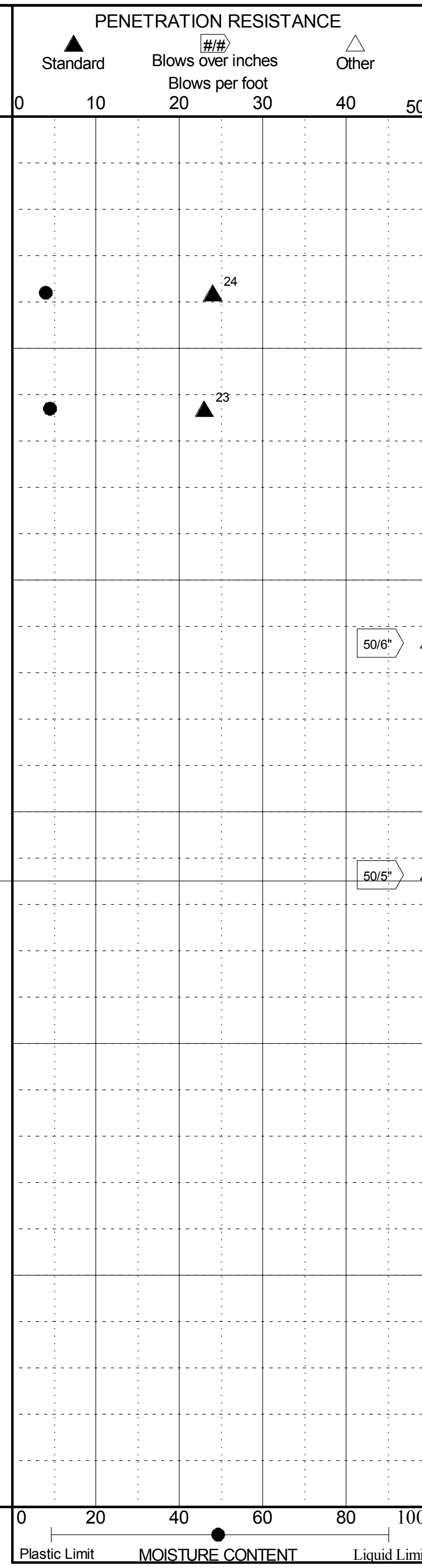
PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *2*

Soil Description

Location: CKMS - E. End of Upper Practice Field

Approximate ground surface elevation: 195.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	MOISTURE CONTENT	TESTING
0	6-inches Sod / Topsoil			N/E			
0.5–8	Medium dense, moist, brown, silty SAND with gravel (Fill).						
3.5		50%	S-1		24		28
6		50%	S-2		23		
8–16.5	Very dense, moist, gray, silty SAND with gravel (Qvt - Glacial Till).						
11		40%	S-3		50/6"		
16		30%	S-4		50/5"		
16.5	Boring terminated at approximately 16.5 feet						



LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- 200 Wash (% fines shown)

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

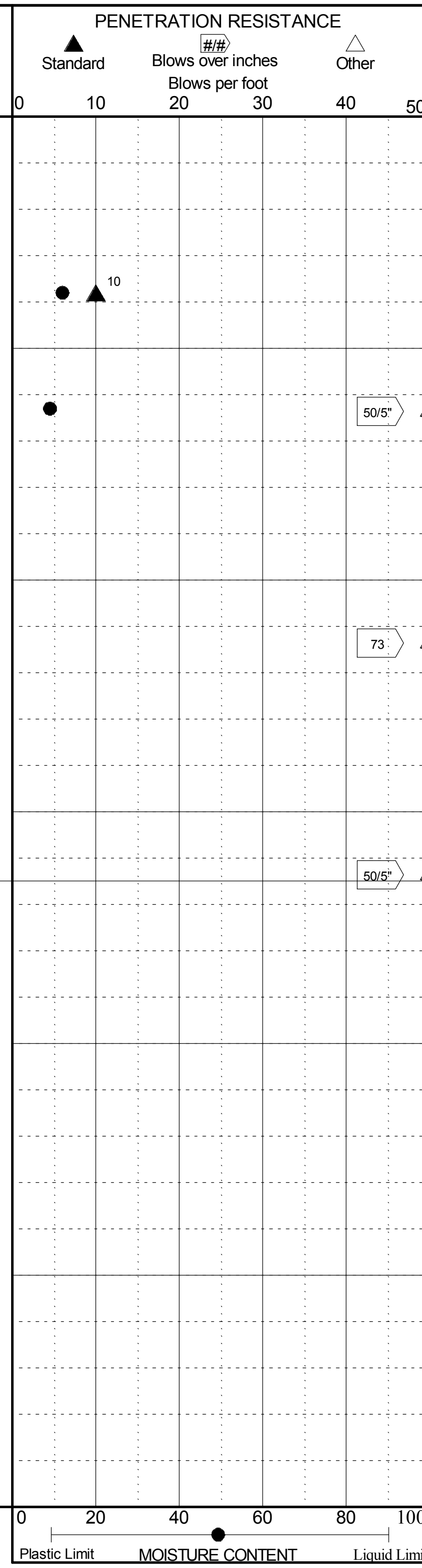
Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *3*

Location: CKMS - Football Field W. Goal Post

Approximate ground surface elevation: 184.0 feet

Depth (feet)	Soil Description	Sample Type	Sample Number	Ground Water	Testing
0	6-inches Sod / Topsoil			N/E	
	Medium dense, moist, brown, gravelly, silty SAND (Fill).	80%	S-1		21
5	Very dense, moist, gray with brown mottling, silty SAND with gravel (Qvt - Glacial Till).	70%	S-2		
	Becomes gray with no mottling				
10		90%	S-3		
15		30%	S-4		
	Boring terminated at approximately 16.5 feet				



Page 1 of 1

LEGEND

2.00-inch OD split-spoon sampler

N/E No groundwater encountered

Grain Size Analysis (% fines shown)

BOTHELL_GEO_2015.GLB BOTHELL_LOG FORMAT 2012 CKSD BORINGS 1 THROUGH 15.GPJ BOTHELL GEO 2010 B&TP.GDT PRINTDATE 9/21/16

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *4*

Soil Description
Location: CKMS - Top of Slope 65' E. of Base Ball Field Backstop
Approximate ground surface elevation: 172.5 feet

Page 1 of 1

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	Moisture Content	TESTING
0	6-inches Sod / Topsoil			N/E			
	Very dense, moist, grayish-brown, gravelly, silty SAND with some gravel (Qvt - Glacial Till).						
		40%	S-1		50/6"		
5	Becomes gray	60%	S-2		50/6"	●	35
	Becomes with some gravel						
10		40%	S-3		50/5"	●	37
15		30%	S-4		50/4"		
	Boring terminated at approximately 16.5 feet						
20							
25							
30							

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot (0, 10, 20, 30, 40, 50)

MOISTURE CONTENT: 0, 20, 40, 60, 80, 100 — Plastic Limit, Liquid Limit

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- Grain Size Analysis (% fines shown)

BOTHELL_GEO_2015.GLB BOTHELL_LOG FORMAT 2012 CKSD BORINGS 1 THROUGH 15.GPJ BOTHELL GEO 2010 B&TP.GDT PRINTDATE 9/21/16

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *5*

Soil Description
Location: CKMS - 43' East of Food Service Building NE Corner
Approximate ground surface elevation: 156.5 feet

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Standard / Other; Blows per foot; Blows over inches)	TESTING
0	6-inches Sod / Topsoil				N/E		
0.5–4.5	Dense, moist, reddish-brown, silty SAND with some gravel and scattered organics (Fill).		20%	S-1		39	18
4.5–8	Very dense, moist, brown, silty SAND with gravel (Qvt - Glacial Till).		60%	S-2		50/6"	
8	Becomes gray						
10			70%	S-3		50/6"	34
15			20%	S-4		50/5"	
16.5	Boring terminated at approximately 16.5 feet						

MOISTURE CONTENT: 0, 20, 40, 60, 80, 100 — Plastic Limit, Liquid Limit

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- 200 Wash (% fines shown)
- Grain Size Analysis (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 16, 2016* Logged By: *FC*
Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *6*

Location: CKHS - 16' N. of Vacant Home within Driveway

Approximate ground surface elevation: 173.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE	TESTING
0	2.5-inches 5/8 inch Crushed Rock			N/E		
	Very dense, moist, gray, gravelly, silty SAND (Qvt - Glacial Till).					
		40%	S-1		50/6"	
5		50%	S-2		50/3"	29
10		30%	S-3		50/4"	
15		15%	S-4		50/2"	
	Boring terminated at approximately 16.5 feet					
20						
25						
30						

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot 0 10 20 30 40 50

MOISTURE CONTENT: Plastic Limit — Liquid Limit, 0 20 40 60 80 100

Page 1 of 1

LEGEND

2.00-inch OD split-spoon sampler

N/E No groundwater encountered

200 Wash (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *7*

Soil Description
Location: CKHS - Vacant Home at NE Corner of Fenced Garden
Approximate ground surface elevation: 158.0 feet

Page 1 of 1

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	6-inches Sod / Topsoil			N/E		
	Very dense, moist, tan with gray mottling, silty SAND with some gravel (Qvt - Glacial Till).					
3.5		40%	S-1		50/4"	
4.5	Becomes gray with brown mottling					
5		80%	S-2		50/6"	22
8	Becomes gray					
10		30%	S-3		50/5"	
15		0%	S-4		100/3"	
16.5	Blow Counts Overstated - Rock Boring terminated at approximately 16.5 feet					

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot: 0, 10, 20, 30, 40, 50

MOISTURE CONTENT: 0, 20, 40, 60, 80, 100; Plastic Limit — Liquid Limit

LEGEND

2.00-inch OD split-spoon sampler

N/E No groundwater encountered

200 Wash (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *8*

Soil Description

Location: CKSD Alternative HS Bldg - 34' E. of Bldg E. Door

Approximate ground surface elevation: 131.0 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	2.5-inches Asphalt			N/E		
	Very dense, moist, grayish-brown, silty SAND (Qvt - Glacial Till).					
		20%	S-1		50/4"	
5	Becomes gray	50%	S-2		50/6"	
10	Very dense, moist, gray, silty, gravelly SAND with some gravel and trace silt (Qva - Advance Outwash ?).	50%	S-3		50/5"	15
15		50%	S-4		50/5"	
	Boring terminated at approximately 16.5 feet					

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot (0, 10, 20, 30, 40, 50)

Page 1 of 1

Plastic Limit — MOISTURE CONTENT — Liquid Limit (0, 20, 40, 60, 80, 100)

LEGEND

2.00-inch OD split-spoon sampler

N/E No groundwater encountered

Grain Size Analysis (% fines shown)

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

BOTHELL_GEO_2015.GLB BOTHELL_LOG FORMAT 2012 CKSD BORINGS 1 THROUGH 15.GPJ BOTHELL GEO 2010 B&TP.GDT PRINTDATE 9/21/16

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *9*

Location: CKHS Base Ball Field Parking Lot - 55' W. of Backstop

Approximate ground surface elevation: 157.0 feet

Page 1 of 1

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	MOISTURE CONTENT	TESTING
0	3-inches Asphlat over 5-inches Base Course.			N/E			
	Very dense, moist, silty, gravelly SAND (Qvt - Glacial Till).						
3–4.5		90%	S-1		58		
5–6.5		60%	S-2		50/5"	●	Grain Size 22
10–11.5		60%	S-3		50/6"		
15–16.5		30%	S-4		50/4"		
16.5	Boring terminated at approximately 16.5 feet						

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other. Scale 0, 10, 20, 30, 40, 50.

MOISTURE CONTENT: Plastic Limit – Liquid Limit. Scale 0, 20, 40, 60, 80, 100.

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- Grain Size Analysis (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *10*

Location: CKHS - 41' E. from Baseball Field Fence at NE. Corner.

Approximate ground surface elevation: 150.0 feet

DEPTH (feet)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (Blows per foot)	Moisture Content	Testing
0	6-inches Sod / Topsoil			N/E			
	Medium dense, moist, brown, silty SAND (Fill).	20%	S-1		25		
5	Very dense, moist, gray, silty, SAND (Qvt - Glacial Till).	50%	S-2		50/6"	●	14
10		30%	S-3		50/5"		
15		40%	S-4		50/4"		
16.5	Boring terminated at approximately 16.5 feet						

Penetration Resistance: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other. Scale: 0, 10, 20, 30, 40, 50

Moisture Content scale: 0, 20, 40, 60, 80, 100 — Plastic Limit, MOISTURE CONTENT, Liquid Limit

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- 200 Wash (% fines shown)

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *11*

Location: 27' SE of Career & Technical Bldg SE Corner
Approximate ground surface elevation: 132.0 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	MOISTURE CONTENT	TESTING
0	2-inches Asphalt over 4-inches Base Course.			N/E			
	Very dense, moist, grayish-brown, silty SAND with some gravel (Qvt - Glacial Till).	40%	S-1		50/6"		
5		30%	S-2		50/6"		
	Becomes gray						
10		60%	S-3		50/6"		29
	Becomes brownish-gray						
15		30%	S-4		50/3"		
	Becomes gray, silty fine SAND						
20		50%	S-5		50/4"		
	Very dense, moist, gray, gravelly SAND with trace silt (Qva - Advance Outwash).						
25		50%	S-6		50/6"		4
	Boring terminated at approximately 26.5 feet						
30							

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other. Scale: 0 10 20 30 40 50

MOISTURE CONTENT: Plastic Limit — Liquid Limit. Scale: 0 20 40 60 80 100

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- Grain Size Analysis (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 16, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *12*

Location: CKHS - Base Ball Field - 114' SE of 1st Base

Approximate ground surface elevation: 153.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0 – 0.5	6-inches Sod / Topsoil			N/E		
0.5 – 4.5	Medium dense, moist, brown, silty SAND (Fill).	20%	S-1		12	23
4.5 – 8	Very dense, moist, gray with brown mottling, gravelly, silty SAND (Qvt - Glacial Till).	80%	S-2		50/6"	
8 – 16.5	Becomes gray	50%	S-3		50/5"	
		20%	S-4		50/5"	
16.5	Boring terminated at approximately 16.5 feet					

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other

MOISTURE CONTENT: Plastic Limit ● Liquid Limit (0 – 100)

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- 200 Wash (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *13*

Soil Description

Location: CKHS - 70' NE. of Long Jump E. End

Approximate ground surface elevation: 134.0 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	6-inches Sod / Topsoil			N/E		
0.5	Medium dense, moist, brown, silty SAND (Fill).					
2.5–4		15%	S-1		11	18
4.5	Becomes loose and gray					
5–6.5		5%	S-2		5	
8	Very dense, moist, gray, gravelly, silty SAND (Qvt - Glacial Till).					
10–11.5		70%	S-3		53	
15–16.5		30%	S-4		50/4"	
20–21.5		30%	S-5		50/5"	
21.5	Boring terminated at approximately 21.5 feet					

PENETRATION RESISTANCE: ▲ Standard; △ Other; #/# Blows over inches; Blows per foot (scale 0, 10, 20, 30, 40, 50)

MOISTURE CONTENT (scale 0, 20, 40, 60, 80, 100): Plastic Limit — ● — Liquid Limit

Page 1 of 1

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- Grain Size Analysis (% fines shown)

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 16, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *14*

Page 1 of 1

Location: Vacant Parcel N. of CKMS - Driveway 43' W. of Bldg

Approximate ground surface elevation: 179.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	2-inches of 5/8 inch Crushed Rock.			N/E		
	Very dense, moist, tan with gray mottling, silty SAND with some gravel (Qvt - Glacial Till).					
~4		30%	S-1		50/6"	25
5	Becomes gray with brown mottling					
~6		90%	S-2		50/6"	
~8	Becomes gray					
~11		40%	S-3		50/5"	
~16		30%	S-4		50/4"	
16.5	Boring terminated at approximately 16.5 feet					

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot (0, 10, 20, 30, 40, 50)

MOISTURE CONTENT: Plastic Limit — Liquid Limit (0, 20, 40, 60, 80, 100)

LEGEND

- 2.00-inch OD split-spoon sampler
- N/E No groundwater encountered
- 200 Wash (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 15, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *15*

Location: CKHS Parking Lot W. of Football Field by Anderson Hill Rd

Approximate ground surface elevation: 109.0 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot)	TESTING
0	2 inches Asphalt over 4-inches Base Course.					
	Very dense, moist, gray, SAND with some silt and gravel (Qva - Advance Outwash).	70%	S-1		50/6"	
5		80%	S-2		50/6"	
10		70%	S-3		61	
	Becomes wet					
15		50%	S-4A			11
	Becomes silty SAND	60%	S-4B		64	
	Becomes saturated and dense			ATD		
20		60%	S-5		41	14
	Becomes very dense					
25		80%	S-6		57	
	Boring terminated at approximately 26.5 feet					
30						

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other. Scale: 0 10 20 30 40 50

MOISTURE CONTENT: 0 20 40 60 80 100 — Plastic Limit, Liquid Limit

LEGEND

2.00-inch OD split-spoon sampler	
ATD	Groundwater level at time of drilling
Grain Size Analysis (% fines shown)	
200 Wash (% fines shown)	

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: HSA Hammer Type: Cathead Date drilled: *August 16, 2016* Logged By: *FC*

Drilled by: *Geologic Dril*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *HB-01*

Location: CKHS Football Field NW Corner - Goal Line

Approximate ground surface elevation: 134.5 feet

DEPTH (feet)	Soil Description	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER
0	4-inches Grass / Topsoil			
	Drainage SAND	Grab	G-1	
	Medium dense, wet, gray, gravelly, silty SAND (Fill). Seepage at contact zone	Grab	G-2	P ATD
	Dense, wet, gray, gravelly, silty SAND (Qvt - Glacial Till).	Grab	G-3	
	Boring terminated at approximately 2.75 feet			
5				

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; Blows per foot; △ Other (scale 0, 10, 20, 30, 40, 50) — TESTING

MOISTURE CONTENT: Plastic Limit — Liquid Limit (scale 0, 20, 40, 60, 80, 100)

LEGEND

Grab Sample

P ATD — Perched water level at time of drilling

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: Hand Auger Hammer Type: N/A Date drilled: *August 16, 2016* Logged By: *KHM*

Drilled by: *KHM*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *HB-02*

DEPTH (feet)	Soil Description Location: CKHS Football Field NE Corner - Goal Line Approximate ground surface elevation: 134.5 feet	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Standard ▲ / Blows over inches #/# / Other △; Blows per foot 0–50)	TESTING
0	4-inches Grass / Topsoil				N/E		
	Drainage SAND		Grab Sample	G-1			
	Loose, moist, brownish-gray, mottled, silty SAND with some gravel (Fill)		Grab Sample	G-2			
	Obstruction at 2.75 Feet - End of Boring						
	Boring terminated at approximately 2.75 feet						
5							

MOISTURE CONTENT: 0 20 40 60 80 100 — Plastic Limit, Liquid Limit

LEGEND

Grab Sample

N/E No groundwater encountered

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: Hand Auger Hammer Type: N/A Date drilled: *August 16, 2016* Logged By: *KHM*

Drilled by: *KHM*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *HB-03*

Page 1 of 1

Location: CKHS Center of Football Field - 50yd Line
Approximate ground surface elevation: 136.0 feet

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE	TESTING
0	6-inches Grass / Topsoil intermixed with Drainage Sand Irregation water trapped in topsoil mix		Grab	G-1	P ATD		
	Drainage SAND		Grab	G-2			
	Loose, moist, brownish-gray, silty SAND with some gravel (Fill)						
	Loose to medium dense, moist, gray, silty SAND with some gravel (Qvt - Glacial Till?)		Grab	G-3			
	Boring terminated at approximately 4.3 feet						
5							

PENETRATION RESISTANCE: ▲ Standard; #/# Blows over inches; △ Other; Blows per foot (0, 10, 20, 30, 40, 50)

MOISTURE CONTENT (0, 20, 40, 60, 80, 100): Plastic Limit — Liquid Limit

LEGEND

- Grab Sample
- P / ATD: Perched water level at time of drilling

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: Hand Auger Hammer Type: N/A Date drilled: *August 16, 2016* Logged By: *KHM*
Drilled by: *KHM*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *HB-04*

DEPTH (feet)	Soil Description Location: CKHS Football Field SW Corner - Goal Line Approximate ground surface elevation: 134.5 feet	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (▲ Standard; #/# Blows over inches; △ Other) Blows per foot 0 10 20 30 40 50	Page 1 of 1 TESTING
0	4-inches Grass / Topsoil						
	Drainage SAND		Grab Sample	G-1			
1					P ATD		
	Medium dense, gray, silty, gravelly SAND (Fill) Seepage at contact zone		Grab Sample	G-2			
2							
	Becomes brownish-gray with occasional organics - rootlets/wood		Grab Sample	G-3		● (moisture content)	Grain Size Analysis 18
3	Boring terminated at approximately 3 feet						
4							
5							

0 20 40 60 80 100
Plastic Limit MOISTURE CONTENT Liquid Limit

LEGEND

- Grab Sample
- P / ATD — Perched water level at time of drilling
- Grain Size Analysis (% fines shown)

amec foster wheeler
11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: Hand Auger Hammer Type: N/A Date drilled: *August 16, 2016* Logged By: *KHM*

Drilled by: *KHM*

PROJECT: *Central Kitsap HS & MS Campus* JOB No. *6-917-18096-0* BORING No. *HB-05*

Location: CKHS Football Field SE Corner - Goal Line

Approximate ground surface elevation: 134.5 feet

DEPTH (feet)	Soil Description	USCS/USGS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Standard / Blows over inches / Other; Blows per foot 0–50)	TESTING
0	4-inches Grass / Topsoil				N/E		
	Drainage SAND		Grab	G-1			
1							
	Loose, moist, gray, gravelly, silty SAND (Fill)						
2			Grab	G-2			
3							
	Boring terminated at approximately 3.2 feet						
4							
5							

MOISTURE CONTENT: 0, 20, 40, 60, 80, 100 — Plastic Limit, Liquid Limit

Page 1 of 1

LEGEND

Grab Sample

N/E No groundwater encountered

amec foster wheeler

11810 North Creek Parkway N
Bothell, WA 98011

Drilling Method: Hand Auger Hammer Type: N/A Date drilled: *August 16, 2016* Logged By: *KHM*

Drilled by: *KHM*

PROJECT: *Nextel Silverdale WA0285-3* W.O. *9-91M-12987-0* BORING No. *B-1*

Location: Approx. center of lease parcel
Approximate ground surface elevation: 180 ft

DEPTH (feet)	Soil Description	USCS GRAPHICS	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	PENETRATION RESISTANCE (Blows per foot; ▲ Standard, △ Other)	TESTING
0	Medium dense to dense, damp, tan silty gravelly SAND (Fill)				N/E		
	Loose, moist, brown silty gravelly SAND		33	S-1		▲ ~8	
5	Very dense, moist, gray silty gravelly SAND (Glacial Till)						
			67	S-2		50/3	
10							
			50	S-3		50/6	
15							
			50	S-4		50/6	23
20							
			100	S-5		50/6	15
	Boring terminated at approximately 23 feet						
25							
30							

Moisture content scale: 0, 20, 40, 60, 80, 100 — Plastic Limit, Moisture Content, Liquid Limit

LEGEND

- 2.00-inch OD split-Spoon sampler (percent recovery shown)
- 200 Wash
- N/E No groundwater encountered

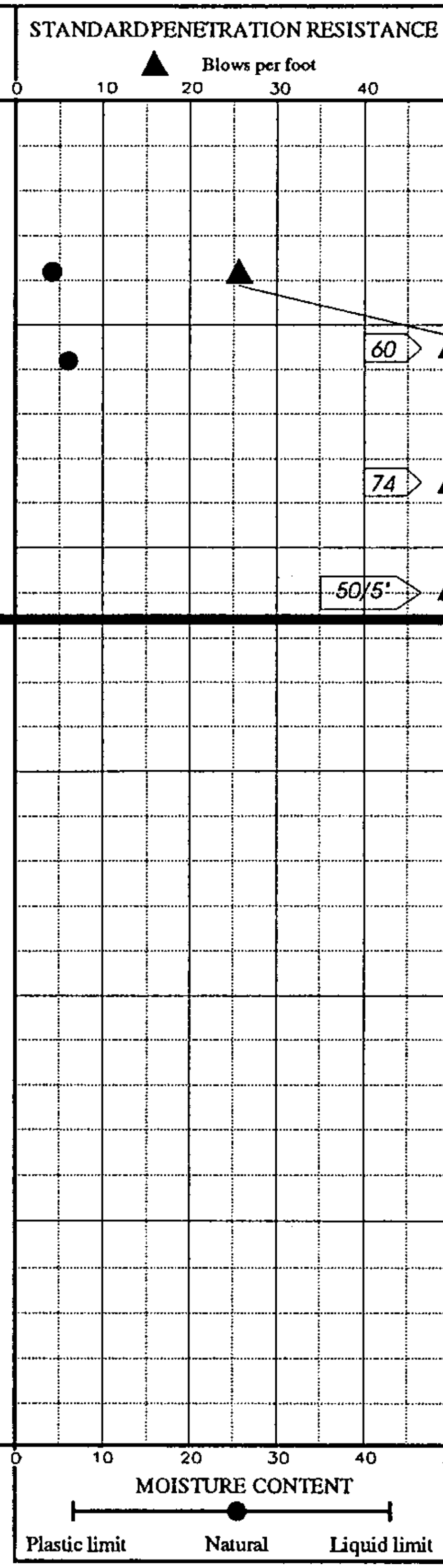
AGRA
ENGINEERING GLOBAL SOLUTIONS
11335 N.E. 122nd Way Suite 100
Kirkland, Washington 98034-6913

4IN1 12987.GPJ WA4IN1.GDT 6/24/99

Drilling Method: HSA Hammer type: Automatic Date drilled: *18 June 1999* Logged By: *JFV*

PROJECT: *Performing Arts Center Science Kit Center Site* W.O. *11-09290-00* BORING NO. *B-1*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot	TESTING
0	*2" Asphalt paving*						
	Medium dense, moist, tan, fine to medium SAND with trace silt	I	*S-1*	*0.0*			
5	*Very dense, moist, tan to gray, medium to coarse SAND with some gravel and trace silt*	I	*S-2*	*0.0*		60	
	Very dense, moist, gray, silty, fine to medium SAND with trace gravel	I	*S-3*	*0.0*		74	
10	*Some gravel*	I	*S-4*	*0.0*		50/5"	
	Boring terminated at approximately 11.5 feet						
15							
20							
25							
30							



LEGEND

I 2-inch OD split-spoon sample

RZA AGRA, Inc
Engineering & Environmental Services
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *06 December 1993* Drilling completed: *06 December 1993* Logged by: *KHM*

PROJECT: Performing Arts Center Science Kit Center Site W.O. 11-09290-00 BORING NO. B-2

Page 1 of 1

Approximate ground surface elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE (▲ Blows per foot)	TESTING
0	Very dense, moist, gray, silty, fine to medium SAND with some gravel						
		I	S-1	0.0		50/5"	
5		I	S-2	0.0		50/5"	
		I	S-3	0.0		50/5"	
10							
		I	S-4	*		50/5"	
	Boring terminated at approximately 11.5 feet						
15							
20							
25							
30							

Scale: 0 10 20 30 40 50

LEGEND

I 2-inch OD split-spoon sample

* Insufficent sample for OVM reading; however, no odor detected

MOISTURE CONTENT

Plastic limit — Natural — Liquid limit

RZA AGRA, Inc
Engineering & Environmental Services

11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

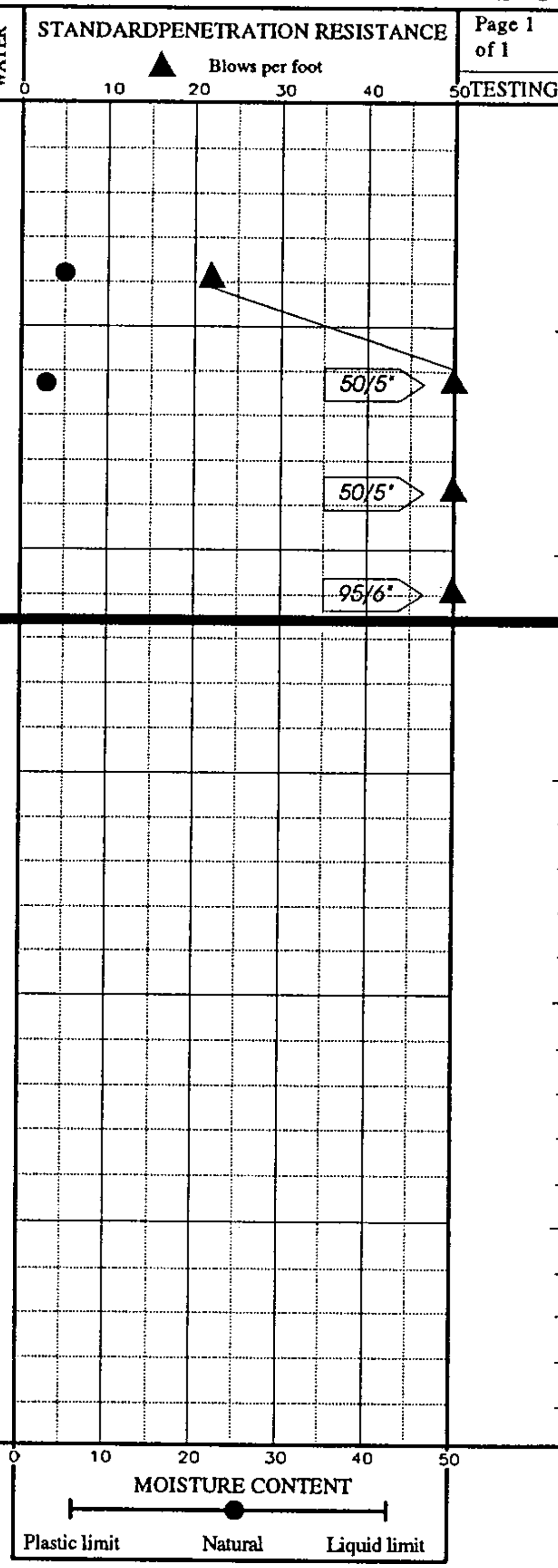
Drilling started: 06 December 1993 Drilling completed: 06 December 1993 Logged by: KHM

PROJECT: Performing Arts Center Science Kit Center Site

W.O. 11-09290-00 BORING NO. B-3

Approximate ground surface elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE (Blows per foot)	TESTING
0	Medium dense, moist, gray, fine to medium SAND with trace gravel and silt						
		I	S-1	*			
5	Very dense, moist, gray, silty, gravelly, fine to medium SAND	I	S-2	0.0		50/5"	
		X	S-3			50/5"	
10	Very dense, moist, gray, silty, fine to medium SAND with some gravel	I	S-4	*		95/6"	
	Boring terminated at approximately 11.5 feet						



LEGEND

I 2-inch OD split-spoon sample

X Sample not recovered

* Insufficient sample for OVM reading; however, no odor detected

RZA AGRA, Inc
Engineering & Environmental Services
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

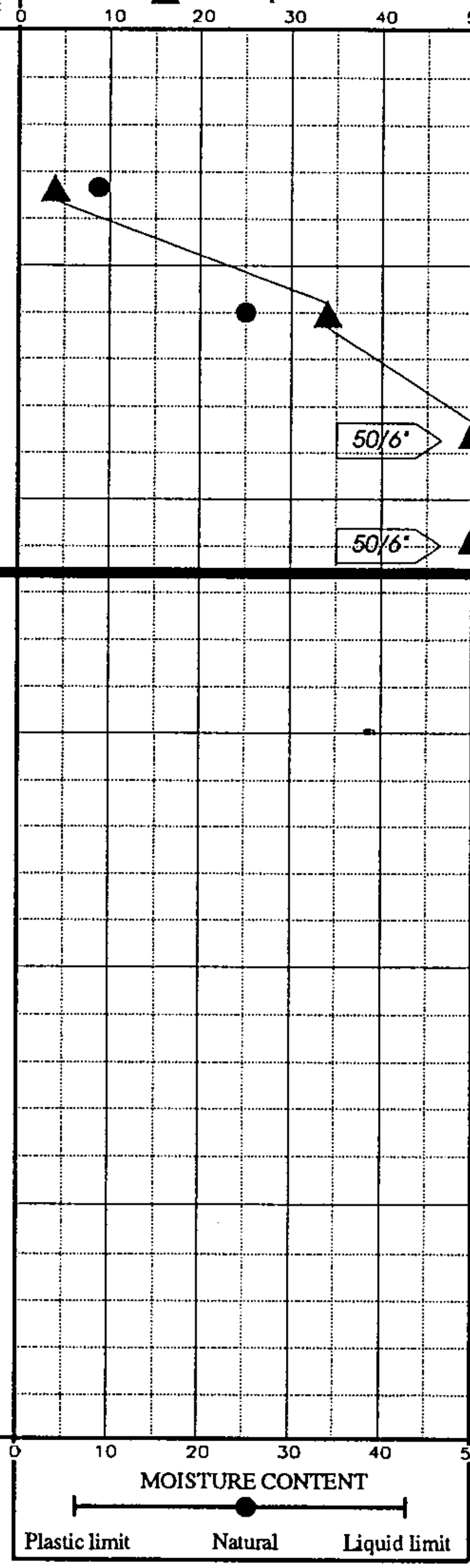
Drilling started: 06 December 1993 Drilling completed: 06 December 1993 Logged by: KHM

PROJECT: *Performing Arts Center*
Science Kit Center Site

W.O. *11-09290-00* BORING NO. *B-4*

Approximate ground surface elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot	TESTING
0–4.5	*Loose, moist, tan, fine to medium SAND with trace silt (Possible Fill)*	I	*S-1*	*0.0*			
4.5–10	*Medium dense, moist, mottled gray, silty, fine SAND*	I	*S-2*	*0.0*			
	Very dense, gray, some gravel	I	*S-3*	*0.0*		*50/6"*	
10–11.5	*Becoming gravelly*	I	*S-4*	*		*50/6"*	
	Boring terminated at approximately 11.5 feet						



LEGEND

I 2-inch OD split-spoon sample

* Insufficient sample for OVM reading; however, no odor detected

RZA AGRA, Inc
Engineering & Environmental Services
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *06 December 1993* Drilling completed: *06 December 1993* Logged by: *KHM*

PROJECT: Central Kitsap High School Library Addition   W.O. W-8871   BORING NO. B-1

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (0–50)	TESTING
	Approximate ground surface elevation:					
0	5 inch concrete slab overlying a medium dense, damp to moist, light brown, silty, gravelly, SAND with some brick fragments (Fill)					
	Boring terminated at approximately 2 feet atop buried concrete					
5						
10						
15						
20						
25						
30						

MOISTURE CONTENT (0–50): Plastic limit — Natural — Liquid limit

LEGEND

2-inch OD split-spoon sample

RZA AGRA, Inc
Engineering & Environmental Services
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

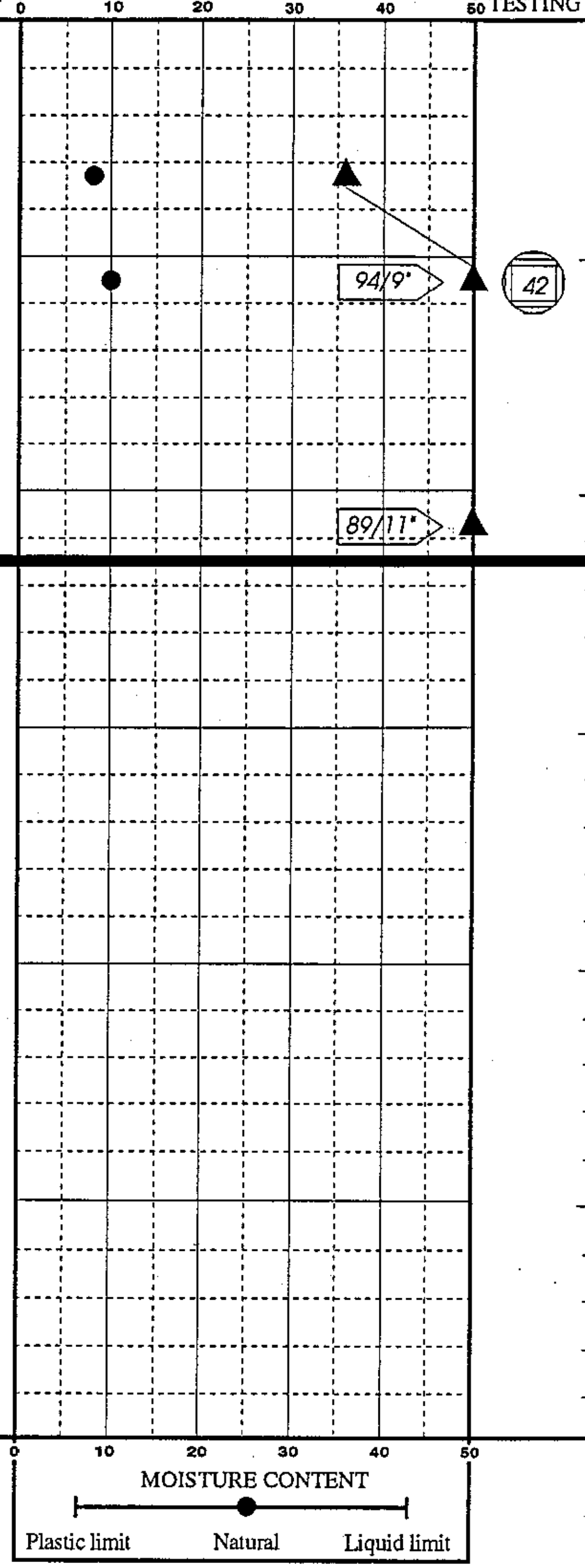
Drilling started: 06 April 1993   Drilling completed: 06 April 1993   Logged by: KSS

Central Kitsap High School

PROJECT: Library Addition **W.O.** W-8871 **BORING NO.** B-2

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	STANDARD PENETRATION RESISTANCE (▲ Blows per foot) 0 10 20 30 40 50	TESTING
0	Medium dense, moist, brown, silty GRAVEL					
	Medium dense, damp, orangish tan, silty, gravelly SAND	I	S-1			
5	Dense to very dense, damp, gray, gravelly, silty, SAND with occassional sand lense	I	S-2		94/9"	42
	Very dense, damp, tan-gray, silty, fine SAND with some gravel					
10		I	S-3		89/11"	
	Boring terminated at approximately 11.5 feet					
15						
20						
25						
30						

Page 1 of 1



LEGEND

I 2-inch OD split-spoon sample

(17) 200 wash (percent fines shown)

RZA AGRA, Inc
Engineering & Environmental Services
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *06 April 1993* Drilling completed: *06 April 1993* Logged by: *KSS*

PROJECT: Central Kitsap High School Library Addition

W.O. W-8871

BORING NO. B-3

Page 1 of 1

Approximate ground surface elevation:

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	STANDARD PENETRATION RESISTANCE (Blows per foot)	TESTING
0	5 inch concrete slab over a medium dense, damp, tan, gravelly SAND, some silt to silty (Fill)					
	Medium dense, damp, brown, silty, gravelly SAND	I	S-1		75/11"	
5	Very dense, damp, gray, silty, gravelly SAND	I	S-2		50/5"	
10	Very dense, damp, tan-gray, silty, fine SAND with some gravel	I	S-3		61	19
	Boring terminated at approximately 11.5 feet					
15						
20						
25						
30						

Blows per foot scale: 0, 10, 20, 30, 40, 50

Moisture content scale: 0, 10, 20, 30, 40, 50

MOISTURE CONTENT: Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split-spoon sample

17 200 wash (percent fines shown)

RZA AGRA, Inc

Engineering & Environmental Services

11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: 06 April 1993 Drilling completed: 06 April 1993 Logged by: KSS

TEST PIT LOGS

Depth (feet)	Soil Classification	W-7726
	Test Pit TP-1	
0.0 - 1.0	Topsoil	
1.0 - 3.5	Medium dense, dry to damp, light brown, fine SAND with some silt and gravel	
3.5 - 7.0	Dense, damp, grey, gravelly SAND with trace silt	
7.0 - 8.0	Dense, dry to damp, grey, fine to medium SAND	
	No Seepage	
	No Caving	
	Test Pit TP-2	
0.0 - 1.0	Topsoil with roots	
1.0 - 2.5	Dense, damp, grey, gravelly SAND	
2.5 - 7.0	Dense, damp, grey, interbedded fine SAND to medium and coarse SAND with trace gravel	
	No seepage	
	No caving	
	Test Pit TP-3	
0.0 - 5.0	Dense, damp, grey, silty SAND with some gravel and pockets of organics and roots (Fill)	
5.0 - 7.5	Dense, damp, light brown, fine SAND with some silt	
7.5 - 8.0	Very dense, damp, grey, silty SAND with some gravel (Glacial Till)	
	No seepage	
	No caving	
	Test Pit TP-4	
0.0 - 5.5	Dense, damp, grey, silty SAND with some gravel (Fill)	
5.5 - 7.0	Dense, damp, light brown, silty SAND with trace roots	
7.0 - 8.0	Very dense, damp, grey, silty SAND with some gravel (Glacial Till)	
	No seepage	
	No caving	

RZA

RITTENHOUSE-ZEMAN & ASSOC., INC.
Geotechnical / Hydrogeological Consultants

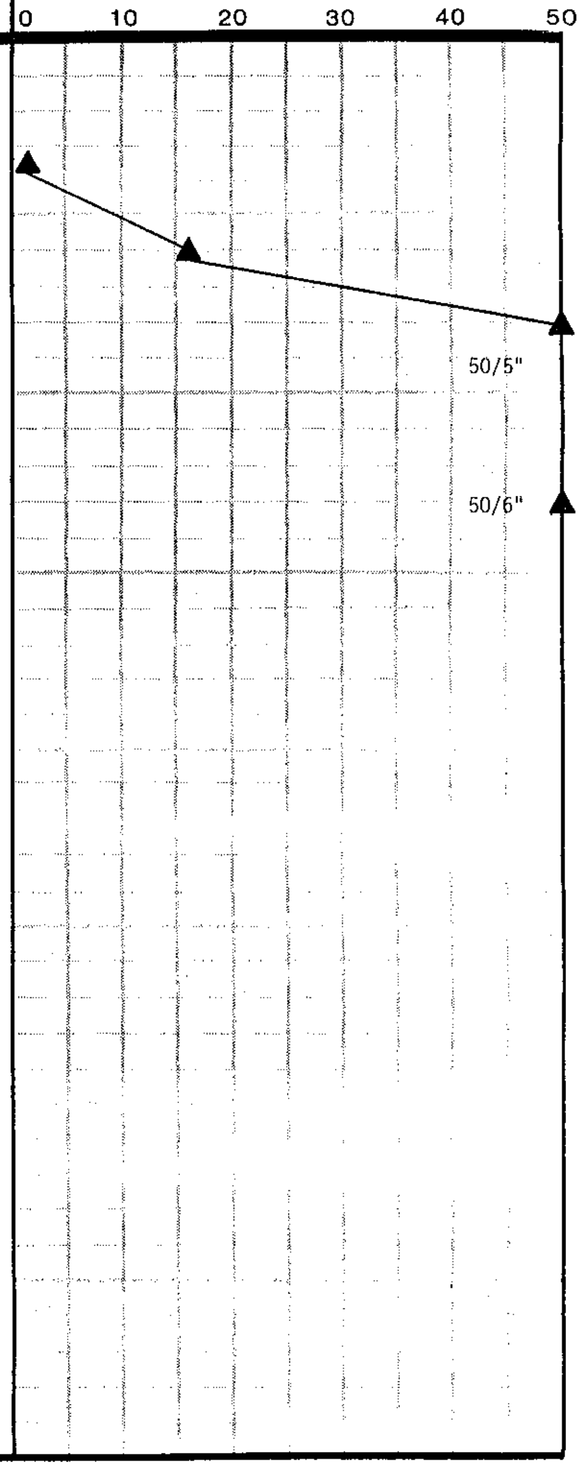
BORING NUMBER B-1 W.O. W-6027

PROJECT NAME Central Kitsap Junior High School

SOIL DESCRIPTION	DEPTH (FEET)	LAB TESTS	SAMPLING	GROUND WATER
Ground Surface Elevation Approximately Feet	0			
Very loose to medium dense, moist, brown/gray, silty, fine to medium SAND, with some coarse sand and gravel, trace organics to 4 feet (FILL)	0–7		1, 2	
Very dense, moist, gray, silty, fine to medium SAND, with some coarse sand and gravel (GLACIAL TILL)	7–13		3, 4	
Completed 22 February 1989 Drilled to 13 feet				

Depth scale (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40

STANDARD PENETRATION RESISTANCE
▲ BLOWS PER FOOT
(140 lb. hammer, 30 inch drop)



SAMPLING
- I 2" OD SPLIT SPOON SAMPLE
- II 3" OD SHELBY SAMPLE
- ⊠ 2.5" ID RING SAMPLE
- B BULK SAMPLE
- * SAMPLE NOT RECOVERED

GROUND WATER
- SEAL
- DATE
- WATER LEVEL AT TIME OF DRILLING (ATD)
- OBSERVATION WELL TIP

LABORATORY TESTS
- ● % WATER CONTENT
- NP NON PLASTIC
- LIQUID LIMIT
- NATURAL WATER CONTENT
- PLASTIC LIMIT

RZA

RITTENHOUSE-ZEMAN & ASSOC., INC.
Geotechnical / Hydrogeological Consultants

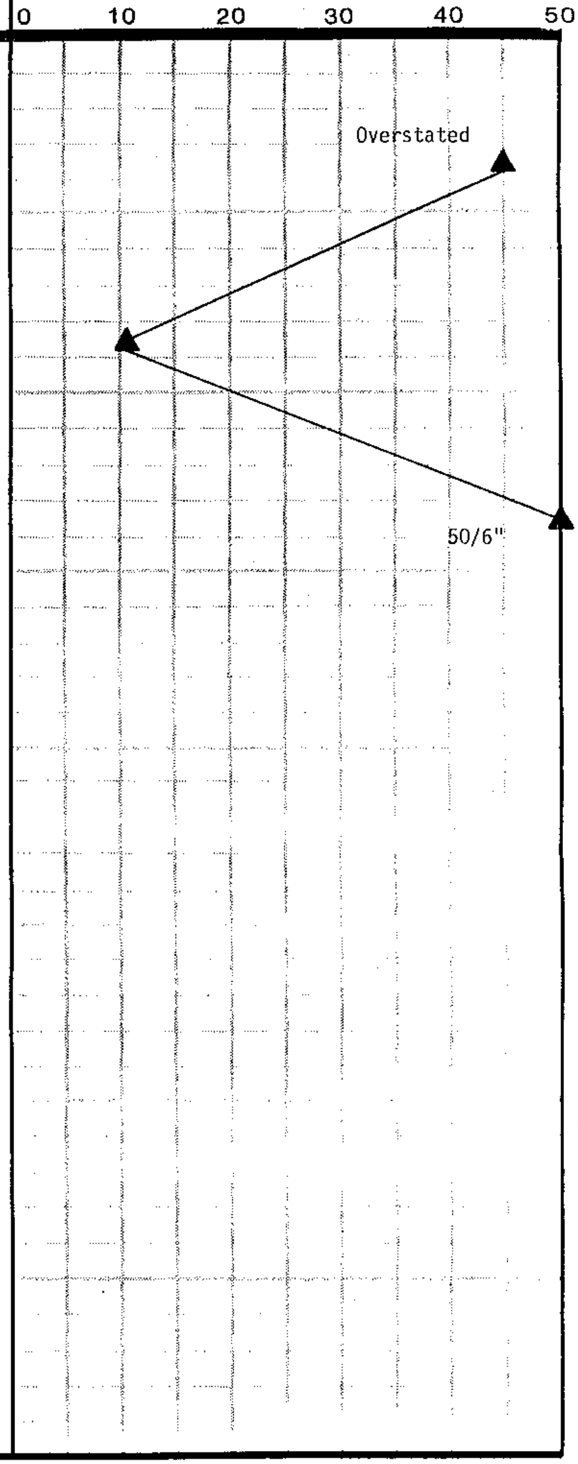
BORING NUMBER B-2   W.O. W-6027

PROJECT NAME Central Kitsap Junior High School

SOIL DESCRIPTION	DEPTH (FEET)	LAB TESTS	SAMPLING	GROUND WATER
Ground Surface Elevation Approximately ___ Feet	0			
Loose to medium dense, moist, brown to brown/gray, silty, fine to medium SAND, with some coarse snad and gravel, trace organics and wood fragments (FILL)	0–10		I (1) at ~3–4 ft; I at ~8–9 ft	
Very dense, moist, gray/brown, silty, fine to medium SAND, with some coarse sand and gravel (GLACIAL TILL)	10–13.5		I at ~13 ft	
Completed 22 February 1989 Drilled to 13.5 feet				

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40

STANDARD PENETRATION RESISTANCE
▲ BLOWS PER FOOT
(140 lb. hammer, 30 inch drop)



SAMPLING
- I 2" OD SPLIT SPOON SAMPLE
- II 3" OD SHELBY SAMPLE
- ⊠ 2.5" ID RING SAMPLE
- B BULK SAMPLE
- * SAMPLE NOT RECOVERED

GROUND WATER
- SEAL
- DATE
- WATER LEVEL AT TIME OF DRILLING (ATD)
- OBSERVATION WELL TIP

LABORATORY TESTS
- ● % WATER CONTENT
- NP NON PLASTIC
- LIQUID LIMIT
- NATURAL WATER CONTENT
- PLASTIC LIMIT

RZA *RITTENHOUSE-ZEMAN & ASSOC., INC.*
Geotechnical / Hydrogeological Consultants

BORING NUMBER B-3 W.O. W-6007
PROJECT NAME Central Kitsap Junior High School

SOIL DESCRIPTION	DEPTH (FEET)	LAB TESTS	SAMPLING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ BLOWS PER FOOT (140 lb. hammer, 30 inch drop) 0 10 20 30 40 50
Ground Surface Elevation Approximately Feet	0				
Medium dense, moist, brown, silty, gravelly, fine to medium SAND, with some coarse sand (Fill)					
Very dense, moist, brown/gray, silty, gravelly, fine to medium SAND with some coarse sand (GLACIAL TILL)			1 I		50/6" ▲
	5		2 I		50/6" ▲
			3 I		50/6" ▲
Completed 22 February 1989 Derilled to 8 feet	10				
	15				
	20				
	25				
	30				
	35				
	40				

SAMPLING
- I 2" OD SPLIT SPOON SAMPLE
- II 3" OD SHELBY SAMPLE
- ⊠ 2.5" ID RING SAMPLE
- B BULK SAMPLE
- * SAMPLE NOT RECOVERED

GROUND WATER
- SEAL
- DATE
- WATER LEVEL AT TIME OF DRILLING ▽ ATD
- OBSERVATION WELL TIP

LABORATORY TESTS
- ● % WATER CONTENT
- NP NON PLASTIC
- PLASTIC LIMIT — NATURAL WATER CONTENT — LIQUID LIMIT

APPENDIX B

Geotechnical Laboratory Testing Procedures and Results

APPENDIX B
GEOTECHNICAL LABORATORY TESTING PROCEDURES AND RESULTS
Central Kitsap High School and Middle School Campus Redevelopment
Silverdale, Washington

The following paragraphs describe procedures associated with the laboratory tests conducted for this project. Graphical results of certain laboratory tests are enclosed in this appendix.

VISUAL CLASSIFICATION PROCEDURES

Visual soil classifications were conducted on all samples in the field and on selected samples in the laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs contained in Appendix A.

MOISTURE CONTENT DETERMINATION PROCEDURES

Moisture content determinations were performed on representative samples to aid in identification and correlation of soil types. All determinations were made in general accordance with ASTM D-2216. The results of these tests are shown on the exploration logs contained in Appendix A.

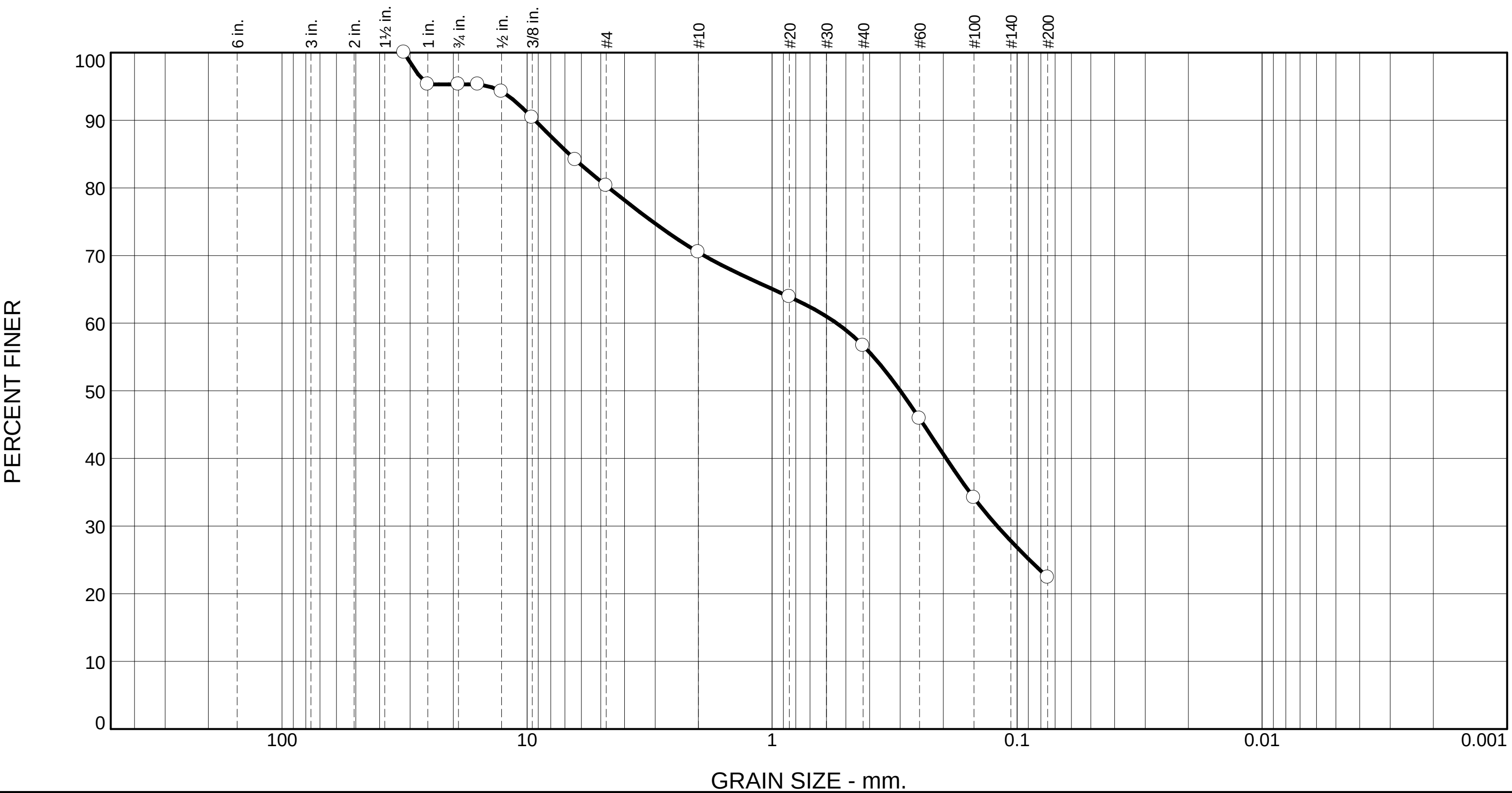
GRAIN-SIZE ANALYSIS PROCEDURES

A grain-size analysis indicates the range of soil particle diameters included in a particular sample. Grain-size analyses were performed on representative samples in general accordance with ASTM D-422. The results of these tests are presented on the enclosed grain-size distribution graphs and were used in soil classifications shown on the exploration logs contained in Appendix A.

200-WASH PROCEDURES

A 200-wash is a procedure in which the fine-grained soil fraction is separated from the sand and gravel by washing the soil on a U.S. No. 200 Sieve. A 200-wash was performed on selected soil samples obtained from our borings in general accordance with ASTM D-1140, Test Method for Amount of Material in Soils Finer than the No. 200 (75-μm) Sieve. The results of these analyses were used in soil classifications shown on the exploration logs presented in Appendix A.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	15.0	9.8	13.8	34.3	22.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.25"	100.0		
1"	95.3		
3/4"	95.3		
5/8"	95.3		
1/2"	94.3		
3/8"	90.4		
1/4"	84.2		
#4	80.3		
#10	70.5		
#20	63.9		
#40	56.7		
#60	45.9		
#100	34.2		
#200	22.4		

* (no specification provided)

Soil Description

Silty sand with gravel
As Received Moisture: 9.2%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 9.2904 D_{85}= 6.7329 D_{60}= 0.5449
D_{50}= 0.2996 D_{30}= 0.1206 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-1, S-1
Depth: 2.5-4.0

Date: 9/14/2016

Terracon Consultants, Inc.

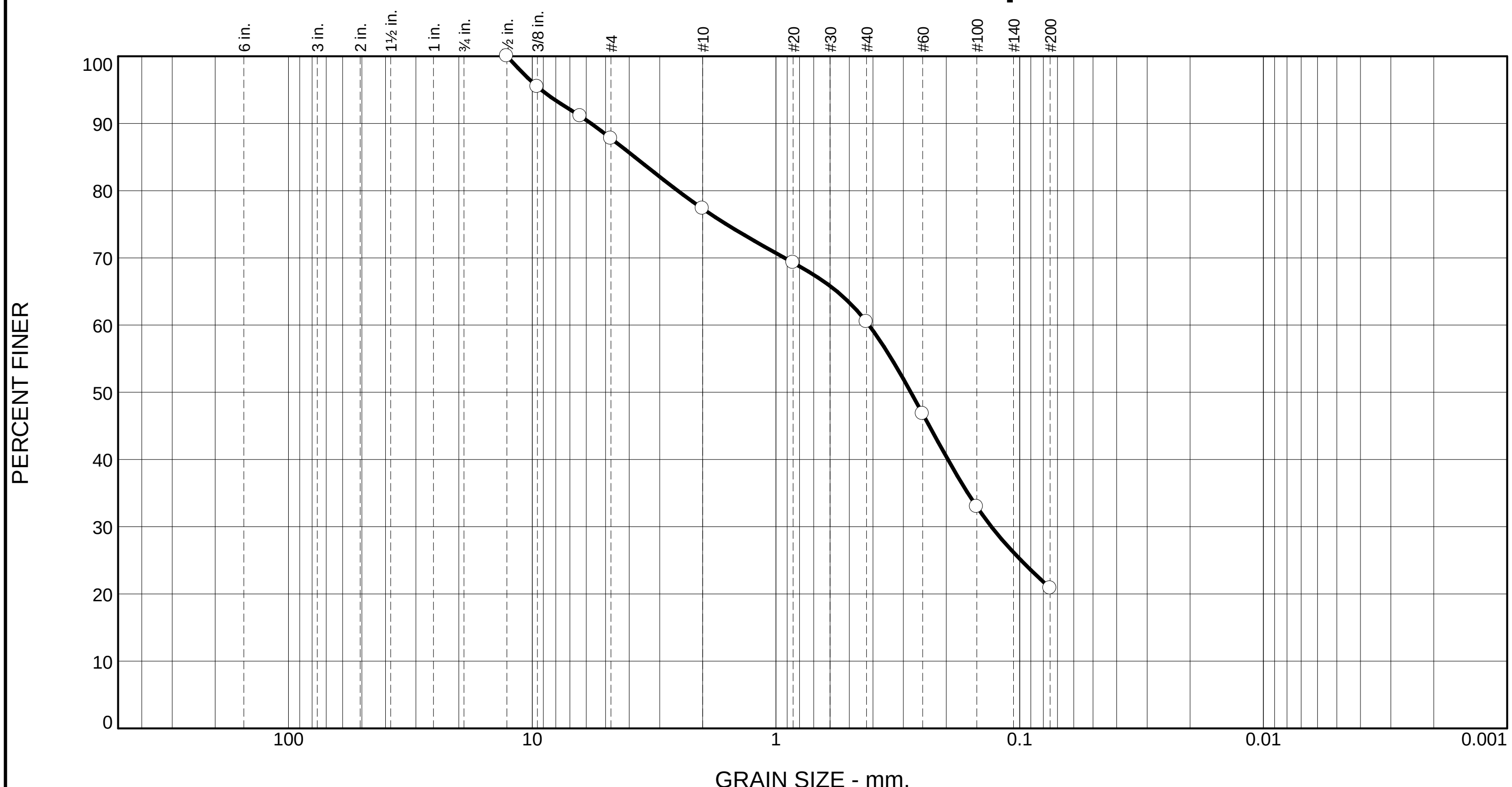
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.2	10.5	16.8	39.7	20.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	95.5		
1/4"	91.1		
#4	87.8		
#10	77.3		
#20	69.3		
#40	60.5		
#60	46.8		
#100	33.0		
#200	20.8		

* (no specification provided)

Soil Description

Silty sand
As Received Moisture: 12.1%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 5.7417 D_{85}= 3.7952 D_{60}= 0.4153
D_{50}= 0.2796 D_{30}= 0.1306 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-3, S-1
Depth: 2.5-4.0

Date: 9/14/2016

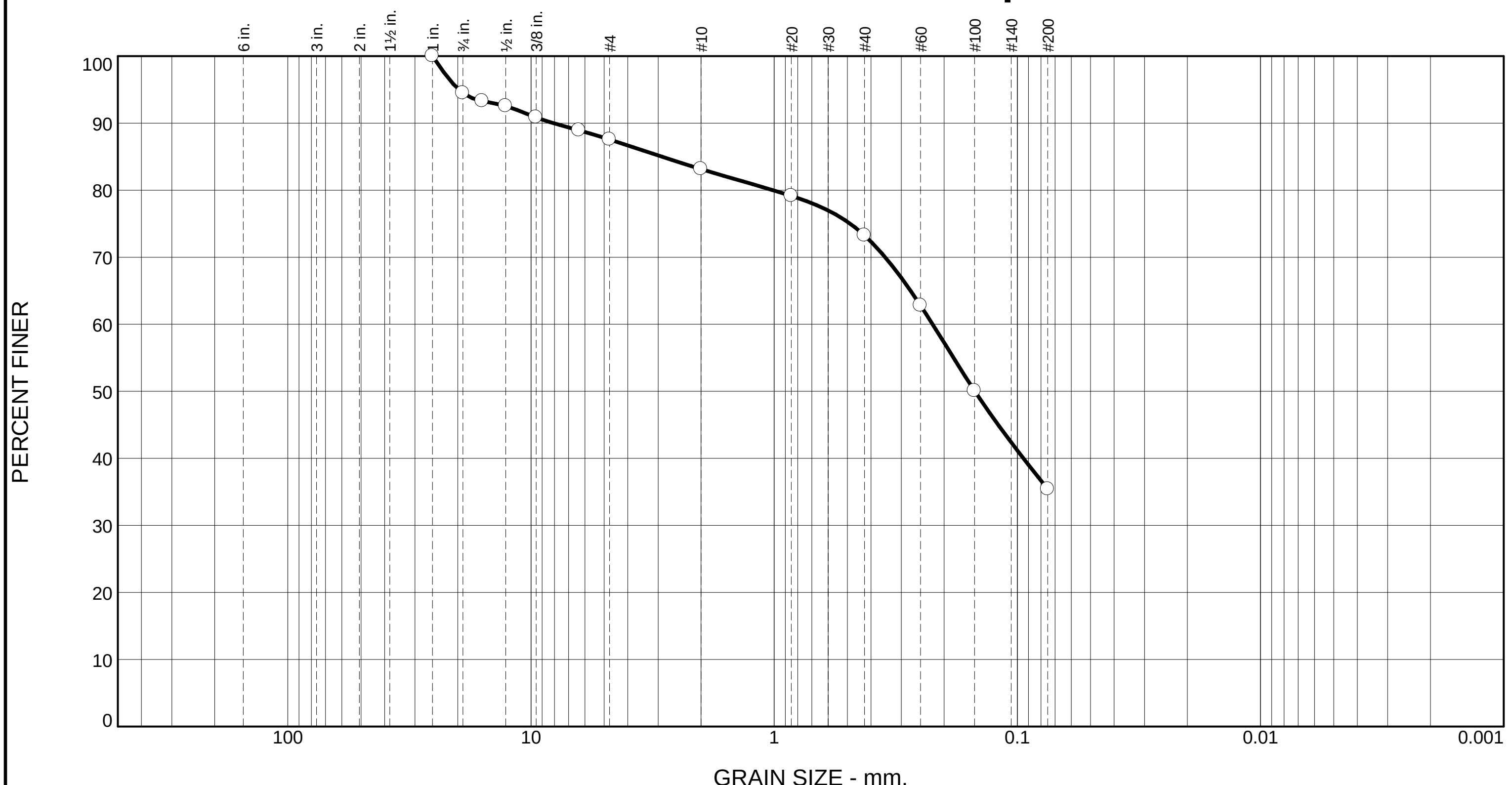
Terracon Consultants, Inc.

Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS
Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.5	6.9	4.5	9.9	37.8	35.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	94.5		
5/8"	93.3		
1/2"	92.5		
3/8"	90.8		
1/4"	88.9		
#4	87.6		
#10	83.1		
#20	79.1		
#40	73.2		
#60	62.8		
#100	50.1		
#200	35.4		

* (no specification provided)

Soil Description

Silty sand
As Received Moisture: 7.0%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 8.0922 D_{85}= 2.8948 D_{60}= 0.2231
D_{50}= 0.1495 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-4, S-2
Depth: 5-6.5

Date: 9/14/2016

Terracon Consultants, Inc.

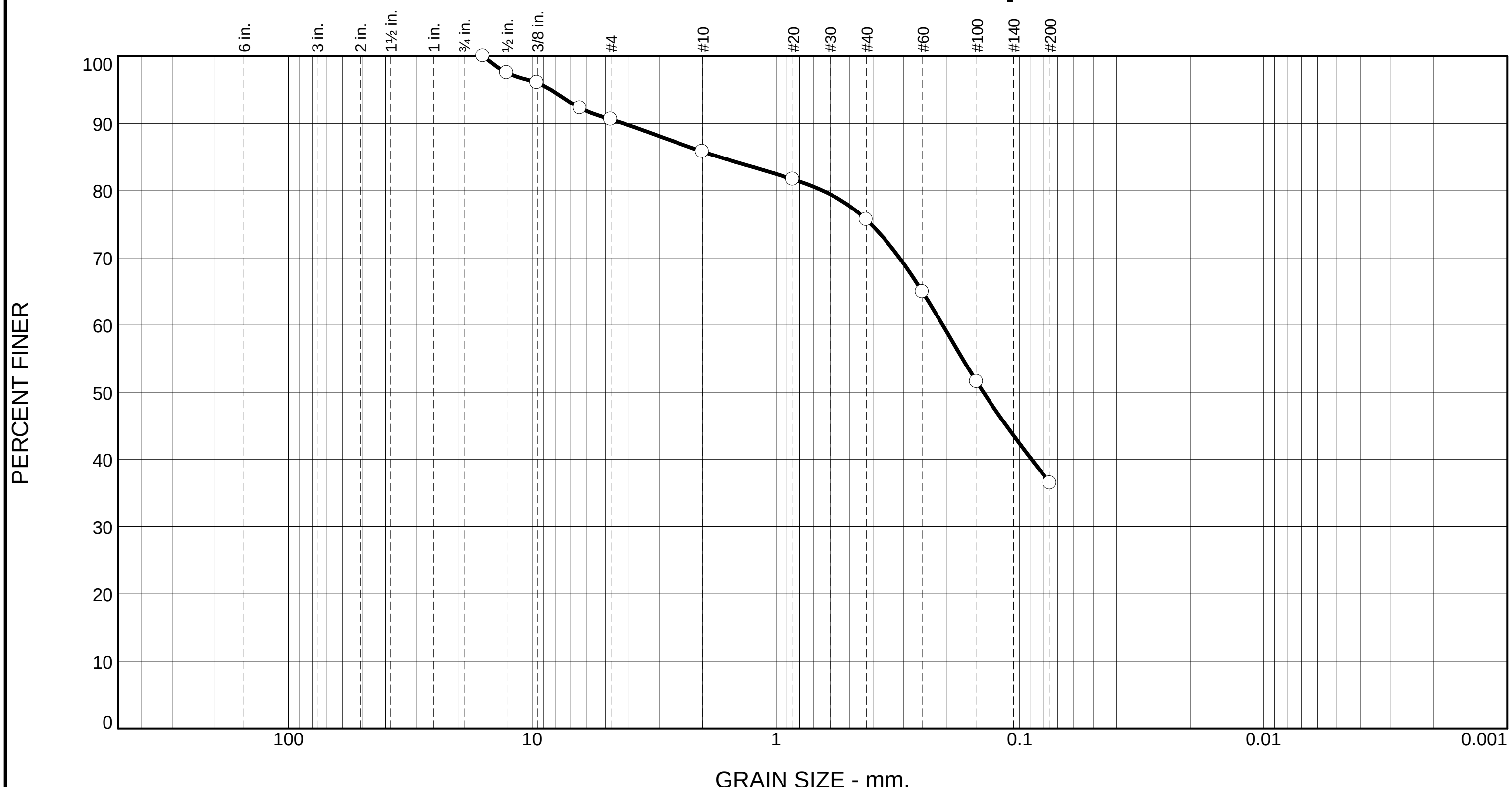
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.4	4.8	10.1	39.2	36.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5/8"	100.0		
1/2"	97.5		
3/8"	96.0		
1/4"	92.3		
#4	90.6		
#10	85.8		
#20	81.7		
#40	75.7		
#60	64.9		
#100	51.5		
#200	36.5		

* (no specification provided)

Soil Description

Silty sand
As Received Moisture: 7.7%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 4.2216 D_{85}= 1.7052 D_{60}= 0.2069
D_{50}= 0.1408 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-4, S-3
Depth: 10-11.5

Date: 9/14/2016

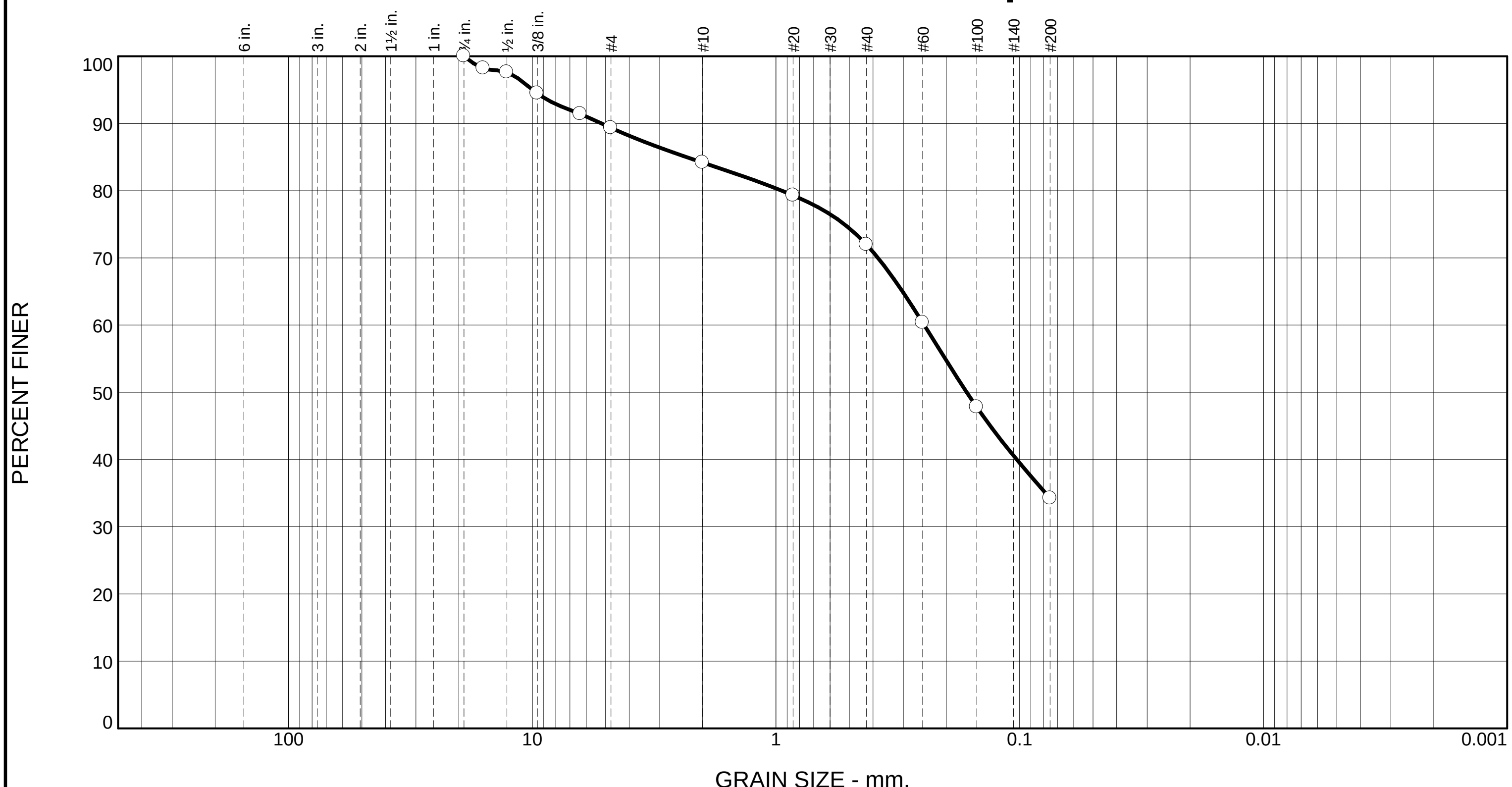
Terracon Consultants, Inc.

Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS
Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.7	5.1	12.2	37.8	34.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
5/8"	98.2		
1/2"	97.6		
3/8"	94.5		
1/4"	91.4		
#4	89.3		
#10	84.2		
#20	79.3		
#40	72.0		
#60	60.4		
#100	47.8		
#200	34.2		

* (no specification provided)

Soil Description

Silty sand
As Received Moisture: 8.5%

Atterberg Limits

PL= NP   LL= NV   PI=

Coefficients

D_{90}= 5.2014 D_{85}= 2.3313 D_{60}= 0.2464
D_{50}= 0.1649 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM   AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-5, S-3
Depth: 10-11.5

Date: 9/14/2016

Terracon Consultants, Inc.

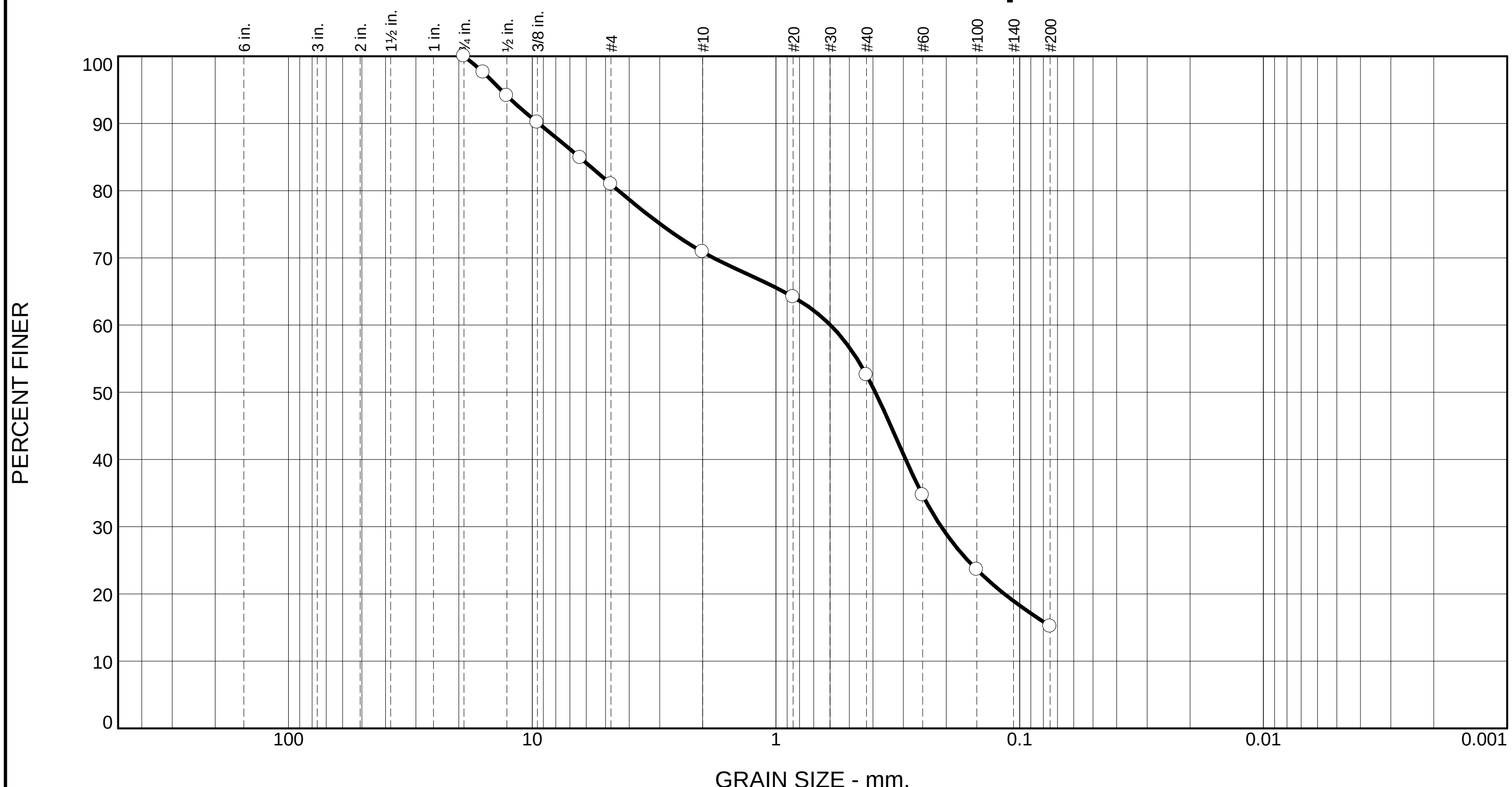
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0   **Figure**

Tested By: Ryan G   **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.1	10.0	18.3	37.4	15.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
5/8"	97.6		
1/2"	94.1		
3/8"	90.2		
1/4"	84.9		
#4	80.9		
#10	70.9		
#20	64.2		
#40	52.6		
#60	34.7		
#100	23.6		
#200	15.2		

* (no specification provided)

Soil Description

Silty sand with gravel
As Received Moisture: 4.7%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 9.4027 D_{85}= 6.4033 D_{60}= 0.5973
D_{50}= 0.3909 D_{30}= 0.2098 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-8, S-3
Depth: 10-11.5

Date: 9/14/2016

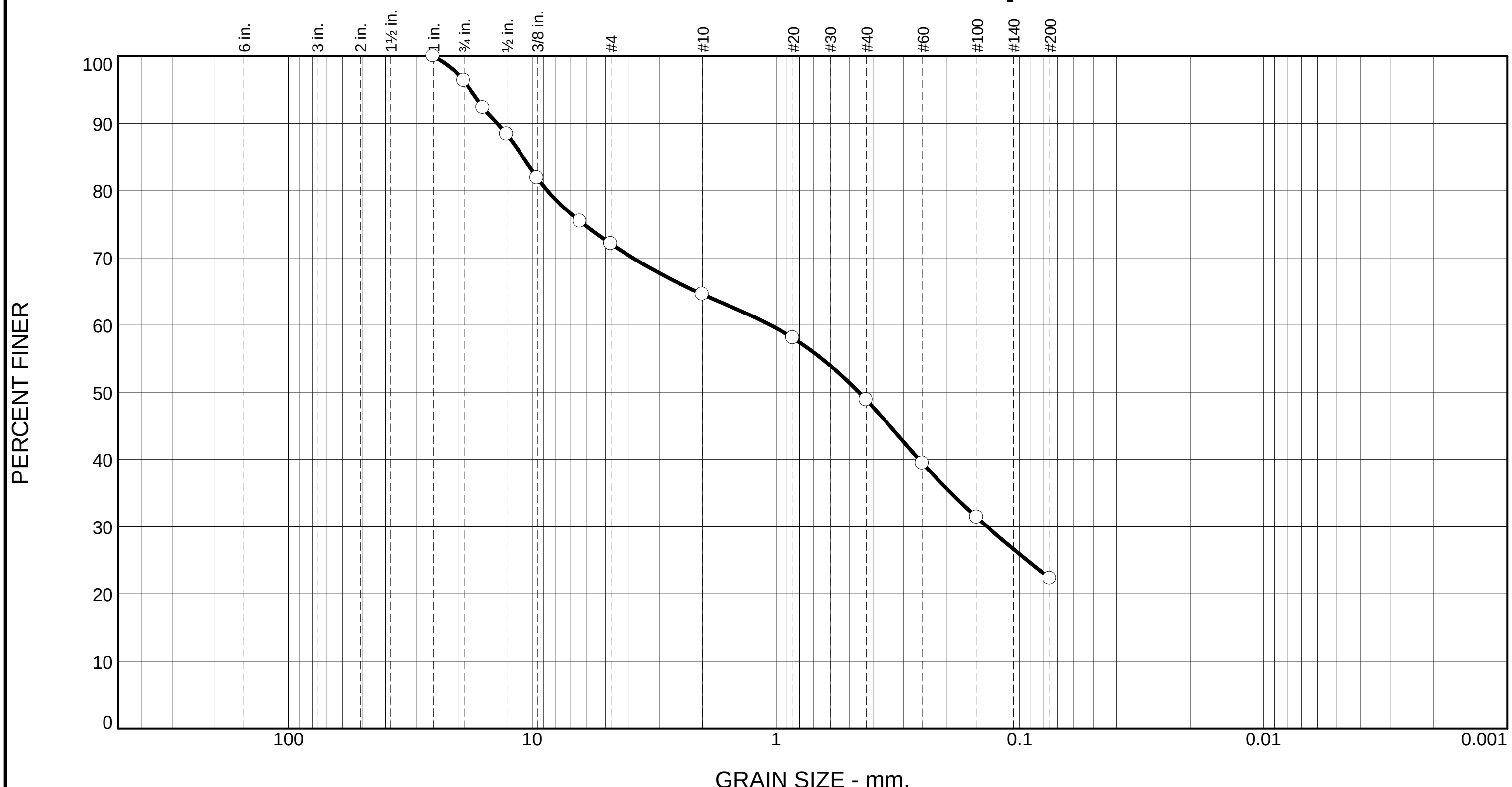
Terracon Consultants, Inc.

Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS
Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.6	24.3	7.5	15.8	26.5	22.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	96.4		
5/8"	92.3		
1/2"	88.4		
3/8"	81.9		
1/4"	75.4		
#4	72.1		
#10	64.6		
#20	58.1		
#40	48.8		
#60	39.4		
#100	31.4		
#200	22.3		

* (no specification provided)

Soil Description

Silty sand with gravel
As Received Moisture: 5.8%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 13.9253 D_{85}= 10.9039 D_{60}= 1.0531
D_{50}= 0.4562 D_{30}= 0.1360 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-9, S-2
Depth: 5-6.5

Date: 9/14/2016

Terracon Consultants, Inc.

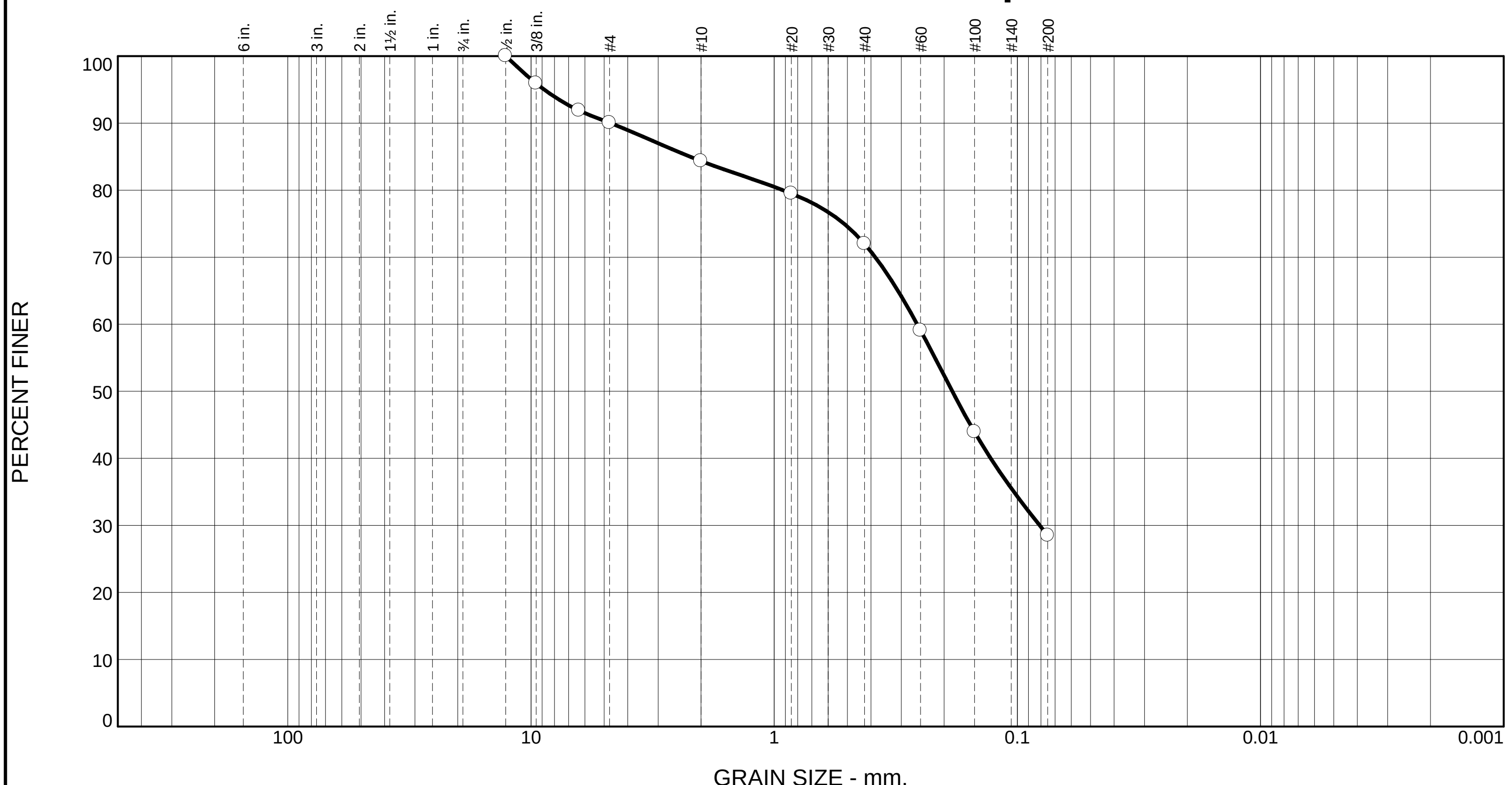
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.0	5.7	12.3	43.5	28.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	95.9		
1/4"	91.9		
#4	90.0		
#10	84.3		
#20	79.5		
#40	72.0		
#60	59.1		
#100	43.9		
#200	28.5		

* (no specification provided)

Soil Description

Silty sand
As Received Moisture: 6.6%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 4.7143 D_{85}= 2.2209 D_{60}= 0.2581
D_{50}= 0.1851 D_{30}= 0.0809 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-11, S-3
Depth: 10-11.5

Date: 9/14/2016

Terracon Consultants, Inc.

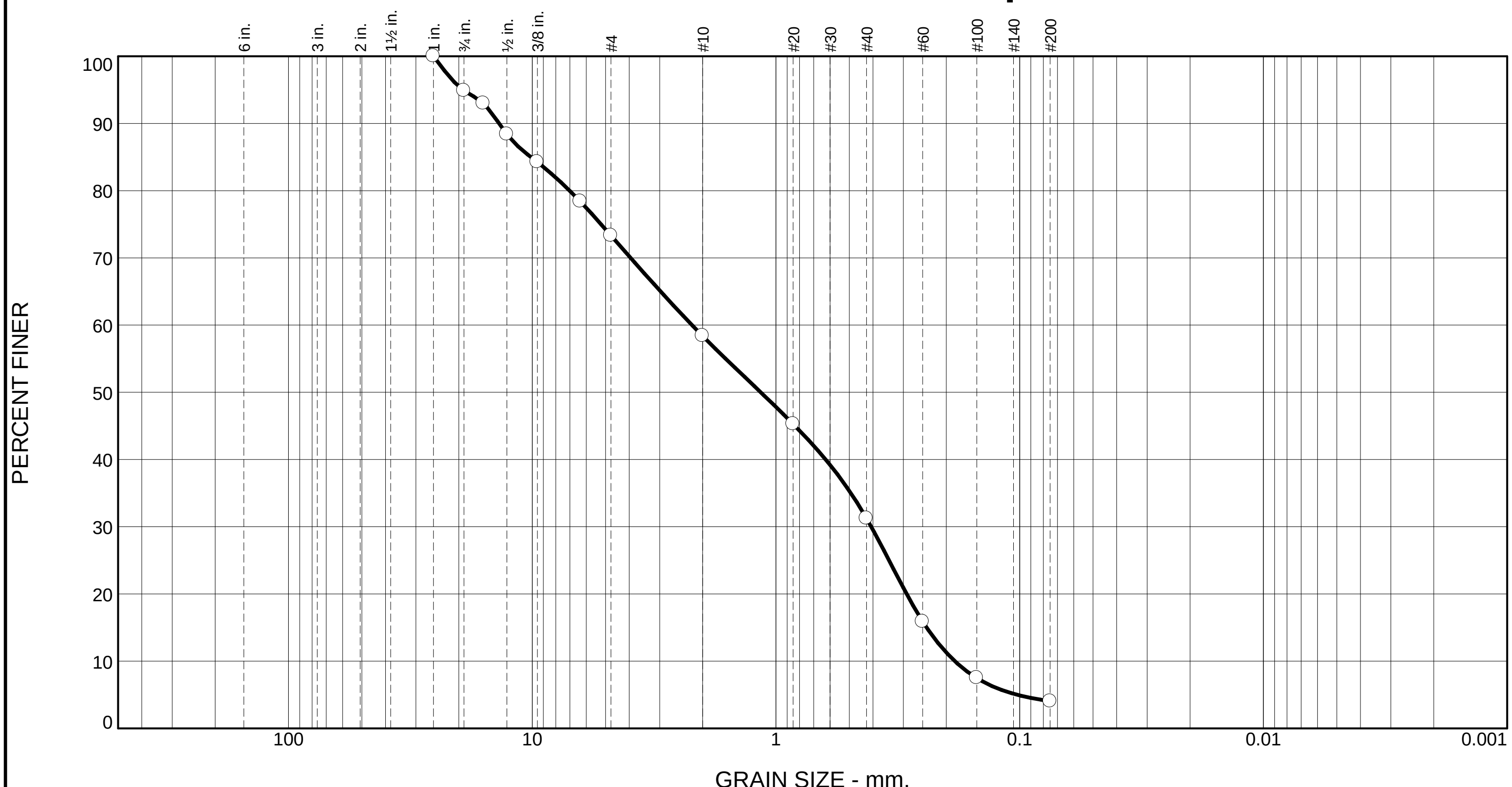
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.1	21.6	14.9	27.2	27.2	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	94.9		
5/8"	93.0		
1/2"	88.4		
3/8"	84.3		
1/4"	78.4		
#4	73.3		
#10	58.4		
#20	45.3		
#40	31.2		
#60	15.9		
#100	7.5		
#200	4.0		

* (no specification provided)

Soil Description

Poorly graded sand with gravel
As Received Moisture: 0.6%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 13.6798 D_{85}= 10.1238 D_{60}= 2.2101
D_{50}= 1.1544 D_{30}= 0.4064 D_{15}= 0.2409
D_{10}= 0.1846 C_u= 11.97 C_c= 0.40

Classification

USCS= SP AASHTO= A-1-b

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-11, S-6
Depth: 25-26.5

Date: 9/14/2016

Terracon Consultants, Inc.

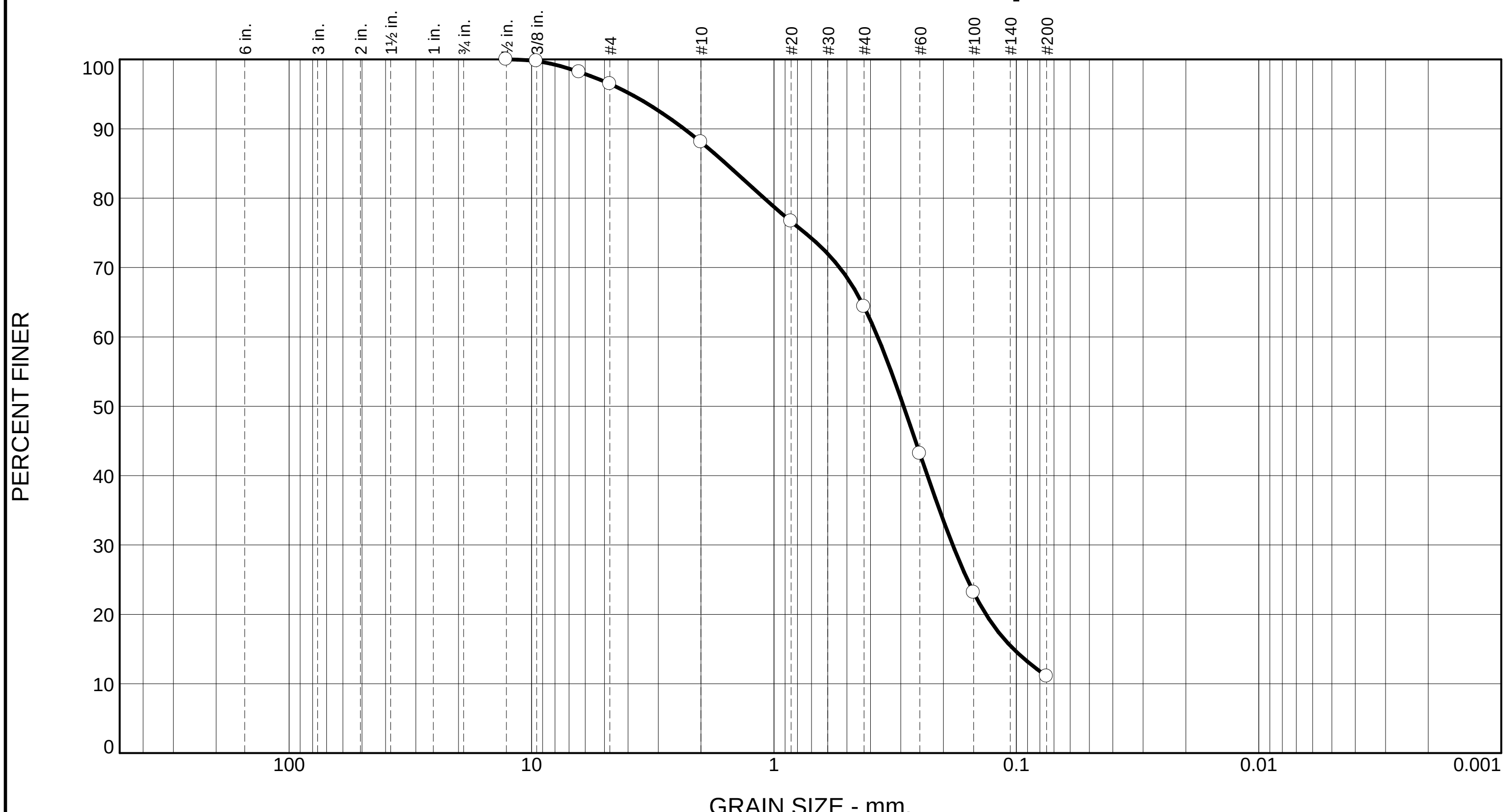
Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

Tested By: Ryan G **Checked By:** Jeff W

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.5	8.4	23.7	53.3	11.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	99.8		
1/4"	98.2		
#4	96.5		
#10	88.1		
#20	76.6		
#40	64.4		
#60	43.2		
#100	23.1		
#200	11.1		

* (no specification provided)

Soil Description

Poorly graded sand with silt
As Received Moisture: 5.2%

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 2.3471 D_{85}= 1.5800 D_{60}= 0.3733
D_{50}= 0.2919 D_{30}= 0.1830 D_{15}= 0.1027
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Remarks

ASTM: C136, D1140, D2216
Sampled: 8/31/16
Sampled By: Konrad M. & Frank C.

Location: B-15, S-4A
Depth: 15-16

Date: 9/19/2016

Terracon Consultants, Inc.

Mountlake Terrace, WA

Client: Central Kitsap School District
Project: Central Kitsap HS/MS

Project No: 6-917-18096-0 **Figure**

MOISTURE CONTENT AND MINUS 200 WASH
ASTM: D2216 D1140

Job Name: Central Kitsap HS/MS	Client: Central Kitsap School District
Job Number: 6-917-18096-0	Sample Date: 8/31/2016
Date: 9/14/2016	Sampled By: Frank C. & Konrad M.

Exploration:	B-1	B-2	B-2	B-3	B-5	B-5	B-6	B-6	B-7	B-7
Sample Number:	S-2	S-1	S-2	S-2	S-1	S-2	S-1	S-2	S-1	S-2
Depth:	5-6.5	2.5-4	5-6.5	5-6.5	2.5-4	5-6.5	2.5-4	5-6.5	2.5-4	5-6.5
% Moisture	7.6%	7.6%	9.0%	8.6%	6.2%	5.8%	6.1%	7.5%	3.0%	4.7%
% -200 Wash	N/A	27.65%	N/A	N/A	17.10%	N/A	N/A	29.09%	N/A	21.80%

Exploration:	B-10	B-11	B-12	B-12	B-13	B-13	B-14	B-14	B-15	B-15
Sample Number:	S-2	S-1	S-1	S-2	S-1	S-2	S1	S-2	S-3	S-4B
Depth:	5-6.5	2.5-4	2.5-4	5-6.5	2.5-4	5-6.5	2.5-4	5-6.5	10-11.5	15-16.5
% Moisture	3.2%	4.5%	10.1%	9.2%	6.6%	8.5%	6.0%	7.2%	3.3%	14.1%
% -200 Wash	13.59%	N/A	23.02%	N/A	17.69%	N/A	24.94%	N/A	N/A	N/A

Exploration:	B-15	HB-3	HB-4	HB-5
Sample Number:	S-5	G-3	G-3	G-2
Depth:	20-21.5	2-4.0	2.5-3	2-3.0
% Moisture	18.7%	5.2%	13.0%	7.4%
% -200 Wash	13.97%	N/A	17.95%	N/A

Tested By: Jeff W.
Reveiwed By: Dave D.
Respectfully submitted,

By: Jeff Ward

Terracon
Consulting Engineers & Scientists