Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

February 13, 2024
ES-9532.01

Sage Homes Northwest, LLC
9505 – 19th Avenue Southeast, Suite 118
Everett, Washington 98208

Attention: Albert Torrico

Subject: Infiltration Evaluation
Williams Crossing
5224, 5228, and 5216 – 15th Avenue Northeast
Thurston County (Olympia), Washington

Dear Albert:

Earth Solutions NW, LLC (ESNW) has prepared this infiltration evaluation for the proposed project. ESNW performed our work in general accordance with the scope of services outlined in our proposal dated November 21, 2023, which was authorized on November 28, 2023. A summary of the subsurface exploration, laboratory analyses, and an evaluation of infiltration feasibility and related considerations are provided in this letter report.

ESNW is currently conducting a seasonal groundwater monitoring program at the subject site to supplement this letter and to further characterize on-site infiltration feasibility. The results of the seasonal groundwater monitoring program have the potential to influence the design parameters given in this letter, which should be reevaluated at the end of the monitoring period. Upon completion of the seasonal monitoring period, an additional summary letter will be provided.

Project & Site Description

The subject site is located on the north side of 15th Avenue Northeast at the intersection with Century Court Northeast, in the Olympia area of unincorporated Thurston County, Washington. The site consists of three adjoining tax parcels (Thurston County Parcel Nos. 11809310-600, -700, and -100) totaling about 18.7 acres of land area. The approximate site location is depicted on Plate 1 (Vicinity Map).

The property is currently developed with a single-family residence and associated improvements. The relatively large site is mostly undeveloped and vacant, vegetated with mature trees, understory growth, and a mixture of native plant species. The site is bordered to the east and west by similarly developed residential lots, to the north by undeveloped and forested land, and to the south by 15th Avenue Northeast.

Per Thurston County GIS mapping and ESNW site experience, topography is relatively level across the southern portion of the project site. North of the existing residence, surface grades descend at moderate gradients to the north for a total of about 70 feet of topographic relief within the parcel boundaries.

Formal site plans were not available for review at the time of letter preparation. However, we understand that a large-scale stormwater infiltration facility is proposed in the northwest portion of the project site as part of the overall site development plans, which was the focus of this letter.

Subsurface Conditions

To explore the subsurface and to characterize the on-site soil and geologic conditions as they relate to infiltration feasibility, an ESNW representative observed, logged, and sampled three borings and three test pits, all targeted at requested locations within the proposed infiltration facility footprint. The borings were completed on November 7, 2023 using a track-mounted drill rig and operators retained by ESNW. The test pits were completed on December 27, 2023 using a trackhoe and operator retained by ESNW. The borings were advanced to a maximum depth of 31.5 feet below the existing ground surface (bgs), and the test pits were advanced to a maximum depth of 18 feet bgs.

The approximate locations of the explorations are depicted on Plate 2 (Subsurface Exploration Plan). Please refer to the attached exploration logs for a more detailed description of subsurface conditions. Representative soil samples collected at the exploration locations were analyzed in general accordance with Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures. Representative soil samples were analyzed for stormwater treatment potential in the form of organic content (OC) and cation exchange capacity (CEC) testing.

Topsoil and Fill

Due to the sampling methods utilized in hollow-stem auger drilling, topsoil thicknesses were not observed at the boring locations. At the test pit locations, however, topsoil was encountered within the upper 10 to 12 inches of existing grades. Deeper or shallower pockets of topsoil may be encountered locally across the site. The topsoil was characterized by its dark brown color, the presence of fine organic material, and small root intrusions.

Fill was not observed at the November and December 2023 exploration sites.

Native Soil

Underlying the topsoil at the test locations, native soils were variable in composition and consistent with typical recessional outwash sand and silt deposits. Based on blow counts recorded during the drilling, the site soils are chiefly in a medium dense condition.

Soil compositions observed across numerous distinct soil strata included poorly graded sand, silty sand, sandy silt, and silt (USCS: SP, SM, and ML). Laminations and interbeds ranging in thickness from inch-scale to foot-scale were observed at variable depths at the exploration sites.

In general, at the test pit locations, silt-dominant soils were encountered immediately below the topsoil and extended to depths between six and ten and one-half feet bgs. Underlying the silts, sand-dominant soils were encountered and generally extended to depths between 15 and 17 feet bgs. Thin, inch-scale laminations were observed within the upper one to two feet of the sand-dominant soils described above. Thicker, foot-scale interbeds of silt-dominant soils were encountered beginning at 15 to 17 feet bgs. At test locations TP-2 and TP-3, relatively free-draining, sand-dominant soils were exposed again below the foot-scale silty interbeds and extended to the termination depth of the explorations. Test pit TP-1 was terminated within a section of silt-dominant soils due to maximum excavator reach.

Laboratory analyses of representative soil samples indicate that fines contents ranged between about 4 and 98 percent. The in-situ moisture content ranged from moist to wet at the time of the exploration.

Geologic Setting

The referenced geologic map indicates the site is underlain by recessional sand and minor silt deposits of Late Vashon age (Qgos).

As reported on the geologic map, the mapped recessional deposits consist of moderately well-sorted fine- to medium-grained sand with minor silt, deposited in and around the margins of glacial lakes. This geologic unit is thought to have been deposited largely during deglaciation when there was stagnant ice occupying much of the southern Puget Lowland.

The referenced WSS resource indicates the site is mantled by the following USDA soil units: Giles silt loam on slopes from 0 to 15 percent, Hoogdal silt loam on slopes from 15 to 30 percent, Indianola loamy sand on slopes from 15 to 30 percent, and Skipopa silt loam on slopes from 3 to 15 percent. Skipopa and Giles series soils surface about 80 percent of the project site.

Per the referenced USDA soil survey report, surface water runoff, erosivity, parent material, and geomorphic position for the identified soil types are as follows:

- Giles series soils maintain slow runoff and slight erosion hazard, formed in volcanic ash and glacial outwash on terraces.

- Hoogdal series soils maintain medium runoff and moderate erosion hazard, formed in loess and glaciolacustrine sediments on terrace escarpments.

- Indianola series soils maintain medium runoff and moderate erosion hazard, formed in sandy glacial drift on terrace escarpments.

- Skipopa series soils maintain slow runoff and slight erosion hazard, formed in volcanic ash and loess over glaciolacustrine sediments on terraces.

Based on conditions observed during the fieldwork, in our opinion, the native soils are representative of stratified recessional outwash deposits and are consistent with the geologic and soil mapping resources reviewed in this section.

Groundwater

Groundwater was observed at two exploration sites completed during the November and December 2023 fieldwork: at boring B-2, heavy groundwater seepage was delineated at approximately 30 feet bgs. At test pit TP-1, light groundwater seepage was observed at about 6 feet bgs, and, after completion of a small-scale Pilot Infiltration Test (which added roughly 2,500 gallons of water to the test hole earlier in the day), heavy seepage was observed perched at about 17 feet bgs.

Groundwater monitoring wells were installed at boring locations B-1, B-2, and B-3. All three wells were installed to their respective bottom of boring depths (31.5 feet bgs at all locations), and the bottom 20 feet of the wells were screened. Seasonal groundwater monitoring services provided by ESNW were ongoing at the time this letter was prepared.

Zones of perched groundwater seepage are common within glacial deposits and should be expected within site excavations at depth, particularly during the wet season. Groundwater seepage rates and elevations may fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Infiltration Evaluation

Based on the results of our investigation, the proposed infiltration facility is underlain by a thick sequence of stratified recessional sand and silt deposits. Large volumes of relatively free-draining sand-dominant soils were observed, and provided adequate separation from the seasonal water table and/or low permeability soil layers is maintained, it is our opinion that full infiltration is considered feasible from for this project from a geotechnical standpoint.

Design Infiltration Rates

To provide design infiltration rates for the proposed infiltration facility, ESNW completed two small-scale Pilot Infiltration Tests (PITs) in general accordance with the requirements of the City of Lacey 2022 Stormwater Design Manual (2022 COLSDM) for which the project is vested. Small-scale PITs were utilized instead of large-scale PITs in this case due to the high infiltration rate of the native soils and limited access to a water source.

The PITs were completed at test locations TP-1 and TP-2 at depths of approximately 9 and 10 feet bgs, respectively, as requested by the project civil engineer and within representative sections of the native recessional sand deposits. Both PITs were completed within the previously described sand-dominant soil strata (USCS: SP) of the identified recessional deposits, which were classified in the lab as USDA soil type: *slightly gravelly sand* at the testing depths within both PIT locations.

The following table presents the measured (K_{sat} initial) and design (K_{sat} design) infiltration rates, as well as the required correction factors for site variability and number of locations tested (CF_v), test method (CF_t), and the degree of influent control to prevent siltation and bio-buildup (CF_m).

Test Pit ID	Test Depth	K_{sat} initial	CF_v	CF_t	CF_m	K_{sat} design
TP-1	9 ft	82 in/hr	0.33	0.5	0.9	12 in/hr
TP-2	10 ft	21 in/hr				3 in/hr

In consideration of the variability between measured rates, design rates, and the soil types outlined in the table above, we recommend a conservative, **facility-wide design infiltration rate of 3 in/hr** be utilized for this project. ESNW must be provided with the opportunity to observe soil conditions at the facility subgrade as they are exposed during construction to confirm suitable soils are exposed across the facility footprint.

Based on the results of our in-situ infiltration testing, the identified sand-dominant recessional outwash deposits present an excellent opportunity for full on-site stormwater infiltration, and the proposed facility should be designed to interface with these soils beginning at depths between about 7.5 and 10.5 feet bgs.

Depth to Bedrock, Water Table, or Impermeable Layer

Per the 2022 COLSDM (Chapter 7 – Section 7.2.2 – Step 2), the base of all infiltration basins, trenches, or galleries shall be a minimum of five feet above the seasonal high groundwater levels, bedrock, dense glacial till ("hardpan"), or other low permeability layer. Reduced vertical separation down to three feet may be considered pending further analyses of groundwater mounding potential, facility geometry, volumetric capacity, and overflow/bypass design. Groundwater mounding analyses may be necessary and should consider the results of the seasonal groundwater monitoring program, which was ongoing at the time of letter preparation.

Subsurface conditions observed during the fieldwork indicate the native soils are stratified with alternating layers of silt- and sand-dominant soils that are variable in thickness and depth. As noted in the *Native Soil* section of this letter, laboratory analyses of representative soil samples indicate that fines contents ranged between about 4 and 98 percent. Silt-dominant soil layers with high fines content are considered "low permeability layers," and should be considered in the infiltration BMP design.

In our opinion, due to the sampling methods employed in hollow-stem auger drilling (under typical conditions, 18 inches of sample recovered for every 5 feet of drilling), there is a distinct possibility that the thicker (i.e. one- to two-foot thick), silt-dominant interbeds observed at the test pit locations were completely bypassed by the exploratory drilling and sampling. Test pit excavations provide an opportunity for "continuous" observation of the soil profile, and therefore provide higher resolution data for use in geotechnical design. In our opinion, the general lack of similar, one- to two-foot thick silty interbeds on the boring logs may not be representative of actual conditions regarding the presence of low permeability layering. In this case, it is pertinent to rely on the test pit observations in the evaluation of vertical separation from hydraulically restrictive soil layers.

Based on the test pit observations, sections of favorable sand for which the design infiltration rates were provided above were observed as follows:

- Test Pit TP-1 between 7.5 and 17 feet bgs (9.5 feet of exposure)
- Test Pit TP-2 between 9 and 15.5 feet bgs (6.5 feet of exposure)
- Test Pit TP-3 between 10.5 and 15 feet bgs (4.5 feet of exposure)

It is important to note that the subsurface exploration activities expose a small fraction of surface area within the proposed facility footprint, and that the native soils – while relatively consistent in geological terms (recessional outwash soil deposits encountered throughout subsurface explorations across the site) – are subject to wide variations in fines content over short lateral and vertical distances, as evidenced by the test pit observations and supporting sieve analyses.

As such, it is our opinion that a contingency should be provided in the budget to account for potential overexcavations necessary to expose favorable soils in areas of the infiltration facility footprint. Where silt-dominant soils may be exposed at infiltration BMP facility subgrades, the excavation would likely need to be further advanced to expose free-draining, granular soils (similar to those tested in this evaluation).

Soil Suitability for Infiltration Treatment

In accordance with the requirements of the 2022 COLSDM (Chapter 8 – Section 8.6.3), we evaluated the native soil for runoff treatment feasibility based on the required soil suitability criteria. In our evaluation, the native soils do not meet the requirements for use as a treatment BMP, and a separate treatment BMP upstream of the infiltration BMP will likely be necessary.

Soil Suitability Criteria #1

Soil suitability criteria #1 states that the measured (K_{sat} initial) soil infiltration rate must be 9 inches per hour or less to be utilized for infiltration treatment. Based on the in-situ infiltration testing (and the measured and design rates provided in the table above), measured soil infiltration rates exceed the maximum allowable threshold of 9 in/hr as required by the 2022 COLSDM.

Soil Suitability Criteria #2

Soil suitability criteria #2 includes requirements for cation exchange capacity (CEC), organic content (OC), depth of soil used for treatment, and the use of waste fill materials.

Representative soil samples collected at the test locations were analyzed for their CEC and OC, the results of which are outlined in the table below.

Test Pit ID	Sample Depth	OC (%)	CEC (meq/100 g)
TP-1	11.0 ft	0.5	5.0
TP-2	12.0 ft	0.8	4.2

Per the 2022 COLSDM, CEC of the treatment soil must be at least 5 milliequivalents per 100 grams of dry soil, and OC of the treatment soil must be at least 1.0 percent. Based on the laboratory analyses and the thresholds outlined above, the tested soils do not meet the CEC and OC requirements for infiltration treatment.

Because the CEC and OC requirements are not met, further evaluation of the depth of soil used for treatment will have to be considered in design of the facility.

Based on our review of Thurston County online GIS mapping, the entire site is located within a Category II ("high aquifer sensitivity") Critical Aquifer Recharge Area (CARA), and a Category I ("extreme aquifer sensitivity") CARA is identified along the northern site boundary. As such, and because the soil does not meet the design requirements for infiltration treatment, a separate treatment BMP upstream of the infiltration BMP will likely be necessary to meet the 2022 COLSDM and Thurston County design standards.

Limitations & Additional Services

This letter report has been prepared for the exclusive use of Sage Homes Northwest, LLC, and its representatives. The recommendations and conclusions provided in this letter report are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. If the design assumptions outlined herein either change or are incorrect, ESNW should be contacted to review the recommendations provided in this letter report. ESNW should be contacted to review the final design to confirm that our geotechnical recommendations have been incorporated into the plans.

ESNW should be retained to provide additional consultation services as needed during future design phases of the project. ESNW can also provide earthwork observations and testing services during the construction phase of this project. Variations in the soil and groundwater conditions observed at the exploration locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this letter report if variations are encountered.

We appreciate the opportunity to be of service to you and trust this letter meets your current needs. Should you have any questions, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Brian C. Snow, L.G.
Project Geologist

Stephen H. Avril
Project Manager

02/13/2024

Kyle R. Campbell, P.E.
Senior Principal Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Subsurface Exploration Plan
Subsurface Exploration Logs
Grain Size Distribution Report
Organic Content Report
AmTest Analysis Report

cc: Sage Homes Northwest, LLC
Attention: Larry Calvin

References:

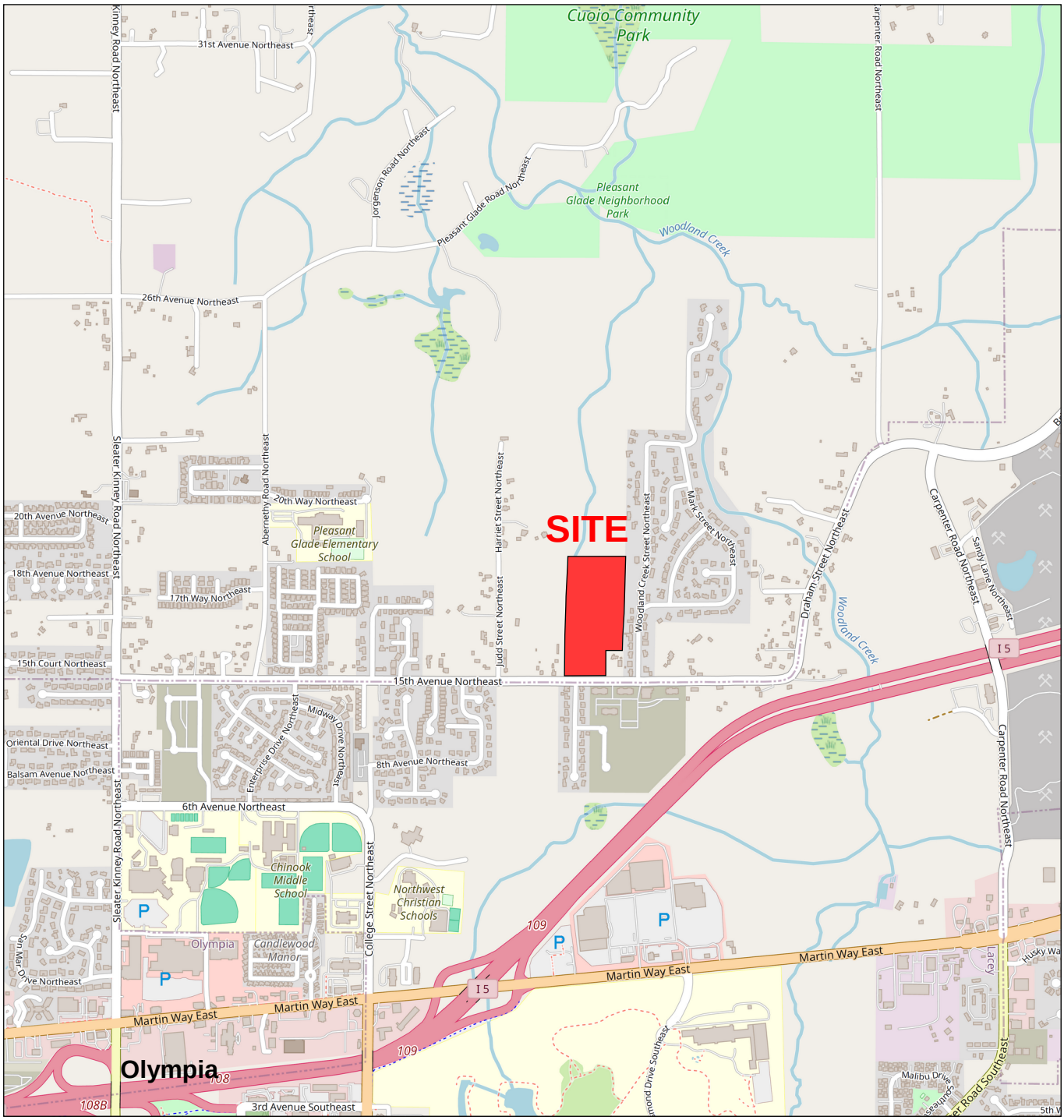
- Geotechnical Engineering Report, prepared by GeoResources, LLC, Project No. 11809310-600,-700, & -100 ThreesCompanyLLC.15thAveNE.RG, dated March 26, 2020

- Geologic Map of the Lacey 7.5-minute Quadrangle, Thurston County, Washington, by Logan, R.L., Walsh, T.J., Schasse, H.W., and Polenz, M., dated 2003

- NRCS Web Soil Survey

- Soil Survey of Thurston County, Washington, prepared by the United States Department of Agriculture, issued June 1990

- City of Lacey Stormwater Design Manual, June 2022 Edition



Reference:
Thurston County, Washington
OpenStreetMap.org

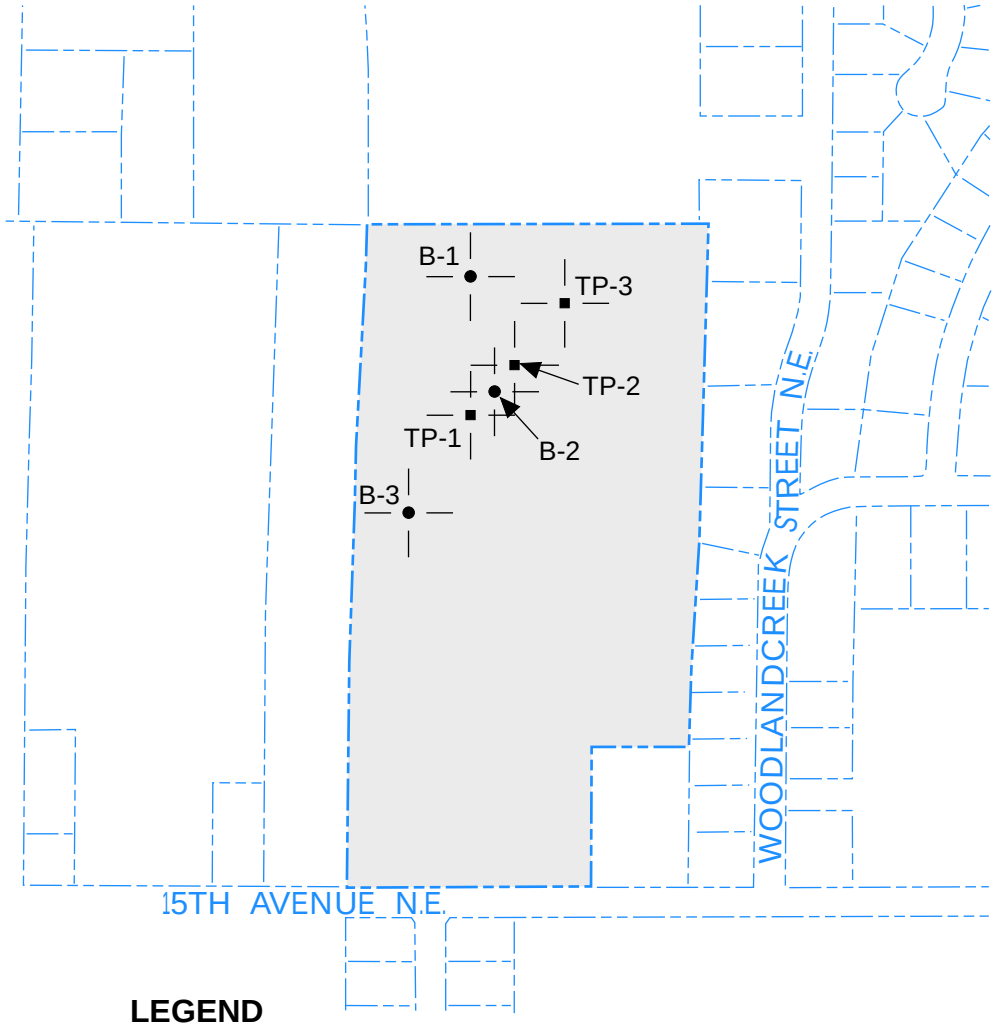
NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Williams Crossing
Thurston County (Olympia), Washington

Drawn MRS	Date 01/29/2024	Proj. No. 9532.01
Checked BCS	Date Jan. 2024	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-9532.01, Dec. 2023

B-1 — Approximate Location of ESNW Boring, Proj. No. ES-9532, Nov. 2023

Subject Site

NORTH

NOT - TO - SCALE

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Subsurface Exploration Plan
Williams Crossing
Thurston County (Olympia), Washington

Drawn MRS	Date 01/29/2024	Proj. No. 9532.01
Checked BCS	Date Jan. 2024	Plate 2

Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

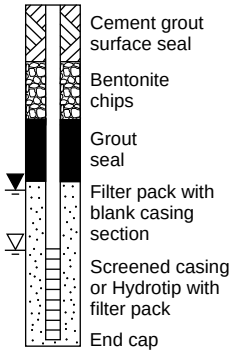
Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols

ATD = At time of drilling

Static water level (date)



Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

EXPLORATION LOG KEY

Earth Solutions NW LLC
15365 NE 90th Street, Suite 100
Redmond, WA 98052
Office (425) 449-4704 | esnw.com
Branch Office: Pasco, WA

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing
DATE STARTED 12/27/23 **COMPLETED** 12/27/23 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.06028 **LONGITUDE** -122.81417
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS Ferns/forest **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL -minor to moderate root intrusions
				1.0	
			ML		Gray SILT, dense, wet -trace iron oxide staining -blocky cuttings
5	GB	MC = 37.2 Fines = 97.6			[USDA Classification: LOAM]
				6.0	
			SM		Gray silty SAND, dense, wet -very light groundwater seepage
	GB	MC = 21.8			-inch-scale interbedding to ~7.5'
				7.5	
			SP		Gray poorly graded SAND, dense, moist -massive soil structure -infiltration test [USDA Classification: slightly gravelly SAND]
	GB	MC = 12.4 Fines = 3.6			
10					
	GB	MC = 13.9 CEC=5.0 meq/100g OC=0.5			
15					
	GB	MC = 20.9			
					-heavy post-test groundwater seepage
				17.0	
			ML		Tan sandy SILT, dense, wet
	GB	MC = 32.1 Fines = 53.6		18.0	[USDA Classification: LOAM]

Test pit terminated at 18.0 feet below existing grade due to max reach. Groundwater seepage encountered at 6.0 and 17.0 feet during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW LLC
15365 NE 90th Street, Suite 100
Redmond, WA 98052
Office (425) 449-4704 | esnw.com
Branch Office: Pasco, WA

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing
DATE STARTED 12/27/23 **COMPLETED** 12/27/23 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.06038 **LONGITUDE** -122.81401
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS Ferns/forest **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL -minor to moderate root intrusions
				1.0	
			SM		Brown silty SAND, medium dense, moist to wet
				3.0	
			ML		Gray SILT, dense, wet -trace iron oxide staining
5	GB	MC = 37.4			-mm-scale laminations -blocky cuttings
				7.0	
			SM		Gray silty SAND, dense, moist -inch-scale interbedding to 9'
	GB	MC = 16.8			
				9.0	
10	GB	MC = 10.2 Fines = 4.7	SP		Gray poorly graded SAND, dense, moist -infiltration test [USDA Classification: slightly gravelly SAND]
	GB	MC = 23.8 CEC=4.2 meq/100g OC=0.8			-moderate caving from 10' - 15' -increasing moisture
				13.0	
			SM		Gray silty SAND, dense, moist
15	GB	MC = 10.2 Fines = 16.1			[USDA Classification: loamy SAND]
				15.5	
	GB	MC = 33.2 Fines = 69.9	ML		Gray sandy SILT, dense, wet -moderate iron oxide staining [USDA Classification: LOAM]
				17.0	
			SP		Gray poorly graded SAND, dense, damp
	GB	MC = 4.9		18.0	

Test pit terminated at 18.0 feet below existing grade due to max reach. No groundwater encountered during excavation. Caving observed from 10.0 to 15.0 feet.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW LLC
15365 NE 90th Street, Suite 100
Redmond, WA 98052
Office (425) 449-4704 | esnw.com
Branch Office: Pasco, WA

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing
DATE STARTED 12/27/23 **COMPLETED** 12/27/23 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.06083 **LONGITUDE** -122.81369
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS Forest **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL -minor root intrusions
1.0			SM		Brown silty SAND, loose to medium dense, moist
2.0			ML		Gray SILT, dense, wet -trace iron oxide staining -mm and cm scale laminations
5	GB	MC = 41.3			-blocky cuttings
10					
10.5			SP		Gray poorly graded SAND, dense, moist
	GB	MC = 14.1			-slight caving 10.5' - 15'
	GB	MC = 11.7			
15	GB	MC = 31.2	ML		Gray sandy SILT, dense, wet
16.0			SP		-strong iron oxide staining near top of layer Gray poorly graded SAND, dense, moist
17.0	GB	MC = 9.7			

Test pit terminated at 17.0 feet below existing grade due to max reach. No groundwater encountered during excavation. Caving observed from 10.5 to 15.0 feet.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW LLC
15365 NE 90th Street, Suite 100
Redmond, WA 98052
Office (425) 449-4704 | esnw.com
Branch Office: Pasco, WA

BORING NUMBER B-1

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.06083 **LONGITUDE** -122.81427
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Gray SILT, loose, wet
5	SS	100	3-3-3 (6)	ML		-trace iron oxide staining
10						10.0
15	SS	100	6-7-9 (16)	SP		Gray poorly graded SAND, medium dense, damp to moist
20	SS	78	6-5-6 (11)	SM		Gray silty fine SAND, medium dense, moist
25	SS	100	8-9-11 (20)	SP		Gray poorly graded SAND, medium dense, damp to moist

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BORING NUMBER B-1

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.06083 **LONGITUDE** -122.81427
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
25	SS	89	5-7-5 (12)	SM		Gray silty fine SAND, medium dense, moist
30					30.0	
	SS		6-7-7 (14)	SP	31.5	Gray poorly graded SAND, medium dense, damp to moist

Boring terminated at 31.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC standpipe installed to bottom of boring. Lower 20.0 feet slotted. Well ID: BPG883. Boring backfilled with silica sand and bentonite chips.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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BORING NUMBER B-2

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.06022 **LONGITUDE** -122.81404
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Gray silty SAND, medium dense, moist
5	SS	100	7-8-8 (16)	SM		
10						10.0
	SS	100	4-5-6 (11)			Gray poorly graded SAND, medium dense, damp to moist
15	SS	100	5-5-6 (11)	SP		
20	SS	100	7-8-8 (16)			
25						

GENERAL BH / TP / WELL - 9532.GPJ - GINT US.GDT - 2/13/24

(Continued Next Page)

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BORING NUMBER B-2

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.06022 **LONGITUDE** -122.81404
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
25	SS	100	6-7-9 (16)	SP		Gray poorly graded SAND, medium dense, damp to moist *(continued)* -minor variations in sand grain size between fine and medium sand
30						30.0
	SS		3-3-4 (7)	ML		Tan SILT with sand, loose, wet -heavy perched groundwater seepage -trace iron oxide staining
						31.5

Boring terminated at 31.5 feet below existing grade. Groundwater seepage encountered at 30.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 20.0 feet slotted. Well ID: BPG884. Boring backfilled with silica sand and bentonite chips.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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Branch Office: Pasco, WA

BORING NUMBER B-3

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.05956 **LONGITUDE** -122.81470
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Gray silty SAND, medium dense, damp to moist
5	SS	67	5-7-9 (16)	SM		-light iron oxide staining
10						10.0
	SS	89	5-7-9 (16)			Gray poorly graded SAND, medium dense, damp
15	SS	100	5-6-7 (13)	SP		
20	SS	100	7-6-6 (12)			
25						

GENERAL BH / TP / WELL - 9532.GPJ - GINT US.GDT - 2/13/24

(Continued Next Page)

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BORING NUMBER B-3

PROJECT NUMBER ES-9532 **PROJECT NAME** Williams Crossing
DATE STARTED 11/7/23 **COMPLETED** 11/7/23 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.05956 **LONGITUDE** -122.81470
LOGGED BY BCS **CHECKED BY** SHA **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
25	SS	100	5-5-4 (9)	SP		Gray poorly graded SAND, medium dense, damp *(continued)*
30	SS	100	5-9-9 (18)			
						31.5

Boring terminated at 31.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC installed to bottom of boring. Lower 20.0 feet slotted. Well ID: BPG885. Boring backfilled with silica sand and bentonite chips.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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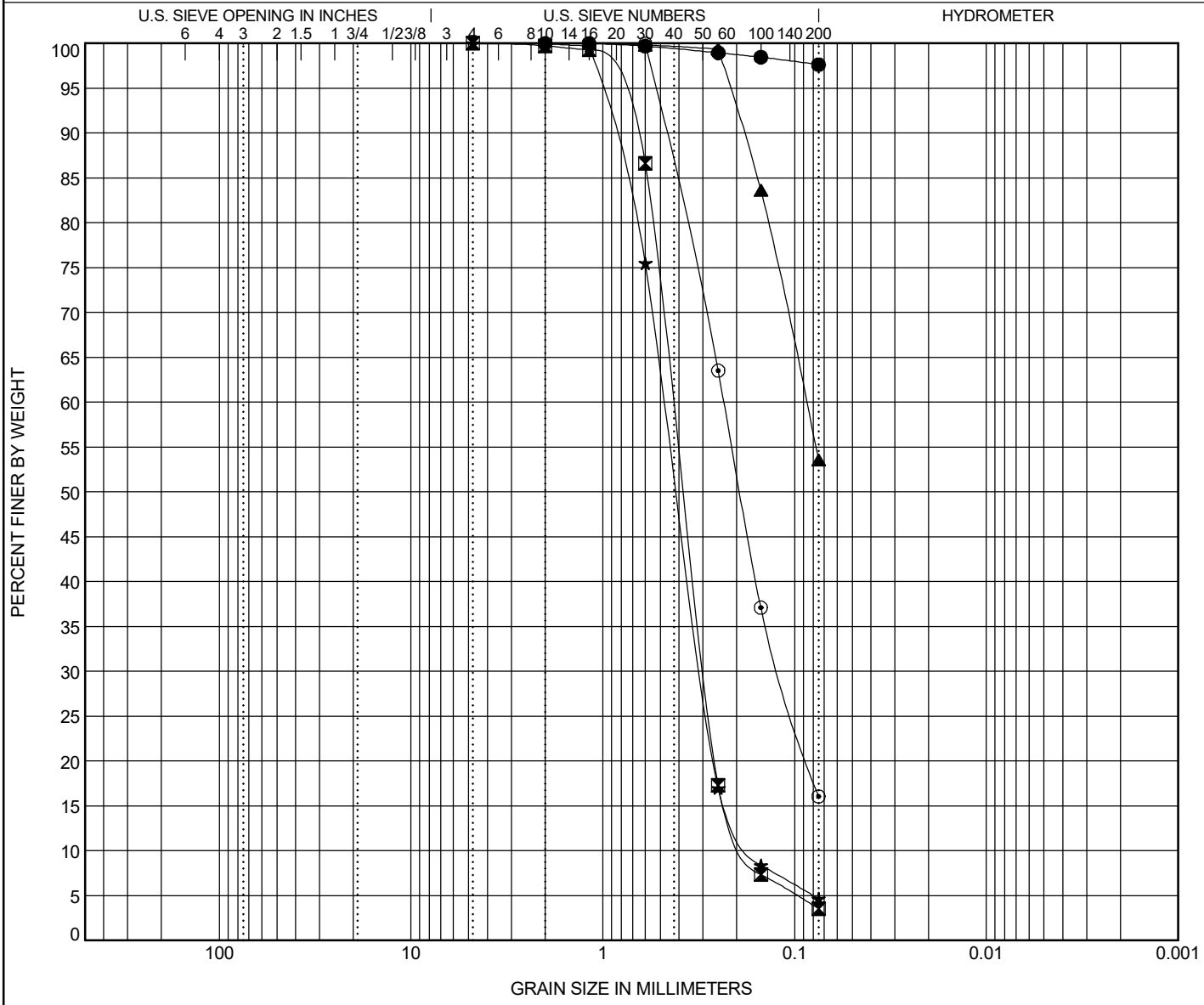
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-01	5.00ft.	USDA: Gray Loam. USCS: ML.		
⊠	TP-01	9.00ft.	USDA: Gray Slightly Gravelly Sand. USCS: SP.	1.17	2.49
▲	TP-01	18.00ft.	USDA: Tan Loam. USCS: Sandy ML.		
★	TP-02	10.00ft.	USDA: Gray Slightly Gravelly Sand. USCS: SP.	1.17	2.88
⊙	TP-02	14.50ft.	USDA: Gray Loamy Sand. USCS: SM.		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	5.0ft.	2							97.6	
⊠	TP-01	9.0ft.	4.75	0.429	0.293	0.172				3.6	
▲	TP-01	18.0ft.	1.18	0.087						53.6	
★	TP-02	10.0ft.	4.75	0.476	0.304	0.165				4.7	
⊙	TP-02	14.5ft.	1.18	0.234	0.119					16.1	

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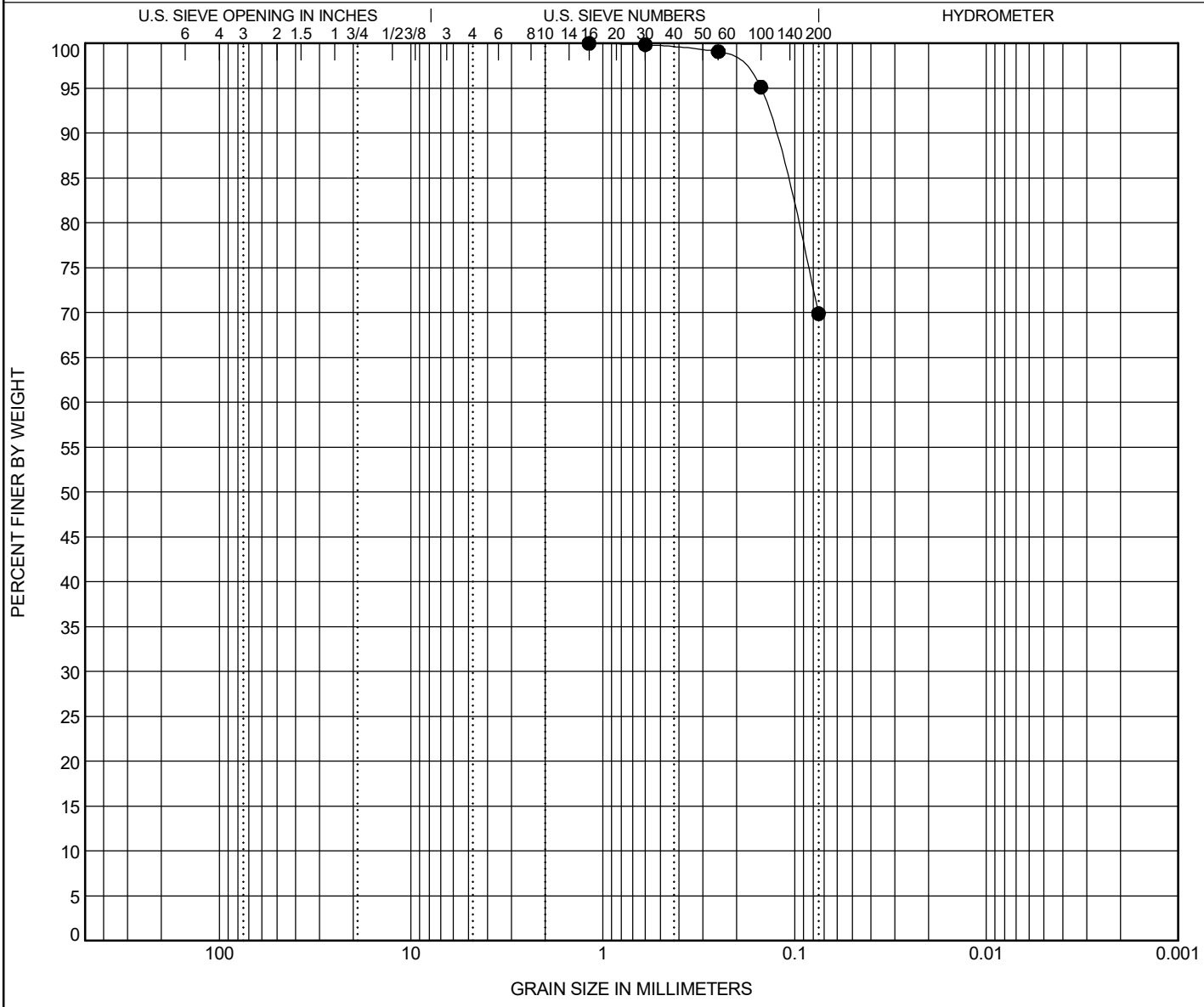
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**TP-02**	**16.00ft.**	**USDA: Gray Loam. USCS: Sandy ML.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-02**	**16.0ft.**	**1.18**							**69.9**	

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SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER ES-9532.01 **PROJECT NAME** Williams Crossing

Borehole, Depth	Sample Location	Date Test Completed	Water Content (%)	Ash Content (%)	Organic Content (%)
TP-01, 11.0'		1/14/24	13.9	99.5	0.5
TP-02, 12.0'		1/14/24	23.8	99.2	0.8

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Jan 24 2024
EARTH SOLUTIONS NW
15365 NORTHEAST 90TH STREET
SUITE 100
REDMOND, WA 98052
Attention: BRIAN SNOW

Dear BRIAN SNOW:

Enclosed please find the analytical data for your WILLIAMS CROSSING project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
TP-1 @ 11 FT	Soil	24-A000681	CONV
TP-2 @ 12 FT	Soil	24-A000682	CONV

Your samples were received on Thursday, January 11, 2024. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Aaron Young
Vice President

Project #: ES-9532.01

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

EARTH SOLUTIONS NW
15365 NORTHEAST 90TH STREET
REDMOND, WA 98052
Attention: BRIAN SNOW
Project Name: WILLIAMS CROSSING
Project #: ES-9532.01
All results reported on an as received basis.

Date Received: 01/11/24
Date Reported: 1/24/24

AMTEST Identification Number **24-A000681**
Client Identification **TP-1 @ 11 FT**
Sampling Date **12/27/23**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	5.0	meq/100g		0.5	SW-846 9081	CM	01/23/24

AMTEST Identification Number **24-A000682**
Client Identification **TP-2 @ 12 FT**
Sampling Date **12/27/23**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	4.2	meq/100g		0.5	SW-846 9081	CM	01/23/24

Aaron Young
Vice President

Am Test Inc.
13600 NE 126th PL
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(425) 885-1664
www.amtestlab.com

Professional Analytical Services

QC Summary for sample numbers: 24-A000681 to 24-A000682

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
24-A000520	Cation Exchange Capacity	meq/100g	7.1	6.1	15.

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Cation Exchange Capacity	meq/100g	2.0	2.0	100. %
Cation Exchange Capacity	meq/100g	2.0	1.9	95.0 %

BLANKS

ANALYTE	UNITS	RESULT
Cation Exchange Capacity	meq/100g	< 0.5
Cation Exchange Capacity	meq/100g	< 0.5

AMTEST LABORATORIES

AmTest Chain of Custody Record

13600 NE 126th PL, Suite C, Kirkland, WA 98034
Ph (425) 885-1664 Fx (425) 820-0245
www.amtestlab.com

Chain of Custody No. 5000

Client Name & Address:	Invoice To:
Earth Solutions NW, LLC 15365 Northeast 90th Street, Suite 100 Redmond, Washington 98052	Attention: Ms. Laura Aby lauraa@esnw.com
Contact Person: Brian Snow	Invoice Contact:
Phone No: 425-449-4704	PO Number:
Fax No:	Invoice Ph/Fax:
E-mail: brians@esnw.com	Invoice E-mail:
Report Delivery: (Choose all that apply) Mail / Fax / Email ✓ / Posted Online	Data posted to online account: YES / NO Web Login ID:

Special Instructions:

Requested TAT: **(Rush must be pre-approved by lab)**
Standard ✓ RUSH (5 Day / 3 Day / 48 HR / 24 HR)

Temperature upon Receipt: 15.3°C

Project Name: Williams Crossing
Project Number: ES-9532.01

AmTest ID	Client ID (35 characters max)	Date Sampled	Time Sampled	Matrix	No. of containers	Analysis Requested: CEC									QA/QC
681	TP-1 @ 11 ft	12/27/23			1	✓									
682	TP-2 @ 12 ft	12/27/23			1	✓									

Collected/Relinquished By:	Date	Time	Received By:	Date	Time
[signature]	1-11-24	11:06	KH	1/11/24	1106
Relinquished By:	Date	Time	Received By:	Date	Time
Relinquished By:	Date	Time	Received By:	Date	Time

COMMENTS: