Dungeness River Flow Enhancement Project

Designs and Supporting Analyses

Technical Memorandum Attachment D-2

River Road Storage Project

Preliminary Geotechnical Memorandum

PgG

ANCHOR QEA

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MEMORANDUM

To:	Amanda Cronin, Washington Water Trust	**Date:**	May 23, 2014
From:	John Laplante, P.E., Anchor QEA, LLC Zachary L. Koehn, Anchor QEA, LLC	**Project:**	130392-01.01
Cc:	Peter Schwartzman, L.H.G., Pacific Groundwater Group		
Re:	Dungeness Flow Enhancement: River Road Storage Project Preliminary Geotechnical Engineering Recommendations		

INTRODUCTION

Washington Water Trust (WWT) is investigating potential projects that will enhance flows in the Dungeness River and its tributaries. Strategies for improving flow rates include infiltration and storage of irrigation water. A preliminary screening of potential project sites identified Clallam County Parcel 043036210000, which is owned by the Washington State Department of Natural Resources (DNR), as a potential location for a storage reservoir. The parcel is located south of the City of Sequim, Washington, between River Road and the Dungeness River (see Figure 1). During high flow periods, the reservoir would capture irrigation water from a drainage ditch, which currently bisects the parcel, and store it for late-summer irrigation use. Water delivered from the reservoir for irrigation would allow for an equal reduction in diversions from the Dungeness River, which would increase flows in the river during the late summer critical low flow period. The proposed storage reservoir would be created by excavating, backfilling, and constructing an earthen embankment. A preliminary analysis of the site indicates that the potential reservoir could be sized to store up to 1,586 acre-feet of water for irrigation. A storage reservoir of this volume would require excavation of approximately 711,000 cubic yards of material and placement of approximately 770,000 cubic yards of material.

Presented in this memorandum are site investigation findings and preliminary geotechnical engineering recommendations for earthwork and reservoir construction. Subsurface explorations, consisting of seven shallow test pits, were performed on May 7, 2014. A total

of eight samples were collected, minimum of one per test pit, and were analyzed for particle size distribution and particle fraction smaller than the No. 200 sieve (ASTM D6913 and D1140, respectively). The subsurface explorations allowed for a physical characterization of the near-surface soils, which inform the recommendations presented herein. The recommendations for earthwork and reservoir construction provided herein apply to typical reservoir designs. Design-specific recommendations based on more thorough analyses, such as stability evaluations and seismic hazard assessment, were not part of this scope of work, and should therefore be developed prior to final design.

SITE CONDITIONS

An Anchor QEA geotechnical engineer investigated the site conditions during two site visits: an initial site reconnaissance and the subsurface exploration. A broad and qualitative description of the surface conditions is provided and is based on observations made during both site visits. The subsurface conditions are described for the soil units observed during the advancement of seven test pits located across the site, as shown in Figure 1.

Surface Conditions

The 319-acre DNR parcel (No. 043036210000) generally slopes from south to north, with minor topographical rises and depressions throughout the site. DNR leases the site for timber harvest, and the cleared portion shown in Figure 1 was logged within the last 10 years. The site is vegetated with grasses, shrubs, and trees ranging from saplings to adult evergreens. Large stumps from logging activities and cobbles and boulders are visible on the ground surface. A drainage ditch, the Highland Ditch Company H-1 Lateral, flows through the property from south to north; the ditch bisects the property and is more than 5 feet wide and roughly 1 foot deep.

Subsurface Conditions

Seven test pits were advanced to depths ranging from 8 to 10 feet below ground surface (bgs). General descriptions of the soil units observed are described below and are listed in order from the ground surface downward. Estimates of density are inferred and reported parenthetically, based on observations of the excavator during digging and collection of samples from in situ material. Actual measurements of the soil density, which would have

required a drill rig and standard penetration test sampler, were beyond the scope of this work. The test pit logs are included as Attachment A.

Top Soil (SM): The soil nearest to the surface was observed in all exploration locations to be top soil ranging from 0.5 to 1.0 foot in thickness. The unit is a (loose), dry to damp, dark brown, fine to medium silty sand with frequent cobbles, occasional boulders, decomposed organics, and abundant fine to small roots. Roots typically extended 1.5 to 2.5 feet bgs. Cobbles and boulders in the top soil unit comprise approximately 20 to 40% of the composition. Larger roots were generally not encountered, as the test pit locations were selected away from trees.

Silty Sand (SM): The soil immediately beneath the top soil is a unit of silty sand ranging from 1.0 to 2.0 foot in thickness. The unit is a loose to medium-dense, dry-to-damp, reddish-brown to reddish yellow-brown, fine-to-medium, gravelly silty sand with frequent cobbles and boulders and some fine to small roots. Cobbles and boulders comprise approximately 30 to 60% of the composition. Based on laboratory sieve analysis of the size fraction less than 1.25-inch diameter, silt composition ranged from 9 to 23%, sand from 42 to 43%, and gravel from 33 to 35%.

Dense Alluvium (SP-SM/SM/GP-SM/GM): Underlying the silty sand is a unit of alluvium comprising primarily cobbles and boulders, with variable amounts of silt, sand, gravel, and rock clasts within the void space of the cobbles and boulders. The unit thickness ranged from 6.0 to over 7.5 feet. The unit is (medium dense to very dense) primarily reddish brown, and dry to damp in the upper 1 to 3 feet, and it transitions to yellow-brown and damp to moist with depth. The cobble and boulder composition ranged from 50 to 80% in the upper 3 to 5 feet of the unit and generally decreased to 40 to 60% with depth. Boulder diameters were frequently observed to be 1 to 2 feet and occasionally observed to be just over 2 feet. Based on laboratory sieve analysis of the size fraction less than 1.25-inch diameter, silt composition ranged from 6 to 19%, sand from 36 to 68%, and gravel from 23 to 46%.

In test pits TP01 and TP04, excavation was difficult due to the very densely packed cobbles and boulders. In test pits TP02, TP05, TP06, and TP07, sand and gravel pockets at depth were observed, where cobble and boulder composition decreased to approximately 40 to

60%. TP07 was the only test pit advanced through the alluvium unit, which was observed to be 6.0 feet thick at this location.

Silty Sand (SM): TP07 was advanced through the alluvium unit and into a (loose to medium dense), damp, yellow-brown gray, uniform, fine to medium silty sand with small, non-plastic silt balls. This silty sand unit was relatively easy to excavate; however, it is unknown if the unit is a localized pocket or underlies the dense alluvium unit in other regions of the site. The silt content was estimated to be 18.9%.

Groundwater: At the time of the explorations, groundwater was not observed in any of the test pits. Laboratory testing consisted of four sieve analyses of particle size distribution (ASTM D6913) and four analyses of particle fraction smaller than the No. 200 sieve (ASTM D1140). A tabulated summary of the results is presented in Table 1; the results are included as Attachment B.

Table 1
Summary of Sieve Analyses

Sample ID	Depth Interval (feet; bgs)	Gravel (%)	Sand (%)	Fines (%)	D_{85}[1] (mm)	D_{15}[2] (mm)
TP01-GRAB01	1.0 to 2.0	33.3	43.4	23.3	16	<0.075
TP02-GRAB02	2.0 to 4.0	46.4	35.5	18.1	23	<0.075
TP03-GRAB03	1.0 to 3.0	35.4	42.0	22.6	14	<0.075
TP04-GRAB04	4.0 to 6.0	---	---	5.6	---	---
TP05-GRAB05	1.0 to 2.0	---	---	9.4	---	---
TP06-GRAB06A	3.0 to 4.0	23.2	68.4	8.4	8	0.3
TP06-GRAB06B	6.0 to 8.0	---	---	7.0	---	---
TP07-GRAB07	8.0 to 10.0	---	---	18.9	---	---

Notes:
1. D_{85} = particle diameter in millimeters corresponding to 85% passing by weight
2. D_{15} = particle diameter in millimeters corresponding to 15% passing by weight
bgs = below ground surface

GEOTECHNICAL RECOMMENDATIONS

This section presents engineering recommendations for earthwork and berm and reservoir construction, including the following:

- Earthwork recommendations
  - Site preparation
  - Material re-use
  - Subgrade Preparation
  - Fill selection, placement, and compaction
- Berm and reservoir construction
  - Embankments, crest, filter, and reservoir liner
  - Erosion control

Construction recommendations provided herein are for preliminary design purposes and are based on typical reservoir designs. Design-specific construction recommendations will need to be developed prior to final design.

Earthwork Recommendations

Site Preparation

Site preparation should be accomplished to provide a firm, unyeilding surface for berm construction and liner placement; therefore, we recommend the following:

- Remove all trees and vegetation from the reservoir and embankment footprint, including large-diameter roots near the final grade surface and existing stumps.
- Remove organic soils and stockpile for future re-vegetation of exterior embankment slopes and general disturbed areas not within the reservoir footprint.
- After site grading, remove large boulders that may be present near the surface, as the presence of boulders will impact fill placement and compaction. Backfill voids that result from the removal of near-surface boulders.
- Excavate soft, pervious soils located beneath the berm footprint and backfill with compacted earth fill. Excavation should be performed to competent subgrade.

Material Re-use

Excavated material can be re-used as berm earth fill, provided that cobbles and boulders larger than 4 inches in diameter are removed prior to re-use. Due to the heterogeneity of the subsurface conditions and the potential for segregation of soils during sorting, careful planning and inventorying will be required during construction to accomplish uniform placement and compaction. Additionally, gravels and cobbles screened from the excavated material ranging from 1 to 12 inches would be suitable for use as a protection layer for the reservoir liner.

Other materials that are suitable for re-use include the following:

- Well-graded sand and gravel may be suitable for use as filter material, provided that the appropriate gradation requirements are met.
- Coarse (1- to 3-inch diameter) gravel can be used for construction of geotextile-encased drains.
- Fine grained soils consisting of at least 20% silt and clay are suitable to line the reservoir floor and upstream embankment.

Soils with appreciable clay and silt content (typically >5%) can be moisture sensitive; therefore, stockpiling should be done with care to prevent excessive drying or saturation of the material. The material may need to be moisture conditioned to meet compaction requirements. Achieving compaction of moisture-sensitive soils during wet weather construction could pose a significant challenge to the contractor.

Subgrade Preparation

Subgrade preparation to accomplish uniform bearing, as a minimum, should be performed as follows:

- Scarify the upper 8 to 12 inches of the subgrade, dry or moisten as necessary, and recompact.
- Certain materials, such as heavily preconsolidated clays, will not benefit from compaction, and saturated silts and silty fine sands that become quick during compaction should be blanketed with a working mat of lean concrete or coarse-grained material to prevent disturbance or softening.

- Depending on the foundation conditions revealed during grading and excavation, loose or soft soils may have to be removed below subgrade and recompacted.

Fill Selection, Placement, and Compaction

To meet desired performance standards, as well as to minimize storage loss through seepage, fill selection, placement, and compaction will be unique for each of the different berm and reservoir components.

Typical berm designs of small dams include a filter and upstream and downstream earth fill embankments. For berm construction we recommend the following:

Filter

Drainage and particle retention required of the filter layer can be accomplished with one of the following options:

- 1- to 3-inch coarse gravel drain rock encased by appropriate geotextile fabric (Class II for rounded rock, Class I for angular rock)
  A well-graded granular material that meets filtering and permeability requirements prescribed by the Washington Department of Ecology for Dam Safety Guidelines (July 1993). Material selected for filter material should be reviewed by a geotechnical engineer prior to use.

Filter layer compaction should be performed to 90% maximum density, per ASTM D1557, and placed in a maximum of 8-inch lifts, for a total minimum thickness/width of 1 foot. Furthermore, material should be handled with care to prevent segregation of material before placement.

Note that clogging and plugging of geotextiles could be problematic when used as filters. Additionally, to prevent damage to the geotextile fabric, the contractor must be especially careful during berm construction. Compromising the integrity of the geotextile could lead to internal erosion and piping, leading to poor performance. The risks related to geotextiles should be considered during filter design, and construction of berms using geotextiles should be performed by an experienced contractor.

Earth Fill

Material selected as earth fill for construction of the upstream and downstream embankments should be placed in a maximum of 12-inch lifts and compacted to 92% maximum density, per ASTM D1557. The material should be placed within -1 to 3% of the optimum moisture content, as determined by ASTM D1557. Avoid over compacting the embankments, as ductility is a desired property.

Liner

Due to the heterogeneity and granular nature of the subsurface conditions, we recommend that a liner be used to limit infiltration of water stored in the reservoir. For construction of the reservoir liner, we recommend using a low-permeability material that consists of at least 20% clay or silt. Compaction should be performed to 90% maximum density, per ASTM D1557, and placed in a maximum of 6-inch lifts. The material should be placed within -2 to 2% of the optimum moisture content, as determined by ASTM D1557. Avoid over compacting the liner material, as ductility is a desired property.

Alternatively, liner objectives can be accomplished by using a geosynthetic liner such as Huesker Canal[3], provided that proper subgrade preparation, seam welding/sealing, and anchorage are performed per the recommendation provided herein and the manufacturer's recommendations.

Berm and Reservoir Construction

For preliminary design purposes, construction of the berm and reservoir floor should be performed to meet the following recommendations. Design-specific recommendation may vary.

- The crest of the berm should include an access path at least 10 feet wide, with a minimum 4-inch-thick coarse top (2-inch crushed rock). For drainage, the crest should slope 1% downstream.
- Embankments should be no steeper than 2H:1V (horizontal:vertical) for the downstream slope and 3H:1V for the upstream slope. Embankment slopes may need to be constructed at shallower grades, pending static and seismic stability evaluations.

- Enough top soil should be placed along the downstream slope to support vegetation and hydroseeded with a suitable grass mixture. Top soil re-use should be free of large woody vegetation. Use appropriate erosion-control measures until vegetation has rooted.
- Filter thickness/width should be at least 1.5 feet.
- If a soil liner is used, then its thickness should be at least 2.5 feet along the upstream berm and at least 2.0 feet for the reservoir floor.
- Geosynthetic liners, if used, should be installed by an experienced contractor.

LIMITATIONS

Because the subsurface explorations were limited to a maximum of 10.0 feet bgs, we recommend that, prior to final design, further investigation of soils at depths greater than 10 feet be performed, at minimum, along the crest of the berm. Furthermore, standardized sampling used to estimate soil density was not performed during this investigation; we therefore recommend that future explorations include in situ penetration testing and split-spoon sampling to estimate engineering soil properties, which will be required for stability evaluations. Due to the presence of boulders, sampling through the dense alluvium unit will not be feasible with standard equipment. Coring could be required for advancing borings through the dense alluvium layer and into underlying soils where penetration testing and sampling is recommended.

Consideration of seismic hazards was outside of the scope of work; however, as observed in TP07 (i.e., fine to medium silty sand at depth), potentially liquefiable soils may underlie the dense alluvium unit. Soils that are liquefiable can lose their load-bearing capacity during seismic events (Kramer 1996). The fine to medium silty sand observed in TP07, if present in a saturated state, could present stability concerns for the berm during a seismic event; therefore, we recommend a site-specific seismic hazard evaluation as part of the final design.

REFERENCES

ASTM Standard D1140, 2006. *Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-µm) Sieve*. West Conshohocken, PA: ASTM International.

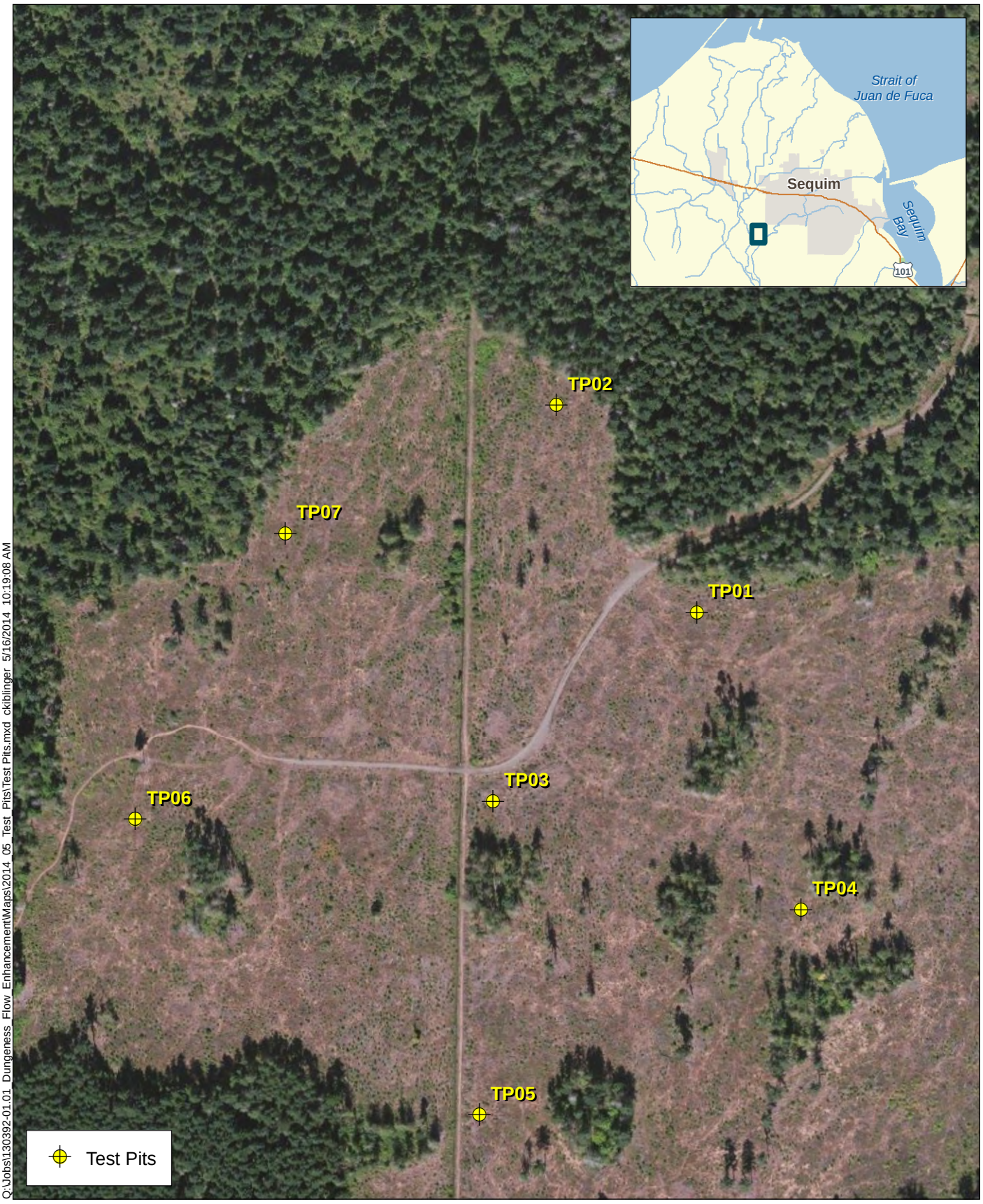
ASTM Standard D1557, 2012. *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))*. West Conshohocken, PA: ASTM International.

ASTM Standard D6913, 2009. *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis*. West Conshohocken, PA: ASTM International.

Kramer, S.L., 1996. *Geotechnical Earthquake Engineering*. Upper Saddle River, New Jersey: Prentice Hall, Inc.

Washington State Department of Ecology, 1993. *Dam Safety Guidelines Part IV: Dam Design and Construction*. July 1993.

FIGURES



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Feet
0 150 300

Figure 1
Test Pit Locations
Dungeness Flow Enhancement
Pacific Groundwater Group

ATTACHMENT A
TEST PIT LOGS

Test Pit Log

TP01

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **392791.868** Easting: **1076802.943**	Total Depth (ft): **8.0 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description (Samples and descriptions are in recovered depths. Classification scheme based on USCS. Description: (density), moist, color, minor, MAJOR, other)	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark brown, fine to medium silty SAND (SM) with some gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 2.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1	GRAB01	GS		Silty SAND (SM): (loose), dry to damp, reddish brown, medium to coarse gravelly silty SAND (SM) with 30% to 50% cobbles and boulders		1
2				ALLUVIUM: (dense to very dense), damp to moist, reddish brown to gray-brown, cobble and boulder matrix with primarily coarse gravel and sand, rock clasts, and some silt between particles, approximately 60% to 80% cobbles and boulders up to 1.8 feet in diameter		2
3						3
4				cobble and boulder content increases to approximately 70% to 80%		4
5						5
6						6
7				excavation is very difficult, very dense matrix of large boulders		7
8				Bottom of test pit at 8.0 feet bgs. Completed on 05/07/2014.		8
9						9
10						10

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Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

Test Pit Log

TP02

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **393255.86** Easting: **1076488.964**	Total Depth (ft): **9.5 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark brown, fine to medium silty SAND (SM) with some gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 2.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1				Silty SAND (SM): (loose), dry to damp, reddish yellow-brown, medium to coarse gravelly silty SAND (SM) with 30% to 50% cobbles and boulders		1
2				ALLUVIUM: (dense to very dense), damp to moist, reddish brown to gray-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 70% to 80% cobbles and boulders up to 2.0 feet in diameter		2
3	GRAB02	GS				3
4						4
5						5
6						6
7				cobble and boulder content decreases to approximately 40% to 60% decreasing gravel content, increasing sand content		7
8						8
9						9
10				Bottom of test pit at 9.5 feet bgs. Completed on 05/07/2014.		10

Soil Description
Samples and descriptions are in recovered depths.
Classification scheme based on USCS

Description: (density), moist, color, minor, MAJOR, other

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Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

Test Pit Log

TP03

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **392369.973** Easting: **1076346.958**	Total Depth (ft): **9.5 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description (Samples and descriptions are in recovered depths. Classification scheme based on USCS. Description: (density), moist, color, minor, MAJOR, other)	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark brown, fine to medium silty SAND (SM) with some gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 2.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1	GRAB03	GS		Silty SAND (SM): (loose), dry to damp, reddish yellow-brown, fine to coarse gravelly silty SAND (SM) with 40% to 60% cobbles and boulders		1
2						2
3				ALLUVIUM: (dense to very dense), damp to moist, reddish brown to gray-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 60% to 80% cobbles and boulders up to 2.0 feet in diameter		3
4						4
5						5
6				transitions to moist, sandy GRAVEL (GP) with 60% to 80% cobbles and boulders		6
7						7
8						8
9						9
10				Bottom of test pit at 9.5 feet bgs. Completed on 05/07/2014.		10

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Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

Test Pit Log

TP04

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **392127.611** Easting: **1077035.66**	Total Depth (ft): **8.0 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark reddish brown, fine to medium silty SAND (SM) with some gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 2.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1				Silty SAND (SM): (loose to medium dense), dry to damp, reddish yellow-brown, fine to coarse gravelly silty SAND (SM) with 40% to 60% cobbles and boulders		1
2						2
3				ALLUVIUM: (dense to very dense), damp to moist, reddish brown to gray-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 60% to 80% cobbles and boulders up to 2.0 feet in diameter		3
4				@ 4.0 to 6.0 ft bgs: pocket of moist, coarse gravelly SAND (SP) with trace silty, 50% to 60% cobbles and boulders		4
5	GRAB04	#200				5
6				boulder content increases; cobble and boulder content increase to 70% to 80%		6
7						7
8				Bottom of test pit at 8.0 feet bgs. Completed on 05/07/2014.		8
9						9
10						10

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Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

Test Pit Log

TP05

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **391669.398** Easting: **1076316.93**	Total Depth (ft): **8.0 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark brown, fine silty SAND (SM) with occasional gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 1.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1	GRAB05	#200		SAND with Silt (SP-SM): (loose to medium dense), dry to damp, reddish yellow-brown, fine to coarse gravelly SAND with Silt (SP-SM), 40% to 60% cobbles and boulders		1
2				@2.0 ft bgs: gravel lense with coarse sand and some cobbles		2
3				ALLUVIUM: (dense to very dense), damp to moist, reddish brown to gray-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 80% cobbles and boulders over 2.0 feet in diameter		3
4						4
5				@5.5 ft bgs: material becomes moist		5
6						6
7				transitions to silty SAND (SM) with cobble and boulder content decreasing to 50% to 60%		7
8				Bottom of test pit at 8.0 feet bgs. Completed on 05/07/2014.		8
9						9
10						10

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Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
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Test Pit Log

TP06

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **392329.805** Easting: **1075548.113**	Total Depth (ft): **8.0 feet bgs**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark reddish brown, fine to medium silty SAND (SM) with some gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 1.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1				Silty SAND (SM): (loose), dry to damp, reddish yellow-brown, fine to coarse gravelly silty SAND (SM) with 40% to 60% cobbles and boulders		1
2				ALLUVIUM: (dense to very dense), damp to moist, reddish yellow-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 60% to 80% cobbles and boulders up to 2.0 feet in diameter		2
3	GRAB06A	GS		@ 3.5 ft bgs: pocket of moist, yellow-brown, coarse SAND with Silt (SP- SM), 50% to 60% cobbles and boulders		3
4						4
5				boulder content increases; cobble and boulder content increase to 70% to 80% and is very difficult to rip		5
6						6
7	GRAB06B	#200		transitions to gray-brown, sandy GRAVEL with Silt (GP-SM), 40% to 50% cobbles and boulders		7
8						8
9				Bottom of test pit at 8.0 feet bgs. Completed on 05/07/2014.		9
10						10

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, WA 98101
206-287-9130

Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

Test Pit Log

TP07

Sheet 1 of 1

Project: **Dungeness River Flow Enhancement**	Location: **Sequim, WA**	Excavation Method: **Excavator**
Project #: **130392-01.01**	Northing: **392968.449** Easting: **1075883.018**	Total Depth (ft): **10.0 feet**
Client: **Pacific Groundwater Group**	Horizontal Datum: **WASPN NAD83 US SURVEY FEET**	Logged By: **ZLK**
Collection Date: **05/07/2014**	Sample Collection Method: **Grab/Bulk Sample**	Contractor: **C and J Excavating**

Depth (ft)	Sample Interval	Analytical Tests	Groundwater	Soil Description (Samples and descriptions are in recovered depths. Classification scheme based on USCS. Description: (density), moist, color, minor, MAJOR, other)	Graphic Log	Depth (ft)
0				Top Soil (SM): (loose), dry to damp, dark brown, fine silty SAND (SM) with occasional gravel and abundant roots and other organics, frequent cobbles, fine to small roots to 1.5 ft bgs, approximately 20% to 40% cobbles and boulders		0
1				Silty SAND (SM): (loose to medium dense), dry to damp, reddish yellow-brown, fine to coarse gravelly silty SAND (SM) with 40% to 60% cobbles and boulders		1
2				ALLUVIUM: (dense to very dense), damp to moist, reddish yellow-brown, cobble and boulder matrix with primarily coarse gravel and sand and some silt content between particles, approximately 60% to 80% cobbles and boulders over 2.0 feet in diameter		2
3						3
4						4
5						5
6				@5.5 ft bgs: material becomes moist		6
7				transitions to silty SAND (SM) with cobble and boulder content decreasing to 50% to 60%		7
8						8
9	GRAB07	#200		Silty SAND (SM): (loose to medium dense), damp, yellow-gray brown, fine to medium silty SAND (SM), uniform particle size that is similar to beach sand, silt is present as fine spherical silt balls, no cobbles and boulders		9
10				Bottom of test pit at 10.0 feet bgs. Completed on 05/07/2014.		10

ANCHOR QEA
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Seattle, WA 98101
206-287-9130

Notes:
1. Soil characterization is based on material observed between cobbles and boulders.
2. Samples collected for laboratory testing includes gravel-size particles and smaller.
3. GS = Grain Size Analysis (ASTM D6913); #200 = Grain Size Analysis for #200 sieve only (ASTM D1140); ARC = Archive

ATTACHMENT B
MATERIALS TESTING LABORATORY RESULTS

Materials Testing & Consulting, Inc.

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Client:	Anchor QEA, LLC	**Date:**	May 14, 2014
Address:	720 Olive Way, Suite 1900	**Project:**	Dungeness River Flow Enhancements
	Seattle WA 98101	**Project #:**	14K018
Attn:	Zac Koehn	**Sample #:**	K14-038

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	See Attached	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☐	WSDOT Degradation	
☐	Fracture Count		☐		
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Harold Benny
WABO Supervising Laboratory Technician

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Materials Testing & Consulting, Inc.

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Sieve Report

Project: Dungeness River Flow Enhancements
Project #: 14K018
Client: Anchor QEA, LLC
Source: GRAB01
Sample#: K14-038

Date Received: 8-May-14
Sampled By: Client
Date Tested: 14-May-14
Tested By: HB/HS

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand with Gravel
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

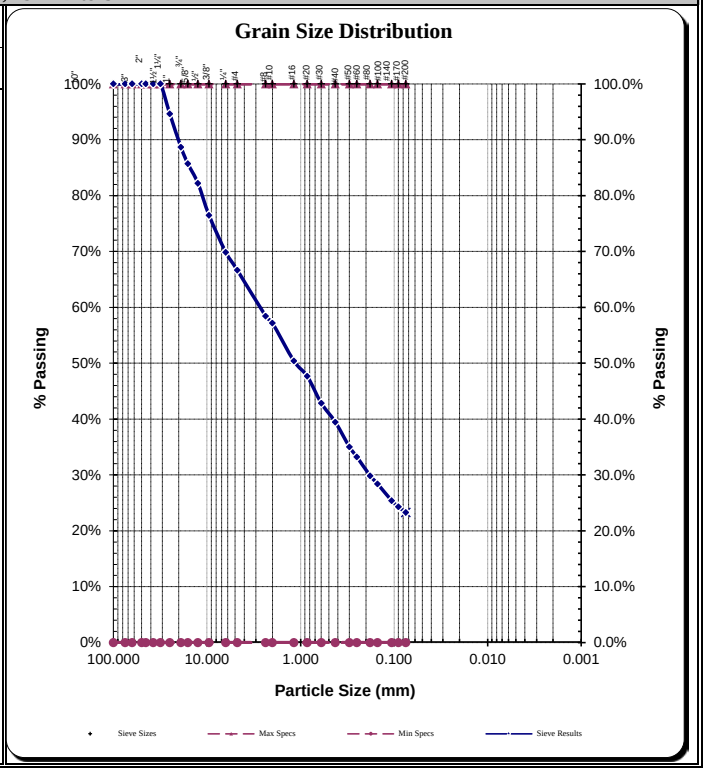
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? Yes

$D_{(5)}$ =	0.016 mm	% Gravel =	33.3%	Coeff. of Curvature, C_C =	0.37
$D_{(10)}$ =	0.032 mm	% Sand =	43.4%	Coeff. of Uniformity, C_U =	87.27
$D_{(15)}$ =	mm	% Silt & Clay =	23.3%	Fineness Modulus =	3.53
$D_{(30)}$ =	0.183 mm	Liquid Limit =	0.0%	Plastic Limit =	0.0%
$D_{(50)}$ =	1.129 mm	Plasticity Index =	0.0%	Moisture %, as sampled =	10.6%
$D_{(60)}$ =	2.813 mm	Sand Equivalent =	n/a	Fracture % =	n/a
$D_{(90)}$ =	20.329 mm	Req'd Sand Equivalent =		Req'd Fracture % =	

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50	100%	100%	100.0%	0.0%
1.00"	25.00	95%	95%	100.0%	0.0%
3/4"	19.00		89%	100.0%	0.0%
5/8"	16.00		86%	100.0%	0.0%
1/2"	12.50	82%	82%	100.0%	0.0%
3/8"	9.50	76%	76%	100.0%	0.0%
1/4"	6.30		70%	100.0%	0.0%
#4	4.75	67%	67%	100.0%	0.0%
#8	2.36		58%	100.0%	0.0%
#10	2.00	57%	57%	100.0%	0.0%
#16	1.18		50%	100.0%	0.0%
#20	0.850	48%	48%	100.0%	0.0%
#30	0.600		43%	100.0%	0.0%
#40	0.425	39%	39%	100.0%	0.0%
#50	0.300		35%	100.0%	0.0%
#60	0.250	33%	33%	100.0%	0.0%
#80	0.180		30%	100.0%	0.0%
#100	0.150	28%	28%	100.0%	0.0%
#140	0.106		25%	100.0%	0.0%
#170	0.090		24%	100.0%	0.0%
#200	0.075	23.3%	23.3%	100.0%	0.0%



Comments:

Reviewed by:

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Visit our website: www.mtc-inc.net

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Client:	Anchor QEA, LLC	**Date:**	May 14, 2014
Address:	720 Olive Way, Suite 1900	**Project:**	Dungeness River Flow Enhancements
	Seattle WA 98101	**Project #:**	14K018
Attn:	Zac Koehn	**Sample #:**	K14-039

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	See Attached	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☐	WSDOT Degradation	
☐	Fracture Count		☐		
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Harold Benny
WABO Supervising Laboratory Technician

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Sieve Report

Project: Dungeness River Flow Enhancements
Project #: 14K018
Client: Anchor QEA, LLC
Source: GRAB02
Sample#: K14-039

Date Received: 14-May-14
Sampled By: Client
Date Tested: 14-May-14
Tested By: HB/HS

ASTM D-2487 Unified Soils Classification System
GM, Silty Gravel with Sand
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

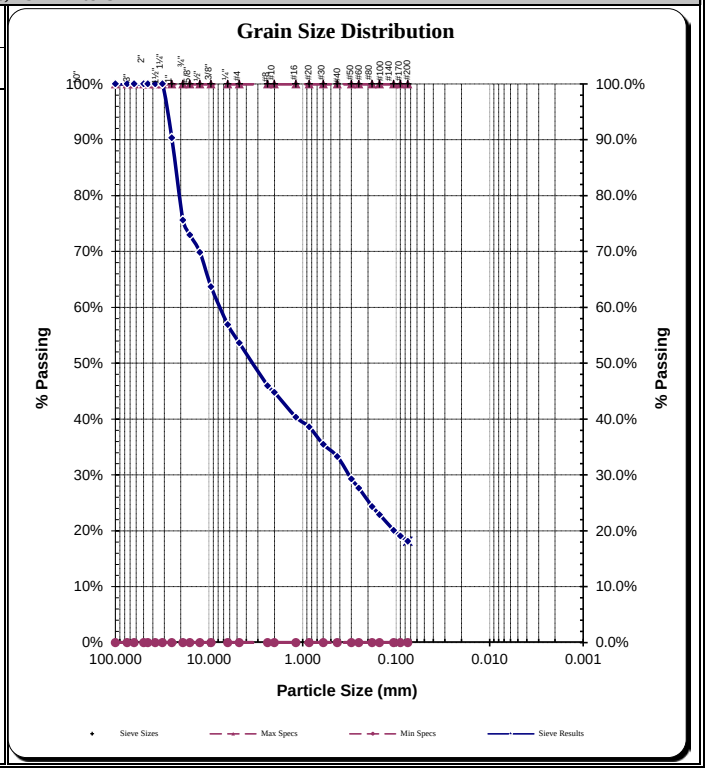
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? Yes

$D_{(5)}$ =	0.021 mm	% Gravel =	46.4%	Coeff. of Curvature, C_C =	0.32
$D_{(10)}$ =	0.041 mm	% Sand =	35.5%	Coeff. of Uniformity, C_U =	187.52
$D_{(15)}$ =	mm	% Silt & Clay =	18.1%	Fineness Modulus =	4.33
$D_{(30)}$ =	0.322 mm	Liquid Limit =	0.0%	Plastic Limit =	0.0%
$D_{(50)}$ =	3.617 mm	Plasticity Index =	0.0%	Moisture %, as sampled =	8.2%
$D_{(60)}$ =	7.753 mm	Sand Equivalent =	n/a	Fracture % =	n/a
$D_{(90)}$ =	24.859 mm	Req'd Sand Equivalent =		Req'd Fracture % =	

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50	100%	100%	100.0%	0.0%
1.00"	25.00	90%	90%	100.0%	0.0%
3/4"	19.00	76%	76%	100.0%	0.0%
5/8"	16.00		73%	100.0%	0.0%
1/2"	12.50	70%	70%	100.0%	0.0%
3/8"	9.50	64%	64%	100.0%	0.0%
1/4"	6.30		57%	100.0%	0.0%
#4	4.75	54%	54%	100.0%	0.0%
#8	2.36		46%	100.0%	0.0%
#10	2.00	45%	45%	100.0%	0.0%
#16	1.18		40%	100.0%	0.0%
#20	0.850	39%	39%	100.0%	0.0%
#30	0.600		35%	100.0%	0.0%
#40	0.425	33%	33%	100.0%	0.0%
#50	0.300		29%	100.0%	0.0%
#60	0.250	28%	28%	100.0%	0.0%
#80	0.180		24%	100.0%	0.0%
#100	0.150	23%	23%	100.0%	0.0%
#140	0.106		20%	100.0%	0.0%
#170	0.090		19%	100.0%	0.0%
#200	0.075	18.1%	18.1%	100.0%	0.0%



Comments: _____

Reviewed by: _____

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Client:	Anchor QEA, LLC	**Date:**	May 14, 2014
Address:	720 Olive Way, Suite 1900	**Project:**	Dungeness River Flow Enhancements
	Seattle WA 98101	**Project #:**	14K018
Attn:	Zac Koehn	**Sample #:**	K14-040

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	See Attached	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☐	WSDOT Degradation	
☐	Fracture Count		☐		
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Harold Benny
WABO Supervising Laboratory Technician

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Sieve Report

Project: Dungeness River Flow Enhancements
Project #: 14K018
Client: Anchor QEA, LLC
Source: GRAB03
Sample#: K14-040

Date Received: 8-May-14
Sampled By: Client
Date Tested: 14-May-14
Tested By: HB/HS

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand with Gravel
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

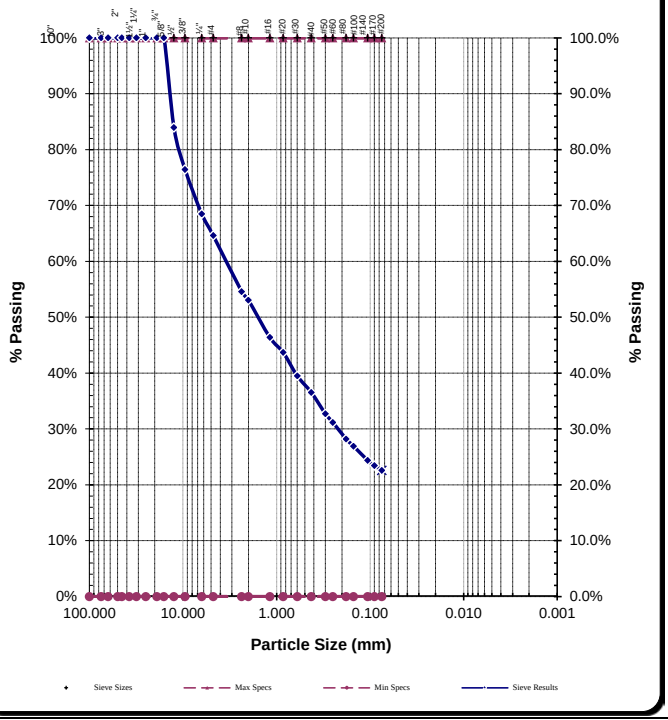
Specifications
No Specs
Sample Meets Specs ? Yes

$D_{(5)}$ =	0.017 mm	% Gravel =	35.4%	Coeff. of Curvature, C_C =	0.41
$D_{(10)}$ =	0.033 mm	% Sand =	42.0%	Coeff. of Uniformity, C_U =	109.87
$D_{(15)}$ =	mm	% Silt & Clay =	22.6%	Fineness Modulus =	3.59
$D_{(30)}$ =	0.222 mm	Liquid Limit =	0.0%	Plastic Limit =	0.0%
$D_{(50)}$ =	1.623 mm	Plasticity Index =	0.0%	Moisture %, as sampled =	11.1%
$D_{(60)}$ =	3.650 mm	Sand Equivalent =	n/a	Fracture % =	n/a
$D_{(90)}$ =	13.816 mm	Req'd Sand Equivalent =		Req'd Fracture % =	

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00		100%	100.0%	0.0%
3/4"	19.00		100%	100.0%	0.0%
5/8"	16.00	100%	100%	100.0%	0.0%
1/2"	12.50	84%	84%	100.0%	0.0%
3/8"	9.50	76%	76%	100.0%	0.0%
1/4"	6.30		68%	100.0%	0.0%
#4	4.75	65%	65%	100.0%	0.0%
#8	2.36		55%	100.0%	0.0%
#10	2.00	53%	53%	100.0%	0.0%
#16	1.18		46%	100.0%	0.0%
#20	0.850	44%	44%	100.0%	0.0%
#30	0.600		39%	100.0%	0.0%
#40	0.425	37%	37%	100.0%	0.0%
#50	0.300		33%	100.0%	0.0%
#60	0.250	31%	31%	100.0%	0.0%
#80	0.180		28%	100.0%	0.0%
#100	0.150	27%	27%	100.0%	0.0%
#140	0.106		24%	100.0%	0.0%
#170	0.090		23%	100.0%	0.0%
#200	0.075	22.6%	22.6%	100.0%	0.0%

Grain Size Distribution



Comments: _____

Reviewed by: _____

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Client:	Anchor QEA, LLC	**Date:**	May 14, 2014
Address:	720 Olive Way, Suite 1900	**Project:**	Dungeness River Flow Enhancements
	Seattle WA 98101	**Project #:**	14K018
Attn:	Zac Koehn	**Sample #:**	K14-043

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	See Attached	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☐	WSDOT Degradation	
☐	Fracture Count		☐		
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Harold Benny
WABO Supervising Laboratory Technician

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Sieve Report

Project: Dungeness River Flow Enhancements
Project #: 14K018
Client: Anchor QEA, LLC
Source: GRAB06A
Sample#: K14-043

Date Received: 14-May-14
Sampled By: Client
Date Tested: 14-May-14
Tested By: HB/HS

ASTM D-2487 Unified Soils Classification System
SW-SC, Well-graded Sand with Silty Clay and Gravel
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

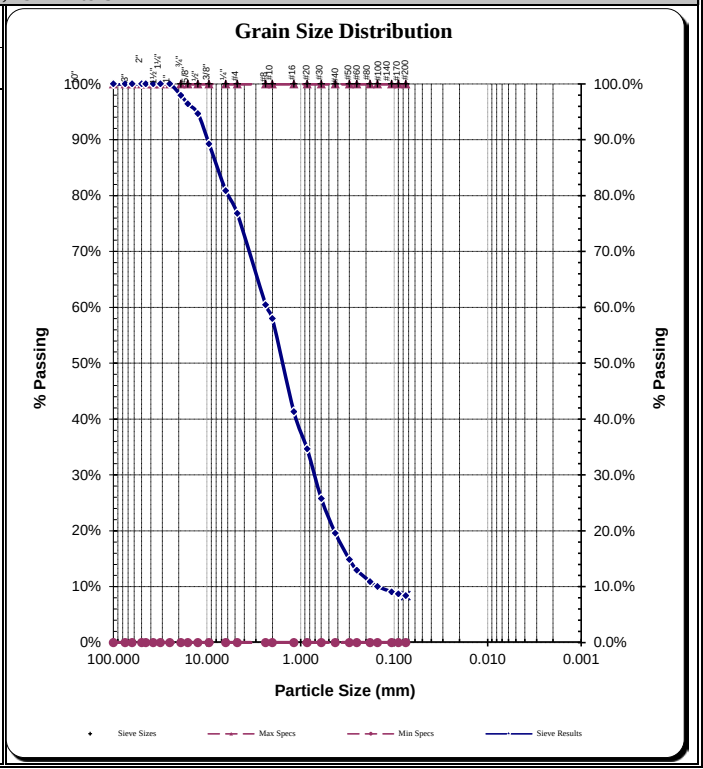
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? Yes

$D_{(5)}$ =	0.045	mm	% Gravel =	23.2%	Coeff. of Curvature, C_C = 1.52
$D_{(10)}$ =	0.148	mm	% Sand =	68.4%	Coeff. of Uniformity, C_U = 15.49
$D_{(15)}$ =	0.304	mm	% Silt & Clay =	8.4%	Fineness Modulus = 3.83
$D_{(30)}$ =	0.719	mm	Liquid Limit =	0.0%	Plastic Limit = 0.0%
$D_{(50)}$ =	1.606	mm	Plasticity Index =	0.0%	Moisture %, as sampled = 6.3%
$D_{(60)}$ =	2.293	mm	Sand Equivalent =	n/a	Fracture % = n/a
$D_{(90)}$ =	9.915	mm	Req'd Sand Equivalent =		Req'd Fracture % =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	98%	98%	100.0%	0.0%
5/8"	16.00		96%	100.0%	0.0%
1/2"	12.50	95%	95%	100.0%	0.0%
3/8"	9.50	89%	89%	100.0%	0.0%
1/4"	6.30		81%	100.0%	0.0%
#4	4.75	77%	77%	100.0%	0.0%
#8	2.36		60%	100.0%	0.0%
#10	2.00	58%	58%	100.0%	0.0%
#16	1.18		41%	100.0%	0.0%
#20	0.850	35%	35%	100.0%	0.0%
#30	0.600		26%	100.0%	0.0%
#40	0.425	20%	20%	100.0%	0.0%
#50	0.300		15%	100.0%	0.0%
#60	0.250	13%	13%	100.0%	0.0%
#80	0.180		11%	100.0%	0.0%
#100	0.150	10%	10%	100.0%	0.0%
#140	0.106		9%	100.0%	0.0%
#170	0.090		9%	100.0%	0.0%
#200	0.075	8.4%	8.4%	100.0%	0.0%



Comments: _____

Reviewed by: _____

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Client:	Anchor QEA, LLC	**Date:**	May 14, 2014
Address:	720 Olive Way, Suite 1900	**Project:**	Dungeness River Flow Enhancements
	Seattle WA, 98101	**Project #:**	14K018
Attn:	Zac Koehn	**Sample #:**	K14-041, K14-042, K14-044, K14-045

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☐	Percent Fines		☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☐	WSDOT Degradation	
☐	Fracture Count		☐		
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Harold Benny
WABO Supervising Laboratory Technician

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Project: Dungeness River Flow Enhancements
Project #: 14K018
Date Received: May 8, 2014
Date Tested: May 13, 2014

Client: Anchor QEA, LLC
Sampled by: Client
Tested by: HS / HB

Moisture Content - ASTM C-117, ASTM D-1140 & AASHTO T-11

Sample #	Location	Tare	Before Wash + Tare	After Wash + Tare	Amount of Loss	% -#200
K14-041	GRAB04	498.2	1216.5	1176.5	40.0	5.6%
K14-042	GRAB05	300.6	793.4	746.9	46.5	9.4%
K14-044	GRAB06B	225.0	1011.9	957.1	54.8	7.0%
K14-045	GRAB07	224.0	705.1	614.0	91.1	18.9%
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