

---

*Data Report*

# **Geotechnical Data Report Wild Horse Wind Power Project**

Prepared for  
**Zilkha Renewable Energy**

Revised January 2004

**CH2MHILL**  
700 Clearwater Lane  
Boise, ID 83712

Copyright 2003 by CH2M HILL, Inc.  
Reproduction in whole or in part without the  
written consent of CH2M HILL is prohibited.

# Contents

---

Section	Page
<b>Introduction</b> .....	<b>3</b>
Purpose and Scope .....	1
Project Description .....	1
Limitations.....	2
<b>Technical Data</b> .....	<b>3</b>
Field Exploration .....	3
Laboratory Testing .....	4
<b>Interpretation</b> .....	<b>6</b>
Geologic Conditions.....	6
Seismicity .....	8
Subsurface Conditions.....	9
Groundwater Conditions .....	10
<b>References</b> .....	<b>11</b>

## Appendixes

- A Test Pit Logs
- B Laboratory Test Results

## Tables

1	Test Pit Summary .....	3
2	Laboratory Test Result Summary .....	5

## Attachment

Test Pit Locations Map

---

---

# Introduction

---

## Purpose and Scope

This geotechnical exploration was conducted to evaluate general subsurface conditions in the proposed project area, to support an Energy Facility Site Evaluation Council (EFSEC) permit application for the project. This phase of permit exploration is preliminary, and is intended to gain general geotechnical and geological information. Additional exploration and evaluation is necessary to provide geotechnical design recommendations. The scope of the geotechnical exploration included the following:

- Review geologic and available subsurface information
- Perform a site reconnaissance to identify geology, potential geologic hazards, and proposed test pit locations
- Conduct an exploration of subsurface conditions consisting of fifteen test pit excavations
- Conduct laboratory testing of selected soil samples
- Prepare this data report that summarizes the findings

## Project Description

The proposed Wild Horse Wind Power Project is located within northeast Kittitas County in south central Washington. The Project is located east of the Cascade Range, approximately 8 miles west of the Columbia River. The project area lies less than 5 miles north of State Highway 10 (Vantage Highway) and Interstate 90, approximately 15 miles east of Ellensburg, Washington (see the Test Pit Locations map presented in the Attachment).

The proposed Wild Horse Wind Power Project includes the construction of 18 strings of wind turbines (labeled A through R) along ridges that generally run northwest to southeast from the Wenatchee Mountains to the north of the project. Each string contains between 3 and 39 wind turbines, and ranges in length from 0.2 to 3.9 miles. Turbines within a string are identified by their sequential number in a string, such as A<sub>1</sub>, A<sub>2</sub>, and so forth. Individual wind turbines are electrically connected to an underground utility line, and all strings are linked to the proposed project substation through either underground or overhead electric lines. The proposed strings that are part of the project are shown on the map provided at the end of this report (Attachment).

In general, the wind turbines proposed for this project are 3-bladed rotors with a radius of 100 to 150 feet. The rotors and machine house (nacelle) sit atop a tower that is 200 to 250 feet high. Towers are commonly 10 to 15 feet in diameter. Wind turbines are typically supported by spread footings with foundation anchoring, or by deeper cylindrical mono-piles that can be up to 17 feet in diameter. The wind turbines proposed for this project have a rated

generation capacity between 1 and 3 megawatts. At the time of this report revision, a total of 136 turbines are proposed for the project, for a total generating capacity of approximately 201 megawatts.

The project site covers just over 13 square miles (approximately 8,500 acres), although the actual footprint of the area occupied by all of the proposed towers is less than 200 acres. The project site contains ephemeral and perennial creeks that primarily flow eastward into the Columbia River. Exceptions are Dorse Spring and a spring in the south part of the project that flow south and west, that drain into the Yakima River. Most of these drainages originate at springs that exist approximately between elevations 3300 and 3400 feet above mean sea level. Slopes within the Project area generally range from less than 5 degrees on the flat plateau area of the northeast portion of the site, up to 40 degrees on Whiskey Dick Mountain and along sideslopes and drainages. Occasional rock outcrops with vertical exposures are also present on the project site. The greatest vertical height of any exposure has been observed to be approximately 25 feet. Elevations in the project area and adjacent lands generally range from 2300 to 3900 feet.

The majority of the project area is open range, with nearly full coverage by small vegetation. Native bunchgrass, wildflowers, and low shrubs, such as bitterbrush and sagebrush dominate the vegetation. In one localized area of the project, mature conifers border the creek below Pine Spring. More pines and junipers border Whiskey Dick Creek. Most of the ridgetops proposed for development consist of rocky grassland.

## Limitations

This report has been prepared for the exclusive use of Zilkha Renewable Energy for specific application to the Wild Horse Wind Power Project. This report has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, expressed or implied, is made.

The information contained in this report is based on data obtained from review of geologic literature, observations made at the project site, and test pits excavated at the site. Test pit logs depict subsurface conditions only at the specific locations and times indicated, and only to the depths penetrated. Subsurface conditions and water levels at other locations may differ from conditions at these locations.

CH2M HILL is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data without the express written authorization of CH2M HILL.

# Technical Data

## Field Exploration

The field exploration was completed on May 7 and 8, 2003. Fifteen test pits were excavated at various locations along the string lines during the exploration (TPG-1 through TPF-15). Additional geologic reconnaissance was completed on November 22, 2003 in response to additions and revisions to the project size and turbine locations.

Test pits were excavated by Fulleton-Pacific Construction, Inc., of Ellensburg, Washington, using a 2002 Cat 420D rubber-tired backhoe, and a 24-inch bucket. Subsurface conditions were observed and logged by a CH2M HILL geotechnical engineer and engineering geologist. Field copies of test pit logs are presented in Appendix A. Soil samples were examined in the field and visually classified in general accordance with ASTM D2488 – Description and Identification of Soils (Visual-Manual Procedure). An engineering geologist classified properties of rock (including type, color, mineralogy, hardness, degree of weathering, fracturing). The field classifications are shown on the test pit logs in Appendix A. Test pits were located after completion in the field with a hand-held Global Positioning System (GPS), to an accuracy of approximately 20 feet. Elevations were also determined using a GPS. All locations and elevations are based on the North American Datum (NAD 1983). Latitude and longitude are given for each test pit in Table 1, along with the depth of each excavation and position with respect to the nearest wind turbine.

**TABLE 1**  
Test Pit Summary

Test Pit	Latitude	Longitude	Elevation (ft)	Nearest String Position	Depth (ft)
TPG-1*	47.010	-120.210	3300	E <sub>2</sub>	3.0
TPB-2	47.01718	-120.22416	3648	B <sub>4</sub>	2.6
TPA-3	47.02444	-120.23671	3832	A <sub>2</sub>	7.0
TPC-4	47.04965	-120.22296	3481	N <sub>2</sub>	3.8
TPE-5	47.02710	-120.21622	3450	H <sub>2</sub>	2.5
TPI-6	47.02416	-120.19748	3306	I <sub>4</sub>	3.0
TPD-7	47.03644	-120.21842	3478	J <sub>4</sub>	1.3
TPD-8	47.03979	-120.22094	3492	J <sub>1</sub>	4.5
TPH-9	47.03893	-120.20934	3508	K <sub>6</sub>	0.5
TPJ-10	47.03778	-120.19463	3333	L <sub>5</sub>	9.0

**TABLE 1**  
Test Pit Summary

Test Pit	Latitude	Longitude	Elevation (ft)	Nearest String Position	Depth (ft)
TPJ-11	47.01948	-120.18074	3149	L <sub>20</sub>	2.0
TPM-12	47.03359	-120.17977	3280	M <sub>2</sub>	4.5
TPK-13	47.04469	-120.18797	3268	Q <sub>6</sub>	2.0
TPL-14	47.04815	-120.17585	3092	R <sub>3</sub>	2.4
TPF-15	47.01379	-120.20472	3504	E <sub>1</sub>	2.3

Note: All locations and elevations are based on NAD 83.

\*Position and elevation of TPG-1 was approximated using the USGS 7-1/2 minute quad map.

The average test pit depth is just over 3 feet, due to backhoe refusal in hard rock. The same excavation effort for the backhoe was used in determining the final depths of all test pits.

## Laboratory Testing

Samples collected during the preliminary field exploration were delivered to a laboratory for testing of index parameters and for verifying field classifications. Laboratory testing was conducted by Strata, Inc., of Boise, Idaho. Testing included the following:

- ASTM D2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock
- ASTM D4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422: Particle-Size Analysis of Soils

The laboratory test results are summarized in Table 2. Complete geotechnical laboratory test results are provided in Appendix B.

**TABLE 2**  
Laboratory Test Result Summary

Test Pit	Sample Type	Sample Depth Interval (ft)	Soil Type ASTM D 2488	Moisture Content (%)	Atterberg Limits (%)			% Passing No. 200 Sieve
					LL	PL	PI	
TPG-1	Bag	1.0	CL	23.6				
	Bulk	1.0-3.0	GP-GC					7.3
TPB-2	Bag	0.5	SC	19.0				
	Bulk	0.5-2.5	GP-GC					9.5
TPA-3	Bag	1.5	CL	34.2				
	Bag	4.5	CLAYSTONE	38.3				
	Bulk	1.0-5.0	GP-GC					41
TPC-4	Bulk	1.0-3.0	SP-SM					7.3
TPI-6	Bag	0.5-3.0	GP-GM					13.7
TPD-7	Bulk	0.5-1.3	CL	16.0				
TPD-8	Bag	2.0	CL	17.0	31	19	12	36
	Bulk	1.5-3.5	GC					13.5
TPJ-10	Bag	6.5	CH	59.1	67	27	40	
	Bulk	2.0-7.0	GC					5.9

LL = Liquid Limit.  
PL = Plastic Limit.  
PI = Plasticity Index.

GP = Poorly graded gravel with sand.  
GP-GM = Poorly graded gravel with silt and sand.  
GP-GC = Poorly graded gravel with clay and sand.  
GM = Silty gravel.

GC = Clayey gravel.  
SP-SM = Poorly graded sand with silt and gravel.  
SM = Silty sand.  
SC = Clayey sand.  
CL = Lean clay.  
CH = Fat clay.  
ML = Silt, silt with sand/gravel, and sandy/gravelly silt.

# Interpretation

---

## Geologic Conditions

The Project area is located on the Columbia Plateau, which is located at the eastern base of the Cascade Range, and at the western edge of the Columbia Intermontane Physiographic Province (Freeman and others, 1945). This lowland province is surrounded on all sides by mountain ranges and highlands, and covers a vast area of eastern Washington and parts of northern Oregon. The province is characterized by moderate topography incised by a network of streams and rivers that drain towards the Columbia River.

The Columbia Plateau is underlain by a series of layered basalt flows extruded from vents (located mainly in southeastern Washington and northeastern Oregon) during the Miocene epoch (between 6 and 18 million years before present [B.P.] – Reidel et al., 1994). Collectively, these basalt flows are known as the Columbia River Basalt Group. Individual basalt flows range in thickness from a few feet to as much as 300 feet. The Project site is located in the Yakima Fold Belt subprovince, an area that includes most of the western half of the Columbia Plateau north of the Blue Mountains. The bedrock underlying the Project site consists of Miocene-age basalt flows, and includes the upper Grande Ronde Basalt and the Frenchman Springs Member of the Wanapum Basalt, with interbedded Ellensburg Formation.

The structural geology of the site includes primarily folded and dipping basalt beds. The Whiskey Dick Anticline trends east-southeast through Whiskey Dick Mountain. The south-trending Naneum Ridge Anticline runs along the western edge of the Project vicinity and intersects the Whiskey Dick Anticline atop Whiskey Dick mountain. These anticlines define topographic high areas. An east-dipping monocline is mapped just east of the Project area. The basalt beds in the eastern side of the project dip up to 6 degrees eastward, towards the Columbia River.

More detailed descriptions of the individual geologic units and geologic hazards at the project site are given below.

**Grande Ronde Basalt.** This material consists of multiple basalt flows that are sometimes interbedded with the Ellensburg formation. This formation is a subgroup of the Columbia River Basalt Group, and has been described to have a thickness up to 300 meters, although the thickness in the project vicinity is not known. Based on observations of outcrops and test pits excavated during the site visit, the Grande Ronde Basalt appears to be dark gray, fine-grained, and very hard but fractured into angular to subround cobble within a few feet of the ground surface. The fractured portion is infilled by silty and sandy matrix. In most of the test pits excavated in this basalt, the upper few feet is fractured and rippable but fracture density decreases and rock mass quality increases downward rapidly. Most test pits were terminated within 3 feet of ground surface due to backhoe refusal.

**Vantage Member of the Ellensburg Formation.** A localized outcrop of the Vantage Member of the Ellensburg Formation is mapped in the southeast portion of the Project area. This unit consists of interbedded, weakly-cemented, volcanoclastic sandstone, siltstone, and minor dark mudstone. This member occurs between the Grande Ronde and Wanapum basalts, and has an average thickness of 16 to 33 feet, and pinches out to the west towards the Naneum Ridge anticline. This unit appears to influence local groundwater flow beneath the site. Based on observations and documentation of springs in the Project site, it appears that the springs are located along a relatively horizontal low-permeability zone that likely correlates with the Vantage Member.

**Frenchman Springs Member of the Wanapum Basalt.** This formation is mapped in the project area north of Whiskey Dick Mountain and overlies the Grande Ronde Basalt. Based on observations of outcrops and test pits excavated during the site visit, the Frenchman Springs member is similar in characteristics to the Grande Ronde Basalt, and can be described as dark gray, fine-grained, and very hard but fractured. The fractured portion is infilled by silty and sandy matrix. In most of the test pits excavated in this basalt, the upper few feet is fractured and rippable but fracture density decreases and rock mass quality increases downward. Most test pits were terminated within 2 to 3 feet in depth and were unable to be excavated further by the backhoe.

**Unconsolidated Deposits.** Unconsolidated deposits are thin or absent in the Project vicinity. Based on observations made during the site visit, the surficial materials consisted primarily of a thin veneer of brown, silty clay topsoil that was likely wind-deposited. The thickness of this material varied across the site from a few inches to three feet, based on test pit observations. In several areas bedrock and talus were observed at the ground surface.

**Mass Wasting Deposits (Landslides).** Based on field reconnaissance, several landslides are located in the project vicinity, including one large landslide in the south part of the project. This landslide is also shown on the geologic map, located on the south side of Whiskey Dick Mountain (Tabor et. al, 1982). The approximate boundary of this landslide is shown on the Test Pit Locations map attached to the end of this report. This slide was observed during the site visit and is noted as a possible area of concern for the adjacent strings. This is a large landslide, estimated to be approximately 1/3 mi<sup>2</sup> in area and almost a mile long. The elevation ranges from approximately 3700 feet to 3000 feet over the length of the slide, with a corresponding average ground slope of approximately 2 horizontal to 1 vertical. The surface of this landslide is irregular and hummocky, and springs appeared to be emanating from some areas of the slide. Native vegetation was observed at the surface throughout the slide area, suggesting that activity on the slide was either historical, or is of a rate slow enough to enable the establishment of native vegetation. This slide is mapped between the C and D strings. The boundary of the slide is approximately 230 feet east of the C string, and approximately 550 feet west of the D string.

Several other possible landslides are mapped southwest of the project boundary, and in the southeast area of the project, near the end of the G string, according to the Washington Division of Geology and Earth Resources digital geologic maps (WDGER, 2001). These slides are much smaller in size. Two are located south of the C and E strings; two others lie on either side of the ridge on which the G string is located. Horizontal distances from these

potential landslide areas to the nearest turbine are approximately 1,200 to 1,800 feet (see Test Pit Locations map, attached). These areas are mapped as landslide deposits (Tabor et al., 1982; WDGER, 2001), but can also be mass-wasting features resulting from other mechanisms of erosion.

**Cliffs.** In the southeast area of the project near turbine G<sub>4</sub>, basalt outcrops form a series of small cliffs directly east of turbine G<sub>4</sub>. These cliffs have vertical heights ranging from approximately 15 to 25 feet. As of the date of this report, the nearest cliff to turbine G<sub>4</sub> is mapped approximately 340 feet to the east of the turbine. Observation of the exposed wall of these cliffs indicate the basalt has fairly tight jointing, although small talus fields exist down hill from the cliffs.

## Seismicity

Seismic sources include the Cascadia Subduction Zone (CSZ), intraslab, and crustal (local fault) sources (Geomatrix 1995). Each of these events has different causes, and therefore, produces earthquakes with different characteristics (that is, peak ground accelerations, response spectra, and duration of strong shaking). The two source mechanisms associated with the CSZ are currently thought to be capable of producing moment magnitudes of approximately 9.0 and 7.5, respectively (Geomatrix 1995).

Seismic deaggregation mapping was also considered for selection of the most probable earthquake magnitude for the Wild Horse site. This resource provides an estimate of earthquake magnitude at discrete locations, considering the percent contribution of all potential sources for an area (subduction, intraslab, and crustal), as developed by the United States Geological Survey (USGS) Seismic Hazard Mapping Project. Based on input of latitude and longitude for the Wild Horse project site, the highest statistical contribution is for a seismic event with a magnitude of approximately 6.0, for a 475-year mean return period (USGS, 2003).

For new construction, the site should be designed for the maximum considered earthquake, or MCE, according to the International Building Code (IBC, 2000). This earthquake event corresponds to an event having a 2 percent probability of exceedance in 50 years (or 2500-year return period). The MCE has a PGA of approximately 0.18 g at the bedrock surface. This value of PGA on rock is an average representation of the acceleration most likely to occur at the site for all seismic events (crustal, intraplate, or subduction). The corresponding short-period (0.2 second) spectral acceleration is approximately 0.46 g. Additional exploration at the site is necessary before a site class determination can be made for selecting amplification factors for site-specific conditions.

No faults are mapped within the Project Area, but a few faults are mapped within approximately 4 miles southwest of the Project area. Many of these faults are inferred and shown as dotted lines buried by alluvial fan materials. It appears that these faults are inferred based on scattered outcrops of bedrock in the alluvial fans. If the faults had moved after the deposition of the alluvial fans the alluvial fans would be truncated and that would be an indication that these faults had been active in the late Quaternary. More exploration would be required to determine the age and activity of faults in the project vicinity.

## Subsurface Conditions

The predominant subsurface conditions for the project consist of dry to moist silty clay topsoil overlying basalt bedrock. At some locations (TPC-4 and TPJ-10), a multicolored cemented clay and sand with glassy clasts was also encountered near the surface. This material was intruded by pockets of basalt rock, and by basalt tubes that were bisected by the test pits. At TPA-3, a layer of blocky, brown, weak claystone was encountered near the bottom of the test pit. This material was weathered into fine gravel-sized particles.

Moist silt to clay was predominant at the surface across the site, supporting vegetative roots in the upper 6 to 12 inches typically. Natural moisture content in near-surface fine-grained samples ranged from 16 to 34 percent, although the portion of silts and clays in the material excavated in any test pit was typically less than 15 percent. The near-surface material was dry in some locations with moisture increasing with depth. In some locations (TPA-3, TPD-8), the thickness of topsoil was greater, and more moist and clayey with depth.

Considering the proportion of fine-grained material and the proportion of rock in the test pits, and assuming a moisture content in the rock and coarse-grained materials of 7 percent, an estimate can be made of the overall moisture content of bulk excavated material. This estimated moisture content for bulk samples is in the range of 8 to 18 percent. The majority of the material collected consisted of gravel and cobble-sized particles, with a typical maximum diameter of 4 inches. Some boulders were also encountered across the site, with a typical size of 12 to 18 inches diameter.

Short-term (typically less than an hour) stability of excavation walls in the test pits ranged from good to excellent, depending on the size of cobbles and the natural moisture in the soil. However, most test pits were relatively shallow, and so deep excavation sidewalls were not observed for sloughing.

**Cemented Clay and Sand.** In test pits TPC-4 and TPJ-10, a highly-cemented clay and sand layer was encountered below the topsoil, up to a depth of 8.5 feet below ground surface. Below 5.5 feet in TPJ-10, this material was highly plastic and more moist, and did not exhibit the degree of cementation found closer to the surface. This material is believed to be part of the Vantage Member of the Ellensburg formation (Tabor et al., 1982), and appears to have weathered in-place to a more plastic state. This material contained varying percentages of fine sand and gravels. This material was difficult to excavate in the cemented zone, although excavation stability was excellent.

**Weak Claystone.** Test pit TPA-3 encountered a layer of brown, blocky, weak claystone overlying basalt, between the depths of 3.5 and 5.5 feet. This material was broken up into gravel-sized pieces, and was similar in texture to a soapstone. The natural moisture content of this material was 38 percent. Excavation in this material was fairly easy.

**Basalt Rock.** Basalt rock encountered at the site consisted of two flows – the Grande Ronde Basalt, and the Frenchman Springs Member of the Wanapum Basalt. Both of these formations are part of the Columbia River Basalt Group. All test pits were terminated in this material, at depths between 0.5 and 9.0 feet. The rock was typically weathered and more

fractured in the upper 2 to 3 feet, becoming harder with depth and very difficult to excavate further with the equipment used.

## Groundwater Conditions

Groundwater was not observed in any of the test pits excavated at the project area. However, some zones of soil in the test pits were observed to have free water in the voids, which was likely water from surface infiltration.

There are numerous springs mapped and unmapped in the area, and a few ponds that are anticipated to be seasonal only. The springs are consistently at elevations between approximately 3300 and 3400 feet across the site, and are believed to coincide with the low-permeability Vantage Member of the Ellensburg formation. In May, springs were observed to produce flows ranging from 1 to 5 gallons per minute (gpm). During the field visit in November, most springs were dry. One spring was observed to be producing approximately 1 gpm, or approximately 20 percent of its springtime flow.

In some of the swales and small drainages near known springs, groundwater is anticipated to be present very near the surface. Groundwater is not anticipated to be typically present on the ridges where most of the proposed wind turbine strings are located. However, localized pockets of saturated subsurface soils and perched groundwater may be encountered on ridges in places where surface water infiltrates the subsurface and collects above rock or fine-grained material. Fine-grained and cemented soils have lower porosity and permeability, and were typically found in the upper 1 to 4 feet of test pits excavated at the project area.

---

# References

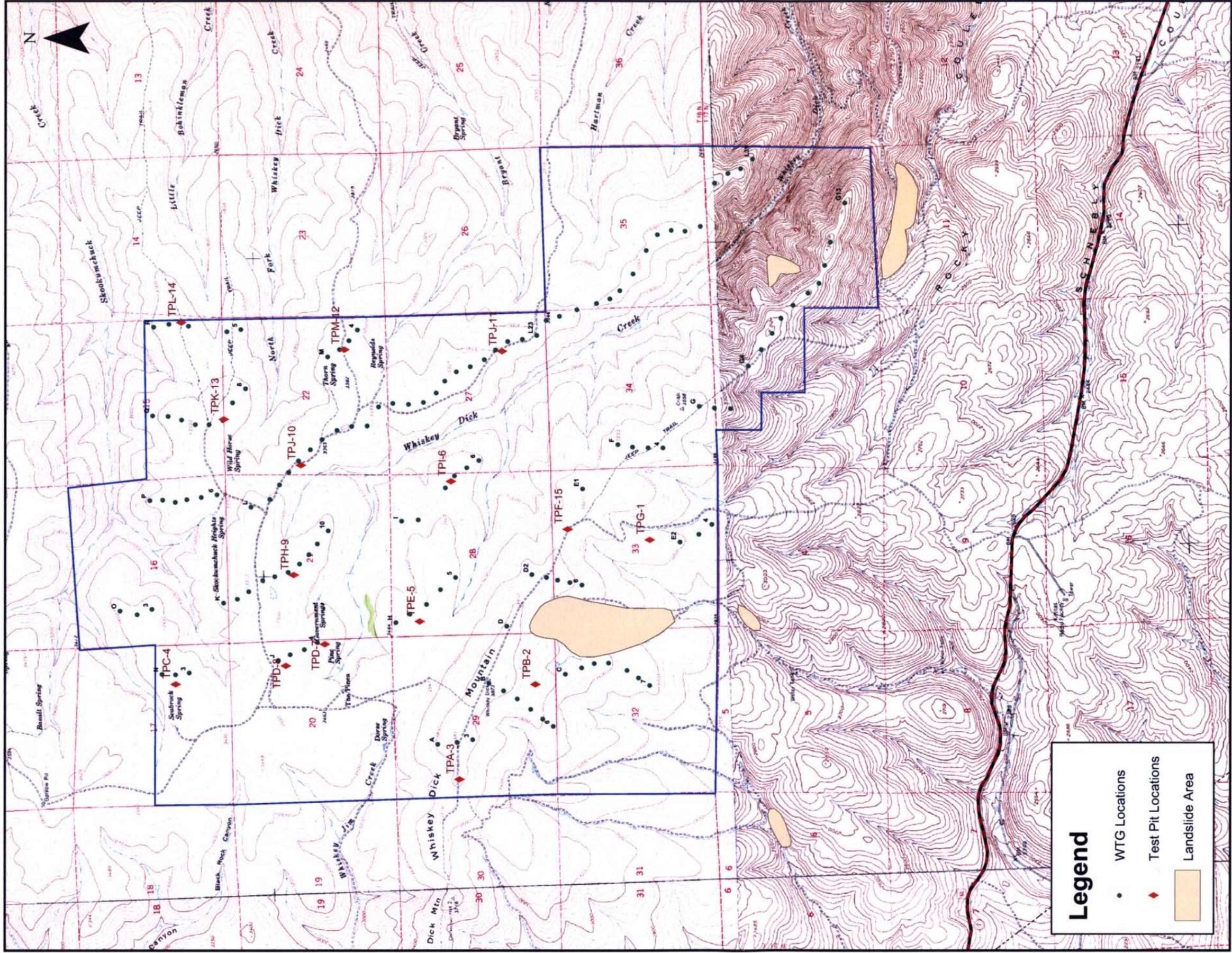
---

- Freeman, O.W., Forrester, J.O., and Luper, R.I. 1945. *Physiographic divisions of the Columbia Intermontane Province*. Annual Association American Geographer, v. 35, no. 2, p. 50-75.
- Geomatrix. 1995. *Final Report, Seismic Design Mapping, State of Oregon*. Report prepared for the Oregon Department of Transportation, Project No. 2442.
- International Building Code. 2000. Published by the International Code Council.
- Reidel, S.P., Campbell, N.P., Fecht, K.R., Lindsay, K.A. 1994. *Late Cenozoic Structure and Stratigraphy of South-Central Washington*. Washington Division of Geology and Earth Resources, Bulletin 80, pp. 159-180.
- Tabor, R.W., Waitt, Jr., R.B., Frizzell, V.A., Swanson, D.A., Byerly, G.R., and Bentley, R.D. 1982. *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington*. Department of the Interior, United States Geologic Survey, Miscellaneous Investigations Series, Map I-1311.
- Uniform Building Code. 1997.
- United States Geological Survey. 2003. *Earthquake Hazards Program, National Seismic Hazard Mapping Project: 2002 Data*. Deaggregated Seismic Hazards Maps, available on the USGS website, <http://geohazards.cr.usgs.gov/eq/>.
- Washington Division of Geology and Earth Resources. 2001. *Digital Geologic Maps of the Wenatchee and Yakima 1:100,000 Quadrangles, Washington*. Washington State Department of Natural Resources, Division of Geology and Earth Resources. Digital Report 2, Version 1, 1 CD-ROM Disk.

Attachment

**Test Pit Locations Map**

---



**Legend**

- WTG Locations
- ◆ Test Pit Locations
- Landslide Area



**CONFIDENTIAL**  
 PRELIMINARY  
 NOT FOR  
 CONSTRUCTION

**Wind Ridge Partners, LLC**  
 210 SW MORRISON  
 SUITE 310  
 PORTLAND, OR 97204  
 TEL: (503) 222-9400  
 FAX: (503) 222-9404



**TEST PIT LOCATIONS**  
 Wild Horse Wind Power Project

DWG: Test Pit Locations  
 DATE: January 23, 2004  
 FILENAME: JBFig.mxd



PROJECT NUMBER 17967A.B1-01	TEST PIT NUMBER TPG-1	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION G string, G<sub>2</sub>-G<sub>3</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3300 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft. Width 2 ft. Max Depth 3 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			LEAN CLAY w/ SAND (CL), brown, slightly moist, roots to 1.1 ft.	WX = weathered
1		1.1 ft. CONTACT		
2		BULK	WX BASALT, fractured but hard rock (R4-R5); dark grey, pillow basalt, broken into 1" to 6" angular gravel/cobbles	Difficult excavation with this equipment; operator thinks could go a little further w/ bigger equipment Photo R1/P1
3				Backhoe refusal
4				T.D. = 3.0 ft.
5				
6				

PROJECT NUMBER 179679.B1-01	TEST PIT NUMBER TPB-2	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION B string B6 LOGGER J. Butler, PE  
 ELEVATION Approx. 3648 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft. Max Depth 2.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty LEAN CLAY w/ SAND (CL) brown, moist 0.5 ft. CONTACT	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
1	Bag	BULK	LX BASALT, dark gray, crystalline, breaks into platy pieces; sand/silt in fractures	
2				Photo R1/P2 Very solid rock @ 2.5 ft. Backhoe refusal T.D. = 2.5 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPA-3	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION A String, A<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3832 ft. CONTRACTOR Fullerton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 10-12 ft. Width 2 ft Max Depth 7 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0				
2	Bag -	1.0	LEAN CLAY, brown, moist to wet, w/ sand + gravel (< 15%), and pockets of wx basalt; roots to 0.8 ft.	
			2.5 ft. Becoming dry to moist	
4	Bag -	3.0	CLAYSTONE, dark brown, soapy texture (soapstone), breaks into blocky, angular pieces	Photo RI/PS
			3.5 ft. CONTACT	
6			BASALT, dark gray, fractured + rippable, hard (RS)	Backhoe Refusal
			5.5 ft. CONTACT	
8				T.D. = 7.0 ft.
10				
12				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPC-4	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION C String, C2 LOGGER J. Butler, PE  
 ELEVATION Approx. 3481 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 422 D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft. Max Depth 3.8 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty LEAN CLAY (CL), brown, slightly moist	
1		1.0	Contact 0.9 ft.	
2		BULK	Cemented Sand/Gravel, w/ glassy clasts, medium brown to yellow-brown, hardness R1-R2; contains basalt "tubes" 10-12" in diameter, at various depths intersecting the trench direction	Photo R1/P6
3			3.07	Refusal on basalt at 3.8 ft., very hard
4				Backhoe refusal T.D. = 3.8 ft.
5				
6				

PROJECT NUMBER <b>179679-B1-01</b>	TEST PIT NUMBER <b>TPE-5</b>
SHEET <b>1</b> OF <b>1</b>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION E string E<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3450 Ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 Ft. Width 2 Ft. Max Depth 25 Ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Silty topsoil (SILT, ML), roots and some cobbles Contact @ 0.7 Ft.	
1			BASALT, broken and fractured, very hard, broken into 0.2' to 1.0' boulders	Looks like riprap in exc. spoils pile  Photo R1/P8
2				Back hoe refusal
3				T.O. = 2.5 Ft.
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPI-6	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION I string, I4 LOGGER J. Butler, PE  
 ELEVATION Approx. 3306 ft. CONTRACTOR Fulleton-Pacific  
 EXCAVATION EQUIPMENT Cat 420D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft. Max Depth 3.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			SILT w/ SAND (ML), brown slightly moist, root zone	
0.5			Contact @ 0.6 ft.	
1			BASALT, spheroidally fractured (cores + shells), very hard (RS), 0.1' to 0.8' diameter rounded clasts	
2				
3				Backhoe refusal
3.0				T.D. = 3.0 ft.
4				
5				
6				



PROJECT NUMBER 179679-B1-01	TEST PIT NUMBER TPD-7	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION D string D4 LOGGER J. Butler, PE  
 ELEVATION Approx. 3478 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 5-6 ft. Width 2 ft. Max Depth 1.3 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE		
0				
1		0.5 ← Bag	Sandy LEAN CLAY (CL), slightly moist, approx. 30% sand, with cobbles + boulders	Backhoe refusal
2		1.3		T.D. = 1.3 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679-B1.01	TEST PIT NUMBER TPD-8	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION D string, D, LOGGER J. Butler, PE  
 ELEVATION Approx. 3492 CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft. Width 2 ft. Max Depth 4.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE		
0			SILT (ML) to LEAN CLAY (CL) w/ SAND, brown, moist, soft to firm	
1				
2	Bag	1.5 BULK		
3			Contact @ 3.0 ft. BASALT, silty and broken, angular, weathered with spheroidal inclusions	
4		3.5		Backhoe refusal
5				T.D. = 4.5 ft.
6				

PROJECT NUMBER <b>179679.131.01</b>	TEST PIT NUMBER <b>TPH-9</b>
SHEET <b>1</b> OF <b>1</b>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION H String, Itz LOGGER J. Butler, PE  
 ELEVATION Approx. 3508 ft CONTRACTOR Fullerton-Pacific (Bob Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 2 ft. Width 2 ft. Max Depth 0.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Minimal silty soil, roots, and vegetation Contact @ 0.5' -/ BASALT	Backhoe refusal T.D. = 0.5 ft.
1				Attempted 2 test pits in the vicinity of TPH-9 Basalt outcrops nearby, approx. 50-100 ft. SW
2				
3				
4				
5				
6				

PROJECT NUMBER 179679	TEST PIT NUMBER TRJ-10	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION J King, Js LOGGER J. Butler, PE  
 ELEVATION Approx. 3353 ft CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED \_\_\_\_\_  
 WATER LEVEL AND DATE Not available APPROX. DIMENSIONS: Length 12-14 ft, Width 2 ft, Max Depth 9.0 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			SILTY SAND (SM), dry to moist, root zone	
			Contact @ 1.5 ft.	
2	2.0		Clayey GRAVEL (GC), w/ glassy clasts, mottled brown, plastic fines; angular basalt clasts	
4			Transitional	
6			Contact @ 5.5 ft.	
			Gravelly CLAY (CL-CH), orange-brown, small gravels, very plastic	
8	7.0		Contact @ 8.5 ft.	
			BASALT, hard, clasts	Backhoe refusal
10				T.D. = 9.0 ft
12				

Bag  
 TSULK  
 2.0  
 7.0

PROJECT NUMBER 179679-BL-01	TEST PIT NUMBER TRJ-11	SHEET ( OF ) 1 ( 1 )
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION J string, J20 LOGGER J. Butler, PE  
 ELEVATION Approx. 3149 ft. CONTRACTOR Fulleton - Pacific  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft. Max Depth 2.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION <small>SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY</small>	COMMENTS <small>DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION</small>
	INTERVAL	NUMBER AND TYPE		
0			Sandy silt (ML), brown, dry to moist, with roots	
1			BASALT @ 0.5 ft. weathered, hard but fractured, pieces up to 1 foot diameter	spoils look like rip rap
2				Backhoe refusal T.D. = 2.0 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679 B1.01	TEST PIT NUMBER TPM-12	SHEET 1	OF 1
<b>TEST PIT LOG</b>			

PROJECT Wild Horse Wind LOCATION M string, M<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3280 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft Max Depth 4.5 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty / clayey SAND (SM/SC), brown, moist, roots	
1			Contact @ 1.1 ft.	
2			BASALT, highly fractured, with vitrophyse (R1-R2), dark grey basalt, fractures to angular silty/sandy gravel, 0.1' to 0.5' clasts, approx. 30% matrix	
3				
4				
5				Backhoe Refusal T.D. = 4.5 ft.
6				

PROJECT NUMBER 179679-B1.01	TEST PIT NUMBER TPK-13	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION K. String, K6 LOGGER J. Butler, PE  
 ELEVATION Approx. 3268 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6.8 ft. Width 2 ft Max Depth 2.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE		
0			silt topsoil, brown, dry to moist, roots	
1			BASALT @ 0.5 ft., hard, fractured, RS; angular clasts up to 0.5 ft. diameter, silty matrix.	
2				Backhoe refusal T.D. = 2.0 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPL-14	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION L String, L3 LOGGER J. Butler, PE  
 ELEVATION Approx. 3092 ft CONTRACTOR Fulleton-Pacific  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6-8 ft Width 2 ft Max Depth 2.4 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty topsoil, brown, roots Contact @ 0.4 ft.	
1			BASALT, broken, very hard, subangular clasts up to 1' diameter; surface littered w/ boulders	
2				Backhoe refusal
3				T.D. = 2.4 ft.
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPF-15	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION F string, F<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3504 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft Max Depth 2.3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty topsoil, brown, roots	
1			BASALT @ 2.3 ft. very hard (RS) and fractured, angular clasts up to 0.8 ft. diameter, silt/sand matrix	Hard digging
2				Backhoe refusal
3				T.D. = 2.3 ft.
4				
5				
6				

Appendix B

## **Laboratory Test Results**

---



**S T R A T A**

GEOTECHNICAL ENGINEERING & MATERIALS TESTING

Summary of Test Results

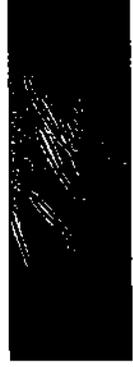
Project: Zilkha Wild Horse  
Report to: Ch2MHill

Report Date: 5/23/2003  
File Name: CH2MHill-BM02418

Test Pit -	Depth - Feet	Lab Number	Description and remarks (classification)	Gradation Provided	In situ Moisture, %	Passing No. 200, %	Atterberg Limits LL	Atterberg Limits PI	Fines Class.
TPG-1	1	B3L1000	Dk. Brn. Clay w/footlet*		23.6%				
	1-3	B3L1001	Gravel w/Silt & Cobbles	X		7.3			
TPB-2	0.5	B3L1002			19.0%				
	0.5-2.5	B3L1003	Gravel w/sand, Clay, & Cobbles			9.5			
TPA-3	1.5	B3L1004	Brn. Clay*		34.2%				
	4.5	B3L1005	Dk. Brn. Weathered Rock*		38.3%				
	1-5	B3L1006	Clayey Gravel w/Sand & Cobbles	X		41			
TPC-4	1-3	B3L1007	Sand w/Silt & Trace Gravel			7.3			
TPI-6	0.5-3	B3L1008	Silty Sand w/Basalt gravel			13.7			
TPD-7	0.5-1.3	B3L1009	Brn. Sandy Silt*		16.0%				
TPD-8	2	B3L1010			17.0%		31	12	CL
	1.5-3.5	B3L1011	Brn. Clayey Sand w/Grav. & Cob.			13.5			
TPJ-10	6.5	B3L1012	Red Brn. Clay w/Sand		59.1		67	40	CH
	2 - 7	B3L1013	Gravel w/Sand & Silt	X		5.9			

\* Indicates ASTM D2488 Visual Classification.

Reviewed by:

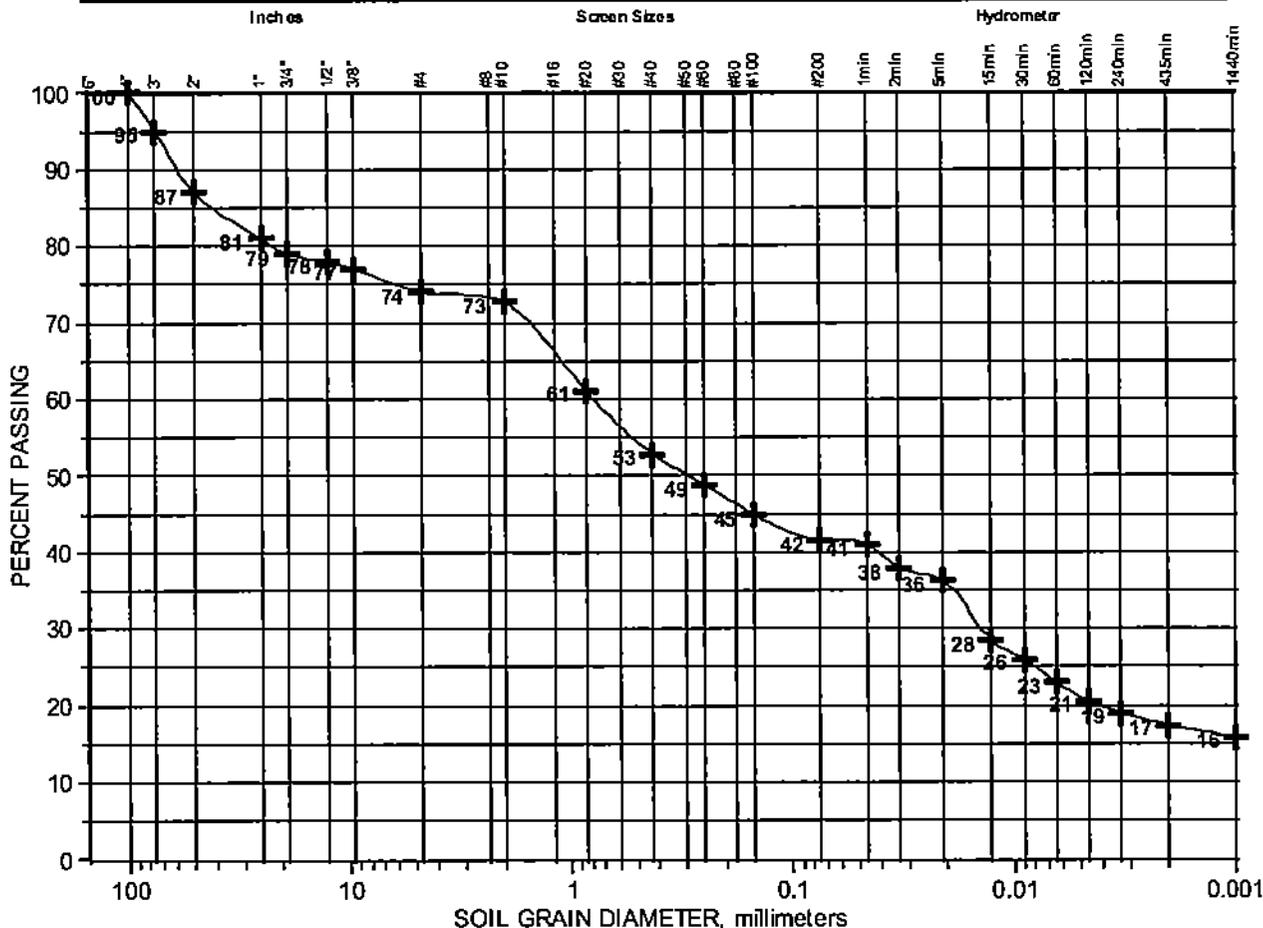


# GRADATION ANALYSIS

ASTM D422

Project: Zilkha Wild Horse  
 Client: CH2MHill  
 File: CH2H03 BM02418  
 Sample No.: B3L1006  
 Sample Location: TPA-3 @ 1-5'  
 Description: Clayey Gravel w/Sand & Cobbles  
 Date Received: 5/16/03  
 Date tested: 5/22/03

Cobbles	Gravel		Sand			Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Reviewed by:



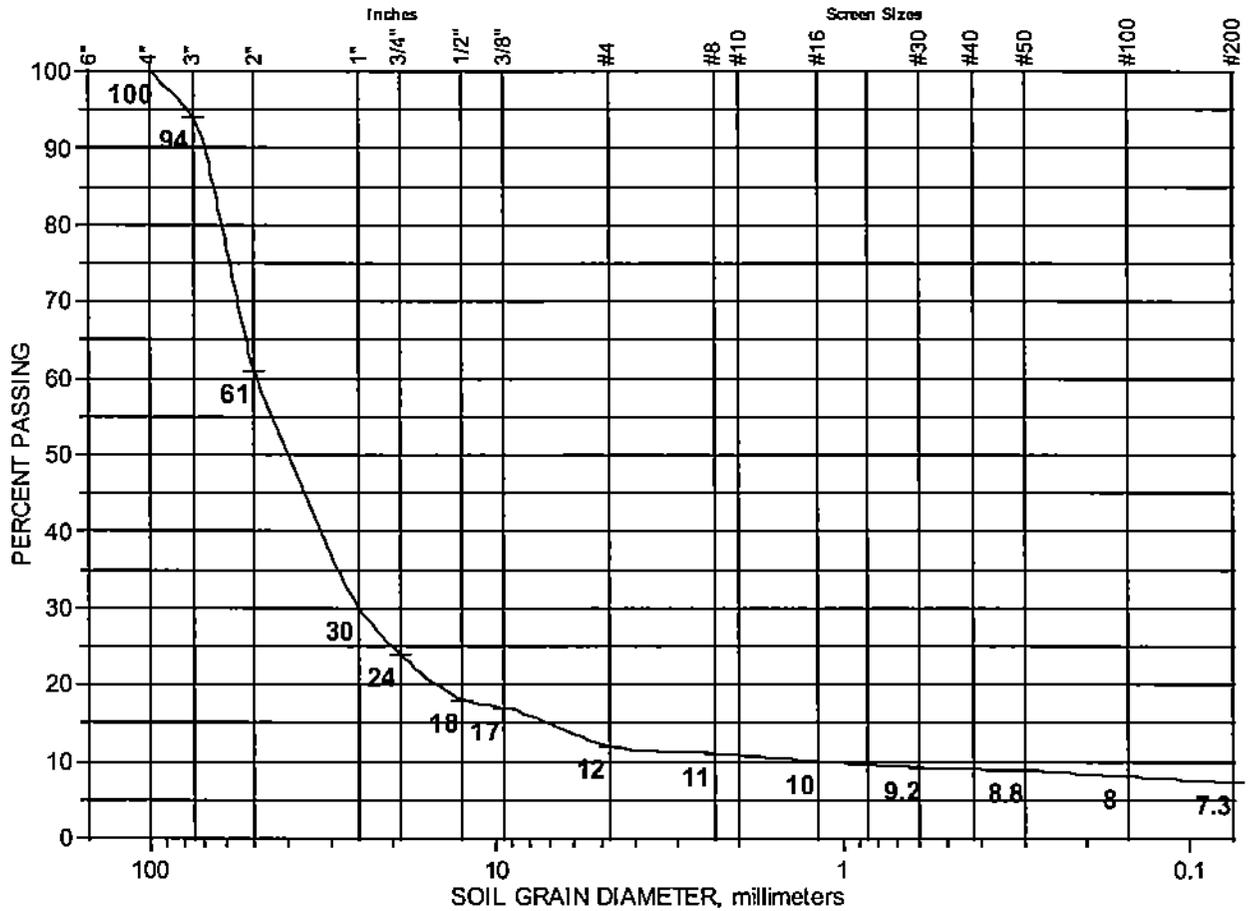
**STRATA**  
 GEOTECHNICAL ENGINEERING & MATERIALS TESTING

# GRADATION ANALYSIS

ASTM C 136/C117

Project: Zilkha Wild Horse  
 Client: CH2MHill  
 File: CH2H03 BM02418  
 Sample No.: B3L1001  
 Sample Location: TPG-1 @ 1-3'  
 Description: Gravel w/Silt & Cobbles  
 Date tested: 5/7/03

Cobbles	Gravel			Sand		
	Coarse	Fine		Coarse	Medium	Fine



Reviewed by: *[Signature]*



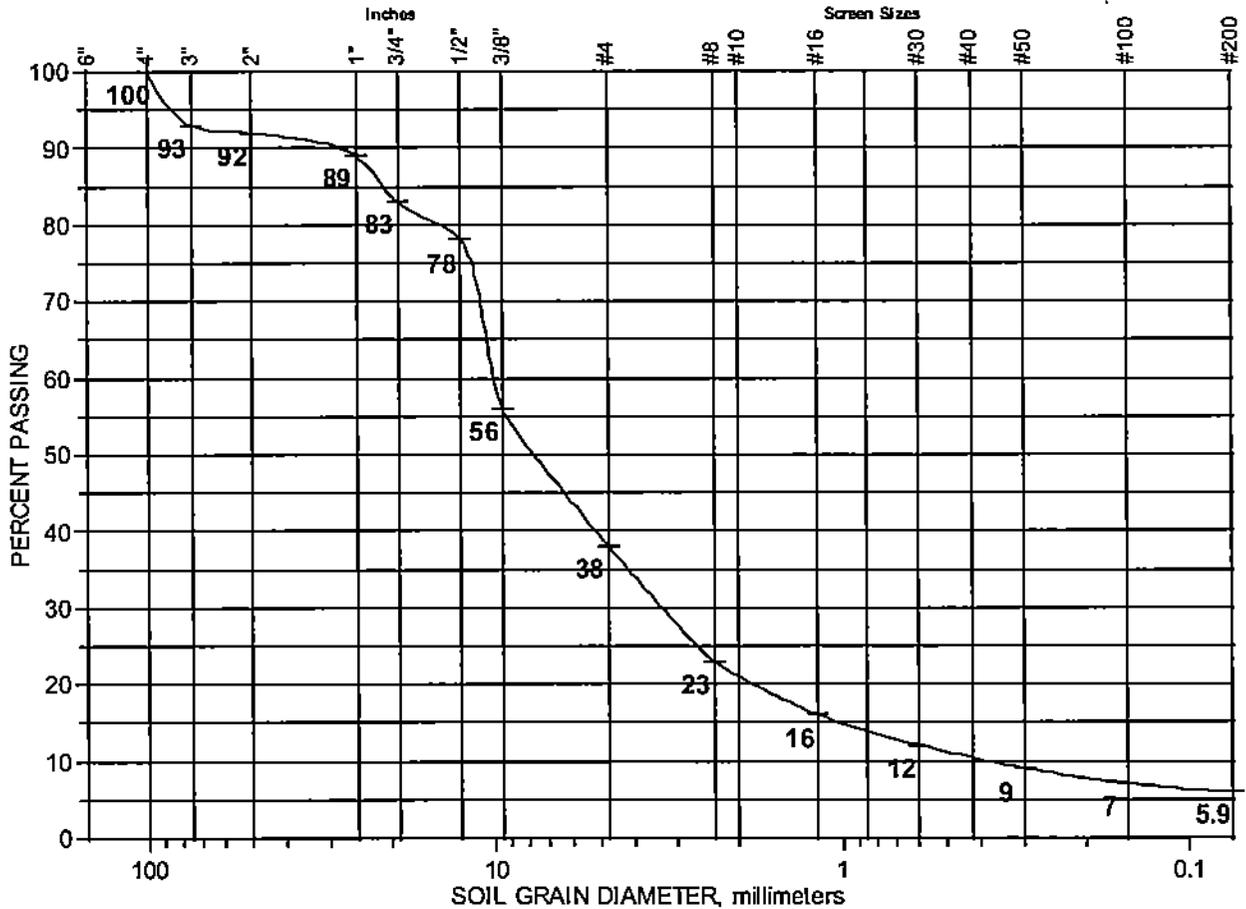
**STRATA**  
 GEOTECHNICAL ENGINEERING & MATERIALS TESTING

# GRADATION ANALYSIS

ASTM C 136/C117

Project: Zilkha Wild Horse  
 Client: CH2MHill  
 File: CH2H03 BM02418  
 Sample No.:B3L1013  
 Sample Location: TPJ-10 @ 2-7'  
 Description: Gravel w/Sand & Silt  
 Date tested: 5/8/03

Cobbles	Gravel		Sand		
	Coarse	Fine	Coarse	Medium	Fine



Reviewed by: *[Signature]*

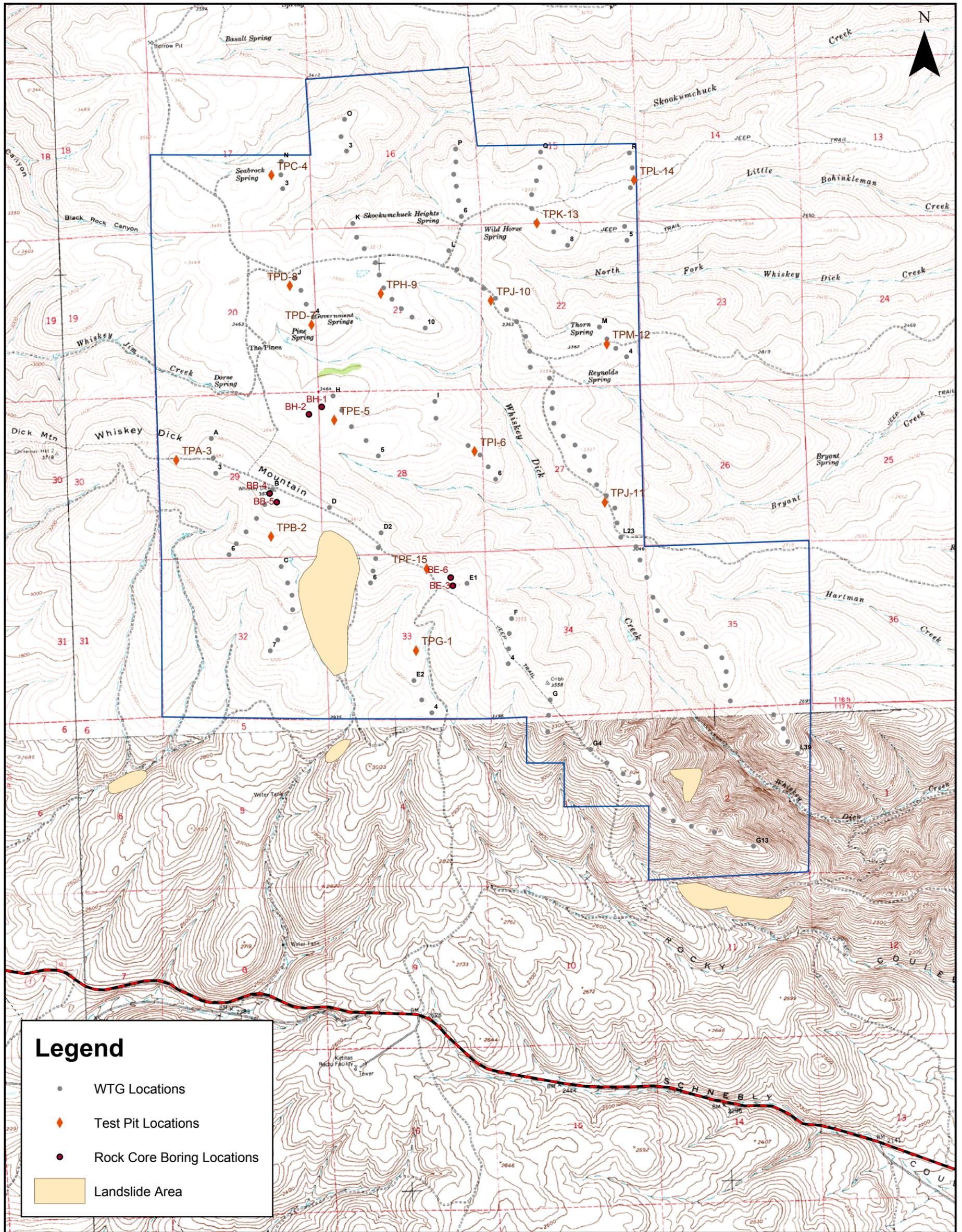


**STRATA**  
 GEOTECHNICAL ENGINEERING & MATERIALS TESTING

Attachment

**Test Pit Locations Map**

---



**CONFIDENTIAL**  
 PRELIMINARY  
 NOT FOR  
 CONSTRUCTION

**Wind Ridge Partners, LLC**  
 Zilkha Renewable Energy  
 210 SW MORRISON  
 SUITE 310  
 PORTLAND, OR 97204  
 TEL: (503) 222-9400  
 FAX: (503) 222-9404

**SITE MAP:  
 TEST PIT and BORING LOCATIONS**  
**Wild Horse Wind Power Project**

DWG: Test Pit Locations  
 DATE: February 9, 2004  
 FILENAME: JBFig.mxd

PROJECT NUMBER 17967A.B1.01	TEST PIT NUMBER TPG-1	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION G String, G<sub>2</sub>-G<sub>3</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3300 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft. Width 2 ft. Max Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			LEAN CLAY w/ SAND (CL), brown, slightly moist, roots to 1.1 ft.	WX = weathered
1		1.1 ft. CONTACT		
2		Bulk	WX BASALT, fractured but hard rock (R4-R5); dark grey, pillow basalt, broken into 1" to 6" angular gravel/cobbles	Difficult excavation with this equipment; operator thinks could go a little further w/ bigger equipment Photo R1/P1
3				Backhoe refusal T.D. = 3.0 ft.
4				
5				
6				

PROJECT NUMBER <b>179679.B1.01</b>	TEST PIT NUMBER <b>TPB-2</b>	SHEET <b>1</b> OF <b>1</b>
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION B string, B6 LOGGER J. Butler, PE  
 ELEVATION Approx. 3648 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft. Max Depth 2.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Silty LEAN CLAY w/ SAND (CL) brown, moist 0.5 ft. CONTACT	
1	Bag	A	WX BASALT, dark gray, crystalline, breaks into platy pieces; sand/silt in fractures	Photo R1/P2
2		BULK		Very solid rock @ 2.5 ft. Backhoe refusal
3				T.D. = 2.5 ft.
4				
5				
6				

PROJECT NUMBER 179679.81.01	TEST PIT NUMBER TPA-3	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION A String, A<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3832 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 10-12 ft. Width 2 ft. Max Depth 7 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			LEAN CLAY, brown, moist to wet, w/ sand + gravel (< 15%), and pockets of wx basalt; roots to 0.8 ft.	
2	Bag -	1.0	2.5 ft. Becoming dry to moist	
4	Bag -	3.0	3.5 ft. CONTACT CLAYSTONE, dark brown, soapy texture (soapstone), breaks into blocky, angular pieces	Photo RI/PS
6			5.5 ft. CONTACT BASALT, dark gray, fractured + rippable, hard (RS)	Backhoe Refusal
8				T.D. = 7.0 ft.
10				
12				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPC-4	SHEET 1 OF 1
<b>TEST PIT LOG</b>		

PROJECT Wild Horse Wind LOCATION C String, C2 LOGGER J. Butler, PE  
 ELEVATION Approx. 3481 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 42D D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft. Max Depth 3.8 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE		
0			Silty LEAN CLAY (CL), brown, slightly moist	
1		1.0	Contact 0.9 ft.	
2		BULK	Cemented Sand/Gravel, w/ glassy clasts, medium brown to yellow-brown, hardness R1-R2; contains basalt "tubes" 10-12" in diameter, at various depths intersecting the trench direction	Photo R1/P6
3		3.0	Refusal on basalt at 3.8 ft., very hard	
4				Backhoe refusal T.D. = 3.8 ft.
5				
6				

PROJECT NUMBER 179679-B1-01	TEST PIT NUMBER TPE-5
SHEET 1 OF 1	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION E string, E. LOGGER J. Butler, PE  
 ELEVATION Approx. 3450 Ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft. Width 2 ft. Max Depth 2.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Silty topsoil (SILT, ML), roots and some cobbles Contact @ 0.7 ft.	
1			BASALT, broken and fractured, very hard, broken into 0.2' to 1.0' boulders	Looks like riprap in exc. spoils pile  Photo R1/P8
2				Back hoe refusal
3				T.O. = 2.5 ft.
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPI-6
SHEET 1 OF 1	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION I string, I4 LOGGER J. Butler, PE  
 ELEVATION Approx. 3306 ft. CONTRACTOR Fulleton-Pacific  
 EXCAVATION EQUIPMENT Cat 420D Backhoe DATE EXCAVATED May 7, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft. Max Depth 3.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			SILT w/ SAND (ML), brown slightly moist, root zone Contact @ 0.6 ft.	
1		0.5	BASALT, spheroidally fractured (cores + shells), very hard (RS), 0.1' to 0.8' diameter rounded clasts	
2		BULK		
3		3.0		Backhoe refusal T.D. = 3.0 ft.
4				
5				
6				

PROJECT NUMBER <u>179679-B1.01</u>	TEST PIT NUMBER <u>TPD-7</u>
SHEET <u>1</u> OF <u>1</u>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION D string, D4 LOGGER J. Butler, PE  
 ELEVATION Approx. 3478 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 5-6 ft. Width 2 ft. Max Depth 1.3 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0 1 2 3 4 5 6		<div style="margin-bottom: 10px;">0.5</div> <div style="margin-bottom: 10px;">← Bag</div> <div style="margin-bottom: 10px;">1.3</div>	<p>Sandy LEAN CLAY (CL), slightly moist, approx. 30% sand, with cobbles + boulders</p>	<p>Backhoe refusal T.D. = 1.3 ft.</p>

PROJECT NUMBER <b>179679-B1.01</b>	TEST PIT NUMBER <b>TPD-8</b>
SHEET <b>1</b> OF <b>1</b>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION D string, D, LOGGER J. Butler, PE  
 ELEVATION Approx. 3492 CONTRACTOR Fulleton-Pacific (Ride Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 8-10 ft. Width 2 ft. Max Depth 4.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0				
1			SILT (ML) to LEAN CLAY (CL) w/ SAND, brown, moist, soft to firm	
2	Bag	1.5 ↑ BULK ↓ 3.5		
3			Contact @ 3.0 ft. BASALT, silty and broken, angular, weathered with spheroidal inclusions	
4				Backhoe refusal
5				T.D. = 4.5 ft.
6				

PROJECT NUMBER <b>179679.131.01</b>	TEST PIT NUMBER <b>TPH-9</b>
SHEET <b>1</b> OF <b>1</b>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION H String, Hs LOGGER J. Butler, PE  
 ELEVATION Approx. 3508 ft. CONTRACTOR Fulleton-Pacific (Red River)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 2 ft. Width 2 ft. Max Depth 0.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Minimal silty soil, roots, and vegetation Contact @ 0.5' w/ BASALT	Backhoe refusal T.D. = 0.5 ft.
1				Attempted 2 test pits in the vicinity of TPH-9 Basalt outcrops nearby, approx. 50-100 ft. SW
2				
3				
4				
5				
6				

PROJECT NUMBER <b>179679</b>	TEST PIT NUMBER <b>TRJ-10</b>
SHEET <b>1</b> OF <b>1</b>	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION J String, Js LOGGER J. Butler, PE  
 ELEVATION Approx. 3333 ft. CONTRACTOR Fulleton-Pacific (Rick Riey)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED \_\_\_\_\_  
 WATER LEVEL AND DATE Not known APPROX. DIMENSIONS: Length 12-14 ft. Width 2 ft. Max Depth 9.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			SILTY SAND (SM), dry to moist, root zone	
2		2.0	Contact @ 1.5 ft. Clayey GRAVEL (GC), w/ glassy clasts, mottled brown, plastic fines; angular basalt clasts	
4			Transitional Contact @ 5.5 ft.	
6	Bag		Gravelly CLAY (CL-CH), orange-brown, small gravels, very plastic	
8		7.0	Contact @ 8.5 ft. BASALT, hard, clasts	Backhoe refusal T.D. = 9.0 ft.
10				
12				

PROJECT NUMBER 179679.B1-01	TEST PIT NUMBER TRJ-11
SHEET ( OF )	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION J string, J20 LOGGER J. Butler, PE  
 ELEVATION Approx. 3149 ft. CONTRACTOR Fulleton - Pacific  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft. Max Depth 2.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Sandy SILT (ML), brown, dry to moist, with roots	
1			BASALT @ 0.5 ft. weathered, hard but fractured, pieces up to 1 foot diameter	spots look like rip rap
2				Backhoe refusal T.D. = 2.0 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPM-12	SHEET 1	OF 1
<b>TEST PIT LOG</b>			

PROJECT Wild Horse Wind LOCATION M string, M<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3280 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not found APPROX. DIMENSIONS: Length 8-10 ft Width 2 ft Max Depth 4.5 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE		
0			Silty / clayey SAND (SM/SC), brown, moist, roots	
1			Contact @ 1.1 ft.	
2			BASALT, highly fractured, with vitrophyse (R1-R2), dark grey basalt, fractures to angular silty/sandy gravel, 0.1' to 0.5' clasts, approx. 30% matrix	
3				
4				
5				Backhoe Refusal T.D. = 4.5 ft.
6				

PROJECT NUMBER 179679, Bl. 01	TEST PIT NUMBER TPK-13
SHEET 1 OF 1	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION K String, K6 LOGGER J. Butler, PE  
 ELEVATION Approx. 3268 ft. CONTRACTOR Fulleton-Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft Max Depth 2.0 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			silt topsoil, brown, dry to moist, roots	
1			BASALT @ 0.5 ft., hard, fractured, RS; angular clasts up to 0.5 ft. diameter, silty matrix	
2				Backhoe refusal T.D. = 2.0 ft.
3				
4				
5				
6				

PROJECT NUMBER 179679.B1.01	TEST PIT NUMBER TPL-14
SHEET 1 OF 1	
<b>TEST PIT LOG</b>	

PROJECT Wild Horse Wind LOCATION L String, L3 LOGGER J. Butler, PE  
 ELEVATION Approx. 3092 ft. CONTRACTOR Fulleton-Pacific  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6-8 ft Width 2 ft Max Depth 2.4 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Silty topsoil, brown, roots	
1			Contact @ 0.4 ft. BASALT, broken, very hard, subangular clasts up to 1' diameter; surface littered w/ boulders	
2				Backhoe refusal
3				T.D. = 2.4 ft.
4				
5				
6				

PROJECT NUMBER 179679.131.01	TEST PIT NUMBER TPF-15	SHEET 1	OF 1
<b>TEST PIT LOG</b>			

PROJECT Wild Horse Wind LOCATION F string, F<sub>2</sub> LOGGER J. Butler, PE  
 ELEVATION Approx. 3504 ft. CONTRACTOR Fulleton - Pacific (Rick Riley)  
 EXCAVATION EQUIPMENT Cat 420 D Backhoe DATE EXCAVATED May 8, 2003  
 WATER LEVEL AND DATE Not Found APPROX. DIMENSIONS: Length 6-8 ft. Width 2 ft Max Depth 2.3 ft.

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	COMMENTS
	INTERVAL	NUMBER AND TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DIFFULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS, INSTRUMENTATION
0			Silty topsoil, brown, roots	
1			BASALT @ 2.3 ft. very hard (RS) and fractured, angular clasts up to 0.8 ft. diameter, silt/sand matrix	Hard digging
2				Backhoe refusal
3				T.D. = 2.3 ft.
4				
5				
6				



**S T R A T A**

GEOTECHNICAL ENGINEERING & MATERIALS TESTING

### Summary of Test Results

Project: Zilkha Wild Horse  
Report to: Ch2MHill

Report Date: 5/23/2003  
File Name: CH2MHill-BM02418

Test Pit -	Depth - Feet	Lab Number	Description and remarks (classification)	Gradation Provided	In situ Moisture, %	Passing No. 200,%	Atterberg Limits		Fines Class.
							LL	PI	
TPG-1	1	B3L1000	Dk. Brn. Clay w/rootlet*		23.6%				
	1-3	B3L1001	Gravel w/Silt & Cobbles	X		7.3			
TPB-2	0.5	B3L1002			19.0%				
	0.5-2.5	B3L1003	Gravel w/sand ,Clay,&Cobbles			9.5			
TPA-3	1.5	B3L1004	Brn. Clay*		34.2%				
	4.5	B3L1005	Dk. Brn. Weathered Rock*		38.3%				
	1-5	B3L1006	Clayey Gravel w/Sand & Cobbles	X		41			
TPC-4	1-3	B3L1007	Sand w/Silt & Trace Gravel			7.3			
TPI-6	0.5-3	B3L1008	Silty Sand w/Basalt gravel			13.7			
TPD-7	0.5-1.3	B3L1009	Brn. Sandy Silt*		16.0%				
TPD-8	2	B3L1010			17.0%		31	12	CL
	1.5-3.5	B3L1011	Brn. Clayey Sand w/Grav.&Cob.			13.5			
TPJ-10	6.5	B3L1012	Red Brn. Clay w/Sand		59.1		67	40	CH
	2 - 7	B3L1013	Gravel w/Sand & Silt	X		5.9			

\* Indicates ASTM D2488 Visual Classification.

Reviewed by:

# GRADATION ANALYSIS

ASTM D422

Project: Zilkha Wild Horse

Client: CH2MHill

File: CH2H03 BM02418

Sample No.: B3L1006

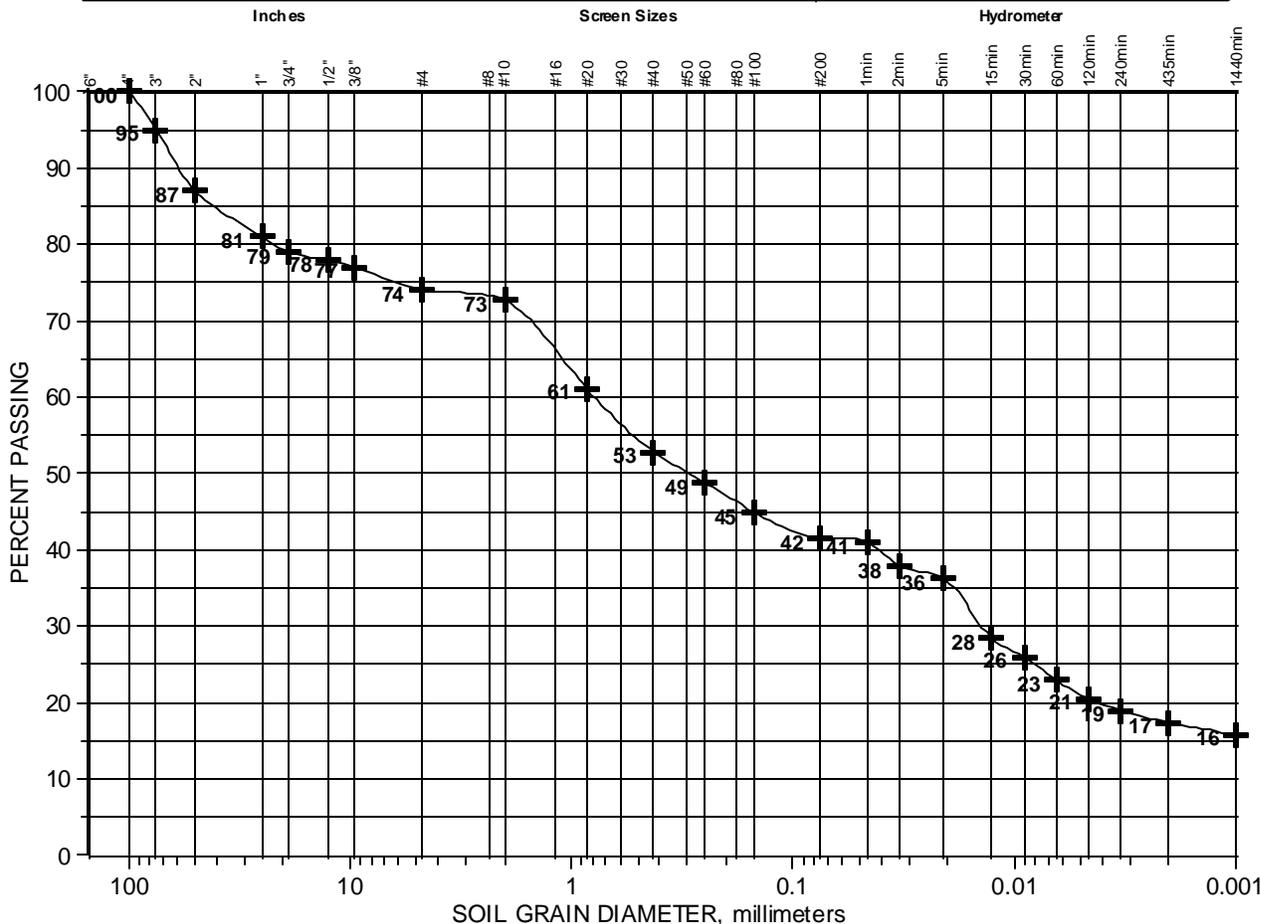
Sample Location: TPA-3 @ 1-5'

Description: Clayey Gravel w/Sand & Cobbles

Date Received: 5/16/03

Date tested: 5/22/03

Cobbles	Gravel		Sand			Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Reviewed by: 

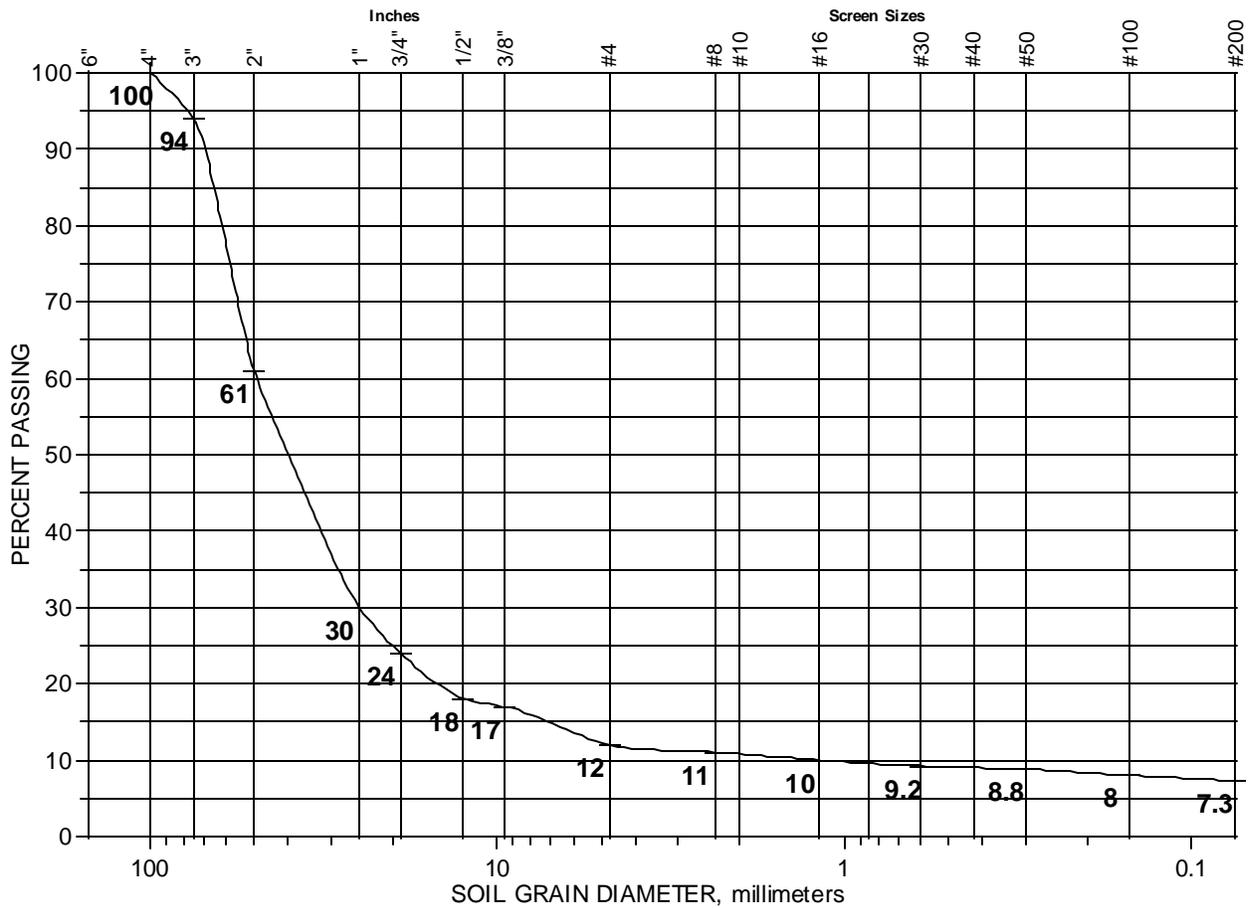


# GRADATION ANALYSIS

ASTM C 136/C117

Project: Zilkha Wild Horse  
 Client: CH2MHill  
 File: CH2H03 BM02418  
 Sample No.: B3L1001  
 Sample Location: TPG-1 @ 1-3'  
 Description: Gravel w/Silt & Cobbles  
 Date tested: 5/7/03

Cobbles	Gravel			Sand		
	Coarse	Fine		Coarse	Medium	Fine



Reviewed by: *[Signature]*

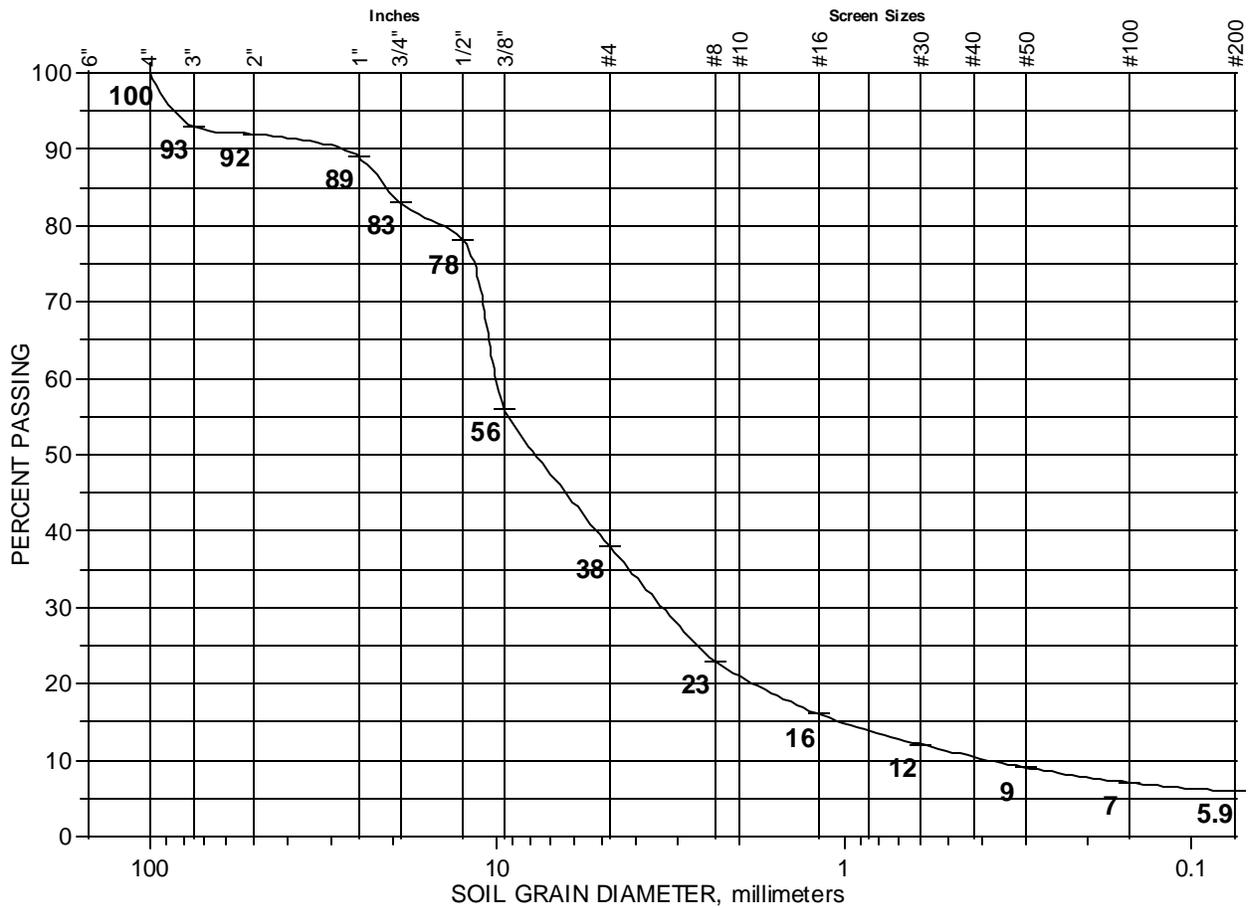


# GRADATION ANALYSIS

ASTM C 136/C117

Project: Zilkha Wild Horse  
 Client: CH2MHill  
 File: CH2H03 BM02418  
 Sample No.:B3L1013  
 Sample Location: TPJ-10 @ 2-7'  
 Description: Gravel w/Sand & Silt  
 Date tested: 5/8/03

Cobbles	Gravel		Sand		
	Coarse	Fine	Coarse	Medium	Fine



Reviewed by: *[Signature]*

