TRINITY VALLEY
CONSULTING ENGINEERS, INC

Joshua T. McKnight CE 60687

LETTER OF TRANSMITTAL

TO: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp CA 96039
ATTN: Richard Black

Date: June 16, 2015
Job No.: 236
Project: Skyline Development
Indian Creek Development

TRANSMITTED BY: X Mail ____Hand Delivered ____ UPS/FedEx

	Quantity	Description
1.	2	Engineering Geologic Report for Skyline Development
3.	2	Engineering Geologic Report for Indian Creek Development

REMARKS: Please call 530.629.3000 if you have any questions.

THIS MATERIAL SENT: Upon Request

Josh McKnight

Josh McKnight, P.E.

Engineering Geologic Report

For

Skyline Site Design
Happy Camp, California
APN: 016-412-240

Report Provided For:

Karuk Tribe Housing Authority
Attn: Richard Black
Post Office Box 1159
Happy Camp, California 96039

Report Provided By:

Trinity Valley Consulting Engineers, Inc.
67 Walnut Way / PO Box 1567
Willow Creek, California 95573
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JUNE 2015
Project Number: 236

Table of Contents

1.0 Introduction

This evaluation is prepared at the request of Mr. Richard Black, Project Manager for the Karuk Tribe Housing Authority (client), for an engineering geologic report for the project property. Specifically, this report evaluates geologic hazards, sub-surface soil and bedrock conditions at the project site, and based on conditions encountered, provides recommendations for the proposed single-story residences, infrastructure improvements and grading activities in general accordance with the Siskiyou County grading ordinance and California Building Code (CBC, 2013).

1.1 Project Understanding

Based on communications with the client, it is understood the scope of this project is to develop six individual homes at present, with a future potential to develop two more for a total of eight individual home sites on the 3-acre subject parcel. As part of the proposed project, the owner will install new storm drains, onsite wastewater treatment (septic) systems, and provide water, power, and telecommunications to these newly constructed residences. New paved roadways will be constructed as part of the proposed development. This report is focused on the soils and geologic conditions of the parcel identified by the Siskiyou County Assessor as APN 016-412-240. Considerations of vehicular access and utilities are presented on the project engineer's site plans (separate documents). Existing paved surfaced roads from Hillside Road and Park Way provide access to the proposed dvelopment. Local utilities (water, power, etc.) are available from the adjoining developments to the west of the project site.

1.2 Scope of Work

The scope of services for this investigation included evaluation of exploratory soil test pits and descriptions of subsurface materials and conditions; performing a site reconnaissance of the area proposed for development; developing criteria for grading and earthwork; and preparation of this report. The following information, recommendations, and design criteria are presented in this report:

- Descriptions of the local geology and geomorphology.
- Description of subsurface soil and groundwater conditions interpreted based on our field exploration.
- Assessment of potential geologic and geotechnical hazards including earthquake-related surface fault rupture, liquefaction, settlement (total and differential), site instability, and discussion of potential mitigation measures as necessary.
- Recommendations for grading, earthwork, site and subgrade preparation, fill placement, compaction requirements and erosion control.

2.0 Site Description

The site is identified by Assessor's Parcel Number (APN) **016-412-240** in Siskiyou County, California and is approximately 3.0 acres in size (**Figure 1**).

2.1 Project Location

Based on published mapping, this parcel is at an elevation of approximately 1,120 feet above mean sea-level, and is accessed by paved road from Hillside Road from the western portion of the property, or an unpaved road that bisects the elementary school to the east. Adjacent to this parcel are residential and, commercial properties, and the Happy Camp Elementary School. Pertinent location information is provided in Table 1 below. The project site is situated on an alluvial terrace adjacent to the Klamath River. The aspect of this relatively-flat parcel is southwest (**Figure 2**).

Table 1: Pertinent Location Information	
Latitude and Longitude	41.792983°, -123.373945°
Legal Description	Section 11, Township 16N, Range 7E HB&M
USGS Quadrangle	Slater Butte, USGS 7.5-minute quadrangle

2.2 Project Extent

The project extents include only the one parcel mentioned. The proposed project ultimately involves construction of six to eight single-story residential structures (**Figure 3**).

2.3 Site History

Review of historical aerial photos from September 7, 1972 to present shows the subject property to be an undeveloped, vacant parcel (USGS, 2015).

3.0 Site Conditions

Our site conditions description are compiled from existing published and unpublished sources, stereo-pair analysis or historical aerial photography, and from the results of the engineering-geologic site exploration.

3.1 Regional Geological Settings

Geological mapping shows the parcel underlain by undifferentiated Western Paleozoic and Triassic Belt (sch) geologic materials (**Figure 4**). Wagner and Saucedo (1987) describe this

component of the undifferentiated rocks as amphibolite and greenschist composition. Gray (2006) describes the western Paleozoic and Triassic belt as a complex assemblage of ophiolitic, volcanic, and sedimentary rocks that were accreted to the North American continent in the Late Triassic. The project site is located north of a step-over strand of the Happy Camp Fault, a major inter-formational thrust fault placing Paleozoic/Triassic-aged Western Paleozoic and Triassic belt metavolcanics and metasedimentary rocks structurally on top of Jurassic-aged Galice Formation and is considered largely quiescent (Wagner and Saucedo, 1987).

The project site is located approximately 45 miles northeast of the Bald Mountain-Big Lagoon Fault zone. The Bald Mountain-Big Lagoon Fault is broad zone of northwest striking, reverse and thrust faults, with Quaternary-aged movement, with a slip rate between 0.2 to 1.0 mm/year (USGS, 2002). The Bald Mountain-Big Lagoon fault zone is not considered active by the State of California and is not subject to the Alquist-Priolo Special Studies Act of 1972.

3.2 Site Soil Conditions

Soil exposures were observed in backhoe test pits during the site investigation and the results are provided below. This soils report describes those test pit soil exposures and laboratory analysis of samples collected at project site. Two test pits were excavated during the site visit on April 2, 2015. The following table summarizes our findings. Laboratory results are attached in Appendix A. The locations of test pits are shown on **Figure 3**. Bedrock was encountered at shallow depths in our excavations, or in surface outcrop.

3.2.1 TP-1 Soils

Soils encountered during the excavation of TP-1 are tabulated and summarized below:

Depth (ft)	Material Description
3	Gravel-Sand Mixture (GP) – gray-brown coloration, low moisture content, dense to very dense consistency, contains gravels (subangular/angular) sourced from highly weathered and fractured metamorphic bedrock, well- drained, slight stratification, evidence of groundwater movement from oxidation of iron minerals (USDA classification: Loamy sand classification); Bedrock encountered at the bottom of pit @ 3' – determined by resistance of backhoe and impedance of further excavation

Textural analysis of one sample (TP-1A) revealed a sand content of 78 percent, clay content of 6 percent, and silt content of 16 percent. The soil was determined to be a zone two material.

Analysis of soils supported a composition of loamy sand, with sand and silt comprising a minimum of 94 percent of the total soil matrix. Due to the high sand/silt content of the soil it is unlikely that expansive soils are present.

3.2.2 TP-2 Soils

Soils encountered during the excavation of TP-2 are tabulated and summarized below:

Depth (ft)	Material Description
1	Gravel-Sand Mixture (GP) – gray-brown coloration, low moisture content, dense to very dense consistency, contains gravels (subangular/angular) sourced from highly weathered and fractured metamorphic bedrock, well- drained, massive, no stratification, evidence of groundwater movement from oxidation of iron minerals (USDA classification: Loamy sand classification); Bedrock encountered at the bottom of pit @ 1.5' – determined by resistance of backhoe and impedance of further excavation

Textural analysis of one sample (TP-2A) revealed a sand content of 84 percent, clay content of 5 percent, and silt content of 11 percent. The soil was determined to be a zone one material.

Analysis of soils supported a composition of loamy sand and sandy loam, with sand and silt comprising a minimum of 95 percent of the total soil matrix. Due to the high sand/silt content of the soil it is unlikely that expansive soils are present.

3.2.3 Site Soil Evaluation

Based on the soils observed on site, presumptive load-bearing values are summarized below as per the 2013 CBC, Table 1806.2:

Class of Materials	Vertical Foundation Pressure (psf)	Lateral Bearing Pressure (psf/ft below natural grade)	Lateral Sliding Resistance	
			Coefficient of friction	Cohesion (psf)
Sedimentary and Foliated rock	4,000	400	0.35	
Sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	-

Total Settlement will be less than one inch, and anticipated differential settlement will be less than three-quarters (3/4) inch.

3.3 Site Stability Conditions

Site stability conditions were determined from compilation of existing resources and the results of the site investigation.

3.3.1 Previous Mapping

Wagner and Saucedo (1987) had mapped several large Quaternary-aged landslides in the vicinity of Happy Camp. Due to the scale of their mapping, there are no landslide features mapped at or adjoining the project site. In the field, there was no evidence observable of slope instability features that might affect this parcel.

3.3.2 Site Mapping

No unstable features were encountered during site reconnaissance.

3.3.3 Seismic Considerations

The following coefficients (see Attachment B) shall be used for seismic design as per the USGS Earthquake Ground Motion Parameters:

Site Class	D	C
Mapped Spectral Response Acceleration (short), S_S:	0.885 g	0.861 g
Mapped Spectral Response Acceleration (1-sec), S_1:	0.440 g	0.397 g
Site Coefficient, Fa:	1.146	1.056
Site Coefficient, Fv:	1.560	1.403
Acceleration Spectral Response (short), S_{DS}:	0.676 g	0.606 g
Acceleration Spectral Response (1-sec), S_{D1}:	0.457 g	0.371 g
Seismic Design Category:	D	D
Occupancy Category:	II	II
Importance Factor:	1.0	1.0

Use Site Class D for foundations on soils, and use Site Class C for foundations on bedrock. Due to the site soil conditions, depth to groundwater, and distance to the nearest known quaternary fault, the potential for liquefaction, surface fault rupture, or soil strength loss at this site is low, and no special hazard mitigations appear necessary.

3.4 Existing Fills

The parcel may contain undocumented fills associated with historic site clearing and grading. Due to the lack of nearly-flat, gentle slopes, and the proximity of bedrock to the ground surface at the project site, fills if they exist, do not appear to be a factor for this project, and their existing conditions appear stable. Any fills on-site have likely been in place for approximately 50 years and have likely experienced record setting rainfall seasons and relative strong motions from nearby earthquakes.

It should be noted that because of the lack of documentation of the placement and geotechnical criteria met for these fills, a definitive statement of stability cannot be made. Placement of any foundations on undocumented fills is strongly discouraged. No existing undocumented fill

should be used as a structural fill to support building elements or their utilities without prior testing and approval of the project engineer.

4.0 Recommendations

This section contains recommendations to the design professional based on the 2013 CBC and Siskiyou County grading ordinance.

4.1 General Recommendations

4.1.1 Site Preparation

All earthwork, including but not limited to, site clearing, grubbing, and stripping should be conducted during dry weather conditions.

Undocumented fill soils, fine-grained residual soils, and any other debris encountered at or below the existing ground surface shall be removed at the locations of areas to receive foundations, pavements or fills.

If any existing undocumented fills are used: 1) to support structural building elements, 2) are within 3 feet of structural building elements, and 3) intended to support utilities of the building, these undocumented fill soils shall be tested in place to determine if they meet the appropriate compaction specifications listed below in section ***4.1.3 Compaction Standards***, or removed.

4.1.2 Fills

Fills shall be constructed as controlled and compacted engineered fills. Fill slopes should be graded 1.5:1 (h:v), maximum.

Fills should be free of: 1) organics, 2) rocks larger than 3-inches in diameter, and 3) other deleterious materials.

Fill material should be placed in loose lifts no more than 8-inches thick, at uniform moisture content at or near optimum, and compacted mechanically.

Sufficient testing and inspection should be performed to monitor the suitability of fill materials and assure compliance with the recommended compaction standards.

Fills should be compacted as specified below in the Compaction Standard section.

Fill may be imported as non-expansive fill beneath floor slabs and for pavement subgrade, if any. Select fill should be a soil/rock mixture free of organic material and other deleterious material. The select fill material should contain low plasticity clay, well-graded sand, and/or gravel. Select

fill should contain no rocks larger than 3 inches in greatest dimension, nor more than 15 percent larger than 2 inches.

Additionally, the material should meet the following specifications:

Plasticity index: <12
Liquid Limit: <30
Percent passing No. 200 sieve: 50 maximum, 5 minimum

4.1.3 Compaction Standards

Fills shall be compacted in 8-inch loose lifts with clean native materials at optimum moisture content as determined by testing and approved by the engineer. Non-structural fills shall be compacted to a firm unyielding surface as approved by engineer.

It is recommended that any materials proposed for structural fill material to support residential structures and associated utilities be compacted as specified below in Table 2:

Fill Placement Location	Compaction Recommendations (ASTM D 1557-Modified Proctor)	Moisture Content (Percent Optimum)
Structural fill supporting footings	90%	-1 to +3 percent
Structural fill supporting slabs-on-grade	90%	-1 to +3 percent
Structural fill placed within 3 feet beyond the perimeter of the building pad	90%	-1 to +3 percent
Utility trenches within building and any pavement areas	95%	-1 to +3 percent
Utility trenches beneath landscape and grass areas	90%	-1 to +3 percent

4.1.4 Drainage and Landscaping

The site should be graded to provide drainage such that no water is allowed to: 1) pond anywhere on-site, 2) migrate beneath any structures or fills, or 3) pond at the base of cuts.

Final grading plans should include provisions to provide drainage away from the proposed structures. Per CBC section 1804, the ground surface adjacent to the foundations should be sloped away from the building at a minimum of five percent for 10 feet of soil, and two percent for 10 feet where the is an impervious surface adjacent to the building.

4.1.5 Foundational Design Recommendations

No site-specific foundation plans have been provided to TVCE. All foundations should be constructed of reinforced concrete. The following foundation recommendations assume a one-story structures will be constructed on this site. In our opinion, the proposed structures can be supported by reinforced concrete slabs on grade, with continuous concrete perimeter footings in combination with isolated interior spread footings where necessary. A foundation of this type is expected to be suitable for the site conditions, provided that it is constructed in accordance with our recommendations and specifications, and is designed by a licensed professional to comply with the standards of the 2013 CBC.

Footings:

- A foundation system for this site should be rigid to limit potential structural damage due to differential settlement. Foundations are not anticipated to be located in areas of undocumented fill soils, however there is a possibility that unobserved, undocumented fills could exist on the site;
- If necessary to mitigate undocumented fill soils, excavate and replace with suitable engineered fill, placed and compacted as recommended. Alternately, footings may be built on controlled low strength material (CLSM, e.g. concrete slurry) backfilled footing trenches, excavated into the bearing soil indicated in this report;
- Foundations should be embedded a minimum of 12 inches into suitably dense, undisturbed native bearing soils. Based on the soil profile observed in the building footprint, the base of footings should therefore be approximately 18 inches below existing grade, at minimum;
- Minimum width of footings should be 12 inches for bearing members, and the minimum thickness should be 6 inches, per CBC Section 1809.7.

Floor Slab Design:

- The reinforced concrete floor slabs on grade should have a minimum thickness as specified by the engineer and as appropriate for the anticipated loading;
- Floor slabs should be underlain by the following: at least 6 inches of compacted select fill consisting of Class 1, Type A permeable material (per Caltrans), or an approved equivalent, to act as a capillary moisture break; 6 mil plastic membrane, and 1 inch of clean sand as described below;
- To reduce the possibility of moisture migration through any floor slab-on-grade, a vapor retarder consisting of a 6 mil (minimum) plastic membrane, should be placed on theprepared gravel subgrade;
- Care should be taken during construction to protect the plastic membrane against punctures. Cover the plastic membrane within at least 1-inch of clean sand to protect it during steel and concrete placement, and to provide for a better concrete finish; The difference, if any, between the 6 inches of select fill and sand under the slab and the depth to firm undisturbed native soil may be made up with additional select fill of engineered fill that is placed as specified in the Structural Fill section of this report.

4.1.6 Erosion, Sediment Control and Stabilization Recommendations

Site-specific erosion/sediment control and stabilization recommendations are presented in the bulleted list below. As used herein, *exposed soil areas* and *disturbed areas* include all grading and excavation work performed in connection with the proposed project.

- Storm water erosion and pollution prevention measures should be taken as soon as possible prior to the onset of the winter rains.
- Siskiyou County Erosion Control Standards should be viewed as *minimum* standards for erosion and sediment control at this site.
- Revegetate all disturbed areas immediately by seeding with Caltrans erosion control mix (or equivalent).
- To protect against erosion, heavily mulch all exposed soil areas with straw, or an approved alternate material.
- Poke the straw mulch into the upper 2 inches of the soil to limit loss of straw.
- Stake straw wattles parallel to slope contours into any side cast fills.
- Install silt fencing at toes of any new side cast fill slopes.
- Replant the site with trees and shrubs native to the area.
- Cover any soil stockpiles with 6-mil (min) plastic sheeting, securely anchored to prevent wind disturbance.
- Drive and park vehicles only on paved areas during wet weather.
- Monitor the site before and after runoff-generating rainfall events to verify suitable and appropriate functioning of all erosion-control measures.
- Promptly repair all erosion-control measures as needed.

5.0 Conclusions

This investigation documents geologic hazards, site materials, and provides design recommendations based on site conditions encountered, requirements of the 2013 CBC, and Siskiyou County grading ordinance. Based on review of historical data, laboratory analyses, and site reconnaissance and subsurface exploration, the parcel is considered adequate for the intended use as a site for the proposed single-story residences.

5.1 Limitations

This report, recommendations, and conclusions are solely intended for the site and project discussed above. The information contained in this report is only intended for use at the stated site using the stated uses. This report should not be used as justification for any other project or site, and may only be reviewed for other projects with written permission for informational purposes, and then only if adequately referenced and cited. TVCE recognizes that the site is in a dynamically active area and conditions can and will change. TVCE has used the best professional judgment to assess the present and future risks and assist the landowner in proposing development that does not increase the risk to the resources present in the project area

or subject the landowner to untenable hazards. If conditions different from those described in this report are encountered during construction, the project engineer/builder/owner should contact this office to review the new conditions and evaluate their bearing on the validity of any recommendations provided herein.

The opinions presented herein have been developed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable civil engineers and geologists practicing in this or similar localities as of the date this report was prepared. No other warranty, express or implied, is made as to the professional advice included in this report.

The analyses and recommendations contained in this reports are based on the data obtained from subsurface exploration. The methods used indicate subsurface conditions only at the specific locations where soils were observed, and only to the depths penetrated, and cannot always be relied on to accurately reflect stratigraphic heterogeneity and lateral variability that commonly exist between sampling locations.

Do not apply any this report's conclusions or recommendations if the nature, design, or location of the proposed project is changed. If changes are contemplated, Trinity Valley Consulting Engineers should be consulted to review their impact on the applicability of the recommendations in this report. The authors of this report are not responsible for any claims, damages, or liability associated with any other party's interpretation or the subsurface data or reuse this report for other projects or at other locations without written consent.

Please contact TVCE at (530) 629-3000 if any questions may arise.

12.31.16

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Certified Professional Engineer, P.E. No. 60687

Christian Figueroa
Project Geologist

David N. Lindberg

David N. Lindberg
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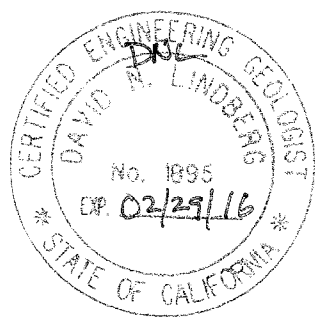

6.0 List of Figures and Appendices

Figure 1: Assessor's Parcel Map
Figure 2: Vicinity Map
Figure 3: Site Map
Figure 4: Regional Geologic Map
Appendix 1: Soil Logs/Textural Analysis
Appendix 2: USGS Seismic Coefficients
Appendix 3: Photo Log

7.0 References

ASCE [American Society of Civil Engineers], 2010 (March 2013 errata), Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10), p. 593.

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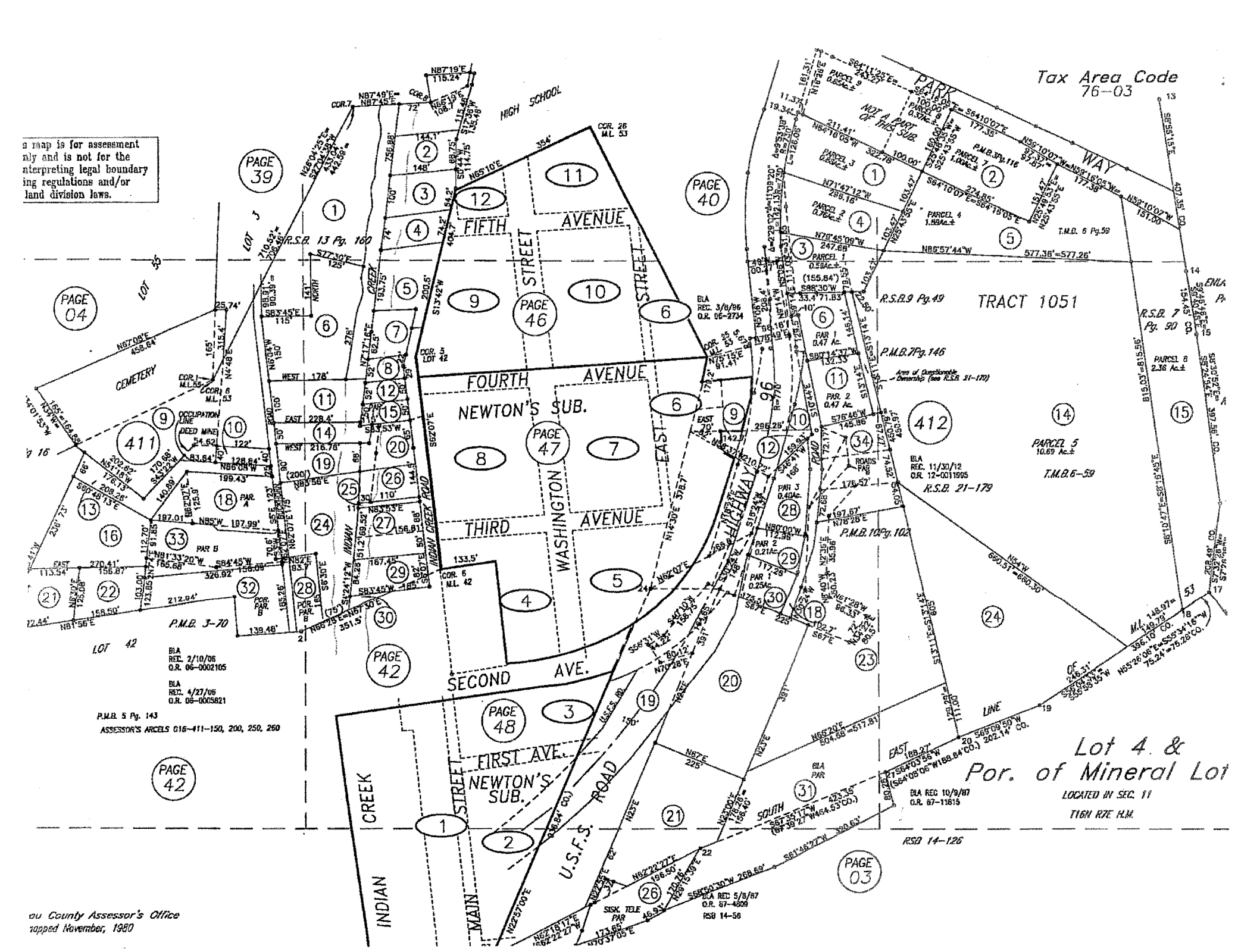
Figures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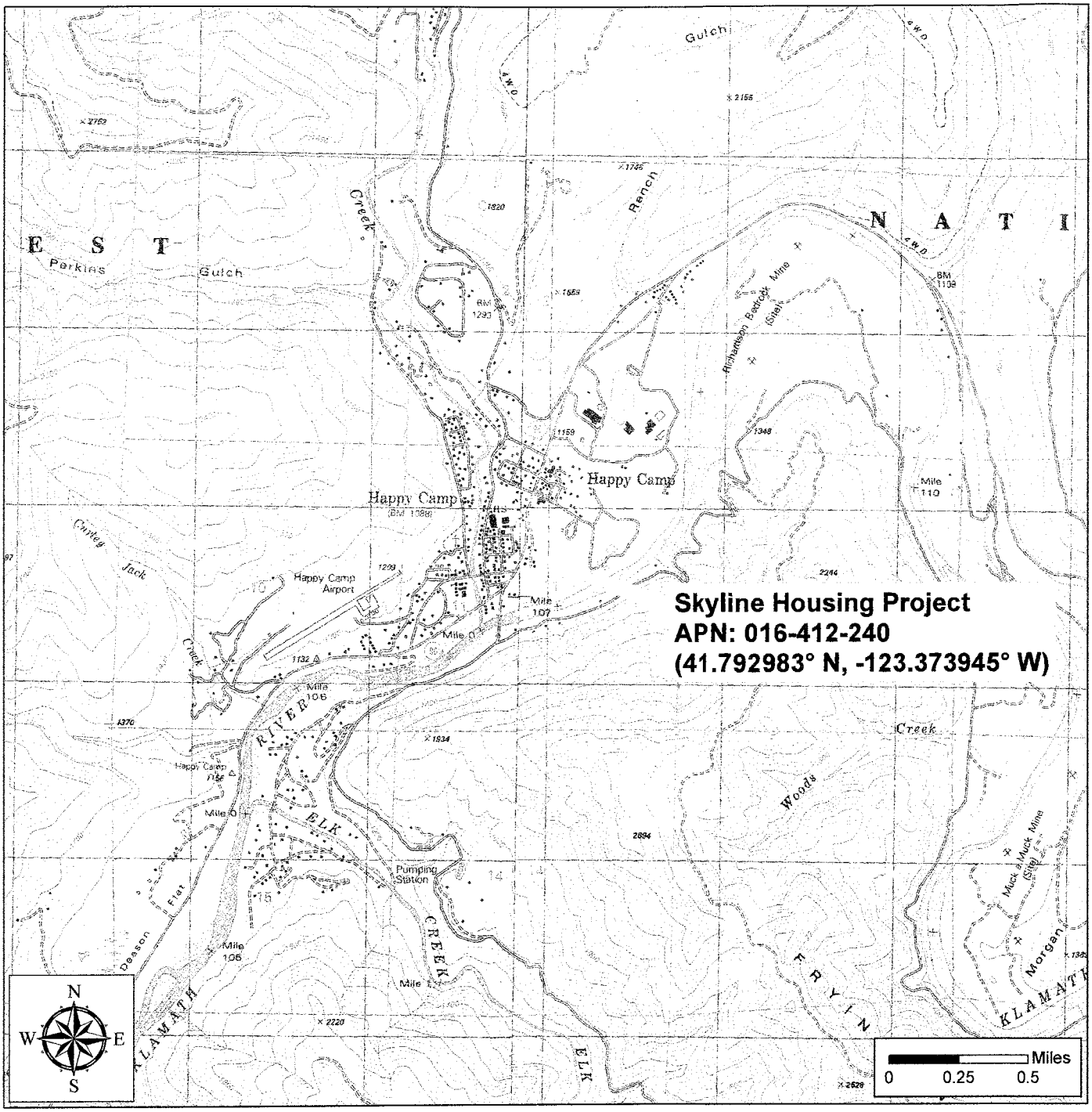
land division laws.
PAGE 39
PAGE 40
PAGE 04
PAGE 46
PAGE 47
PAGE 42
PAGE 48
PAGE 03
FIFTH AVENUE
FOURTH AVENUE
THIRD AVENUE
SECOND AVE.
FIRST AVE.
NEWTON'S SUB.
NEWTON'S SUB.
WASHINGTON STREET
EAST STREET
MAIN STREET
INDIAN CREEK
U.S.F.S. ROAD
PARK WAY
HIGH SCHOOL
CEMETERY
TRACT 1051
R.S.B. 13 Pg. 160
R.S.B. 9 Pg. 49
R.S.B. 7 Pg. 90
P.M.B. 3-70
P.M.B. 5 Pg. 143
P.M.B. 7 Pg. 146
P.M.B. 10 Pg. 102
R.S.B. 21-179
T.M.B. 6 Pg. 59
T.M.B. 6-59
ASSESSOR'S PARCELS 016-411-150, 200, 250, 260
BLA REC. 2/10/06 O.R. 06-0002105
BLA REC. 4/27/06 O.R. 06-0005821
BLA REC. 3/8/96 O.R. 96-2734
BLA REC. 11/30/12 O.R. 12-0011995
BLA REC. 10/9/87 O.R. 87-11615
BLA REC. 5/8/87 O.R. 87-4809
RSB 14-126
RSB 14-56
PARCEL 1 0.59Ac.±
PARCEL 2 0.76Ac.±
PARCEL 3 0.85Ac.±
PARCEL 4 1.89Ac.±
PARCEL 5 10.69 Ac.±
PARCEL 6 2.36 Ac.±
PARCEL 7 1.00Ac.±
PARCEL 8 0.53Ac.±
PARCEL 9 0.85Ac.±
PAR A 0.47 Ac.
PAR B 0.47 Ac.
PAR 1 0.25Ac.
PAR 2 0.21Ac.
PAR 3 0.40Ac.
Lot 4 &
Por. of Mineral Lot
LOCATED IN SEC. 11
T16N R7E H.M.
ou County Assessor's Office
topped November, 1980



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USDA SEAMLESS TOPOGRAPHIC MAP FOR SISKIYOU COUNTY CONTOUR INTERVAL 80 FEET

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Happy Camp, CA

Location Map

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USDA 2014 NAIP IMAGERY

SISKIYOU COUNTY

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Skyline Housing Project
Happy Camp, CA

Site Map

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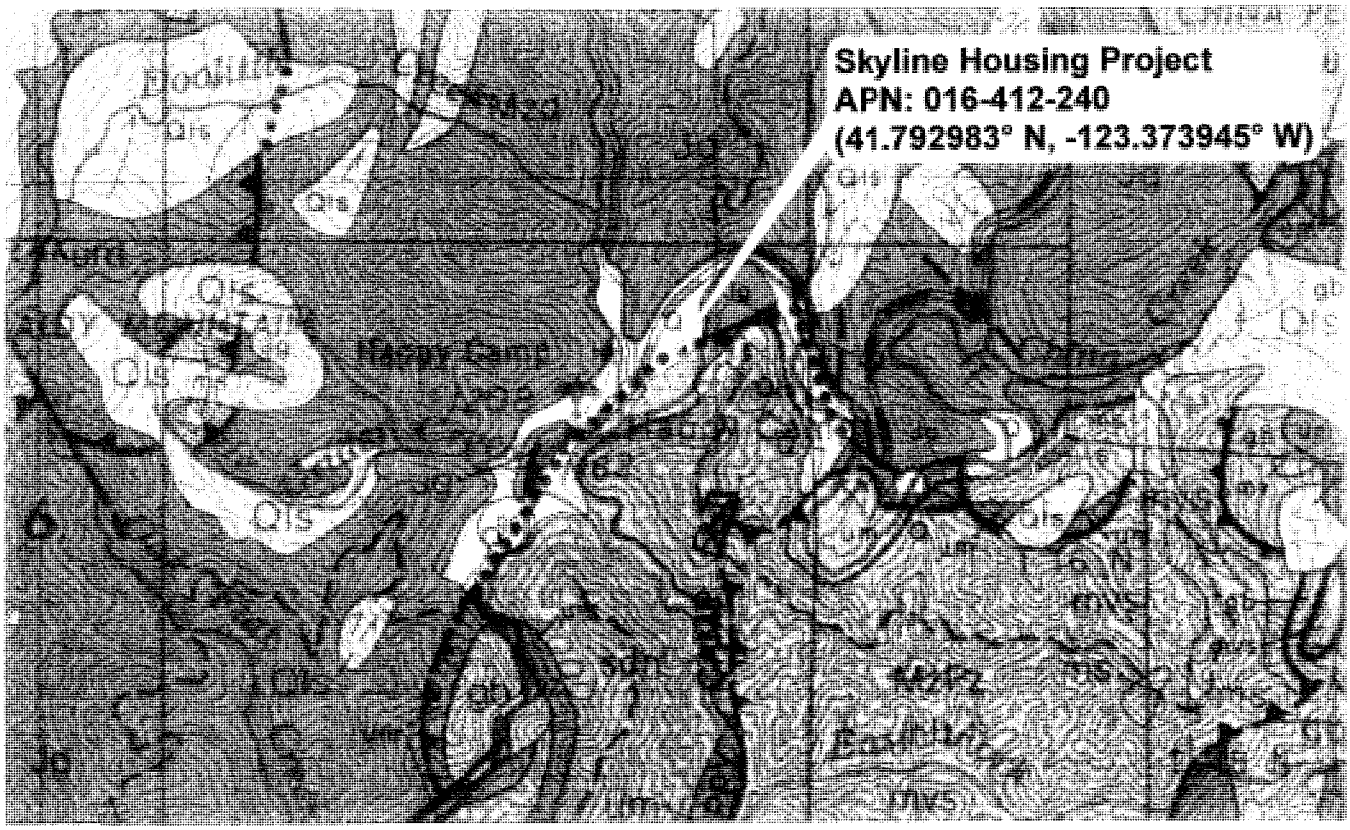

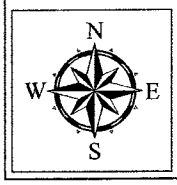

Q - Alluvium
Qls - Landside
Jg - Galice Formation
MzPz - Western Paleozoic Triassic Belt suite

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Wagner and Saucedo (1987)

Geologic Map of the Weed Quadrangle, California

NOT TO SCALE

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Skyline Housing Project
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Regional Geologic Map

Appendix A

Soil Logs/Textural Analysis

SOIL EXPLORATION LOG

Project Name: KTHA_Skyline | Project No: 236 | Date: 4/2/2015

Test Pit #: TP-1 | Hole Dimensions: 3' x 5' | Excavation Method: Backhoe

Pit Location: 41.79295°, -123.37364° | Groundwater Elevation: N/A | Logged by: C. Figueroa

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Gravel-Sand Mixture (GP) - contained gravels (subangular/angular, sourced from highly weathered and fractured metamorphic bedrock, well drained, evidence of gw movement by oxidation of iron minerals, slightly stratified, bedrock encountered at 3 (USDA classifcation: Loamy sand)	GRY-BRN	Low	Dense/V. Dense	GP	-1 -2 -3 -4 -5 -6 -7 -8 -9 -10		TP-1A			

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SOIL EXPLORATION LOG

Project Name: KTHA_Skyline | Project No: 236 | Date: 4/2/2015

Test Pit #: TP-2 | Hole Dimensions: 3' x 5' | Excavation Method: Backhoe

Pit Location: 41.79324°, -123.37410° | Groundwater Elevation: N/A | Logged by: C. Figueroa

DESCRIPTION & REMARKS	COLOR	MOISTURE	CONSIST.	SOIL TYPE - USCS	DEPTH	PROFILE	SAMPLE TYPE / NUMBER	BLOWS / FT	WATER CONTENT %	UNIT DRY WEIGHT, PSF
Gravel-sand mixture (GP) - contains gravels (subangular/angular) sources from highly weathered and fractured bedrock, massive, no stratification, evidence of gw movement from oxidation of iron minerals, Bedrock encountered @ 1.5'; (USDA classification: Loam sand)	GRY/ BRN	Low	Dense/V. Dense	GP	-1 -2 -3 -4 -5 -6 -7 -8 -9 -10		TP-2A			

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Joshua T. McKnight CE 60687

Date: 04/10/2015

Report to: Karuk Tribe Housing Authority
Post Office Box 1159
Happy Camp, CA 96039

Attn: Richard Black

For: APN 016-412-240 Hole #: TP-1A & 2A Depth: 3', & 1' Sample Description: Soil
Skyline Property Development
Happy Camp, California

Sampled By: J. McKnight Date Tested: 04/10/2015 Date Sampled: 04/02/2015

SOILS EXAMINATION FOR SOIL PERCOLATION SUITABILITY

Textural Analysis

	TP-1A	TP-2A
Sand:	78%	84%
Clay:	06%	05%
Silt:	16%	11%
Zone Classification:	**2**	**1**

Bulk Density: N/A

Comments:

Zone 1 - Soils in this zone are very high in sand content. They readily accept effluent, but because of their low silt and clay content, they provide minimal filtration. These soils demand greater separation distances from ground water.

Zone 2 - Soils in this zone provide adequate percolation rates and filtration to effluent. They are suitable for use of a conventional system without further testing.

Zone 3 - Soils in this zone are expected to provide filtration of effluent, but their ability at a suitable rate is questionable. These soils require wet-weather percolation tests to verify their suitability for effluent disposal by conventional leachfield methods.

Zone 4 - Soils in this zone are unsuitable for a conventional leachfield because of their severe limitations for accepting effluent.

Josh McKnight, P.E.

Soil Texture Analysis Worksheet

Job Name: Skyline Property Development

APN: 016-412-240

Job No.: 236

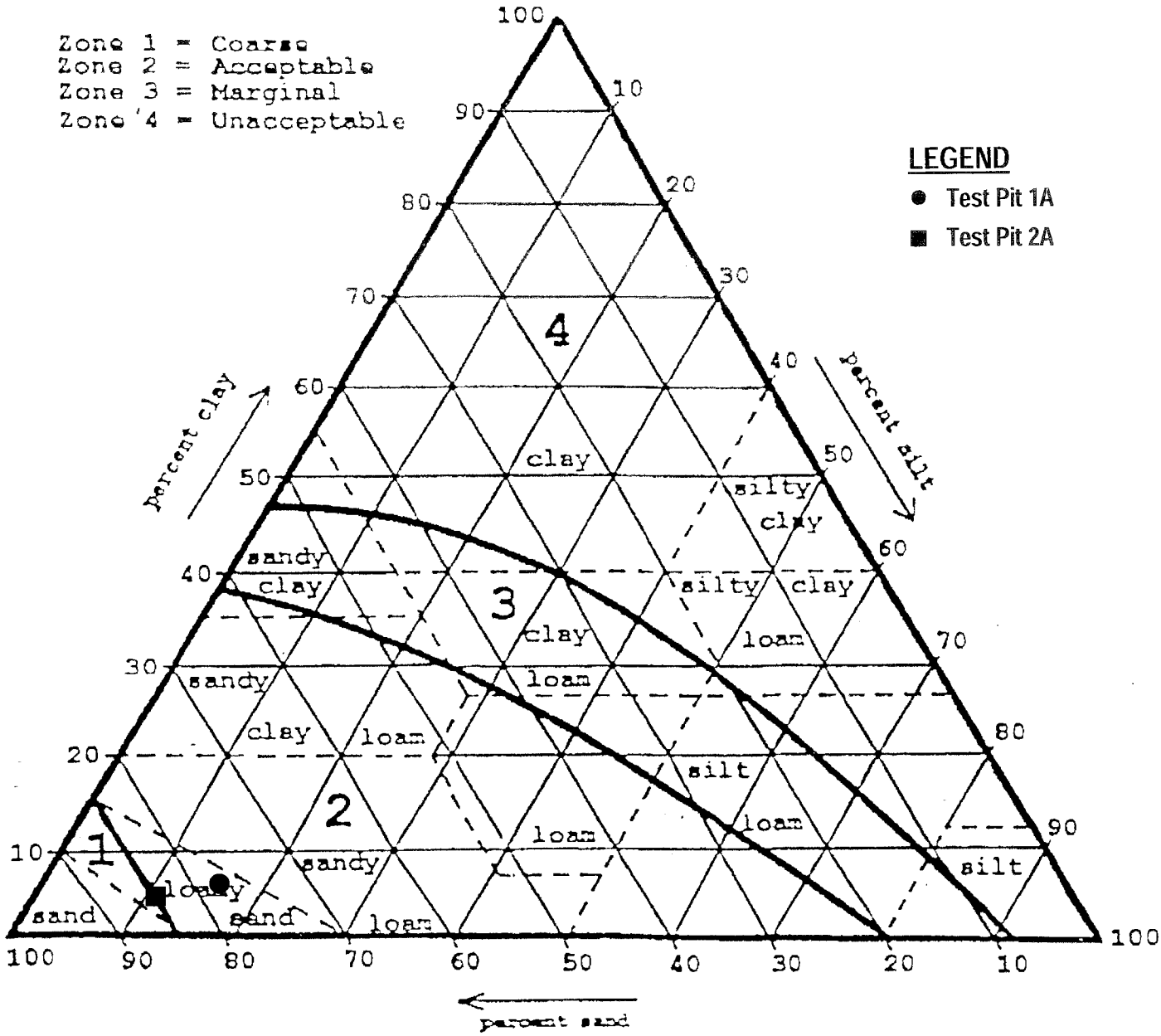
Performed By: J. McKnight

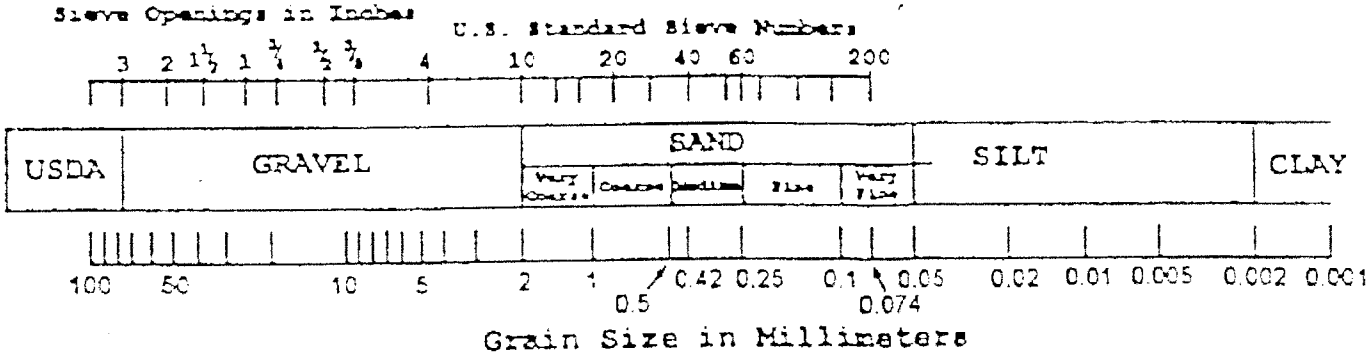
Hole #	TP-1A	TP-2A
Depth (ft)	3'	1'
Oven Dry Weight (g)	100	100
Starting Time	845	835
Temp @ 40 Sec	65	65
Hydrometer Reading @ 40 sec	29	23
Composite Correction	7.1	7.1
True Density @ 40 sec	21.9	15.9
Temp @ 2 Hours	66	66
Hydrometer Reading @ 2 Hours	13	12
Composite Correction	6.9	6.9
True Density @ 2 hours	6.1	5.1
% Sand	78	84
% Clay	6	5
% Silt	16	11
Soil Zone	**2**	**1**
Classification	**Loamy Sand**	**Loamy Sand**

Job Name: Skyline Property Development
APN: 016-412-240
Job No.: 236

Test Pit Number	TP-1A	TP-2A
Percolation Rate (minutes per inch)	15	15
Application Rate (gallons per day per square foot)	0.8	0.8

Skyline Property Development
APN: 016-412-240
Job No. 236





Appendix B

USGS Seismic Coefficients

USGS Design Maps Detailed Report

ASCE 7-10 Standard (41.79298°N, 123.37376°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 0.885 g
From Figure 22-2 [2]	S_1 = 0.440 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content w ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 0.885 g, F_a = 1.146

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.440 g, F_v = 1.560

Equation (11.4-1): $S_{MS} = F_a S_S = 1.146 \times 0.885 = 1.014\ g$

Equation (11.4-2): $S_{M1} = F_v S_1 = 1.560 \times 0.440 = 0.686\ g$

Section 11.4.4 — Design Spectral Acceleration Parameters

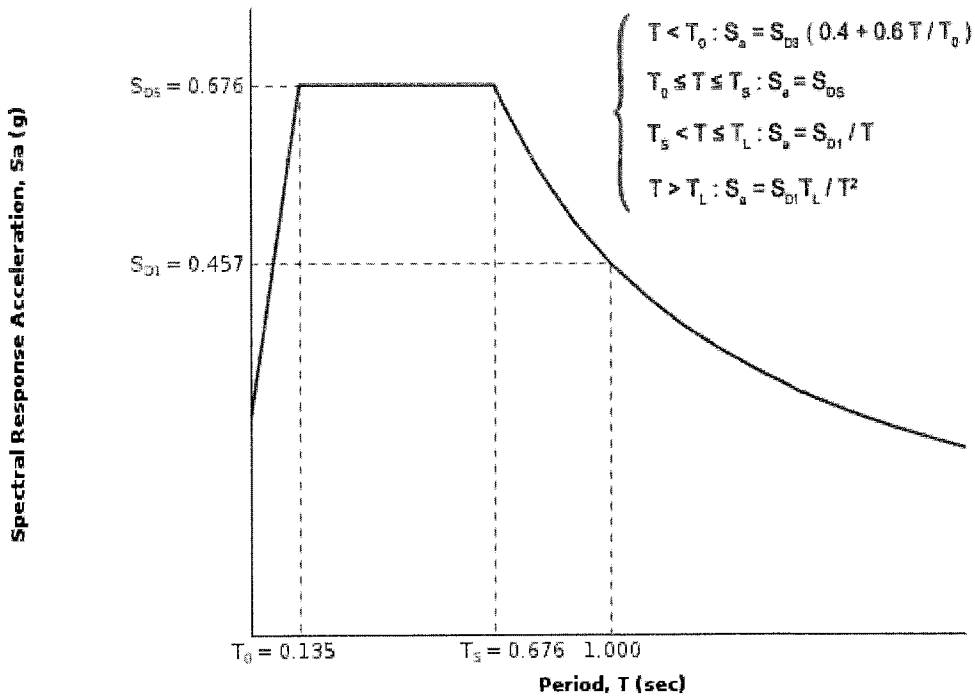
Equation (11.4-3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.014 = 0.676\ g$

Equation (11.4-4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.686 = 0.457\ g$

Section 11.4.5 — Design Response Spectrum

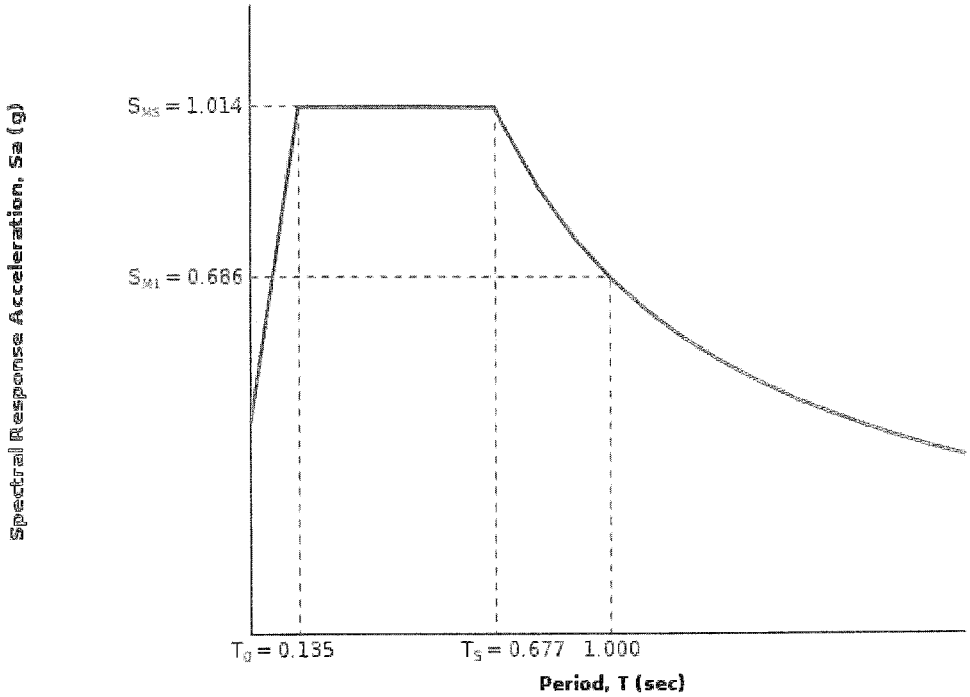
From Figure 22-12 [3] $T_L = 16$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7[4] $PGA = 0.424$

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.076 \times 0.424 = 0.456\ g$

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.424 g, F_{PGA} = 1.076

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17[5] $C_{RS} = 0.853$

From Figure 22-18[6] $C_{R1} = 0.839$

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.676 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.457 g, Seismic Design Category = D

*Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.*

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf*
2. *Figure 22-2: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf*
3. *Figure 22-12: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf*
4. *Figure 22-7: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf*
5. *Figure 22-17: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf*
6. *Figure 22-18: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf*

Appendix C

Photo Log

Photo #1: View of the site facing easterly

Photo #2: View of the site facing southerly, with adjoining commercial property to the south.

Photo #3: View of proposed access to the project site, looking northerly

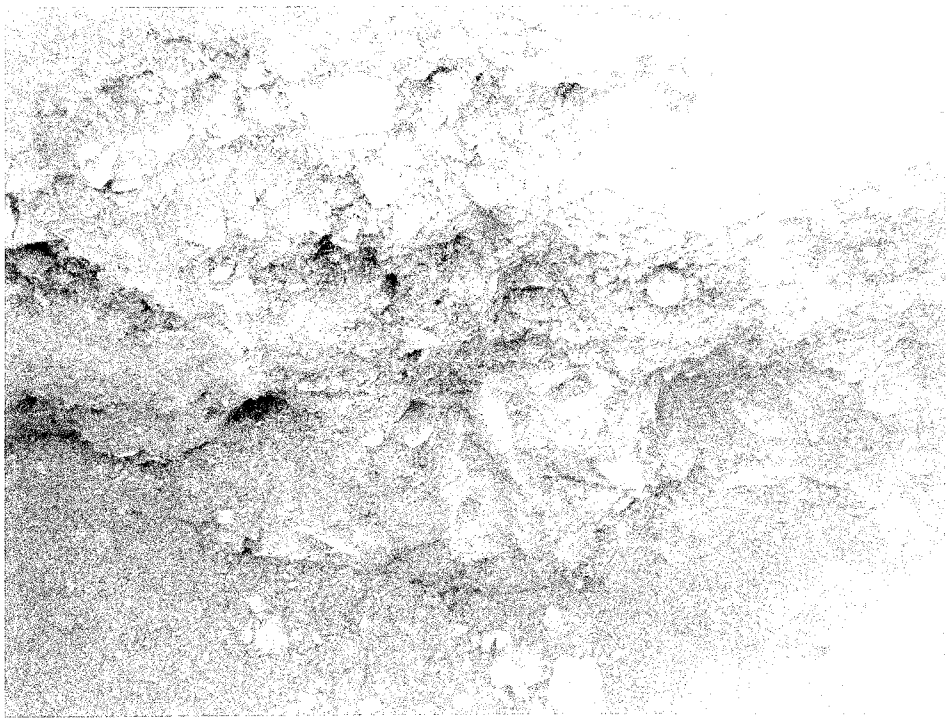


Photo #4: View of test pit #1

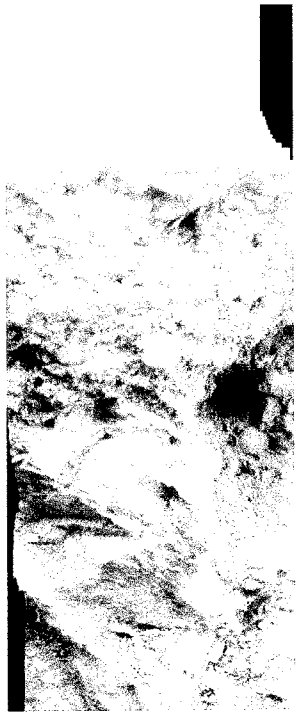


Photo #5: View of Test Pit #2

Photo #6: Excavated channels in bedrock along the southwest boundary

Photo #7: Adjoining property between project site and Klamath River

Photo #8: Fill materials located on site