LINDBERG GEOLOGIC CONSULTING
David N. Lindberg, CEG
Post Office Box 306
Cutten California 95534
(707) 442-6000

Submitted to Building
COPY

March 5, 2018

0257.01

Mr. Justin Baldwin
Post Office Box 5022
Berkeley, California 94705

Subject: Clarification and Amendment; Engineering-Geologic R-2 Soils Exploration Report Existing Pond Expansion Assessment on Assessor's Parcel 222-071-030, at 161 Oak Rock Road, near Garberville, Humboldt County, California

Dear Mr. Baldwin:

Thank you for your telephone call on February 28. We were very interested to learn more about your property, and the pond, from you directly. The purpose of the present letter is to amend and clarify a couple of misconceptions which were reflected in our report of February 20, 2018.

We appreciate that you have clarified our misconception regarding the past use of the pond which was the subject of our explorations. We reported that the pond was used to irrigate cannabis. We now understand that this pond has never been used to irrigate cannabis. Despite being constructed for the purpose of storing water for such irrigation, the fact that this pond fails to hold water (it leaks) has precluded it from being used for irrigation water storage. As you detailed for us in our conversation, past attempts to store water in this pond resulted in the water being lost through percolation into the ground. This also explains why the pond appeared very low, or even dry, in several of the Google Earth satellite images we reviewed.

You have reported to us that the ridge to the northeast of the pond is composed of limestone rather than sandstone, as we reported based on the published geologic mapping. You mentioned that the ridge is colloquially known locally as "limestone ridge" for this reason. In our opinion, the presence of limestone, rather than sandstone, is of little substantive difference regarding the water storage ability of the pond itself. Limestone may store more groundwater in cavities or caverns than sandstone. Sandstone may be expected to store groundwater in small fractures and intergranular porosity. Chemical analyses could potentially be employed to determine if the groundwater source is in a carbonate rock (i.e., limestone), or sandstone, but that is of no relevance to the water-holding ability of the soils at the existing leaky pond site. A liner is, in our opinion, the best solution for a leaky pond in this setting.

We hope this helps clarify our report. Please contact our office if you have any questions or concerns.

Sincerely,

David N. Lindberg

David N. Lindberg CEG 1895
Lindberg Geologic Consulting

CERTIFIED ENGINEERING GEOLOGIST
DAVID N. LINDBERG
No. 1895
EXP. 02/29/20
STATE OF CALIFORNIA
DNL

COUNTY OF HUMBOLDT
PLANNING AND BUILDING DEPARTMENT
BUILDING DIVISION

3015 H STREET EUREKA CA 95501
PHONE: (707) 445-7245 FAX: (707) 445-7446

3-26-18

A# 43442
APN# 222-071-030
Engineering –Geological R-2 soils report

Conditions of Approval

- **Recommend conditional approval.**
- **Engineer to provide observations of deepening of pond and test well as per soils report recommendations.**
- **Engineer to provide additional annual observations certifying safety and stability of pond for five years.**

Gustin Dumler
Senior Building Inspector
County of Humboldt
Building Division
Desk, 707-268-3714
Cell, 707-499-2029
Email, gdumler@co.humboldt.ca.us

Engineer to inspect
footings/excavations

APPROVED
MAR 26 2018
Humboldt County
Building Division

LINDBERG GEOLOGIC CONSULTING
David N. Lindberg, Certified Engineering Geologist

RECEIVED
MAR 14 2018
Humboldt County
Planning Dept.

ENGINEERING-GEOLOGIC R-2 SOILS EXPLORATION REPORT

Existing Pond Expansion Assessment
161 Oak Rock Road
Humboldt County, California

Conditional
APPROVED
MAR 26 2018
Humboldt County
Building Division

Assessor's Parcel Number: 222-071-030

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

Prepared for:
Mr. Justin Baldwin

David N. Lindberg, CEG 1895, Exp. 02/29/2020

CERTIFIED ENGINEERING GEOLOGIST
DAVID N. LINDBERG
No. 1895
EXP. 02/29/20
STATE OF CALIFORNIA

February 20, 2018

LGC Project No. 0267.00

Post Office Box 306 Cutten, California 95534 (707) 442-6000

USGS Design Maps Summary Report

User-Specified Input

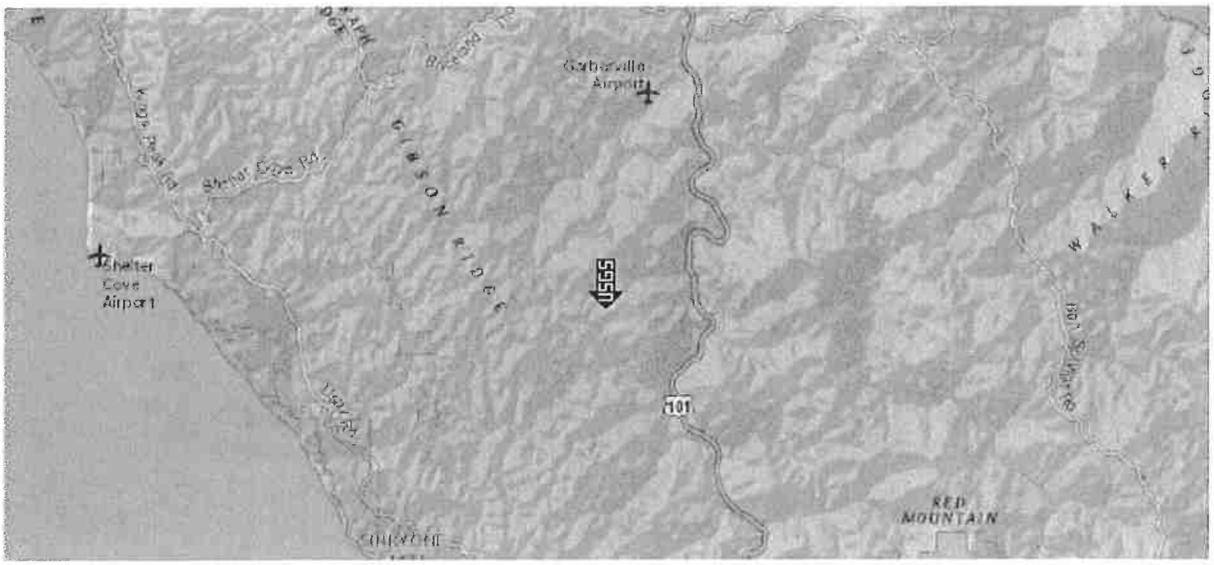
Report Title 222-071-030
Fri March 23, 2018 23:54:09 UTC

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 40.0171°N, 123.8339°W

Site Soil Classification Site Class D – "Stiff Soil"

Risk Category I/II/III

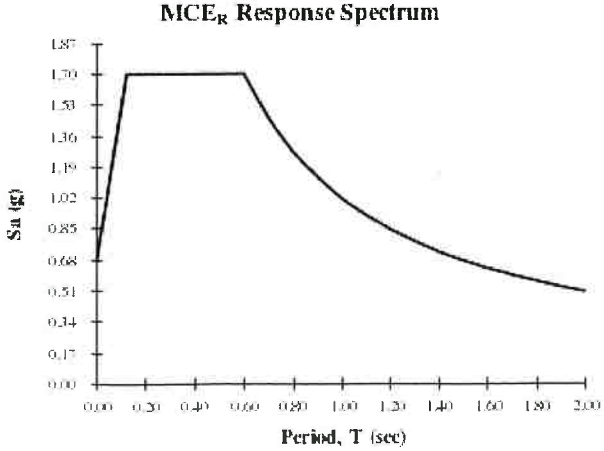


USGS-Provided Output

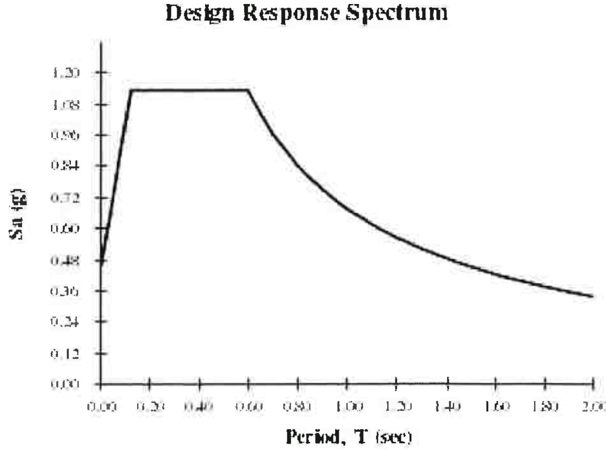
S_S =	1.700 g	S_{MS} =	1.700 g	S_{DS} =	1.133 g
S_1 =	0.674 g	S_{M1} =	1.011 g	S_{D1} =	0.674 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

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Contents:

ENGINEERING-GEOLOGIC R-2 SOILS EXPLORATION REPORT
Existing Pond Expansion Assessment
Justin Baldwin, APN: 222-071-030
161 Oak Rock Road, Garberville, Humboldt County, California

1.0 INTRODUCTION

1.1 Site and Project Description

Presented in this report are the results of a site-specific, engineering-geologic soils reconnaissance conducted by Lindberg Geologic Consulting (LGC) at 161 Oak Rock Road, near Garberville, California (Figure 1). Our explorations were limited to the location of an existing pond on Humboldt County Assessor's parcel 222-071-030 (Figure 2).

The existing pond observed on the parcel was constructed at a formerly-vacant site above the head of a small ephemeral drainage course tributary to the upper headwaters of Sproul Creek. Any runoff from this pond will drain to the small un-named ephemeral drainage course and thence, via Sproul Creek to the South Fork Eel River. Existing pond dimensions were estimated in the field and by satellite imagery to be approximately 150 by 140 feet. Capacity was not estimated; according to the client's representative on-site the pond is "leaky", and that a significant portion of the water stored therein is lost through infiltration. For this reason, the owner wishes to line the pond with a synthetic liner, and increase the storage capacity by deepening the pond within its existing footprint.

Located in the southeastern part of the parcel, near the southeast corner of Section 16, the existing pond was apparently constructed between July 2006, and June 2009, and was approximately half-full at the time of our site explorations (January 19, 2018). Our area of exploration was limited to the pond and immediate vicinity (Figure 3). This pond is accessed by an existing driveway off of Oak Rock Road. Overflow, which reportedly rarely (if ever) occurs is discharged through an existing pipe through the pond dam berm on the northwestern side.

Parcel 222-071-030 has an assessed lot size of 108 acres, and occupies the majority of the southeastern quarter of the Section 16, T5S, R3E. Latitude and longitude of the centroid of this parcel are 40.0172° and -123.8363°, respectively, per the Humboldt County WebGIS. This existing pond is located at approximately 40.0171° and -123.8339° (Figures 1 and 3).

Elevations on the subject parcel range from approximately 1,080 feet at the south property line at Sproul Creek, to 1,705 feet at the highest point of the parcel. Elevation of the existing pond is estimated to be approximately 1,450 feet (Figure 1). The subject parcel is situated below a generally northwest to southeast ridgeline with a southwesterly aspect (Figure 1), and is approximately 2.3 miles west of Richardson Grove State Park and US highway 101. Water is supplied to the pond by rainfall runoff and existing springs. Ingress to the existing pond is via existing graded ranch roads. To the best of our knowledge, no new grading beyond deepening the pond is proposed on this parcel at this time.

Included in this report are brief assessments of the site geology, subsurface soil conditions, and potential geologic hazards associated with the existing pond site. Recommendations are provided as necessary where appropriate, to mitigate potential negative effects of geologic hazards on this pond. Recommendations are provided for excavating the existing pond; design of the overflow piping, and drainage and erosion control was by Omsberg and Preston Engineers. A copy of Omsberg and Preston's Grading and Erosion Control plan is appended to this report.

LGC understands that the property owners require engineering-geologic review of the existing pond site for permitting purposes. The existing pond is used for agricultural water storage for cannabis cultivation. A Certified Engineering Geologist from our office examined the existing and potential pond sites on January 19, 2018. *

1.2 Scope of Work

LGC was retained to observe and characterize the apparent adequacy of the construction of the subject pond; we were subsequently requested to provide our professional opinion of the proposed pond expansion. Recommendations for expanding the existing pond, and disposal of the grading spoils generated are included. As part of our scope we assessed potential geologic hazards, and prepared this brief, preliminary engineering-geologic soils report. The specific scope of this investigation included the following:

- Review pertinent published geologic maps and reports of this area.
- Conduct a reconnaissance field exploration program of the pond site.
- Prepare this engineering-geologic soils report to provide an assessment of stability.
- Provide earthwork recommendations for the owner, his engineer, and contractors.

Excluded from our scope of work were any other proposed or existing site developments, any environmental assessment for the presence or absence of any hazardous waste, toxic, or corrosive materials. Although we assessed subsurface conditions in this investigation, we conducted no laboratory testing of any samples for the presence of hazardous material(s).

1.3 Limitations

This report has been prepared for the exclusive use of Mr. Justin Baldwin, his contractors and subcontractors, and appropriate public authorities, for specific application to the existing pond site described on this parcel. We have endeavored to perform our services within the engineering-geologic standard of care common to the local area at the time this work was performed. LGC makes no other warranty, express or implied.

Analyses and recommendations contained in this report are based on data obtained from existing maps and reports, field observations and limited subsurface explorations. Methods indicate subsurface conditions only at locations explored, only at the time any excavations or borings

* See Attached Letter ...

were opened, and only to the depths penetrated. Soil observations and sampling cannot always be relied on to accurately reflect stratigraphic or lithologic variations that commonly exist between sampling locations, nor do they necessarily represent conditions at any other time.

Recommendations included in this report are based, in part, on assumptions about subsurface conditions that may only be tested during earthwork. Accordingly, the validity of our recommendations is contingent upon how they are applied in the field during construction. Experienced engineers and equipment operators should be retained where necessary and appropriate to provide a complete professional service. LGC cannot assume responsibility or liability for the adequacy of our recommendations when they are applied in the field unless we are retained to observe those phases of the construction work applicable to our recommendations (e.g., earthworks). We are available to discuss the extent that such observations may be necessary to provide assurance of the validity of our recommendations.

Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the pond is changed. If changes are contemplated, LGC should be contacted and consulted to review the impact of the changes on the applicability of the recommendations in this report. LGC is not responsible for any claims, damages, or liability associated with any other party's interpretation of the subsurface data or reuse of this report for other projects or at other locations without our express written authorization. There is no warranty, express or implied.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration Program

In-situ soil conditions were assessed during a site visit on January 19, 2018. Our explorations utilized observation of the existing cut slopes, and the materials in the fill prisms of the pond dam berm, to assess the in-situ soil profiles and materials. Soil stratigraphy was observed and interpreted in the field and in general accordance with ASTM standards.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Topography and Site Conditions

On this subject parcel, the existing pond is located on sloping ground with a generally southwesterly aspect. Maximum slope gradients are approximately 15 to 30 percent at the existing pond site, becoming steeper (30% – 50%) on the west. Steeper-gradient slopes exist in the vicinity; however, these steeper slopes appeared to be well-separated from the existing pond location. Slopes prior to grading are estimated to have been less than 15 percent in the area of the existing pond berm dam.

The U.S. Geologic Survey (USGS 1970) 7.5-minute topographic "Garberville, Calif." quadrangle indicates that this subject parcel is situated at elevations ranging between approximately 1,080 to nearly 1,705 feet above mean sea-level (NAD83) with slopes greater than 30 to greater than 50 percent across much of this parcel. Surrounding the existing pond, the slopes to the north, east and south, rise at 30 to 50 percent. Based on review of satellite imagery dating back to June 12, 1993, it appears that, prior to the pond development, the ground in the vicinity of this pond appears to have been unaltered by any past grading. Native slopes in the immediate vicinity of the pond appeared stable in their present condition.

The parcel is located in the Coast Ranges Geologic Province and is underlain by Pliocene to late Cretaceous mélange of the Coastal Belt of the Franciscan Complex. Coastal terrain is described as: "Predominantly sandstone, argillite and minor polymict conglomerate, that forms highly sheared mélange and broken formation and is highly folded locally. Sandstone locally is thin-bedded to massive, rhythmically interbedded with argillite, arkosic, rich in felsitic intermediate volcanic detritus; and commonly it is veined with calcite, laumontite, and quartz."

McLaughlin and Others (2000) designate the deposits immediately underlying this existing pond as mélange (unit co2), which they describe as follows: "Subequal amounts of shattered sandstone and argillite with much clayey, penetratively sheared rock that exhibits generally irregular topography lacking well-incised sidehill drainages."

3.2 Geologic Setting

The subject parcel is located approximately two miles west of U S highway 101 and Richardson Grove Sate Park. This pond drains to an ephemeral tributary of Sproul Creek (Figure 1). Based on our field review of this pond site, satellite imagery, and published geologic maps (McLaughlin and Others, 2000), we find the project site is underlain by argillite.

At this existing pond site, the observable subgrade appeared to consist of medium dense to dense clayey siltstone. At the pond location, the extent of prior site grading activities appear limited to the pond excavation and the pond dam berm. Undisturbed native soil below the existing ground surface at this site appeared suitable as subgrade bearing material for the existing pond berm. Soil profiles appeared to be uniform in the pond excavation exposed above the water line at the time of our observations.

3.3 Seismicity

The subject property is located within California's Northern Coast Ranges Geomorphic Province (CGS, 2002), a seismically active region in which large earthquakes are expected to occur during the assumed economic life span (50 years) of the site developments (Heaton and Kanamori, 1984). The Northern San Andreas fault, which comes ashore at Shelter Cove, approximately 11 miles to the west-northwest, is the nearest active fault, as defined by the California Geologic Survey (CGS). The Northern San Andreas fault is a northwest-striking, near-vertical, right-lateral strike slip fault. The upper-bound earthquake considered likely to occur on the Northern San Andreas fault has an estimated maximum moment magnitude (Mw) of 7.9 (Petersen et al., 1996).

Based on the record of historical earthquakes (approximately 150 years), faults within the North American plate boundary zone and internally-deforming, subducting Gorda and Juan de Fuca plates have produced numerous small-magnitude and several moderate to large (i.e. magnitude 6.0 or greater) earthquakes affecting the local area. The Cascadia subduction zone (CSZ) is located approximately 15 miles west of the subject parcel and is estimated to be capable of producing earthquakes of magnitude 9.0 when its entire length ruptures from Cape Mendocino to Vancouver Island in British Columbia (Satake, et al, 2003). Several active regional seismic sources in addition to the CSZ, and the Northern San Andreas fault, are proximal to the project site and have the potential to produce strong ground motions. These seismic sources include:

- Mendocino fault offshore: a high-angle, east-west trending, right-lateral strike-slip fault between the Gorda plate and Pacific plate approximately 15 miles to the west-northwest.
- Faults within the subducting, internally-deforming Gorda and Juan de Fuca plates consisting of high-angle, northeast-trending, left-lateral, strike-slip faults.

3.4 Subsurface Conditions and Description of the Site Soils

Subsurface data obtained during our site exploration of the subject property, suggest soils within at least the upper eight to nine feet of the soil profile to consist of weakly-indurated, clayey siltstone. Native topsoil was disturbed or removed by prior grading activities. Native soils below the existing ground surface appeared medium soft, to stiff, in the soil profiles observable. Based on field observations of the soil conditions, we could not determine if site soils might be subject to high groundwater conditions; no soil mottling or free groundwater was observable above the pond waterline. This existing pond drains to the Sproul Creek and the South Fork Eel River, approximately 3.5 miles north of this pond. At the time of our site visit, early in the rainy season (January), there was no emergent groundwater flow observable at or near the existing pond site.

Native clayey and silty soil materials we observed continued to the maximum depths exposed are estimated to be medium soft to stiff, and slightly plastic to friable. Soil structure within the upper nine feet is weakly developed. Materials below may grade to more-dense siltstone bedrock, and deep excavations may encounter intact bedrock at some depth below the ground surface (bgs).

3.5 Groundwater Conditions

Early in the rainy season, emergent groundwater flow, or perched groundwater was observed. Soil mottling, considered indicative of seasonally-saturated or high groundwater conditions, was likewise not observed. It is unlikely that groundwater will rise to within five feet of the ground surface except perhaps briefly in winter during more-intense storm events. Depth to the lowest seasonal is unknown. Pond deepening could encounter the water table during excavation. Significant seepage could occur creating challenging or unstable conditions for achieving design depth of this pond. High groundwater could disturb the liner if the pond is drawn down below it.

4.0 GEOLOGIC AND SOIL HAZARDS

Potential geologic and soil hazards associated with the region and the proposed project at this site include seismic ground shaking, surface fault rupture, liquefaction and related phenomena, settlement, slope instability, flooding and high groundwater, and swelling or shrinking soils. Brief assessments of these potential hazards are presented below.

4.1 Seismic Ground Shaking

As noted in Section 3.3, the project site is situated within a seismically active area proximal to multiple seismic sources capable of generating moderate to strong ground motions. Given the presence of significant regional active faults within and offshore of northern California, there is high likelihood that the project site will experience strong ground shaking during the economic life span of this pond (50 years).

Site-specific seismic Spectral Response Accelerations are presented in Table 1, below, in accordance with 2016 California Building Code (CBC 2016) requirements, and were obtained from the USGS. The on-line USGS ground motion parameter calculator provides spectral acceleration values (S_s and S_1) based on the site-specific geographic coordinates, the latest available seismic database maintained by the USGS, the site classification, site coefficients, and adjusted maximum considered earthquake values (F_a, F_v, SM_s and SM_1).

Based on the site conditions and assumptions of the soils and geologic materials within 100 feet of the ground surface, we conservatively classify the site as Site Class D consisting of a "Stiff soil" profile (Section 1613.3.2, 2016 CBC). The parameters in Table 1 below are based on this classification and were determined using the 2010 ASCE Standard 7 (w/March 2013 errata), minimum design loads for buildings and other structures (USGS, 2016).

Table 1. Spectral Response Accelerations; APN 222-071-030

Site Information	Latitude / Longitude*	40.0171° / -123.8339°
	Occupancy Risk Category (2016 CBC, Sect. 1604.5)	I
	Seismic Design Category (2016 CBC, Sect. 1613.3.5)	D
	Site Class (2016 CBC, Sect. 1613.3.2)	D
Spectral Acceleration	S_s (Site Class C)	1.700
	S_1 (Site Class C)	0.674
Site Coefficients	F_a / F_v	1.0 / 1.5
Response Accelerations	S_{MS}	1.700
	S_{M1}	1.011
	S_{DS}	1.133
	S_{D1}	0.674

* Coordinates for the Parcel Centroid per Humboldt County WebGIS.

4.2 Surface Fault Rupture

The Coastal Belt thrust and the Garberville-Briceland fault (CDMG, 1983) are to the northeast of the property (McLaughlin, et al., 2000. These are ancient, inactive faults, and are therefore not zoned as "active faults" by the California Geologic Survey. The subject parcel is not located within an Alquist-Priolo earthquake fault zone where the State of California anticipates potential surface rupture. Based on the distance to the nearest active fault trace, the potential for surface fault rupture on the subject property is low.

4.3 Liquefaction

Liquefaction is a loss of soil strength that results in fluid mobility through the soil. Liquefaction typically occurs when uniformly-sized, loose, saturated sands or silts that are subjected to strong shaking in areas where the groundwater is less than 50 feet below ground surface. In addition to the necessary soil and groundwater conditions, the ground acceleration must be high enough, and the duration of the shaking must be sufficient, for liquefaction to occur.

According to Special Publication 115, Map S-3 (CDMG, 1995), the project site is not located within an area of recognized liquefaction potential. Based on the likely lack of saturated, loose, poorly-graded sand or silt in the soil profile, the potential for liquefaction to occur at this site is considered low. Site-specific quantitative evaluation of liquefaction potential was not performed.

4.4 Settlement

The shallow bearing soils at this pond site, below the existing stripped ground surface, are clayey silt with minor fine sand. By our observation, the existing pond berm dam exhibited no apparent settlement issues. The pond berm dam fill had experienced no fill material slope failures at the time of our site observations in January 2018. Through approximately the past ten winter wet seasons, this pond berm dam appears to have performed acceptably.

4.5 Landsliding

Landslide mapping has been published by the CDMG for all of the Garberville Quadrangle, (Spittler, 1984) and the landslide inventory mapping, and other geologic mapping (e.g., McLaughlin, 2000); show only areas of disrupted ground to the north of the project pond site, and no earthflow landsliding at the location of the existing pond. A landslide is mapped in the northwestern part of Section 16, across a ridge from this pond. Site-specific exploration of this pond revealed no observable areas of instability. Examination of satellite imagery indicated no recent slope failures in the vicinity of this pond.

4.6 Flooding and Groundwater

4.6.1 Flooding

The subject site is located on high ground above Sproul Creek, and other watercourses in the vicinity. Potential for flooding to affect this existing pond site is minimal.

4.6.2 Groundwater

In our opinion, based on our field observation and professional experience, seasonally high groundwater conditions have some potential to occur at this site. During our field investigation, our observation of the lack of free groundwater or soil mottling, indicates groundwater is unlikely to rise to within five feet of the ground surface during the winter wet season. However, because this existing pond is proposed to be deepened considerably, we estimate a high probability that the proposed deepening of this pond 40+ feet below the existing spillway will very likely encounter free groundwater in the excavation before reaching the proposed total depth. Shallow groundwater conditions appear to have potential to cause difficulty when excavating to the total depth proposed.

4.7 Soil Swelling or Shrinkage Potential

At this pond site, bearing soils consist of clayey silt with fine sand. Soils contained a few fragments of other lithologies. Soils were moist to the ground surface in January. Near-surface soils appeared relatively porous and well-drained.

The presence of clay makes these soils potentially subject to significant shrink-swell potential associated with cyclic seasonal wetting and desiccation. However, site soils do not appear likely to desiccate seasonally to a depth sufficient to affect the earthen berm containing this pond. The shrink-swell hazard to the pond berm dam is low.

5.0 CONCLUSIONS AND DISCUSSION

1) Slope instability, a primary potential geologic hazard on the subject parcel, does not appear to be a significant hazard to the proposed deepening of this existing pond in its present location.

2) The existing pond berm appears likely to be underlain by more-dense soils at depth. These materials should be a suitably-firm subgrade in which to embed compacted fill for a pond berm dam.

3) Early in the rainy season, our field explorations found no free groundwater, or evidence suggestive of seasonally-high groundwater at this existing pond location. Perched groundwater was not observed, but will likely be encountered prior to attaining the proposed depth. Soil mottling indicative of seasonal high groundwater conditions was not observed. The site soils appear relatively well-drained and permeable. The potential for groundwater to be encountered shallower than the design depth is estimated to be high. We were informed that there are springs near this existing pond site, which adds to our shallow groundwater concerns.

Engineer to inspect
footings/excavations

Engineer to inspect
footings/excavations

Engineer to inspect
footings/excavations

4) The nearest faults to the site are the inactive Coastal Belt thrust, and the Garberville-Briceland fault to the east. The State of California does not consider these faults active. The active San Andreas fault is approximately 11 miles from the subject property. Due to the fact that there are no recognized active faults on or near the property, the risk of fault surface rupture at the site may be characterized as low.

5) Strong seismic ground shaking, however, will occur during the economic life of any developments on the subject property. Risks associated with strong ground motions are typical of the region and as such, these risks, as mitigated by prudent, code-compliant design and construction are assumed by owners and developers in the area. The existing pond construction between 2006, and 2009, was not observed while in-progress.

6) At Present, any overflow is via a HDPE pipe, approximately one to three feet lower than the dam crest. Overflow is discharged to an existing drainage course to a Class-III watercourse below. Even qualitatively, we cannot estimate if this pond will resist deformation during strong seismic shaking. Having had no involvement in the design or construction of the pond, we can not provide a quantitative seismic stability evaluation without further, more detailed subsurface exploration.

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

6) For the native clayey silt and fine sand, a presumptive load-bearing value of 1,500 pounds per square foot (psf) for vertical foundation pressure would be used for design. For lateral bearing use 100 psf per foot of embedment below grade. For lateral sliding resistance, use a cohesion factor of 130 psf, multiplied by the contact area.

7) The undisturbed native soils at a depth of two feet below the surface appear suitable to support earthen fills designed and constructed in accordance with the current building codes.

8) In our professional opinion, and provided our recommendations are adhered to, this pond is not expected contribute to, nor be subject to, any site-specific geologic hazards. In our opinion, the existing pond appeared suitably constructed, but we question the stability of the steep deep cut slopes when the pond is deepened below the water table.

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

We understand from our on-site observations that this pond is not lined. As discussed, the existing pond appeared to be built to an acceptable standard, but we were not present to observe the site prior to construction, and we did not observe any of the earthworks during construction operations. Therefore, we have no knowledge of how the earth fills were placed and compacted, or of how the ground beneath the pond dam berm was prepared to receive the fill.

It is our opinion, based on observation of the appearance, that the existing pond was acceptably constructed. The face of the pond berm dam appeared stable in its present configuration. The overflow pipe appears to have functioned adequately to this point. An overflow pipe 18 inches in diameter, with at least 12-inches of freeboard above the pipe is preferable.

6.0 RECOMMENDATIONS

6.1 Slope Setback Considerations

We recommend a minimum construction setback of eight (8) feet from slopes steeper than 30 percent. At minimum, we recommend that space always be allowed to permit access by a typical "bobcat" type tractor around and across pond berm dams, and any ascending and descending slopes, to provide access for repairs should problems occur.

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

6.2 Site Preparation

This existing pond is proposed to be deepened only. We recommend drilling a temporary monitoring well to the proposed pond depth to ensure that suitable materials exist at that depth, and to ascertain the depth to groundwater. If the pond will be deeper than the groundwater, we recommend limiting the pond to the depth to the groundwater table, or designing a means of controlling the groundwater elevation; by drains, for example.

To prepare the fill site to receive the spoils from deepening the pond, remove existing sod and topsoil, and any other debris encountered at or below the ground surface from fill area footprint, and from an area five feet (minimum) beyond the perimeter. Any stumps left from tree removal or historic logging would also be removed. Excavated sod and topsoil should be stockpiled for later use as landscaping fill material.

All earthwork, including but not limited to, site clearing, grubbing and stripping should be conducted during dry weather conditions; generally May through September. Failure to comply with this recommendation could result in detrimental erosion or sedimentation. Erosion and sediment control recommendations are provided later in this report.

6.3 Temporary Excavations

Temporary construction slopes are anticipated to be necessary for this project; such slopes should be designed and excavated in strict compliance with applicable safety regulations including the OSHA Excavation and Trench Safety Standards.

All construction equipment, building materials, excavated soil, vehicular traffic, and other similar loads should never be allowed near the top of any unshored or unbraced excavations. Where the stability of adjoining lands, buildings, walls, pavements, or any other similar improvements may be endangered by excavation operations, support systems such as shoring or bracing may be necessary and should be provided for structural stability and to protect any personnel working in the excavation.

Since excavation operations are dependent on construction methods and scheduling, the owner and contractor shall be solely responsible for the design, installation, maintenance, and performance of all shoring, bracing, underpinning, and other similar systems. Under no circumstances should any comments provided herein be inferred to mean that LGC is assuming any responsibility for temporary excavations or the safety thereof. LGC does not assume any responsibility for the design, installation, maintenance, and performance of any shoring, bracing, underpinning, or other similar systems unless they are designed specifically for the work at this site by a licensed professional from this office.

6.4 Cut and Fill Slopes

Pond deepening excavation will create steep cut and fill slopes. We typically recommend cut slopes be no steeper than 1:1 (H:V) under the liner of a lined pond. Cut slopes exposed to water or air should not exceed 2:1. Fill slopes of compacted soils should be no steeper than 2:1 on the outside face of the pond berm dam, and not more than 3:1 inside the pond. Unrestrained ancillary cut and/or fill slopes (if any) with heights in excess of four feet should be no steeper than two to one, horizontal to vertical (2:1, H:V). Pond grading has been designed by an experienced civil engineer, but the depth of the water table, and the materials at the proposed depth of the pond have not been investigated. We recommend that his pond be improved in accordance with the County grading ordinance and current CBC requirements.

This existing pond may not have been constructed to a rigorous standard, however, is not expected to have a negative impact on the stability of the adjacent slopes, or to impact watercourses, in its present condition, provided that our recommendations are adhered to. We recommend one, 18-inch diameter (minimum) galvanized, corrugated metal (CMP), overflow pipe, with at least 12 inches of freeboard above the top of the pipe, should be constructed at this pond to control discharge of overflow. Use of HDPE pipe is also acceptable. Continue the CMP down the face of the pond berm dam to an outlet point in the existing drainage course with effective erosion control at the outlet. Armor the outlet with rock slope protection (RSP) such as "Light" or "Backing/Facing" per Caltrans to protect from erosion.

6.5 Structural Fills

A pond berm dam structural fill should be constructed as a controlled and compacted engineered fill. Structural fill should be free of organic materials and may be composed of low plasticity clay, sand, or well graded gravel. Native soils below the topsoil appeared suitable for use as general engineered fill for the pond berm provided they were moisture conditioned, free of organic or deleterious materials, and particles larger than approximately 3-inches in diameter.

Imported fill material is not anticipated to be required to achieve finished grades on this pond site; possibly sufficient material sources may be available on the property, but we have not evaluated any. If additional fills are required, native site soils may be suitable for such use.

Pond berm dam fills should consist of select, non-expansive, engineered fill. The material for select, engineered fill should be free of organic material and particles larger than approximately 3-inches in diameter, and should meet the following minimum criteria:

- Plasticity Index: 15 or less,
- Liquid Limit: 35 or less,
- Percent Passing #200 sieve: 10 to 40%,
- Maximum Particle Size: 3 inches

Avoid fill placement on sloping ground. Fills should always be placed on level, suitably prepared subgrade surfaces and keyed into the native subgrade on slopes over 20 percent. Fills should be compacted mechanically as described below to minimize the potential for settlement.

Structural fills placed on level, benched, suitably prepared subgrade surfaces should be compacted mechanically to minimize potential settlement. Approved fill material should be placed in loose lifts no more than 8 inches thick, uniform moisture content at or near optimum, and compacted mechanically.

If structural fill used to construct a taller pond berm dam, that fill should be subject to compaction testing and inspection during construction. It is prudent to monitor the suitability of such fill materials as placed, and to assure compliance with the recommended compaction standards. Structural fills should be compacted as specified in the "Compaction Standard" section following below.

6.6 Compaction Standard

Fills should be compacted mechanically to a minimum of 90 percent relative compaction so that no consolidation or settlement will occur. Vibratory mechanical compactors should be employed to achieve the recommended compaction. Within small shallow excavations such as around overflow discharge pipes, it is recommended that vibrating plate compactors (e.g., "wacker packers") be used. If no other compaction is performed, fill materials should be compacted to be firm and unyielding under a loaded 10-yard dump truck, at minimum.

For granular fill material such as sand and gravel, smooth-drum vibratory compactors should be used. Flooding of granular material should never be employed to consolidate backfill in trenches or other excavations.

It is recommended that structural fill and backfill material be compacted in accordance with the specifications listed in Table 2 below. A qualified person should be present to observe fill placement and assess the field density throughout each lift to verify that the specified compaction is being achieved by the contractor.

TABLE 2 – STRUCTURAL FILL PLACEMENT SPECIFICATIONS		
Fill Placement Location	Compaction Recommendation	Moisture Content (Percent Optimum)
Structural fill and Pond Berm fills.	90 percent	-1 to +3 percent
Utility trenches within building and driveway/parking areas	90 percent	-1 to +3 percent
Landscape and grass areas	Compact such that no settlement will occur	-1 to +3 percent

6.7 Pond Deepening Design Criteria

For this existing pond, following drilling, sampling and monitoring the depth to water, we recommend that the pond be drained and relatively dry prior to initiating the grading for deepening the pond. Limit the depth of the pond to the depth of dry season low groundwater. Ensure that the elevation of the water surface in the newly-deepened pond is never greater than the elevation of the phreatic (groundwater) surface.

We recommend that any new fill in the pond berm dam be observed and approved by a qualified professional during placement. Fill should be placed with a moisture content at or near optimum, and compacted mechanically to 90 percent relative compaction, with sufficient observation and testing to ensure conformance with our compaction recommendations. Construct the berm with a crest width of at least 8 feet for access with a mini-excavator or small backhoe, for potential future maintenance and repair needs. Surface the pond berm dam crest with at least 6 inches of compacted, Class-2 aggregate base (or equivalent) for vehicular access.

Securely anchor the overflow pipe to the face of the pond berm dam. Place a securely-anchored "Tee" at the outlet end of the overflow pipe to slow the velocity of the discharge. Armor the outlet of the overflow pipe with Light RSP boulders (per Caltrans Standard Specifications), and fill the interstices with coarse gravel to limit the potential for erosion. For further erosion control, line the drainage way (an unclassified drainage) below the outlet pipe with Light RSP and coarse gravel, and continue for at least 25 feet downhill below the outlet. The drainage way should be wide enough to contain the maximum potential outflow from the pond; we estimate that the existing depth and width of the drainage course will be sufficient.

All bare soil areas around the pond and fill area should be treated to control erosion. Generalized erosion control measures for the project site are listed in Section 6.9 below. Site-specific erosion control recommendations are included by the engineer in the plans and should be adhered to. Around the pond, we recommend that all exposed soils in the pond berm dam face, and all cut slopes, (and any other bare soil areas) be seeded with native grasses and covered with straw erosion control blankets. Anchor the straw erosion control blankets securely to the bare soil cut and fill slopes. Following the recommendations of the manufacturer and engineer, install silt fencing, securely anchored, at the toe of cut or fill slopes. We recommend fiber rolls (straw wattles), be placed contour-parallel at the approximate midpoint of the pond berm dam fill face slope, and other bare soil slopes.

6.8 Drainage

Grading performed should be conducted to create surface gradients adequate to provide for positive drainage by sheet flow. We recommend that flat areas around the pond be surfaced with an six inch thick layer of Class-2 aggregate base (or equivalent), compacted to provide a firm wearing surface for the personnel and equipment that may potentially operate on the periphery of the pond, or on the pond berm dam.

Landscaping design, grading and construction should be such that no water is allowed to pond onsite, (except in the pond) or to migrate beneath any structural fills. Runoff from the site should be controlled and discharged such that no erosion, sedimentation or discharge of turbid water to any perennial streams will occur. Storm water runoff should be controlled with the installation of rock-lined channel drainage ways, and discharged at suitable outlet points, armored with small boulders, cobbles and coarse gravel, such that no erosion, sedimentation, or ponding will occur.

6.9 Erosion and Sediment Control Recommendations

Wet weather conditions can occur at any time at the subject property but are "a given" from October through April. Storm water erosion and pollution prevention measures should be initiated concurrently with ground disturbance, and should be completed prior to the winter rains.

Except in an emergency, we recommend always avoiding wet-season earthwork and grading. To the extent feasible for this project, Humboldt County Erosion Control Standards should be incorporated into the project design and strictly adhered to during construction; a current edition may be obtainable from the Building Department. We specifically recommend the following erosion and sedimentation control measures for this deepened, lined pond:

- Prevent discharge of suspended sediment; contain sediment on the site.
- Following earthwork, cover disturbed soils above the waterline with stockpiled topsoil.
- Re-vegetate disturbed soils and topsoil promptly and concurrently with earthwork.
- Seed, and mulch exposed flat soil areas with straw at minimum to protect against erosion.
- "Punch" straw into the soil to minimize the potential for wind to blow the straw away.
- Exposed sloping ground, especially fill slopes, will not be protected adequately with only straw mulch and should have straw mats (with seed), straw wattles, and silt fencing.
- Seed mulched soils immediately; water through the dry season as necessary to establish grass for wet-season erosion protection.
- Install silt fence at the toes of all fill slopes and at the base of the pond berm dam.
- Install a rock energy dissipation structure at the outlet point of the pond overflow.
- Direct overflow toward the unclassified drainage below the pond.

- Cover all temporary soil stockpiles with plastic sheeting (6 mil min.) and anchor securely to prevent wind disturbance.
- Drive no vehicles on the native site soils when they are wet; at minimum use six inches of compacted, crushed rock or road base gravel to pave driveways, parking areas, and other areas accessed by vehicles during wet weather.
- Repair improperly functioning erosion control measures immediately when necessary.
- Monitor site conditions (before and after runoff-generating rainfall events to verify proper functioning of erosion control measures, and to repair them when/if necessary.

Engineer to inspect footings/excavations

Engineer to inspect footings/excavations

6.10 Additional Services

6.10.1 Review of Grading and Drainage Plans

The conclusions and recommendations provided in this report are based on the assumption that soil conditions encountered during grading will be essentially as exposed during our evaluation, and that the general nature of the grading and use of the property will be as described above. We recommend that final drafts of grading plans be reviewed by this office prior to implementation.

6.10.2 Observation and Testing

To assure conformance with the specific recommendations contained within this report, and to assure that the assumptions made in the preparation of this report are valid, LGC should be retained to review any new design plans. We should also review and provide written approval of the exposed subgrade prior to placement of the pond liner. Sufficient testing and observation should be performed during construction to ensure that the compaction standards specified above are adhered to.

Engineer to inspect footings/excavations

7.0 REFERENCES

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Spittler, T.E., 1984, DMG Open-File Report 83-26, Geology and Geomorphic Features Related to Landsliding, Garberville 7.5' Quadrangle, Humboldt County, California. Scale 1:24,000

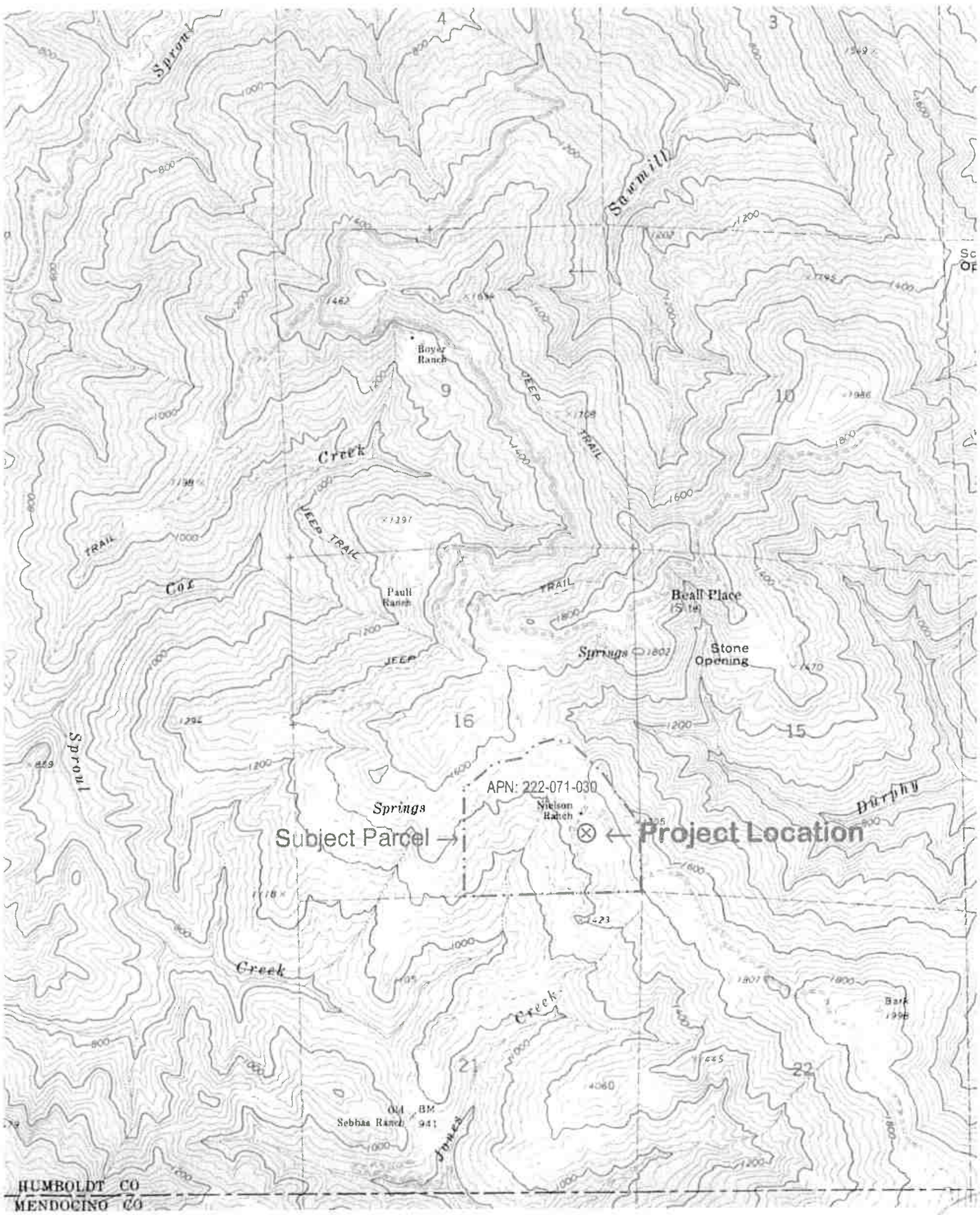
USGS, 1970, Garberville, Calif. 7.5' Quadrangle Map, Humboldt County, California.

USGS, 2018, Seismic Design Values for Buildings; Version. 5.1.0, website, URL: http://earthquake.usgs.gov/research/hazmaps/design/index.php

8.0 LIST OF FIGURES

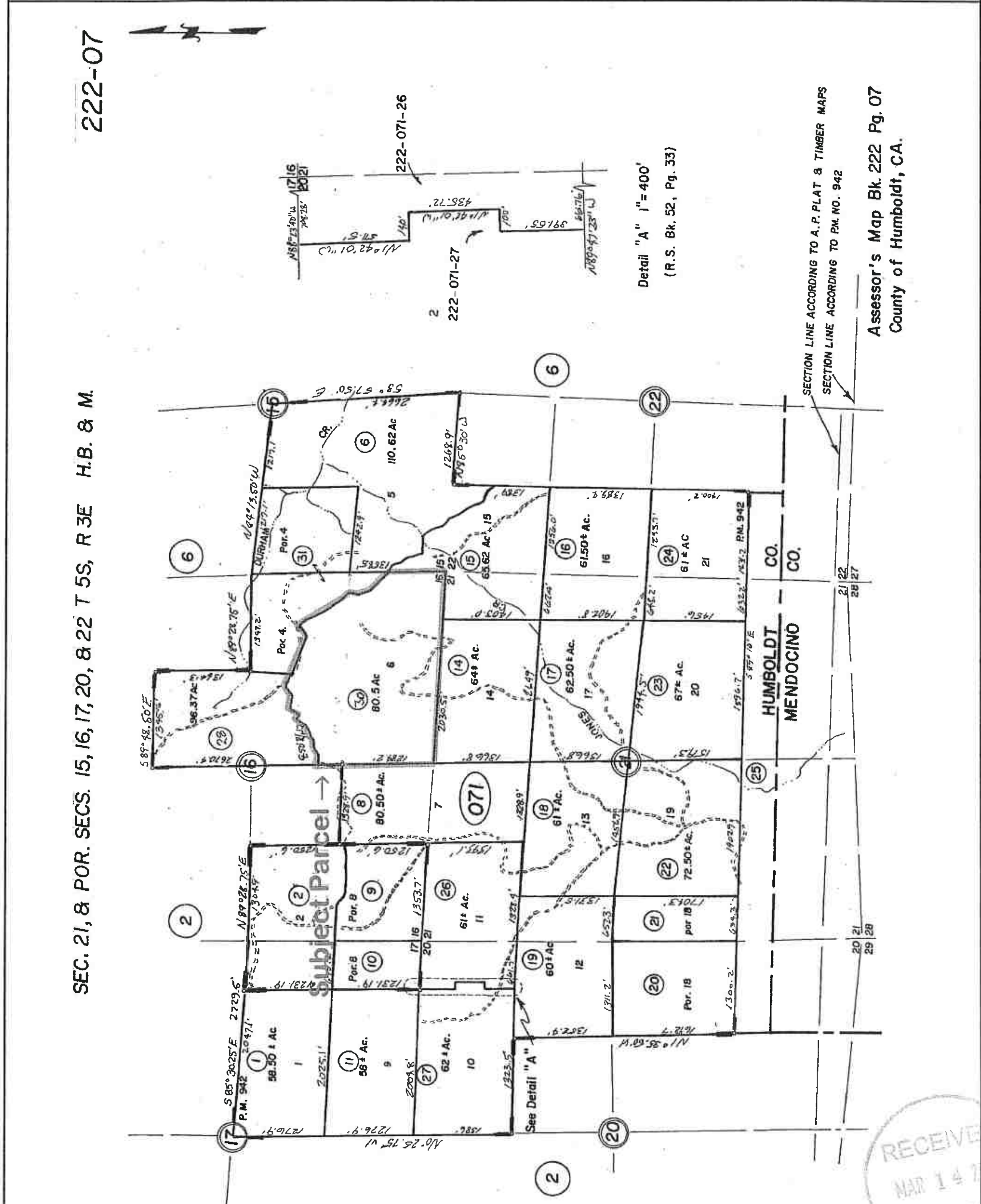
Attachment:
Grading, Drainage & Erosion Control Plan for Justin Baldwin (Omsberg & Preston, 09/23/2016)

Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 1
Post Office Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Topographic Map Project Area - All Locations Approximate	1 inch ≅ 2,300 feet

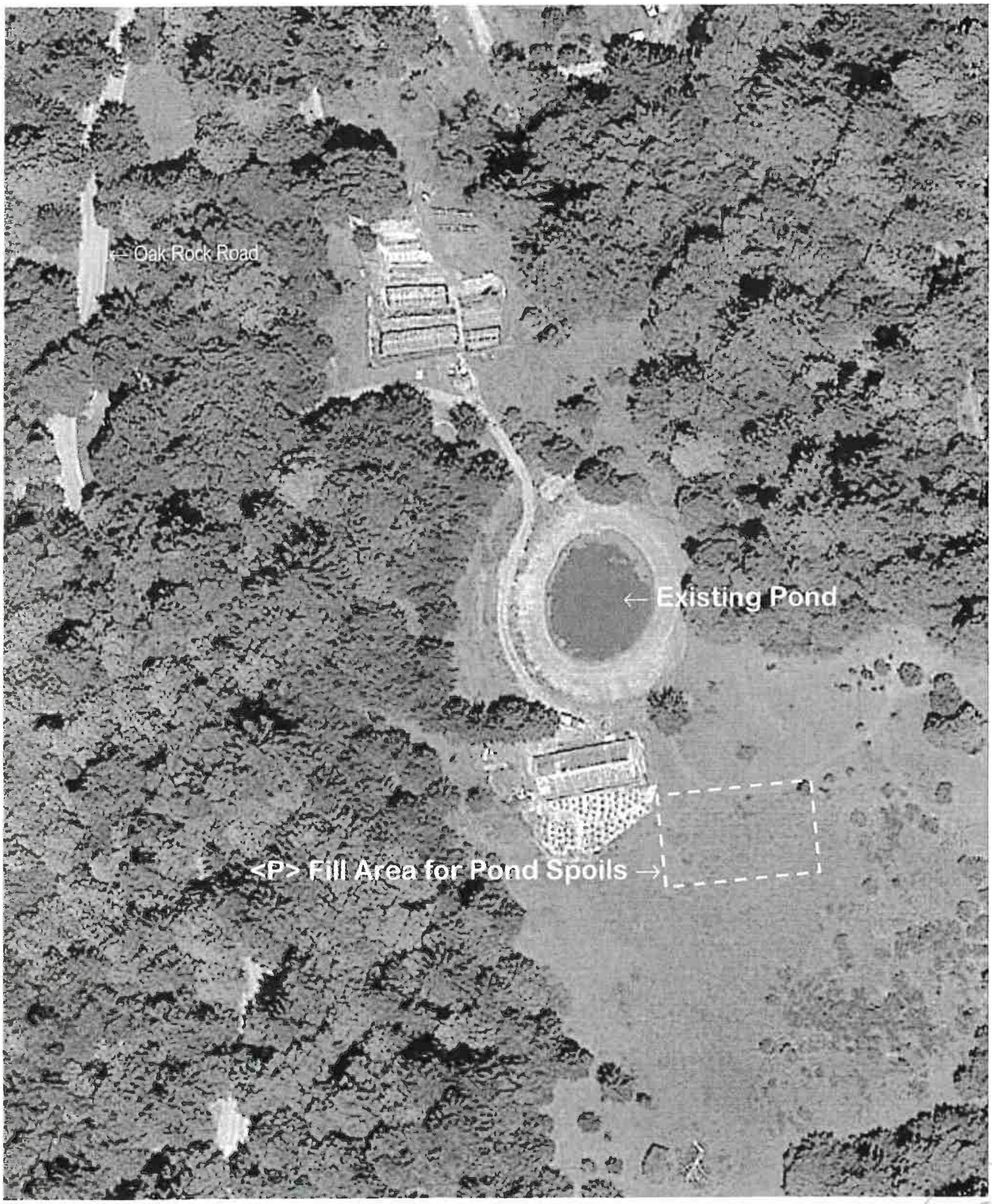


From: USGC "Garberville, Calif." 7.5' Quadrangle (1970). N ≅

Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 2
Post Office Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN: 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Assessor's Parcel Map - All Locations Approximate	1 inch ≅ 2,000 feet

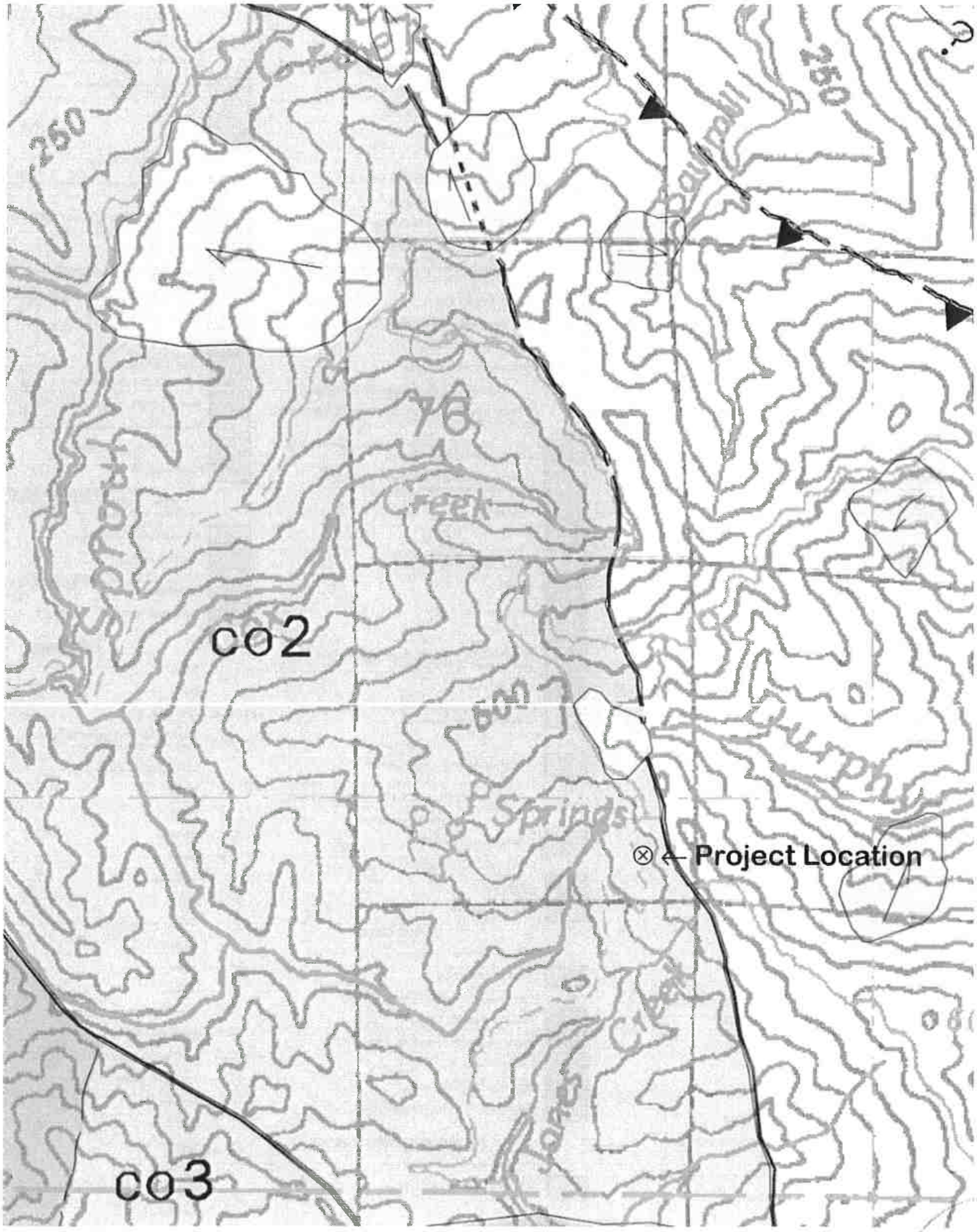


Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 3
Post Office Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Satellite Image of Pond Project Area – Location Approximate	1 inch ≅ 105 feet



Modified from: Google Earth Imagery of May 28, 2014. N ≅ ⬆

Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 4
Post Office Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Geologic Map of Project Area – Location Approximate	1 inch ≅ 2,335 feet



Modified from: McLaughlin and Others, 2000. N ≅ ↑

Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 4a
P. O. Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Geologic Map of Project Area – Location Approximate	No Scale

DESCRIPTION OF MAP UNITS

QUATERNARY AND TERTIARY OVERLAP DEPOSITS

- Qal — Alluvial deposits (Holocene and late Pleistocene?)
- Qm — Undeformed marine shoreline and aolian deposits (Holocene and late Pleistocene)
- Qt — Undifferentiated nonmarine terrace deposits (Holocene and Pleistocene)
- Qls — Landslide deposits (Holocene and Pleistocene)
- QTog — Older alluvium (Pleistocene and (or) Pliocene)
- QTw — Marine and nonmarine overlap deposits (late Pleistocene to middle Miocene)
- [illegible] — Volcanic rocks of Fickle Hill (Oligocene)

COAST RANGES PROVINCE

FRANCISCAN COMPLEX

-- Coastal Belt --

Coastal terrane (Pliocene to Late Cretaceous)

Sedimentary, igneous, and metamorphic rocks of the Coastal terrane (Pliocene to Late Cretaceous):

- co1 — Melange
- co2 — Melange
- co3 — Broken sandstone and argillite
- co4 — Intact sandstone and argillite
- cob — Basaltic Rocks (Late Cretaceous)
- cols — Limestone (Late Cretaceous)
- m — Undivided blueschist (Jurassic?)

King Range terrane (Miocene to Late Cretaceous)

- Krp — Igneous and sedimentary rocks of Point Delgada (Late Cretaceous)
- m — Undivided blueschist blocks (Jurassic?)

Sandstone and argillite of King Peak (middle Miocene to Paleocene(?)):

- krk1 — Melange and (or) folded argillite
- krk2 — Highly folded broken formation
- krk3 — Highly folded, largely unbroken rocks
- krl — Limestone
- krc — Chert
- krb — Basalt

False Cape terrane (Miocene? to Oligocene?)

- fc — Sedimentary rocks of the False Cape terrane (Miocene? to Oligocene?)

Yager terrane (Eocene to Paleocene?)

Sedimentary rocks of the Yager terrane (Eocene to Paleocene?):

- y1 — Sheared and highly folded mudstone
- y2 — Highly folded broken mudstone, sandstone, and conglomeratic sandstone
- y3 — Highly folded, little-broken sandstone, conglomerate, and mudstone
- Ycgl — Conglomerate

-- Central belt --

Melange of the Central belt (early Tertiary to Late Cretaceous):

Unnamed Metasandstone and meta-argillite (Late Cretaceous to Late Jurassic):

- cm1 — Melange
- cm2 — Melange
- cb1 — Broken formation
- cb2 — Broken formation
- cwr — White Rock metasandstone of Jayko and others (1989) (Paleogene and (or) Late Cretaceous)
- chr — Haman Ridge graywacke of Jayko and others (1989) (Cretaceous?)
- cfs — Fort Seward metasandstone (age unknown)
- cls — Limestone (Late to Early Cretaceous)

- [illegible] — Chert (Late Cretaceous to Early Jurassic)
- bs — Basaltic rocks (Cretaceous and Jurassic)
- m — Undivided blueschist blocks (Jurassic?)
- gs — Greenstone
- [illegible] — Metachert
- yb — Metasandstone of Yolla Bolly terrane, undivided
- b — Melange block, lithology unknown

-- Eastern Belt --

Pickett Peak terrane (Early Cretaceous or older)

Metasedimentary and metavolcanic rocks of the Pickett Peak terrane (Early Cretaceous or older):

- ppsm — South Fork Mountain Schist
- mb — Chinquapin Metabasalt Member (Irwin and others, 1974)
- ppv — Valentine Springs Formation
- mv — Metabasalt and minor metachert

Yolla Bolly terrane (Early Cretaceous to Middle Jurassic?)

Metasedimentary and metaigneous rocks of the Yolla Bolly terrane (Early Cretaceous to Middle Jurassic?):

- ybt — Taliaferro Metamorphic Complex of Suppe and Armstrong (1972) (Early Cretaceous to Middle Jurassic?)
- ybc — Chicago Rock melange of Blake and Jayko (1983) (Early Cretaceous to Middle Jurassic)
- gs — Greenstone
- [illegible] — Metachert
- ybh — Metagraywacke of Hammerhorn Ridge (Late Jurassic to Middle Jurassic)
- [illegible] — Metachert
- gs — Greenstone
- sp — Serpentinite
- ybd — Devils Hole Ridge broken formation of Blake and Jayko (1983) (Early Cretaceous to Middle Jurassic)
- [illegible] — Radiolarian chert
- ybi — Little Indian Valley argillite of McLaughlin and Ohlin (1984) (Early Cretaceous to Late Jurassic)

Yolla Bolly terrane

- yb — Rocks of the Yolla Bolly terrane, undivided

GREAT VALLEY SEQUENCE AND COAST RANGE OPHIOLITE

Elder Creek(?) terrane

- ecms — Mudstone (Early Cretaceous)

Coast Range ophiolite (Middle and Late Jurassic):

- ecg — Layered gabbro
- ecsp — Serpentinite melange

Del Puerto(?) terrane

Rocks of the Del Puerto(?) terrane:

- dpms — Mudstone (Late Jurassic)

Coast Range ophiolite (Middle and Late Jurassic):

- dpt — Tuffaceous chert (Late Jurassic)
- dpb — Basaltic flows and keratophyric tuff (Jurassic?)
- dpd — Diabase (Jurassic?)
- dpsp — Serpentinite melange (Jurassic?)
- sp — Undivided Serpentinized peridotite (Jurassic?)

KLAMATH MOUNTAINS PROVINCE

Undivided Great Valley Sequence:

- Ks — Sedimentary rocks (Lower Cretaceous)

GREAT VALLEY SEQUENCE OVERLAP ASSEMBLAGE

Hayfork terrane

Eastern Hayfork subterrane:

- eh — Melange and broken formation (early? Middle Jurassic)
- ehls — Limestone
- ehsp — Serpentinite

Western Hayfork subterrane:

- whu — Hayfork Bally Meta-andesite of Irwin (1985), undivided (Middle Jurassic)
- whwg — Wildwood (Chanchelulla Peak of Wright and Fahan, 1988) pluton (Middle Jurassic)
- whwp — Clinopyroxenite
- whji — Diorite and gabbro plutons (Middle? Jurassic)

Rattlesnake Creek terrane

- rcm — Melange (Jurassic and older)
- rcls — Limestone
- rcc — Radiolarian chert
- rcis — Volcanic Rocks (Jurassic or Triassic)
- rcic — Intrusive complex (Early Jurassic or Late Triassic)
- rcp — Plutonic rocks (Early Jurassic or Late Triassic)
- rcum — Ultramafic rocks (age uncertain)
- rcpd — Blocky peridotite

Western Klamath terrane

Smith River subterrane:

- srs — Galice? formation (Late Jurassic)
- srv — Pyroclastic andesite
- srgb — Glen Creek gabbro-ultramafic complex of Irwin and others (1974)
- srpd — Serpentinized peridotite

MAP SYMBOLS

- Contact
- Fault
- Thrust fault
- Trace of the San Andreas fault associated with 1906 earthquake rupture

Strike and dip of bedding:

- Inclined
- Vertical
- Horizontal
- Overturned
- Approximate
- Joint
- Strike and dip of cleavage

Shear foliation:

- Inclined
- Vertical

Folds:

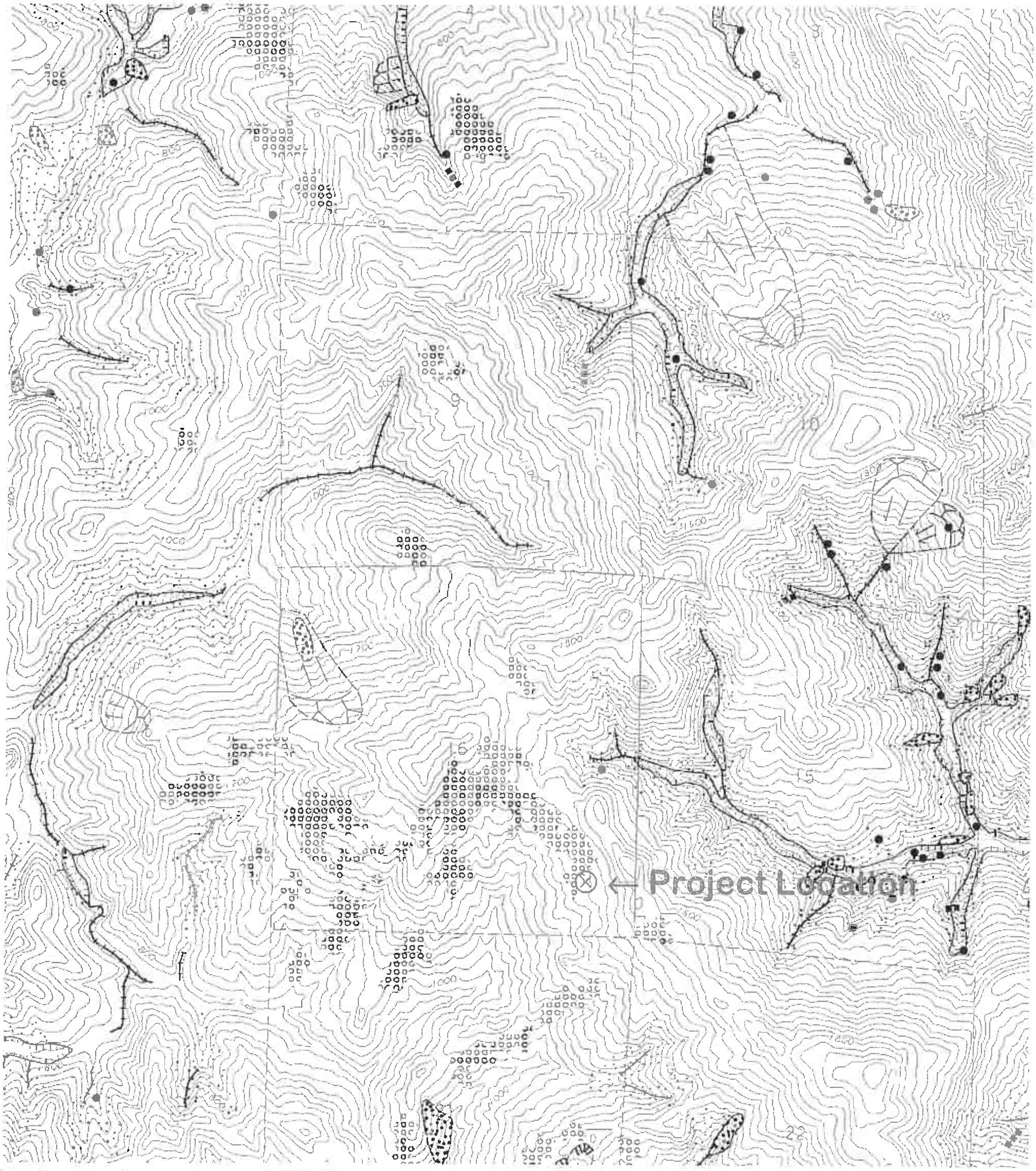
- Synclinal or synformal axis
- Anticlinal or antiformal axis
- Overturned syncline
- Landslide

Melange Blocks:

- Serpentinite
- Chert
- Blueschist
- Greenstone
- Fossil locality and number

GEOLOGY OF THE CAPE MENDOCINO, EUREKA, GARBERVILLE, AND SOUTHWESTERN PART OF THE HAYFORK 30 X 60 MINUTE QUADRANGLES AND ADJACENT OFFSHORE AREA, NORTHERN CALIFORNIA (McLaughlin et al., 2000)

Lindberg Geologic Consulting	Engineering-Geologic R-2 Soils Exploration Report	Figure 5
Post Office Box 306	161 Oak Rock Road, Garberville, Humboldt County, California	February 20, 2018
Cutten, CA 95534	APN 222-071-030, Mr. Justin Baldwin, Client	Project 0267.00
(707) 442-6000	Geomorphic Features Related to Landsliding	1 inch ≅ 2,255 feet



Amphitheater Slope
Disrupted Ground
Debris Slide (dashed line indicates dormant)
Translational/Rotational Slide (dashed line indicates dormant)
Earthflow (dashed line indicates dormant)
Inner Gorge
Active Slide (too small to delineate @ 1:24000)
Torrent Tracks (active)
Torrent Tracks (dormant)
Inner Gorge (too small to delineate @ 1:24000)

Modified from: Spittler, T. E., 1983. N ≅