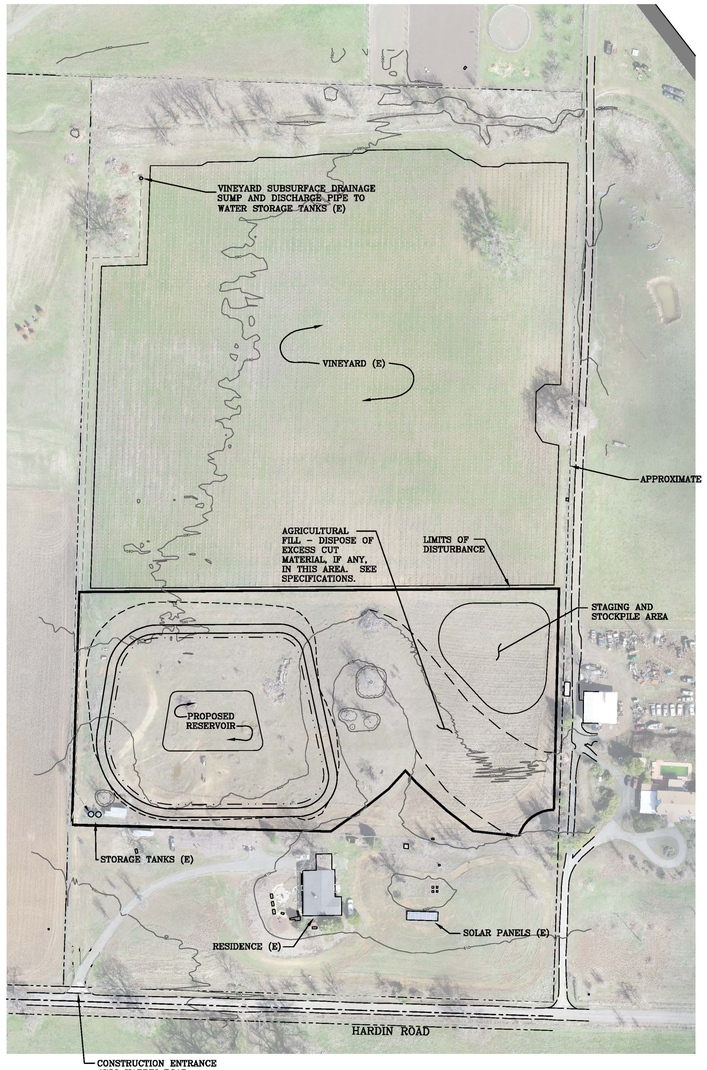



# SITE MAP

1" = 100'

NOTE:

TOPOGRAPHIC SURVEY BY TERRA FIRMA, 12-22-18
AERIAL PHOTOGRAPHY BY EDWARDS ENGINEERING, 2-15-21

NOTES:

1. SITE ADDRESS: 4720 HARDIN ROAD, ST. HELENA, CA 94574
2. APN(S): 018-160-022
3. OWNER: SAMUEL EAKLE & HENRY EAKLE, 4720 HARDIN ROAD, ST. HELENA, CA 94574
4. GEOTECHNICAL ENGINEER: PJC ASSOCIATES, P.O. BOX 469, SONOMA, CA 95476, (707) 935-3747
5. RESERVOIR CAPACITY: 18 ACRE-FEET GROSS
6. UPON COMPLETION OF CONSTRUCTION, OWNER SHALL BE RESPONSIBLE FOR INSTALLING A 6 FOOT HIGH FENCE AROUND THE RESERVOIR. FENCE SHALL REMAIN LOCKED AT ALL TIMES IN ORDER TO PREVENT UNAUTHORIZED ACCESS.
7. UPON COMPLETION OF CONSTRUCTION, OWNER SHALL BE RESPONSIBLE FOR INSTALLING SIGNS ON CHAIN LINK FENCE EVERY 200-FEET STATING "DANGER - KEEP OUT" IN ENGLISH AND SPANISH.
8. THE SPECIFICATIONS DATED FEBRUARY, 2021 ARE PART OF DESIGN PACKAGE FOR THE PROPOSED RESERVOIR. CONSTRUCTION OF PROPOSED RESERVOIR SHALL BE CONSISTENT WITH ALL PARTS OF THESE PLANS AND SPECIFICATIONS.
10. AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION, CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (U.S.A.) AT 1-800-642-2444 IN ORDER TO LOCATE ANY EXISTING UTILITIES WITHIN OR ADJACENT TO PROJECT SITE. UTILITIES ARE KNOWN TO EXIST WITHIN THE PROJECT SITE AND CONTRACTOR SHALL BE RESPONSIBLE FOR THEIR PROTECTION DURING CONSTRUCTION.
11. ARCHEOLOGICAL MITIGATION: IF ARCHEOLOGICAL MATERIALS ARE DISCOVERED DURING FUTURE DEVELOPMENT, ALL ACTIVITY SHALL BE TEMPORARILY HALTED IN THE VICINITY OF THE FIND(S) AND A QUALIFIED ARCHEOLOGIST SHALL BE RETAINED TO EVALUATE THE FIND(S) AND TO RECOMMEND MITIGATION PROCEDURES, IF NECESSARY. PREHISTORIC ARCHEOLOGICAL MATERIALS INCLUDE, BUT ARE NOT LIMITED TO, OBSIDIAN, CHERT, AND BASALT FLAKES AND ARTIFACTS, GROUNDSTONE (SUCH AS MORTARS AND PESTLES), AND HUMAN GRAVES. HISTORIC ARCHEOLOGICAL MATERIALS INCLUDE, BUT ARE NOT LIMITED TO, GLASS BOTTLES, PRIVYS, AND CERAMICS.

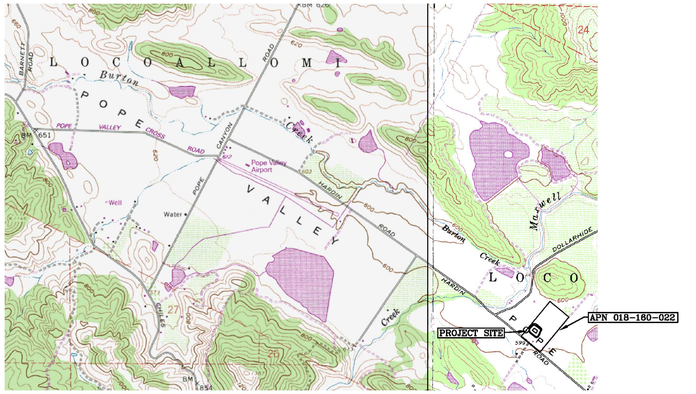
    IF HUMAN REMAINS ARE ENCOUNTERED DURING PROJECT DEVELOPMENT, EXCAVATION OR DISTURBANCE OF THE LOCATION MUST BE HALTED IN THE VICINITY OF THE FIND, AND THE COUNTY CORONER SHALL BE CONTACTED. IF THE CORONER DETERMINES THE REMAINS ARE NATIVE AMERICAN, THE CORONER WILL CONTACT THE NATIVE AMERICAN HERITAGE COMMISSION. THE NATIVE AMERICAN HERITAGE COMMISSION WILL IDENTIFY THE PERSON OR PERSONS BELIEVED TO BE MOST LIKELY DESCENDED FROM THE DECEASED NATIVE AMERICAN. THE MOST LIKELY DESCENDENT MAKES RECOMMENDATIONS REGARDING THE TREATMENT OF THE REMAINS WITH APPROPRIATE DIGNITY.
12. STORM WATER DISCHARGE PERMIT INFORMATION:
    WDID: 5S28W004919
    APPLICATION: 532854
    SUBMISSION DATE: 03/04/21
    STATUS: ACTIVE - WAIVER APPROVED
13. EARTHWORK QUANTITIES*:
    CUT VOLUME: ±13,000 CUBIC YARDS
    FILL VOLUME: ±13,000 CUBIC YARDS (INCLUDING AGRICULTURAL FILL)

    * CONTRACTOR IS RESPONSIBLE FOR CALCULATING EARTHWORK QUANTITIES FOR BIDDING PURPOSES.]

    DISTURBED SOIL AREA
14. THE TOTAL DISTURBED SOIL AREA IS ±4.9 ACRES

EROSION CONTROL NOTES:

1. UPON COMPLETION OF CONSTRUCTION, CONTRACTOR SHALL BE RESPONSIBLE FOR SEEDING AND STRAW MULCHING ALL DISTURBED SOILS. SEED AND MULCH ON SLOPES GREATER THAN 25%, INCLUDING EMBANKMENTS, SHALL BE JUTE NETTED BEGINNING OCTOBER 15 OF THE YEAR OF CONSTRUCTION. SEED SHALL BE DWARF BARLEY AND SHALL BE BROADCAST AT A RATE OF 150 POUNDS PER ACRE. STRAW MULCH SHALL BE APPLIED AT A RATE OF 4,000 POUNDS PER ACRE. WHERE STRAW MULCH AND JUTE NETTING ARE REQUIRED, STRAW SHALL BE APPLIED AFTER SEEDING IS COMPLETED. JUTE NETTING SHALL BE APPLIED OVER THE STRAW MULCH WITH SEAMS RUNNING PERPENDICULAR TO THE SLOPE AND SHALL BE STAPLED IN PLACE ACCORDING TO THE STAPLING SCHEDULE SUPPLIED WITH THE JUTE NETTING.
2. STRAW WATTLES SHALL BE INSTALLED THE YEAR OF CONSTRUCTION IN THE LOCATIONS SHOWN ON THE PLANS AND AS SHOWN ON THE DETAIL. WATTLES SHALL BE STOCKPILED ON-SITE PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES AND SHALL BE INSTALLED IMMEDIATELY IN THE EVENT RAINSTORM ACTIVITY HAS BEEN FORECAST DURING THE CONSTRUCTION SEASON.
3. IF CONSTRUCTION IS NOT COMPLETED BY OCTOBER 15 OF THE YEAR OF CONSTRUCTION, ADDITIONAL TEMPORARY EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED UNTIL GRADING IS COMPLETE AND PERMANENT EROSION CONTROL MEASURES INSTALLED. TEMPORARY MEASURES SHALL BE AS DIRECTED BY ENGINEER IN FIELD.
4. THE SITE ENTRANCE SHALL BE STABILIZED WITH 3-4" CRUSHED ROCK TO PREVENT TRACKING OF SOIL OFFSITE.




# VICINITY MAP

1" = 2000'

REGISTERED PROFESSIONAL ENGINEER
BRENT A. EDWARDS
No. C 051461
EXPIRES 6-30-24
Civil
STATE OF CALIFORNIA

06-06-22 INCORPORATE COMMENTS FROM ENGINEERING PLAN REVIEW DATED MAY 17, 2021
03-21-23 REVISE RESERVOIR DESIGN TO AVOID IMPACT TO TREES PER NAPA COUNTY PLAN REVIEW.

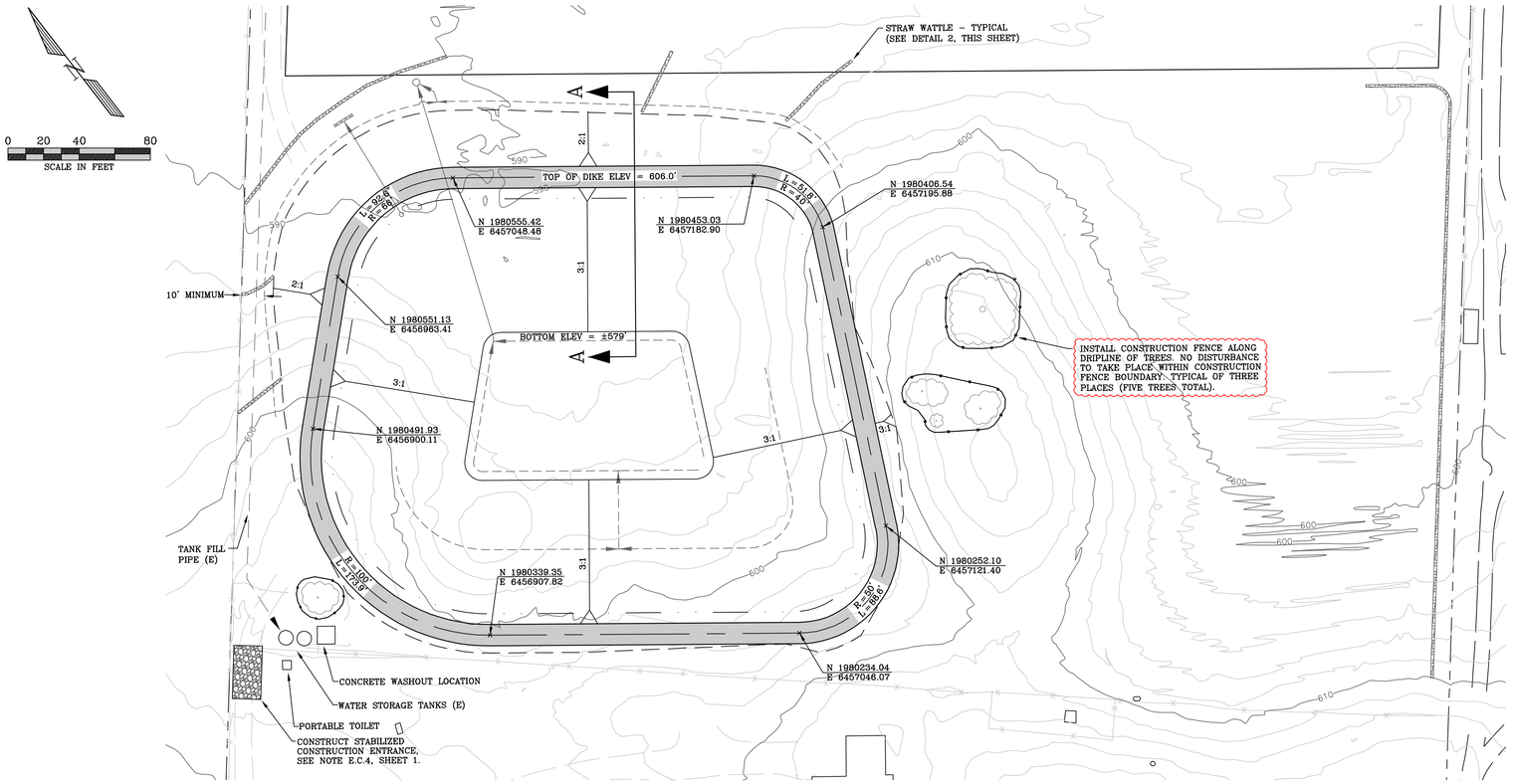
EDWARDS ENGINEERING
1305 E STREET
NAPA, CALIFORNIA 94559
(707) 258-6297
WWW.EDWARDSENGINEERING.NET

DWG. NUMBER: EKLHAR-R
DATE: 03-18-21
SCALE: AS SHOWN

WATER STORAGE RESERVOIR
SITE MAP & NOTES

EAKLE RESERVOIR
4720 HARDIN ROAD
ST. HELENA, CALIFORNIA
APN 018-160-022

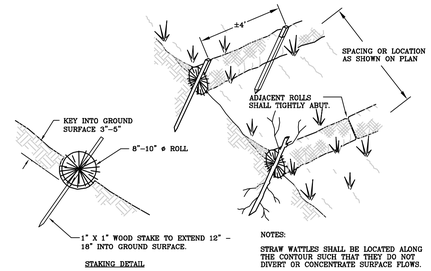
SHEET 1



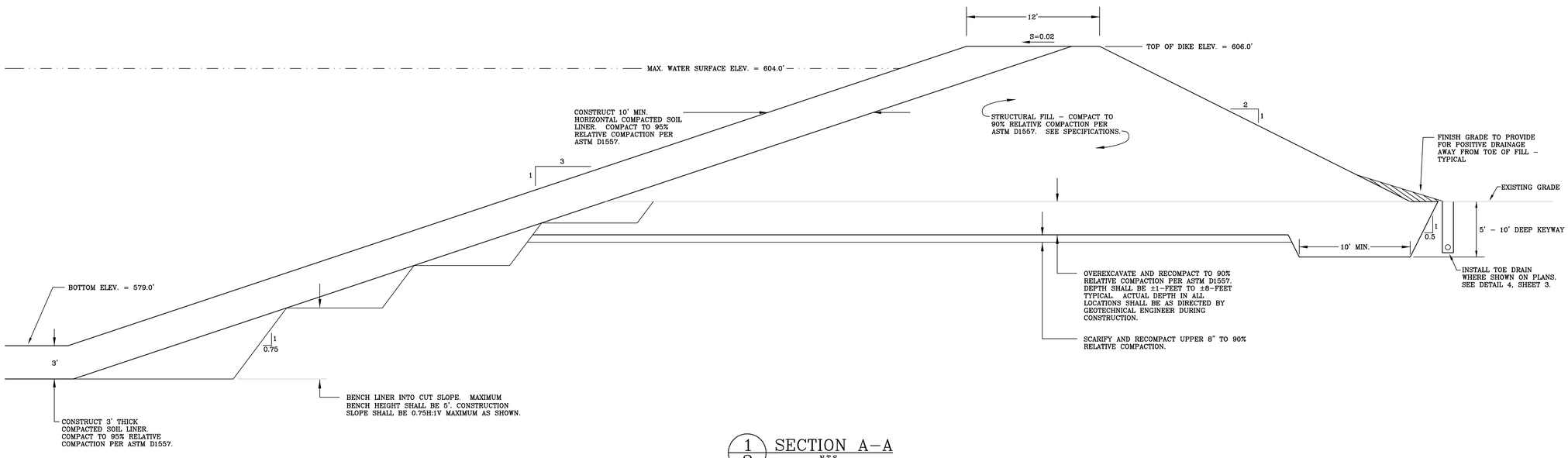

# PLAN
1" = 40'

## LEGEND

| | |
|---|---|
| | PROPOSED NON-PERFORATED DRAIN (SEE DETAIL 6, SHEET 3) |
| | PROPOSED PERFORATED DRAIN (SEE DETAILS 4 & 5, SHEET 3) |
| | CUTOFF COLLAR (SEE DETAIL 1, SHEET 3) |
| | STRAW WATTLE (SEE DETAIL 2, SHEET 2) |
| ELEV. | ELEVATION |
| CPP | CORRUGATED PLASTIC PIPE |
| MAX. | MAXIMUM |
| MIN. | MINIMUM |
| INV. | INVERT |
| PERF. | PERFORATED |
| S | SLOPE |
| DW | DUAL WALL |
| SW | SOLVENT WELD |
| S40 | SCHEDULE 40 |
| PVC | POLYVINYL CHLORIDE |
| HDPE | HIGH DENSITY POLYETHYLENE |




2/2 STRAW WATTLE INSTALLATION
N.T.S.




1/2 SECTION A–A
N.T.S.

REGISTERED PROFESSIONAL ENGINEER
BRENT A. EDWARDS
No. C 051461
EXPIRES 6-30-24
Civil
STATE OF CALIFORNIA

SHEET 2

EAKLE RESERVOIR
4720 HARDIN ROAD
ST. HELENA, CALIFORNIA
APN 018-160-022

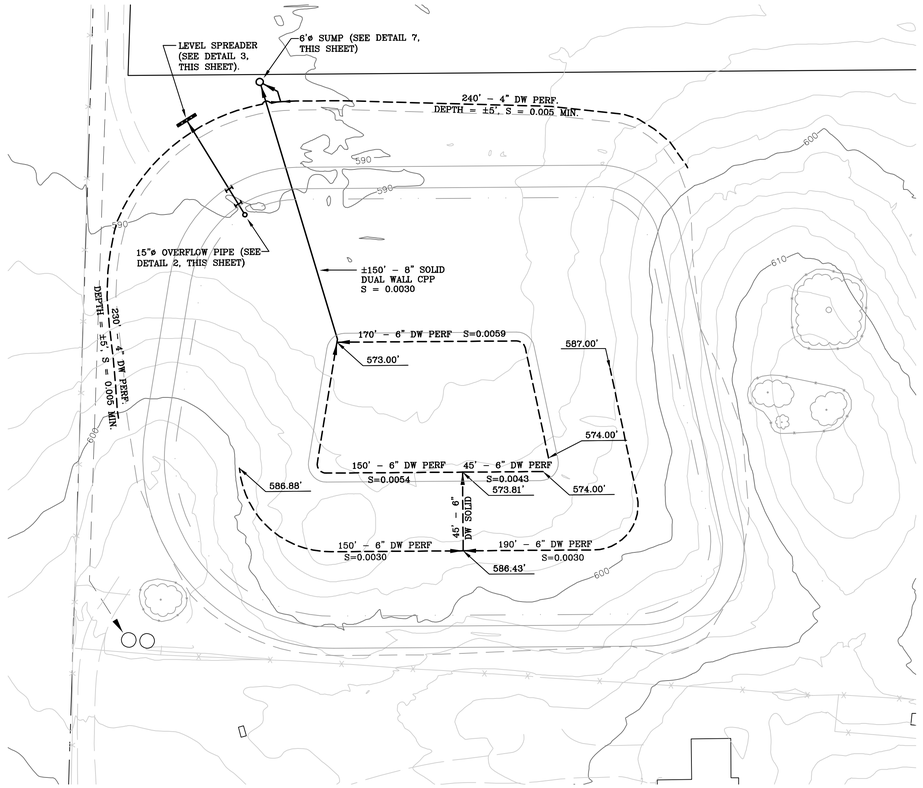
WATER STORAGE RESERVOIR
GRADING PLAN

SCALE: AS SHOWN
DATE: 03-16-21
DWG. NUMBER: EKLHAR-R

1305 E STREET
NAPA, CALIFORNIA 94559
(707) 258-6297
WWW.EDWARDSENGINEERING.NET
EDWARDS ENGINEERING

06-06-22 INCORPORATE COMMENTS FROM ENGINEERING PLAN REVIEW DATED MAY 17, 2021

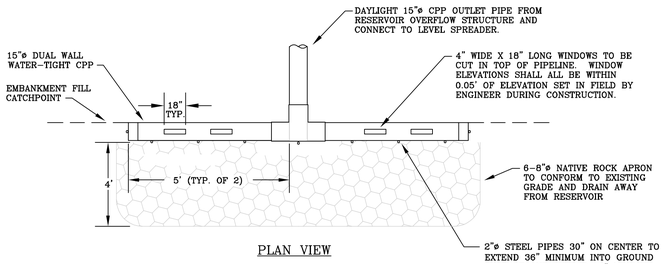
03-21-23 REVISE RESERVOIR DESIGN TO AVOID IMPACT TO TREES PER NAPA COUNTY PLAN REVIEW.




0 20 40 80
SCALE IN FEET

NOTE:
THE SUBSURFACE DRAINS BELOW AND BEHIND THE CLAY LINER ARE INTENDED TO RELIEVE HYDROSTATIC PRESSURE BEHIND THE CLAY LINER. SIZES AND LOCATIONS ARE BASED ON CONDITIONS ENCOUNTERED DURING SUBSURFACE EXPLORATION OF SITE. DURING CONSTRUCTION, IT MAY BECOME APPARENT THAT ADDITIONAL DRAINS ARE REQUIRED IF WET CONDITIONS OR POTENTIALLY WATER-BEARING STRATA ARE ENCOUNTERED. THE CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER IMMEDIATELY UPON DISCOVERY OF SUCH CONDITIONS. IN ADDITION, OVER TIME, GROUNDWATER CONDITIONS MAY DIFFER FROM CONDITIONS AT THE TIME OF THE SUBSURFACE EXPLORATION. THESE CHANGES MAY RESULT IN THE NEED FOR ADDITIONAL DRAINS TO BE INSTALLED AND/OR LINER REPAIRS COMPLETED IN THE FUTURE.

# PLAN
1" = 40'

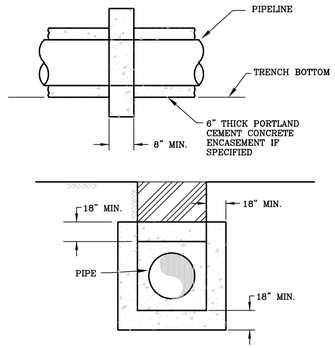



NOTES:

STRUCTURE SHALL BE LOCATED AS STAKED IN FIELD BY ENGINEER.

SUBGRADE SHALL BE STRIPPED OF VEGETATION, SCARIFIED AND COMPACTED PER SPECIFICATIONS. SUBGRADE SHALL BE LEVEL PRIOR TO PLACEMENT OF PIPELINE.

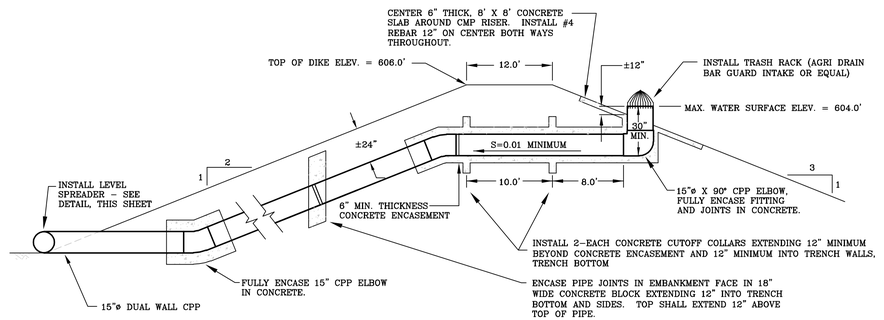
3/3 LEVEL SPREADER
N.T.S.



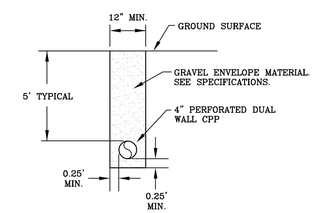

1/3 CUTOFF COLLAR
N.T.S.

## LEGEND

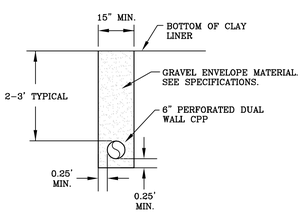
| | |
|---|---|
| ——— | PROPOSED NON-PERFORATED DRAIN (SEE DETAIL 6, THIS SHEET) |
| - - - - - - | PROPOSED PERFORATED DRAIN (SEE DETAILs 4 & 5, THIS SHEET) |
| ——— | CUTOFF COLLAR (SEE DETAIL 1, THIS SHEET) |
| ELEV. | ELEVATION |
| CPP | CORRUGATED PLASTIC PIPE |
| MAX. | MAXIMUM |
| MIN. | MINIMUM |
| INV. | INVERT |
| PERF. | PERFORATED |
| S | SLOPE |
| DW | DUAL WALL |
| SW | SOLVENT WELD |
| S40 | SCHEDULE 40 |
| PVC | POLYVINYL CHLORIDE |
| HDPE | HIGH DENSITY POLYETHYLENE |



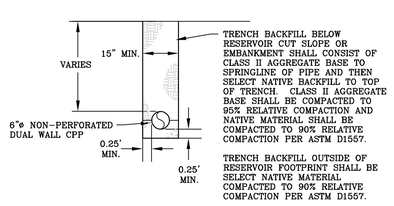

2/3 OVERFLOW PIPE
N.T.S.



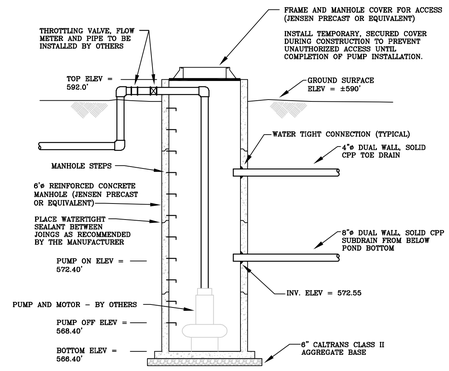

4/3 TOE DRAIN
N.T.S.




5/3 PERFORATED DRAIN
N.T.S.




6/3 NON-PERFORATED SUBSURFACE DRAINAGE PIPELINE
N.T.S.




7/3 CONCRETE SUMP
N.T.S.

REGISTERED PROFESSIONAL ENGINEER
BRENT A. EDWARDS
No. C 051461
EXPIRES: 6-30-24
Civil
STATE OF CALIFORNIA

03-21-23 REVISE RESERVOIR DESIGN TO AVOID IMPACT TO TREES PER NAPA COUNTY PLAN REVIEW


EDWARDS ENGINEERING
1305 E STREET
NAPA, CALIFORNIA 94559
(707) 258-6297
WWW.EDWARDSENGINEERING.NET


# WATER STORAGE RESERVOIR DRAINAGE PLAN

EAKLE RESERVOIR
4720 HARDIN ROAD
ST. HELENA, CALIFORNIA
APN 018-160-022

DWG. NUMBER: EKLHAR-R
DATE: 03-18-21
SCALE: AS SHOWN
SHEET 3

# PLANS, SPECIFICATIONS, & SOILS REPORT

## AGRICULTURAL RESERVOIR PROJECT

---

EAKLE RESERVOIR

---

4720 HARDIN ROAD
ST. HELENA, CA 94574

APN 018-160-022

---

MARCH 18, 2021

EDWARDS ENGINEERING

EDWARDS ENGINEERING

1305 E STREET
NAPA | CALIFORNIA | 94559

PHONE:
(707) 258-6297

FAX:
(707) 258-8971

www.edwardsengineering.net

# PLANS, SPECIFICATIONS, & SOILS REPORT

## AGRICULTURAL RESERVOIR PROJECT

EAKLE RESERVOIR

4720 HARDIN ROAD
ST. HELENA, CA 94574

APN 018-160-022

EKLHAR-R


, 03/18/2021

*BRENT EDWARDS, P.E.* *RCE 51461*

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# TABLE OF CONTENTS

## 2000 GENERAL

## PART I

### 1.1 PROJECT ENGINEER

The work covered by these specifications shall be performed under the observation of the Project Engineer, who shall be retained by the Owner. The Project Engineer will be present at the site intermittently to observe the work. Upon completion of the project, the Contractor and Owner shall be notified in writing by the Project Engineer of any unacceptable work. In the event that work performed by the Contractor does not meet the requirements of these specifications, the Contractor shall repair the work using all necessary means to ensure that the completed work meets the requirements of these specifications. All such required repair work shall be done at the Contractor's own expense. The Project Engineer's costs for observing the repair of unsatisfactory work performed by the Contractor will be billed to the Owner. The Owner will pay the Project Engineer and then deduct the amount for observing and testing the repair of unsatisfactory work from moneys due, or that may become due to the Contractor

### 1.2 GEOTECHNICAL ENGINEER

The Project Geotechnical Engineer shall periodically observe and test certain aspects of the construction. See Section 2200, "Earthwork", including Section 2200, Part I, 1.3, Project Geotechnical Engineer.

### 1.3 CONSTRUCTION STAKING

Prior to commencing construction, Owner shall retain the services of a licensed surveyor to provide staking as necessary to construct reservoir. In addition to initial slope staking, Surveyor will set, at the Owner's expense, necessary stakes and hubs to construct the overflow pipeline and storm drain system upon substantial completion of the embankment. Any additional staking by the Surveyor will be at the Contractor's expense and shall be deducted from final payment to the Contractor.

### 1.4 PRE-CONSTRUCTION MEETING

Prior to commencing construction, a pre-construction meeting shall take place on-site. At a minimum, the following persons will be present at the pre-construction meeting:

- Owner or Owner's Representative
- Contractor
- Contractor's Foreman that will run job if other than Contractor
- Project Engineer
- Project Geotechnical Engineer
- Surveyor

1.5 DISCREPANCIES

Any discrepancies between the Plans, Details or any part of these Specifications are unintentional and shall immediately be brought to the attention of the Project Engineer prior to continuing any work.

1.6 STANDARDS AND SPECIFICATIONS

Any standards or specifications referred to in these Specifications shall refer to the latest version available at the time of construction.

1.7 RESPONSIBILITIES OF THE CONTRACTOR

A. The Contractor agrees that in accordance with generally accepted construction practices, Contractor will be required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including the safety of all persons and property. The requirement shall be made to apply continuously and not be limited to normal working hours. Contractor further agrees to defend, indemnify and hold design professional harmless from any and all liability, real or alleged, in connection with the performance of the work on this project, excepting liability arising from the sole negligence of design professional.

B. The Contractor shall be responsible for controlling dust and mud generated from construction activities. The Contractor shall not allow dust or mud to obstruct vehicular traffic on any public roadways. The Contractor shall be responsible for cleaning vehicles prior to leaving the site as required by the California Highway Patrol.

C. The Contractor shall be responsible for following all applicable safety laws including those issued by CAL-OSHA. The Contractor alone shall be responsible for the safety of his equipment and methods and for any damage or injury that may result from their failure, improper construction, maintenance or operation.

D. Contractor shall be responsible for installing any necessary sediment retention structures should construction activities continue beyond October 15 of the year of construction.

E. Contractor shall keep work site clean and free of rubbish and debris throughout the project. Materials and equipment shall be removed immediately from the site upon completion of the project.

## 1.8 EXISTING UTILITIES & IMPROVEMENTS

At least two working days prior to beginning any excavation on the project, Contractor shall contact Underground Service Alert (USA) at 1-800-642-2444 and request field location of any existing utilities.

In addition to utilities, there are significant existing improvements on the property including but not limited to vineyard and trellis, structures, irrigation systems, and fences. Contractor shall take precautions to prevent damage to any existing improvements at the project site. Any damage shall be repaired at the Contractor's expense. Damage to any existing piping systems including water, gas or septic shall be repaired immediately and shall not be left un-repaired over night.

## 1.9 PROSECUTION OF WORK

Unless otherwise provided, the contract time shall commence upon issuance of a Notice to Proceed by the Owner. The work shall start at the date agreed upon between the Owner and Contractor and shall be diligently prosecuted beginning on that date. Work shall be completed within the time frames submitted with the Contractor's bid for project. If weather conditions prevent completion of work within specified time frames, Owner may extend completion date of project.

## 1.10 PAYMENT

Any work performed on the project in which the quantities vary from those shown on the Plans and Details shall be measured by the Project Engineer. Payment shall be adjusted according to the unit prices included in the Bidder's Proposal. Final payment for the project shall not be made until the Engineer has performed a final observation of the site to verify substantial compliance with the Plans and Specifications.

# 2200 EARTHWORK

## PART I GENERAL

### 1.1 DESCRIPTION

A. This section consists of all clearing, stripping, grubbing, excavation, subgrade preparation, and placement and compaction of embankment fill, and all incidental work necessary to complete the earthworks to conform to the lines and grades shown on the plans. Embankment and liner fill construction shall consist of placement, spreading, moisture conditioning, blending, and compaction of fill materials.

B. Earthwork shall conform to these specifications as well as the recommendations and specifications contained in the Soils Report prepared by PJC & Associates, Inc., dated December 1, 2020 and entitled:

GEOTECHNICAL INVESTIGATION
PROPOSED EAKLE RESERVOIR
4720 HARDIN ROAD
ST. HELENA, CALIFORNIA
Job No. S2007.01

This report is herein incorporated into these specifications by reference. Any discrepancies between these specifications and this Soils Report are unintentional and shall immediately be brought to the attention of the Engineer.

### 1.2 DEFINITIONS

A. Standard Specifications: Where used in these specifications, "Standard Specifications" shall mean the State of California Department of Transportation (Caltrans) Standard Specifications, most recent version. All work shall be carried out in conformance with the Standard Specifications unless otherwise specified herein.

B. Relative Compaction: Where used in these specifications, relative compaction is the ratio expressed as a percentage of the required in-place dry density of the material to its maximum dry density as determined in the laboratory using ASTM D1557.

C. Optimum Moisture Content: Where used in these specifications, optimum moisture content is the moisture content of the material expressed in percent (by dry weight) corresponding to its maximum dry density as determined in the laboratory using ASTM D1557.

D. Soil Subgrade: Where used in these specifications, soil subgrade shall mean any area on which embankment and/or liner materials are to be placed.

E. Completed Course: Where used in these specifications, completed course shall mean the excavation surface, or the surface of a layer of fill that has been prepared as specified, and that it is ready for the next layer or phase of the work.

F. Fill Processing and Moisture Conditioning: Where used in these specifications, fill processing comprises all methods necessary to provide fill materials meeting the specified material gradations. Fill processing may include selective excavation, disking, blading, tilling, crushing, blending, and/or removal of oversize and/or deleterious materials, as required. Moisture conditioning comprises all methods necessary to add and uniformly distribute water or remove water from a fill material to bring it to moisture content as specified by these specifications.

G. Well Graded: Where used in these specifications, well graded shall mean a mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

## 1.3 PROJECT GEOTECHNICAL ENGINEER

The work covered by these specifications shall be performed under the observation of the Project Geotechnical Engineer, who shall be retained and paid by the Owner. The Project Geotechnical Engineer will be present at the site intermittently to observe the work, and to perform field and laboratory tests to evaluate material quality and compaction. The Contractor shall cooperate with the Project Geotechnical Engineer in performing the observations and tests. At the completion of the work, the Project Geotechnical Engineer will submit a report to the Owner, including a tabulation of all tests performed. In the event that work performed by the Contractor does not meet the requirements of these specifications, the Contractor shall repair the work using all necessary means to ensure that the completed work meets the requirements of these specifications. All such required repair work shall be done at the Contractor’s own expense. The Project Geotechnical Engineer's costs for observing and testing the repair of unsatisfactory work performed by the Contractor will be billed to the Owner. The Owner will pay the Project Geotechnical Engineer and then deduct the amount for observing and testing the repair of unsatisfactory work from moneys due, or that may become due to the Contractor.

## 1.4 SAFETY

The Contractor shall be solely responsible for performing all earthwork in a safe manner; and provide appropriate measures to retain excavation sideslopes and prevent rock falls to ensure that persons working in or near the excavation are protected. The Contractor shall comply with all applicable codes, ordinances, statutes, and bear sole responsibility for the penalties imposed for noncompliance.

## PART II MATERIALS

### 2.1 CLEARING, STRIPPING, AND GRUBBING

A. Clearing: Clearing shall consist of the removal of all trees, shrubs, and other vegetation that is not designated to remain. Cleared materials shall be removed from areas to be graded and shall be disposed of in areas designated by the Owner.

B. Stripping: Stripping shall consist of the removal of weeds, grasses, and organic topsoil. Stripped materials shall not be reused as compacted fill and shall either be removed from the site or stockpiled for later use in an area designated by the Owner.

C. Grubbing: Grubbing shall consist of the removal and disposal of wood or root matter below the ground surface remaining after clearing and shall include stumps, trunks, roots, or root systems greater than 2 inches in diameter or thickness to a depth of 6 inches below the ground surface. Grubbed materials shall be removed from areas to be graded and shall be disposed of in areas designated by the Owner.

### 2.2 EMBANKMENT FILL MATERIAL

All embankment fill material shall be free of deleterious material and rocks or lumps larger than 6 inches in greatest dimension. All embankment fill material shall be approved by the Project Geotechnical Engineer prior to its use, shall be well graded, and shall conform to the following gradation as determined by ASTM D422 and ASTM D1140:

| **Sieve Size** | **Percent Passing** |
|---|---|
| 6 inch | 100 |
| 4 inch | 85-100 |
| No. 200 | 30-100 |

### 2.3 ONSITE MATERIALS

A. Onsite materials meeting the requirements of these specifications may be used as embankment fill. All deleterious and oversize material shall be removed prior to use. Onsite materials may require selective excavation, and may need to be segregated, crushed, blended, and moisture conditioned to meet the requirements of these specifications.

B. Onsite materials with moisture contents substantially wet of optimum will need to be disced, harrowed, plowed, bladed, or otherwise mechanically processed to bring the material to the specified moisture content for placement and compaction. Use of chemical admixtures is not permitted.

C. Add water to onsite materials that have moisture contents dry of optimum to bring the material to the specified moisture content for placement and compaction. Insofar as practicable, add water to the material at the site of the excavation or stockpile; supplement by sprinkling the fill. Use blades, discs, harrows, and other mechanical means as appropriate to thoroughly mix the water to ensure that the specified moisture content is attained throughout each lift of the fill.

2.4 LINER

A. A liner shall be constructed on the inside of the reservoir on the bottom and all sides. Liner shall be constructed of select native material.

B. The material used for the liner shall be soil excavated from the reservoir site which has relatively high clay content. The material to be utilized in the liner shall be identified by the Geotechnical Engineer during construction. Contractor shall be responsible for separating suitable material from unsuitable material as necessary during construction.

C. The liner shall be 3.0-feet thick minimum on the reservoir bottom and 10-feet thick minimum measured horizontally on the reservoir sides. The liner shall be benched into existing ground as shown on the Details and as described in the soils report. The liner shall be constructed simultaneously with the embankment and therefore shall not require benching into the embankment.

D. All loose or soft material beneath the liner shall be removed to expose compacted fill or firm native soils. On the reservoir bottom, the liner subrade shall be proof rolled under the direction of the Geotechnical Engineer. Any loose or soft material shall be excavated and recompacted as directed by the Geotechnical Engineer prior to commencing placement of the liner material.

E. Liner material shall be placed in 8-inch maximum horizontal lifts, moisture conditioned and compacted to specifications as described in the soils report.

F. Contractor shall be responsible for quality control as the liner is installed to ensure that the full liner thickness specified in the Plans and Details is contructed. Contractor shall periodically pothole the liner as directed by the Geotechnical Engineer to measure liner thickness. Contractor shall repair potholes by compacting to 93% relative compaction clay material excavated from the pothole. Fill in potholes shall be compacted using a vibratory or other type of hand operated compactor.

2.4 IMPORTED MATERIALS

A. Imported material, if required, shall be tested and approved by the Project Geotechnical Engineer prior to use. All imported materials specified in this section are subject to the following requirements:

1. All tests necessary for the Contractor to locate an acceptable source of imported material shall be made by the Contractor. Certification that the material conforms to these specifications along with copies of the test

results from a qualified commercial testing laboratory shall be submitted to the Project Geotechnical Engineer for approval at least 4 days before the material is required for use. Final acceptance shall be based on tests made on samples of material taken from the completed and compacted course. All testing for final acceptance will be performed by the Project Geotechnical Engineer.

2. If tests conducted by the Project Geotechnical Engineer indicate that the material does not meet Specification requirements, material placement shall be terminated until corrective measures are taken. Material that does not conform to these specifications that is placed in the work shall be removed and replaced at the Contractor's sole expense. Sampling and testing performed by the Contractor shall be done at the Contractor's sole expense.

## PART III EXECUTION

### 3.1 WEATHER CONDITIONS

No soil shall be placed and compacted during periods of rain or on ground that is not drained of free water or is frozen. Soil that has been stockpiled and wetted by rain or by any other cause shall not be placed and compacted until its moisture content is within the limits specified or approved by the Project Geotechnical Engineer.

### 3.2 EQUIPMENT

A. Compaction equipment shall be of suitable mechanical type and adequate to obtain the densities specified, and shall provide satisfactory breakdown on materials to form a dense, well-graded fill. Flooding or jetting shall not be allowed.

B. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained in such condition that it shall deliver the manufacturer's rated compactive effort. If inadequate densities are obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall be capable of achieving the specified densities.

C. Equipment for applying water shall be of a type and quality adequate for the work, shall not leak, and shall be equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying out material shall consist of blades, discs, or other approved equipment.

### 3.3 SPILLS, DUST, AND EROSION CONTROL

A. Spills: The Contractor shall prevent spills when hauling on or adjacent to any public street or highway. In the event that a spill occurs, the Contractor shall remove all spilled material and sweep, wash, or otherwise clean such streets or highways as required by local City and County authorities and/or the State of California.

B. Dust and Erosion Control: The Contractor shall take all necessary precautions to prevent a dust nuisance to adjacent public or private properties, and to prevent erosion and transport of soil to downstream or adjacent properties that may be caused by work under this Contract. All damage so caused shall be corrected or repaired by the Contractor at the Contractor's expense.

C. Owner's Prerogative: In the event of the Contractor fails to take necessary precautions or to make corrections or repairs promptly, the Owner may take such steps as deemed necessary and deduct the cost of the same from the moneys due to the Contractor. Any such action or lack of action on the part of the Owner in no way alters or relieves the Contractor of the responsibility for proper protection of the work, for preventing or cleaning spills, or for dust and erosion control.

## 3.4 CLEARING, STRIPPING, AND GRUBBING

A. Clearing: The areas to be graded shall be cleared of all grass, brush, roots, rubbish, and debris.

B. Stripping: Topsoil containing grass, roots, and other vegetation shall be removed. These materials shall not be reused as compacted fill.

C. Grubbing: Roots and other vegetation greater than 2 inches in diameter shall be grubbed and removed to a depth of 6 inches below the ground surface.

## 3.5 EXCAVATION BELOW GRADE/REMOVAL OF EXISTING EMBANKMENTS

Soft, compressible, or loose soils encountered at the embankment subgrade shall be excavated to expose competent materials on which fill may be placed. The Project Geotechnical Engineer shall observe and approve the embankment subgrade prior to placement of fill. Existing reservoir embankments, if present, shall be completely removed prior to placement of any fill. Subgrade in these areas shall be observed by Geotechnical Engineer prior to placement of any fill.

## 3.6 GROUNDWATER CONTROL

Provide and operate equipment adequate to keep all excavations and trenches free of water. Remove all water during periods when pipe is being laid, during the placing of embankment fill, and at such other times as required for efficient and safe execution of the work. Avoid settlement or damage to adjacent property. Dispose of water in a manner that shall not damage adjacent property. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. Design groundwater control systems to prevent removal of fines from existing ground. The Contractor shall install, operate, and maintain all drains, sumps, wells, pumps, and other means necessary to maintain water levels at least 4 feet below excavations during construction to facilitate excavation and fill placement.

## 3.7 EXCAVATION

Perform all excavation of every description, regardless of the type, nature, or condition of material encountered, as specified, shown, or required to accomplish the construction. Transport excavated material to where it shall be stockpiled, or used as fill. Finished surfaces of completed excavations shall be true to the lines and grades shown, or as required to accomplish the work, and the prepared surface shall be smooth, firm, and unyielding. All loose material shall be removed. All depressions shall be filled with embankment fill, placed and compacted as specified.

## 3.8 SUBGRADE MOISTURE CONDITIONING AND COMPACTION

After completion of excavation, and prior to subgrade preparation, proof-roll the excavation surfaces to detect soft or loose zones. Notify the Project Geotechnical Engineer prior to commencement of proof-rolling. If soft or loose zones are found, excavate the soft or loose material to a depth accepted by the Project Geotechnical Engineer, then fill and compact as specified for similar areas of embankment. The subgrade exposed by stripping or excavation shall be scarified to the depth specified in the Soils Report and as shown on the Details, moisture conditioned to between optimum moisture content and 3 percent above optimum moisture content, and compacted as specified in the Soils Report and as shown on the Details.

## 3.9 BENCHING

Embankment fill and liner fill shall be benched into the prepared surface on slopes inclined steeper than 6:1 (horizontal:vertical). Benches cut for construction of embankment shall be less than 5 feet high, and shall be sloped no steeper than 0.75:1. The exposed bench surface shall be scarified to the depth specified in the Soils Report, moisture conditioned as specified, and compacted as specified in the Soils Report.

## 3.10 FILL PLACEMENT, MOISTURE CONDITIONING, AND COMPACTION

A. The Contractor shall obtain the Project Geotechnical Engineer's approval of the completed course prior to placing the next layer, or proceeding with the next phase of work. Embankment fill and liner shall be placed in layers 8 inches or less in loose thickness, moisture conditioned as specified, and compacted with a sheepsfoot roller or other approved equipment. Embankment fill shall be moisture conditioned and compacted as specified in the Soils Report. Smooth-wheeled, or rubber-tired compactors will not be permitted. All fill shall be placed in horizontal layers. Unless otherwise approved in writing by the Project Geotechnical Engineer, construct the embankment in horizontal layers across its full length and width before placing the next layer.

B. If field density tests indicate that specified compaction and/or moisture content has not been attained, the fill shall be reconditioned, as necessary, and re-compacted as specified prior to placing additional fill. The Contractor shall be responsible for placing, moisture conditioning, and compacting approved material in accordance with these specifications. The Contractor shall adjust haul rates, or furnish additional spreading, moisture-conditioning, and/or compaction equipment, or make any other

adjustments until a satisfactory fill meeting the requirements of these specifications is obtained.

C. If pipelines are to be laid in embankment, construct embankment to an elevation 2 feet above the top of proposed pipeline prior to excavating for the pipeline.

D. During all compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of fill. Maintain moisture content uniform throughout the lift. At the time of compaction, the water content of the material shall be as specified by these specifications.

3.11 FILL SLOPES

Fill slopes shall be true to the lines and grades shown, and shall be overfilled and trimmed back to a firm, smooth surface free of loose material.

3.12 FINISH / NON-STRUCTURAL FILL

A. The completed surface of all excavations and fills shall be true to the lines and grades, and shall be smooth and unyielding. Any deviations from the lines and grades shown shall be corrected by excavating or filling as specified.

B. Upon completion of structural fill, all excess cut material and strippings shall be placed where shown on the Plans as directed by the Project Geotechnical Engineer. Non-structural fill shall be graded such that it uniformly drains and does not affect natural drainage patterns. No ponding shall be allowed within non-structural fill. Non-structural fill less than 5-feet in depth shall be placed in 12” maximum horizontal lifts and shall be compacted to 85% relative compaction per ASTM D1557. For non-structural fills greater than 5-feet in depth, the portion of fill below a depth of 5-feet shall be compacted to 90% relative compaction and shall be placed in accordance with structural fill specifications above. No roots or organic matter larger than 6” in diameter shall be allowed in non-structural fill.

C. Where non-structural fills are placed on slopes of 5:1 or greater and fills are greater than 2-feet in height, fill shall be keyed and benched into native slope as directed in field by Geotechnical Engineer.

3.13 FIELD QUALITY CONTROL

A. The Project Geotechnical Engineer will observe the clearing, stripping, and grubbing operations, and will determine the required depth of stripping and the required extent of grubbing. In addition, the Project Geotechnical Engineer will observe the excavation, moisture-conditioning, and compaction operations. The Project Geotechnical Engineer will perform field and laboratory tests to determine if the materials used in the work meet the requirements of the specifications.

B. The Project Geotechnical Engineer will determine in-place density and moisture content by any one or combination of the following methods: ASTM D2922, D1556, D2216, D3017, or other methods selected by the Project Geotechnical

Engineer. The Contractor shall cooperate with this testing work by leveling small test areas designated by the Project Geotechnical Engineer. Backfill all test areas at Contractor's sole expense. The frequency and location of testing shall be determined solely by the Project Geotechnical Engineer. The Project Geotechnical Engineer may test any lift of fill at any time, location, or elevation.

## 3.14 GUARANTEE OF WORK

A. Notwithstanding observation and testing of the work by the Project Geotechnical Engineer, the Contractor warrants that all construction will be of good quality, that the work will be free from defects in material or workmanship, and that the work will conform to the specification requirements. Work not conforming to specification requirements may be considered defective.

B. This warranty by the Contractor is in addition to any warranties or guarantees required elsewhere in the Contract, or in the specifications for specified items of equipment or materials. This warranty shall be in effect notwithstanding any disclaimers, or limiting or conditional terms contained in such separate warranties furnished by manufactures or suppliers. In addition, after final payment to the Contractor, the Contractor shall not be relieved or excused from responsibility for breach of warranty.

## 3.15 AUTHORITY OF THE PROJECT GEOTECHNICAL ENGINEER

A. The Project Geotechnical Engineer shall decide all questions that may arise as to the quality or acceptability of embankment materials placed and compacted, and all earthwork performed. The Project Geotechnical Engineer shall decide all questions as to the manner of performance and rate of progress of earthwork, and all questions that may arise as to the interpretation of the earthwork specifications. The Project Geotechnical Engineer will have the final authority to reject all earthwork that does not conform to the requirements of these specifications.

B. Work and materials shall conform to the lines, grades, cross sections, dimensions and material requirements, including tolerances, shown on the plans or indicated in the specifications. Although measurement, sampling, and testing may be considered evidence as to such conformity, the Project Geotechnical Engineer shall be the sole judge as to whether the earthwork or materials deviate from the plans and specifications.

## 3.16 OBSERVATION OF CONSTRUCTION

A. The Project Geotechnical Engineer shall at all times have safe access to the work during its construction, and shall be furnished with every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements and intentions of the specifications. All work done and all materials furnished shall be subject to the Project Geotechnical Engineer’s observation.

B. The observation of the construction or materials by the Project Geotechnical Engineer shall not relieve the Contractor of any obligations to fulfill its Contract as prescribed. Work and materials not meeting such requirements shall be corrected, and unsuitable work or material may be rejected, notwithstanding that such work or materials have been previously reviewed by the Project Geotechnical Engineer, or that payment therefore has been made.

C. The Project Geotechnical Engineer may order re-examination of questioned work at any time before final acceptance. If so ordered, the work shall be uncovered by the Contractor. If such work is found to be in accordance with the Contract, the Contractor will be paid for the cost of uncovering, removal, recovering, and replacing the parts removed. If such work so exposed or examined is not in accordance with the Contract, the uncovering, removal, recovering, and replacement shall be at the Contractor's sole expense. Work that has been covered prior to observation by the Project Geotechnical Engineer does not qualify as re-examined work; the Project Geotechnical Engineer may order it uncovered for observation without payment of costs.

D. The Contractor shall give due notice to the Project Geotechnical Engineer before placing fill so that the Project Geotechnical Engineer may observe the materials and installation. The observations performed by the Project Geotechnical Engineer shall not relieve the Contractor of its responsibility to conduct comprehensive inspections of the work and to furnish materials and perform work in conformance with the requirements of these specifications.

## 3.17 CORRECTION, REMOVAL, OR REJECTED WORK

A. The Contractor shall promptly correct work rejected by the Project Geotechnical Engineer as failing to conform to the requirements of the specifications so that it does comply. The Contractor shall bear the costs of correcting such rejected work, including additional testing, inspections, and compensation for the Project Geotechnical Engineer's services and expenses made necessary thereby.

B. The Contractor shall remove from the site portions of the work that are not in accordance with the specifications, or which are not corrected by the Contractor, all at the Contractor's own expense. If the Contractor fails to promptly correct nonconforming or rejected work, the Owner may cause such work to be remedied, removed, or replaced, and the costs thereof will be deducted from any monies due or that may become due the Contractor. Failure on the part of the Project Geotechnical Engineer to reject nonconforming work shall not be construed to imply acceptance of such work.

## 2300 OVERFLOW PIPE & LEVEL SPREADER

## PART I GENERAL

### 1.1 DESCRIPTION

This section consists of all materials, excavation, fabrication, concrete work, backfill and all incidental work associated with construction of the overflow pipe as shown on the Plans. In addition to these specifications, overflow pipe construction shall conform to the Plans and Details.

### 1.2 DEFINITIONS

A. Riser: Where used in these specifications, "Riser" shall mean the vertically oriented portion of the overflow pipeline.

B. Overflow Pipeline: Where used in these specifications, "Overflow pipeline" shall mean the structure used to outlet water from within the reservoir to a protected outlet, including the riser and horizontal pipeline through and below the embankment.

C. Apron: Where used in these specifications, "Apron" shall mean the concrete pad surrounding the riser.

D. Level Spreader – Where used in these specifications, the structure at the overflow pipe outlet that spreads water such that it outlets the structure as sheet flow.

## PART II MATERIALS

### 2.1 PIPE

A. Riser, outlet pipe, level spreader and all fittings shall be gasketed, water-tight non-perforated dual wall corrugated polyethylene pipe (CPP). CPP shall conform to AASHTO M294 and ASTM F667.

### 2.2 CONCRETE & REINFORCEMENT STEEL

A. Concrete for construction of the apron shall be Portland cement concrete with a minimum compressive strength of 3000 psi.

B. Concrete for use as encasement around the outlet pipe, anchors and cutoff collars shall be Portland cement concrete with a minimum compressive strength of 2000 psi. Concrete for pipeline encasement shall have a 6" slump and shall be adequately moist to easily flow around the outlet pipeline and adhere to trench walls.

C. Reinforcement steel shall conform to ASTM A615. Rebar shall be clean of oil and rust prior to placement.

2.3 TRENCH BACKFILL MATERIAL

A. Trench backfill material above the outlet pipe shall meet requirements for structural fill as specified in Section 2200, "Earthwork."

## PART III EXECUTION

3.1 EXCAVATION AND OVERFLOW PIPE INSTALLATION

A. Except where otherwise stated in these Specifications, installation of corrugated polyethylene pipe shall conform to ASTM D2321.

B. The excavation for the overflow pipeline within the embankment shall be made into compacted structural fill. Fill shall extend a minimum of 24" above the top of the pipeline prior to excavation of the trench for the pipeline.

C. The overflow pipe and riser shall be well supported on the trench bottom with concrete blocks or other means acceptable to the Project Engineer. The trench bottom shall be clean of any loose debris or clods. Gaps larger than ¼" in size will not be allowed at pipe joints. All CPP pipe joints, including those encased in concrete, shall be fully gasketed.

D. Construction staking shall be provided by the Project Engineer and Surveyor. Elevations of pipes shall be as shown on the Plans. Invert elevations may be a maximum of 0.05 feet above or 0.10 feet below design elevation. No reverse grades shall be allowed.

E. Level Spreader shall be constructed as shown on the Plans.

3.2 CONCRETE PLACEMENT

A. Prior to placement of encasement concrete, pipeline shall be anchored in place in order to prevent the pipeline from moving or floating during placement of concrete. During placement of concrete, concrete shall be vibrated in place in order to ensure that concrete flows around spillway riser and outlet pipe. Concrete shall not be excessively vibrated such that concrete components begin to separate. Care shall be taken during placement of concrete to prevent debris from falling into the trench or concrete.

B. If multiple trucks will be required in order to deliver the necessary concrete, trucks shall be scheduled adequately such that successive pours are not allowed to begin to cure. Cold joints within the encasement will not be allowed. If

Contractor chooses to pour the apron as a separate pour, dowels shall be installed in the concrete encasement to tie the apron to the encasement. Dowels shall be made of #4 steel rebar placed 8" on center around the perimeter of the riser pipeline.

C. Concrete shall be allowed to cure for seven days prior to any equipment activity being allowed over the top of the pipeline. Contractor may, upon Civil Engineer's approval, utilize admixtures in order to reduce required curing time. Contractor shall provide necessary submittals at least 3 days prior to pouring concrete in order to obtain approval.

D. The concrete apron shall be reinforced with steel rebar as specified on the Details. Rebar shall be uniformly supported with concrete or metal supports such that the curtain is located at the middle of the slab. Splices of horizontal bars shall be staggered and shall overlap a minimum of 30 bar diameters.

## 2400 SUBSURFACE DRAINAGE SYSTEM

## PART I GENERAL

### 1.1 DESCRIPTION

This section consists of all materials, excavation and installation associated with installation of a subsurface drainage system below the reservoir bottom and a 6-inch PVC wet well. In addition to these specifications, the subsurface drainage system shall conform to the Plans and Details.

### 1.2 DEFINITIONS

A. Subdrain: Where used in these specifications, "Subdrain" shall mean a buried perforated pipeline encased in envelope material backfill unless specified as "non-perforated" on Plans.

B. Envelope material: Where used in these specifications, "Envelope material" shall mean a self-filtering, highly permeable material that is placed around and above subdrains. See Part 2, Section 2.2 B for alternate envelope material option.

## PART II MATERIALS

### 2.1 PIPE

A. Pipe and fittings for subdrains shall consist of perforated Corrugated Polyethylene Pipe (CPP) meeting AASHTO M252M and ASTM F405.

B. Pipe and fittings for Corrugated Polyethylene Pipe shall meet AASHTO M 252M and ASTM F405

### 2.2 ENVELOPE MATERIAL

A. Envelope material shall be Class 2 Permeable Material as described in Cal Trans Standard Specifications, Section 68.

B. As an alternate, Class 2 Permeable Material may be replaced with ¾" crushed, angular rock if the gravel envelope is fully wrapped in non-woven geotextile fabric. Fabric shall be placed in open trench, rock and pipe placed in trench, and fabric then folded over top of trench with fabric over-lapping the full width of the trench. Fabric shall be Mira-fi 140N or equal.

C. As an alternate, Class 2 Permeable Material may be replaced with 3/8" unwashed, crushed lava rock from locally available source. A sample of material must be provided to engineer for approval prior to delivery of material.

## PART III EXECUTION

### 3.1 EXCAVATION AND SUBDRAIN INSTALLATION

A. Contractor shall be responsible for protecting subdrains from damage upon completion of construction of drains and during construction of embankment.

B. Excavation of trenches for subdrain piping shall be as shown on the Plans. Trenches shall be clean prior to placement of pipe and envelope material.

C. For perforated subdrains, a minimum of 0.25 feet of envelope material shall be placed below the pipeline and on both sides of the pipe between the pipe and the trench wall. Envelope material shall extend to top of trench. Care shall be taken during construction of the subdrains to keep the envelope material, both stockpiled and in place, clean of any dirt or debris. Loader operator shall take care not to pickup soil when excavating envelope material from stockpiles.

D. Construction staking shall be provided by the Project Engineer and Surveyor. A gradual variation of no more than 1.0 foot will be allowed from the staked alignment. Elevations of pipes shall be as shown on the Plans. Invert elevations may be a maximum of 0.05 feet above or 0.10 feet below design elevation. No reverse grades shall be allowed.

**PJC & Associates, Inc.**
*Consulting Engineers & Geologists*

December 1, 2020 Job No. S2007.01

Edwards Engineering, Inc.
Attention: Brent Edwards
1305 E Street
Napa, CA 94559

Subject: Geotechnical Investigation
Proposed Eakle Reservoir
4720 Hardin Road
Saint Helena, California

PJC & Associates, Inc. (PJC) is pleased to submit this report which presents the results of our geotechnical investigation for the proposed Eakle reservoir located at 4720 Hardin Road in Saint Helena, California. The approximate location of the site is shown on the Site Location Map, Plate 1. This report presents our engineering opinions and recommendations regarding the geotechnical aspects of the design and construction of the proposed reservoir. Based on the results of this study, it is our opinion that the project is feasible from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated in the design and carried out through construction.

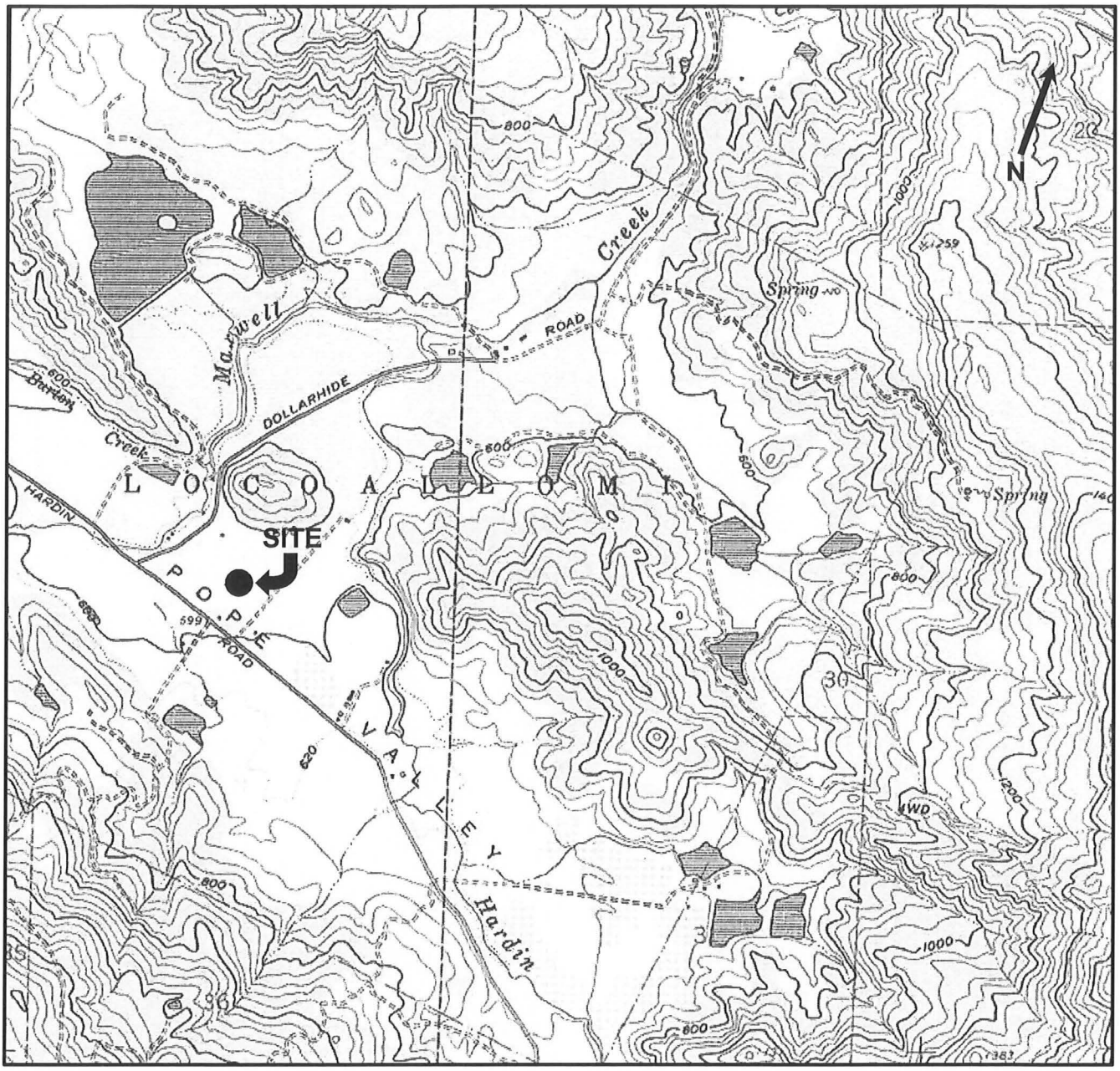
## 1. PROJECT DESCRIPTION

Based on the preliminary site plan and information provided by you, it is our understanding that the project will consist of constructing an earthen reservoir at the site. We anticipate that the reservoir will be graded by cutting within the reservoir area and uphill side, and filling along the downhill perimeter to construct an earthen embankment. Based on the information provided by you, we anticipate that the exterior embankment may have a maximum height of 18 feet, graded to two horizontal to one vertical (2H:1V) and the interior of the embankment will be approximately 27 feet tall graded to 3H:1V.

## 2. SCOPE OF SERVICES

The purpose of this investigation was to evaluate the subsurface conditions at the site and to develop geotechnical criteria for design and construction of the project. Specifically, the scope of our services consisted of the following:

a. Excavate eight exploratory test pits to depths between four and 15 feet below the existing ground surface to observe the soil, bedrock




SCALE 1:24,000

REFERENCE: USGS CHILES VALLEY CALIFORNIA QUADRANGLE, DATED 1993.

| | | |
|---|---|---|
| PJC & Associates, Inc.<br>Consulting Engineers & Geologists | SITE LOCATION MAP<br>PROPOSED EAKLE RESERVOIR<br>4720 HARDIN ROAD<br>SAINT HELENA, CALIFORNIA | PLATE<br>1 |
| | Proj. No: S2007.01 Date: 11/20 App'd by: AJD | |

and groundwater conditions. Our project geologist was on site to observe the excavations, log the materials encountered in the test pits and to obtain representative samples for visual classification and laboratory testing.

b. Perform laboratory tests on selected samples to evaluate their index and engineering properties.

c. Review seismological and geologic literature on the site area, discuss site geology and seismicity, and evaluate potential earthquake effects (i.e., liquefaction, ground rupture, lurching and lateral spreading, etc.).

d. Perform engineering analyses to develop geotechnical recommendations for site preparation and earthwork, slope and embankment stability, maximum permissible cut and fill slope inclinations, compaction requirements and subsurface drainage control.

e. Preparation of this formal report summarizing our work on this project.

3. SITE CONDITIONS

a. General: The site is located in a rural residential and agricultural area of Pope Valley, approximately one-quarter mile southeast of the intersection of Dollarhide Road and Hardin Road. The site is generally bounded by vineyards, agricultural land and single-family residences to the north, east and south, and Hardin Road to the west. At the time of our investigation, the site was occupied by an existing single-family residence, landscape areas and a vineyard. The remaining portions of the site, and the general location of the proposed pond area, were relatively undeveloped.

b. Topography and Drainage: The site is situated near the low-lying, southeastern area of Pope Valley on relatively level to moderately sloping topography with maximum estimated natural gradients of five horizontal to one vertical (5H:1V). According to the United States Geological Survey (USGS) Chiles Valley, California, 7.5 Minute Quadrangle Map (Topographic), the site is situated near an approximate elevation of 600 feet above mean sea level (MSL). No creeks or drainage swales pass through the site. Site drainage generally consists of sheet flow and surface infiltration, and is provided by Maxwell Creek, which is located approximately one-quarter mile northwest of the site.

## 4. GEOLOGIC SETTING

The site is located in the Coast Ranges Geomorphic Province of California. This province is characterized by northwest trending topographic and geologic features, and includes many separate ranges, coalescing mountain masses and several major structural valleys. The province is bounded on the east by the Great Valley and on the west by the Pacific Ocean. It extends north into Oregon and south to the Transverse Ranges in Ventura County.

The structure of the northern Coast Ranges region is extremely complex due to continuous tectonic deformation imposed over a long period of time. The initial tectonic episode in the northern Coast Ranges was a result of plate convergence which is believed to have begun during late Jurassic time. This process involved eastward thrusting of oceanic crust beneath the continental crust (Klamath Mountains and Sierra Nevada) and the scraping off of materials that are now accreted to the continent (northern Coast Ranges). East-dipping thrust and reverse faults were believed to be the dominant structures formed.

Right lateral, strike slip deformation was superimposed on the earlier structures beginning mid-Cenozoic time, and has progressed northward to the vicinity of Cape Mendocino in Southern Humbolt County (Hart, Bryant and Smith, 1983). Thus, the principal structures south of Cape Mendocino are northwest-trending, nearly vertical faults of the San Andreas system.

Based on published geologic literature, the site is mapped within late Pleistocene alluvium (Qpa), which are in turn underlain at a relatively shallow depth by sandstone and shale bedrock deposits of the Great Valley Sequence (KJgv). The Great Valley Sequence has been characterized to consist of undifferentiated marine mudstone, shale, siltstone, sandstone and conglomerate, and ultramafic rocks from the late Jurassic to early Cretaceous period. Locally, the bedrock is masked by alluvial and residual soils.

## 5. FAULTING

Geologic structures in the region are primarily controlled by northwest trending faults. No known active fault passes through the site. The site is not located in the Alquist-Priolo Earthquake Fault Studies Zone. Based on our research, the three closest known potentially active faults to the site are the Hunting Creek, the Great Valley IV, and the West Napa. The Hunting Creek fault is located four miles to the northeast, the Great Valley IV fault is located 11 miles to the east, and the West Napa fault is located 13 miles southeast of the site. Table 1 outlines the nearest known active faults and their associated maximum magnitude and peak site acceleration.

**TABLE 1**
**CLOSEST KNOWN ACTIVE FAULTS**

| Fault Name | Distance from Site (Miles) | Maximum Earthquakes (Moment Magnitude) |
|---|---|---|
| Hunting Creek | 4 | 6.9 |
| Great Valley IV | 11 | 6.6 |
| West Napa | 13 | 6.5 |

6. SEISMICITY

The site is located within a zone of high seismic activity related to active faults that transverse through the surrounding region. Future damaging earthquakes could occur on any of these fault systems during the lifetime of the proposed project. In general, the intensity of ground shaking at the site will depend upon the distance to the causative earthquake epicenter, the magnitude of the shock, the response characteristics of the underlying earth materials, and the quality of construction. Seismic considerations and hazards are discussed in the following subsections of this report.

7. SUBSURFACE CONDITIONS

a. Soils & Bedrock. The subsurface conditions of the site were investigated by excavating eight exploratory test pits (TP-1 through TP-8) in the reservoir and embankment areas to depths between four and 15 feet below the existing ground surface. The approximate test pit locations are shown on the Test Pit Location Plan, Plate 4. The test pits were excavated to observe the soil, bedrock and groundwater conditions. The excavation procedures and descriptive test pit logs are included in Appendix A of this report. The laboratory procedures are included in Appendix B.

The test pits generally encountered young alluvial soils, older alluvial deposits and residual soils, underlain by bedrock deposits of the Great Valley Sequence. At the surface of TP-1 through TP-7, the test pits encountered young alluvial soils consisting of sandy clays, clayey sands and clayey gravels that extended to depths between one and eight feet below the existing ground surface. The sandy clay young alluvial soils appeared moist to wet, soft to very stiff, and exhibited low to high plasticity characteristics. The granular young alluvial deposits appeared moist to very moist, dense and fine to coarse grained. Underlying the young alluvial soils at TP-1 and TP-3, our exploration encountered older alluvial deposits consisting of sandy and silty clays that extended to depths between nine and 13 feet below the existing ground surface. The older alluvial clays appeared very moist to saturated, very stiff to hard, and exhibited high plasticity characteristics. Encountered at the surface at TP-8 and underlying the alluvial soils at TP-1 through

TP-4, TP-6, and TP-7 were residual soil deposits consisting of sandy clays that extended to depths between one and 12 feet and to the maximum explored depths of TP-1 and TP-3. The residual sandy clays appeared moist to saturated, very stiff and exhibited medium to high plasticity characteristics. The alluvial and residual soils at TP-2 and TP-4 through TP-8 were underlain by shale bedrock deposits of the Great Valley Sequence. The bedrock appeared soft to slightly hard, friable to moderately strong and highly weathered.

b. Groundwater. Minor groundwater seepage was encountered in TP-1 at a depth of five feet below the existing ground surface during our field exploration on February 13, 2020. The groundwater level in TP-1 appeared to equalize at a depth of nine feet below the existing ground surface. No groundwater or seepage was encountered in the other test pits. However, seepage within the upper soil layers and bedrock fractures should be anticipated in the winter and early spring, and may vary depending on the amount of rainfall. Furthermore, groundwater levels can fluctuate by several feet throughout the year due to seasonal rainfall and other factors. Evaluation of these factors is beyond the scope of this report.

## 8. GEOLOGIC HAZARDS & SEISMIC CONSIDERATIONS

The site is located within a region subject to a high level of seismic activity. Therefore, the purposed project could experience strong seismic ground shaking during the lifetime of the project. The following discussion reflects the possible earthquake effects which could result in damage to the proposed pond.

a. Fault Rupture. Rupture of the ground surface is expected to occur along known active fault traces. No evidence of existing faults or previous ground displacement on the site due to fault movement is indicated in the geologic literature or field exploration. Therefore, the likelihood of ground rupture at the site due to faulting is considered to be low.

b. Ground Shaking. The site has been subjected in the past to ground shaking by earthquakes on the active fault systems that traverse the region. It is believed that earthquakes with significant ground shaking will occur in the region within the next several decades. Therefore, it must be assumed that the proposed reservoir will be subjected to strong ground shaking during its design life.

c. Liquefaction. Our field exploration did not encounter loose, saturated, granular soil stratums within the top 15.0 feet of the ground surface. Our field exploration did encounter stratums of

granular soils which could become saturated due to an elevated groundwater condition. However, the granular stratums had moderate to high relative densities and significant fines content. Therefore, it is judged that the risk of soil liquefaction within 15 feet of the ground surface at the site is low. The risk of liquefaction below 15 feet is beyond the scope of this report. However, according to the Association of Bay Area Governments (ABAG) liquefaction map, the site is located in an area of low susceptibility to seismically induced liquefaction. Additionally, the site is also underlain by relatively shallow bedrock deposits of the Great Valley Sequence, which are not considered susceptible to seismically induced liquefaction.

d. Lateral Spreading and Lurching. Lateral spreading is normally induced by vibration of near-horizontal alluvial soil layers adjacent to an exposed face. Lurching is an action, which produces cracks or fissures parallel to streams or banks when the earthquake motion is at right angles to them. There are no exposed faces or a creek embankment adjacent to the site. Therefore, we judge that the potential for lateral spreading and lurching at the site is low

e. Expansive Soils. Based on our visual observations and laboratory testing (PI=8), the surface young alluvial soils are judged to generally have a low expansion potential. However, our exploration did encounter the near surface soils that are judged to have a moderate to high (PI=21 & 41) expansion potential.

9. SLOPE STABILITY ANALYSIS

a. Analysis Method. The overall stability of the fill embankment was analyzed for stability by conventional limit equilibrium methods to determine factors of safety against sliding. A 18 foot tall exterior fill embankment was computer analyzed for circular arc failure modes using Bishop's procedures. The computer program, PCSTABL5, developed by Purdue University in 1985, was used to perform the slope stability analysis. The computer program performs an automatic search for the slip surface having a minimum factor of safety. In Bishop's procedure, the interslice shear forces are neglected and the factor of safety is determined by taking moments about the center of rotation. The trial and error solution assumes many possible failure surfaces and computes the corresponding factors of safety until a minimum is determined.

The slope stability analyses were performed on a cross section through a 18 foot tall fill exterior embankment with a side slope of 2H:1V. The interior of the embankment analyzed was 27 feet tall at a gradient of 3H:1V. The cross section used for slope stability

analyses was based on topographic information provided by the preliminary plans. Optimum moisture content, maximum dry density and direct shear strength laboratory test data were also used for our analysis. Static and pseudostatic conditions were analyzed and factors of safety were determined against landsliding. Table 2, Slope Stability Analyses and Strength Parameters, presents a summary of the strength parameters used.

**TABLE 2**
**SLOPE STABILITY ANALYSES AND STRENGTH PARAMETERS**

| Material | Total Unit Weight | Shear Strength Parameters | |
|---|---|---|---|
| | (pcf) | Friction Angle (Degrees) | Cohesion (psf) |
| Sandy Clay (CL) (Fill) | 125 | 28 | 270 |
| Sandy Clay (CL) (Young Alluvium) | 115 | 24 | 150 |
| Sandy Clay (CL) (Firm Native Soils/Bedrock) | 125 | 30 | 400 |

b. Pond Embankment Slope Stability. A slope stability analysis for the overall embankment stability was performed using a cross section of a 18 feet high exterior fill slope graded to an inclination of 2H:1V on the exterior. The results of our analysis are presented on Plates 2 and 3. Furthermore, the associated factors of safety are presented on Table 3.

**TABLE 3**
**MINIMUM FACTORS OF SAFETY**
**18-FOOT FILL SLOPE @ 2H:1V**

| Condition | Factor of Safety | Minimum Recommended Values** |
|---|---|---|
| Static | 2.2 | 1.5 |
| Seismic* | 1.3 | 1.2 |

*Using a psedostatic coefficient of 0.2 g
** Referenced from manual titled "An Engineering Manual for Slope Stability Studies," by Duncan, Buchignan and DeWet, dated March 1987.

c. Discussion. Based on the results of our analysis, a 18 foot tall exterior fill embankment graded to 2H:1V has adequate factors of safety for both static and psedostatic conditions. Furthermore, cut slopes constructed in firm residual soils and bedrock should be stable at gradients of 3H:1V and less. However, we should observe all cut slopes to verify the conditions of the cut slopes and revise our recommendations, if necessary.

## 10. CONCLUSIONS

Based on the results of this investigation, we judge that the project is feasible from a geotechnical engineering standpoint provided the recommendations of this report are incorporated in design and carried out through construction. The primary geotechnical considerations are the presence of weak and compressible surface and near surface soils, and the capacity of the native soils to retain water.

The surface and near surface soils at the site are weak, compressible and not suitable for support of the proposed fill embankment. Therefore, the upper weak soils will have to be removed prior to fill placement.

Our subsurface exploration encountered predominantly fine grained soils with significant fines content (fines content=72.8%, 76.8% and 77.9%). Furthermore, the near surface soils have moderate to high (PI=21 & 41) plasticity characteristics are considered to have an adequate capacity to retain water. These soils could be used as a compacted clay liner. However, our exploration did encounter isolated deposits of granular soils stratums at the site. Therefore, the native soils should be approved by the geotechnical engineer in the field during construction before use as an impermeable liner to the interior of the pond, and additional permeability tests will probably be required. If sufficient quantities of suitable soils are not available, it may be necessary to import clay soils, treat the on-site soils with bentonite or install a synthetic liner.

## 11. GRADING

a. General. Based on the preliminary plan, we anticipate that the pond grading will consist of a combination of cutting to achieve the desired pond grade, and filling to construct an earthen embankment along the downhill perimeter. Based on the preliminary plan, we anticipate that the exterior embankment will be approximately 18 feet tall and less graded to two horizontal to one vertical (2H:1V) and the interior of the embankment will be approximately 27 feet tall graded to 3H:1V.

b. Stripping. Soils containing roots, tree stumps and organic matter must be stripped from the pond area. The stripping should extend a minimum of five feet from the edge of all fill embankments. The stripped material should be removed from the site or should be stockpiled for later distribution on exterior graded slopes. The thickness of required stripping is expected to be generally on the order of two to four inches.

c. Removal of Existing Weak Soils. The weak soils in fill embankment and pond areas should be completely removed and firm native soils

or bedrock exposed as directed by the geotechnical engineer in the field during construction. Based on our exploratory test pits, we anticipate that the depth of weak soils will generally vary between one and eight feet below the existing ground surface.

d. Keyway. To enhance stability, a keyway extending a minimum of five feet below the ground surface and two feet into firm native soils or bedrock should be excavated under all fill embankments. However, we anticipate that the keyway may extend to an approximate depth of 10 feet below the existing ground surface in some areas. The keyway should be at least 10 feet wide and extend at least two feet into firm native soils or bedrock on the downhill side. Temporary slopes of the keyway should be sloped to no steeper than ½ H:1V. The bottom of the keyway should be scarified to a depth of eight inches, moisture conditioned to near optimum moisture content and compacted to at least 90 percent relative compaction. If groundwater is encountered, de-watering will be required.

   A subdrain should be installed in all keyways. The subdrain should consist of a heavy walled, four inch diameter, perforated pipe sloped to drain to outlets by gravity, and of clean, free draining, three-quarter to one and one-half inch crushed rock or gravel. The crushed rock should be wrapped with filter fabric or Class II permeable material be used in lieu of the filter fabric and drain rock. The perforated pipe should be tied to a closed rigid pipe and daylighted through the keyway.

e. Fill Material. Excavated material to be used for the construction of the embankment should not contain organic material, should have no rock or similar irreducible material with a maximum dimension greater than four inches, and should be approved by the geotechnical before use. Native material should be approved by the geotechnical engineer before use for the pond liner, and additional permeability tests may be required prior to geotechnical approval. If sufficient quantities of suitable soils are not available, it may be necessary to import clay soils, treat the on site soils with bentonite or install a synthetic liner.

f. Compaction. All fill material should be placed in uniform lifts not exceeding eight inches in loose thickness. The subgrade and all fills should be compacted, by mechanical means only, with acceptable equipment, to a minimum of 90 percent relative compaction as determined by ASTM D1557. Depressions or ruts created in the process of the grading operations should be properly backfilled with suitable fill and compacted to not less than 90 percent relative compaction. The top 24 inches of the interior of the

reservoir should consist of impermeable material and be moisture conditioned to over optimum moisture content and compacted to at least 95 percent relative compaction. However, if a dewatering subdrain system is necessary for construction of the reservoir, the clay liner should be increased to a minimum of 36 inches over any dewatering drains. Furthermore, it is critical that the dewatering continue until the reservoir is sufficiently full to balance hydrostatic pressures from the groundwater. If the dewatering is not maintained, the hydrostatic pressures below the liner can rupture the liner and lead to leakage.

g. Cut and Fill Slopes. It is recommended that cut and fill slopes be constructed at an inclination no steeper than 2H:1V. Exterior slopes should be protected from erosion as determined by the project civil engineer.

## 12. DRAINAGE

The site should be graded to include provisions for positive surface gradients so that the surface runoff is not permitted to pond, particularly on the fill embankments. Finished slopes should be provided with measures to control erosion.

## 13. LIMITATIONS

The data, information, interpretations and recommendations in this report are presented solely as bases and guides for the geotechnical design geotechnical design of the proposed Eakle reservoir located at 4720 Hardin Road in Saint Helena, California. PJC & Associates developed the conclusions and professional opinions presented herein in accordance with generally accepted geotechnical engineering principles and practices. As with all geotechnical reports, the opinions expressed here are subject to revisions in light of new information, which may be developed in the future, and no warranties are either expressed or implied.

This report has not been prepared for use by parties other than the designers of the project. It may not contain sufficient information for the purpose of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and recommendations contained herein should not be considered valid unless the changes are reviewed by PJC, and the conclusions and recommendations are modified and approved in writing. This report and the drawings contained herein are intended only for the design of the proposed project. They are not intended to act by themselves as construction drawings or specifications.

Soil and bedrock deposits may vary in type, strength, and many other important properties between the points of observation and exploration.

Additionally, changes can occur in groundwater and soil moisture conditions due to seasonal variations, or for other reasons. Therefore, it must be recognized that PJC does not and cannot have complete knowledge of the subsurface conditions underlying the subject site. The criteria presented are based upon the findings at the points of exploration and upon interpretative data, including interpolation and extrapolation of information obtained at points of observation.

14. ADDITIONAL SERVICES

Upon completion of the project plans, they should be reviewed by our firm to verify that the design is consistent with the recommendations of this report. Observation and testing services should be provided by PJC to verify that the intent of the plans and specifications is carried out during construction; these services should include observing the grading and earthwork, field density testing of fill, and installation of the subsurface drainage facilities.

These services will be performed only if PJC is provided with sufficient notice to perform the work. PJC does not accept the responsibility for items that they are not notified to observe.

It has been a pleasure working with you on this project. Please call us if you have any questions regarding the results of this investigation, or if we can be of further assistance.

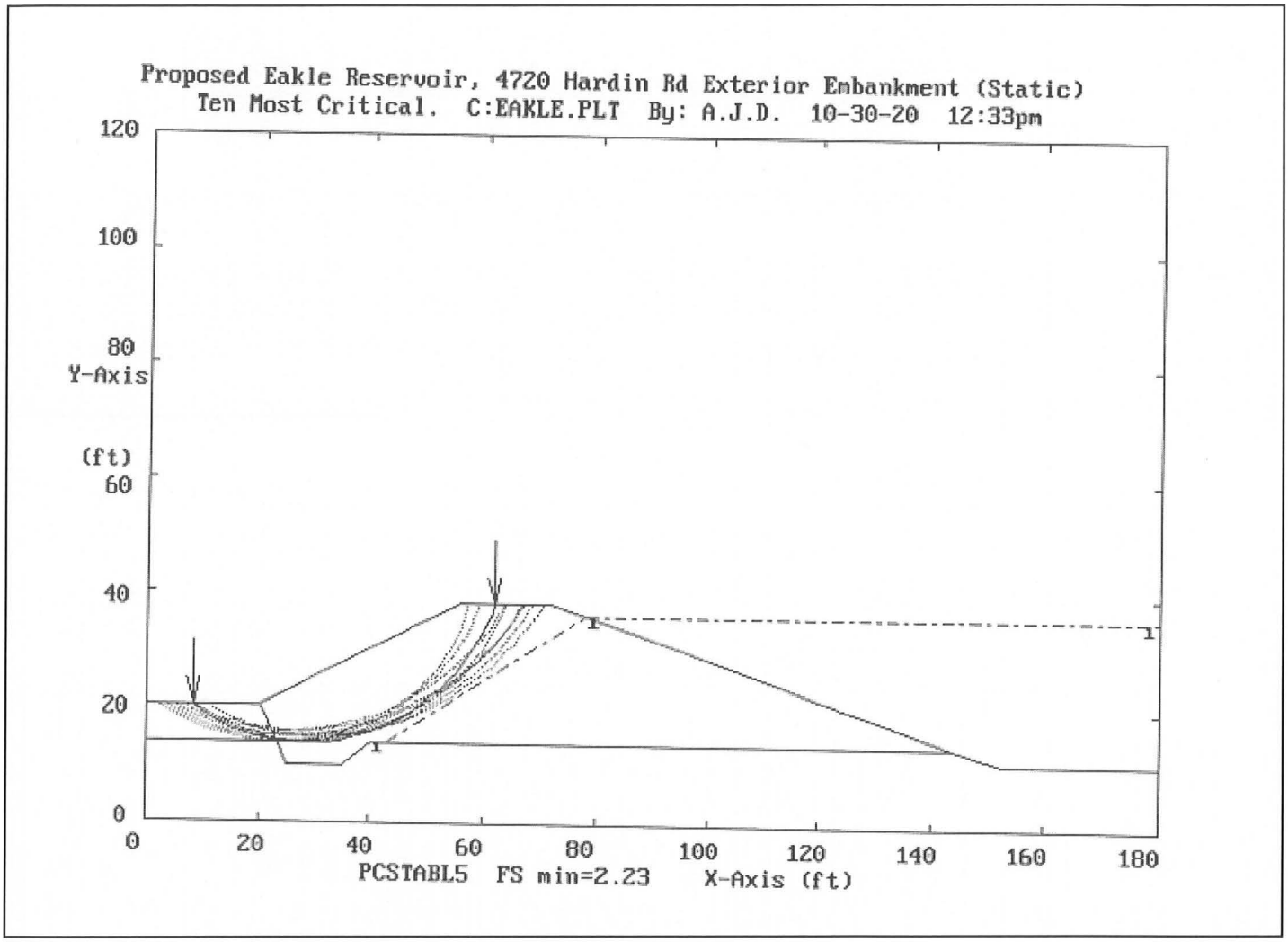
Sincerely,

PJC & Associates, Inc.

Donald A. Whyte
Project Geologist
PG 9109, California

Anthony J. DeMartini
Geotechnical Engineer
GE 2750, California


# APPENDIX A
# SLOPE STABILITY ANALYSIS



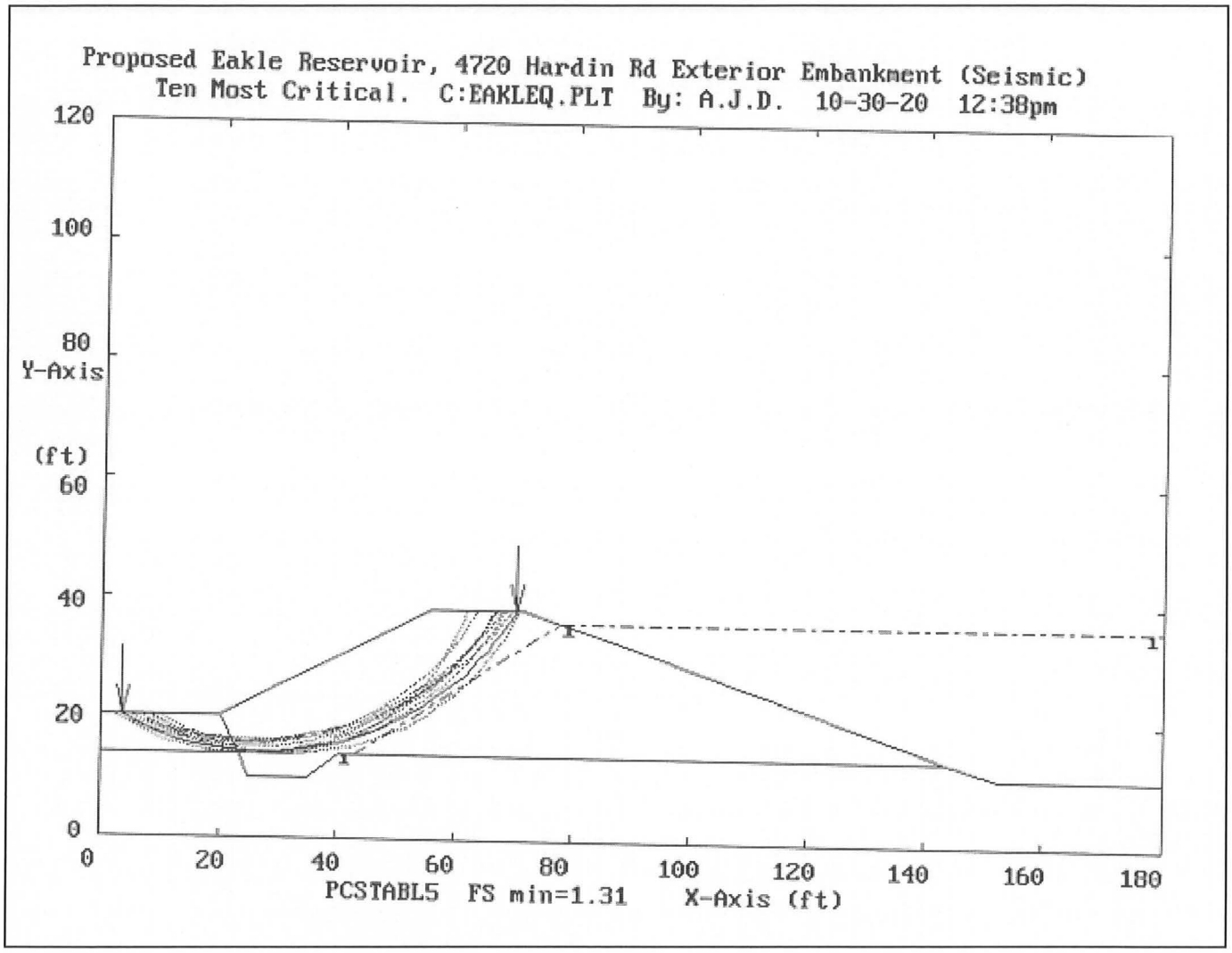

**Slope Stability Analysis:**
**Eakle Reservoir Exterior Embankment**
**Static Condition, Factor of Safety = 2.23**

PJC & Associates, Inc.
Consulting Engineers & Geologists

STABILITY ANALYSIS (STATIC)
PROPOSED EAKLE RESERVOIR
4720 HARDIN ROAD
SAINT HELENA, CALIFORNIA

PLATE
2

Proj. No: S2007.01 Date: 11/20 App'd by: AJD




**Slope Stability Analysis:**
**Eakle Reservoir Exterior Embankment**
**Pseudostatic Condition, Factor of Safety = 1.31**

PJC & Associates, Inc.
Consulting Engineers & Geologists

STABILITY ANALYSIS (SEISMIC)
PROPOSED EAKLE RESERVOIR
4720 HARDIN ROAD
SAINT HELENA, CALIFORNIA

PLATE
3

Proj. No: S2007.01 Date: 11/20 App'd by: AJD

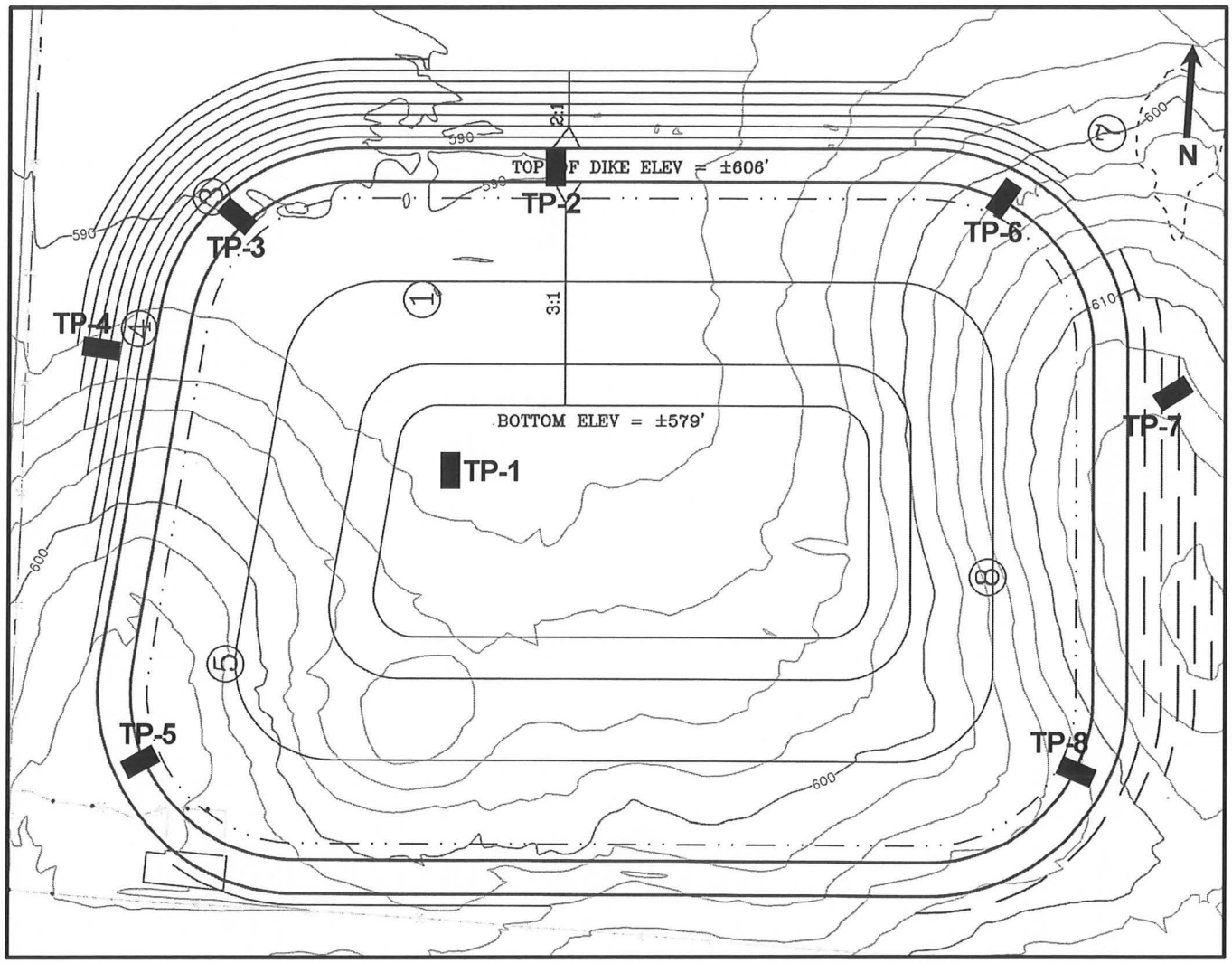
# APPENDIX B
# FIELD INVESTIGATION

## 1. INTRODUCTION

The field program performed for this study consisted of excavating eight exploratory test pits (TP-1 through TP-8) in the vicinity of the proposed reservoir area. The exploration was completed on February 13, 2020. The test pit locations are shown on the Test Pit Location Plan, Plate 4. Descriptive logs of the test pits are presented in this appendix as Plates 5 through 12.

## 2. TEST PITS

The test pits were excavated using a track-mounted excavator with a 30-inch bucket. The soil was classified according to the Unified Soil Classification System, as explained in Plate 13. The bedrock was classified according to Plate 14.



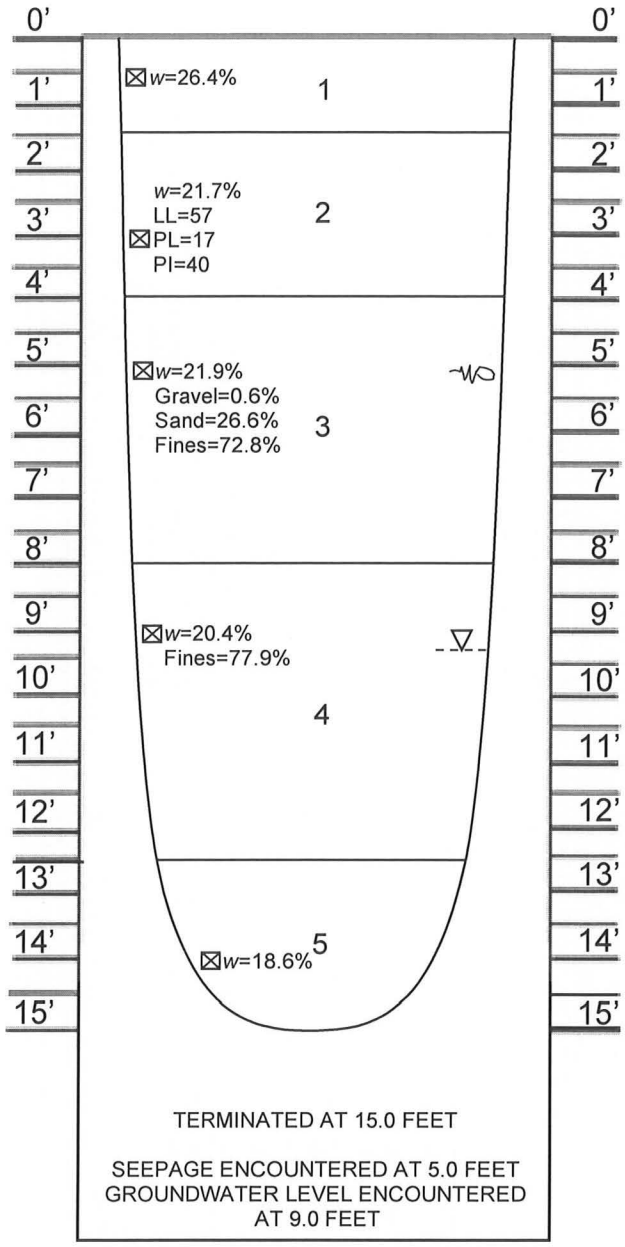

EXPLANATION

▮ TEST PIT LOCATION AND DESIGNATION

NO SCALE

REFERENCE: PRELIMINARY SITE PLAN PREPARED BY EDWARDS ENGINEERING, UNDATED.

| | | |
|---|---|---|
| PJC & Associates, Inc.<br>Consulting Engineers & Geologists | TEST PIT LOCATION PLAN<br>PROPOSED EAKLE RESERVOIR<br>4720 HARDIN ROAD<br>SAINT HELENA, CALIFORNIA | PLATE<br>4 |
| | Proj. No: S2007.01 Date: 11/20 App'd by: AJD | |




LITHOLOGY

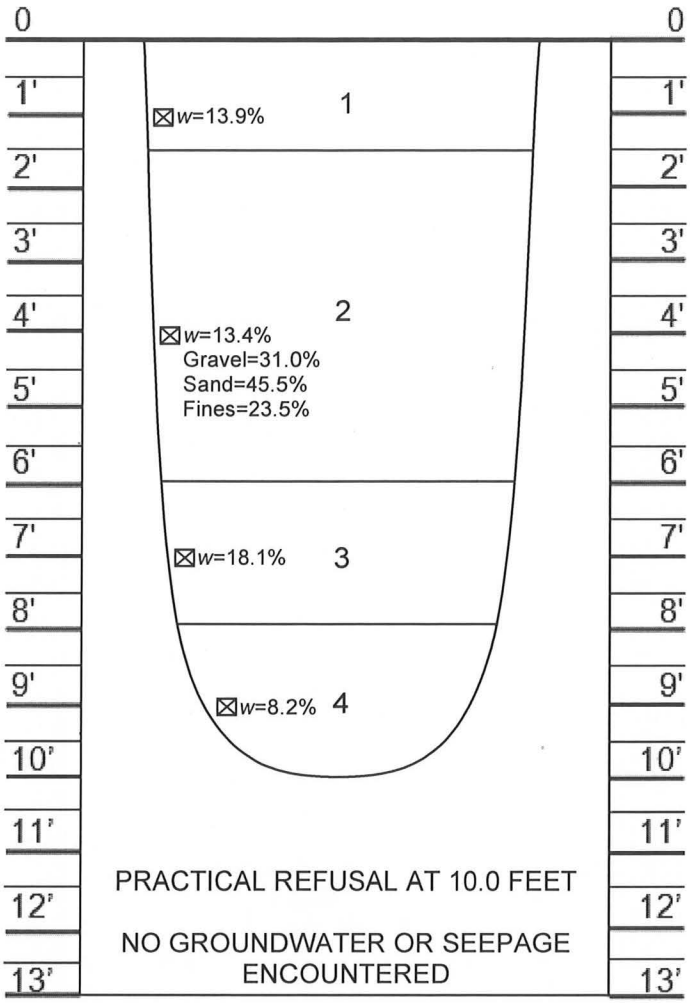
1) 0.0-1.5'; SANDY CLAY (CL); yellowish brown, very moist, soft, medium plasticity. (YOUNG ALLUVIUM)

2) 1.5'-4.0'; SANDY CLAY (CH); olive brown, very moist, stiff to very stiff, high plasticity. (YOUNG ALLUVIUM)

3) 4.0'-8.0'; SANDY CLAY (CH); dark yellowish brown, very moist to wet, very stiff, high plasticity. (YOUNG ALLUVIUM)

4) 8.0'-13.0'; SANDY CLAY (CH); orange brown, with gray mottling, very moist to saturated, very stiff, high plasticity. (OLDER ALLUVIUM)

5) 13.0'-15.0'; SANDY CLAY (CL); dark orange brown, saturated, very stiff, medium plasticity. (RESIDUAL SOIL)



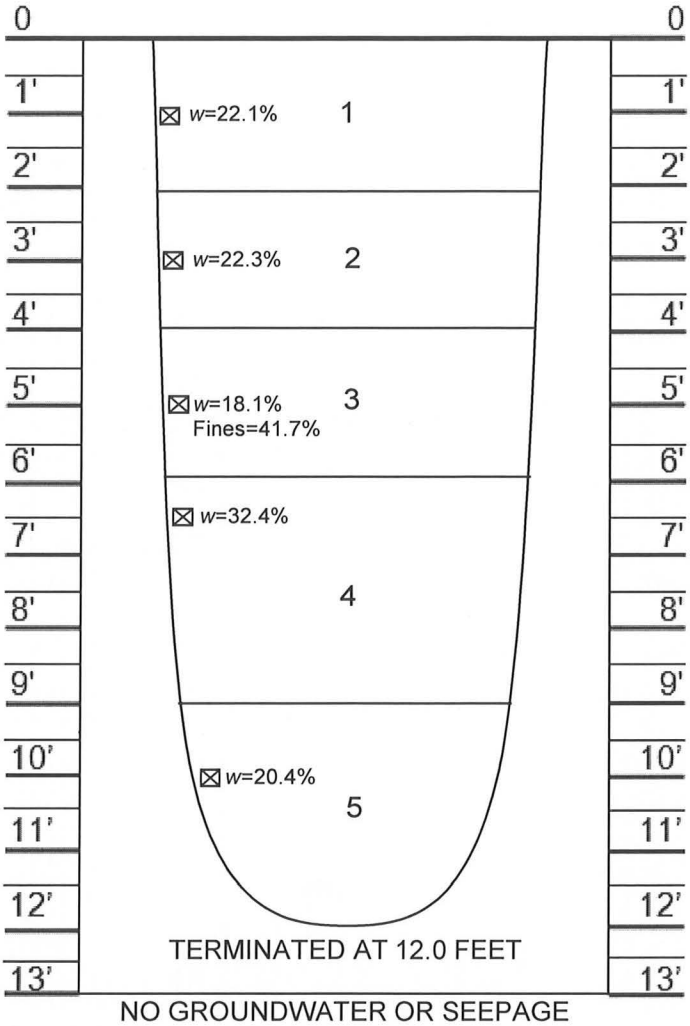

## LITHOLOGY

1) 0.0-1.5'; SANDY CLAY (CL); light brown, moist, soft, disturbed, low plasticity. (YOUNG ALLUVIUM)

2) 1.5'-6.0'; CLAYEY SAND (SC); brown, very moist, dense, fine to coarse grained, with gravels. (YOUNG ALLUVIUM)

3) 6.0'-8.0'; SANDY CLAY (CH); dark yellowish brown, moist, very stiff, high plasticity. (RESIDUAL SOIL)

4) 8.0'-10.0'; SHALE; yellowish gray, soft to slightly hard, friable, highly weathered. (BEDROCK)




LITHOLOGY

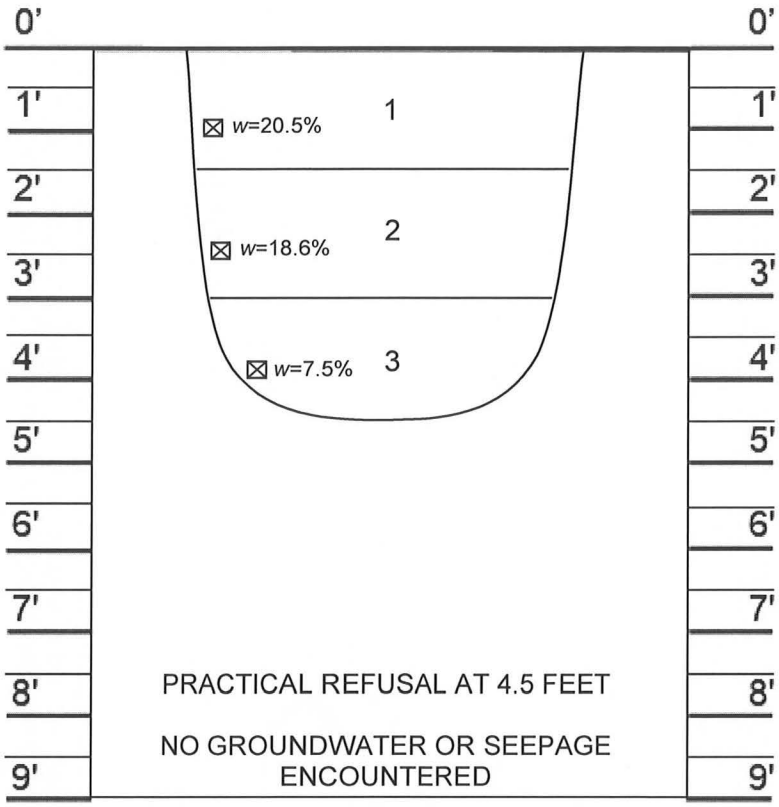
1) 0.0-2.0'; SANDY CLAY (CL); dark yellow-brown, very moist, low plasticity. (YOUNG ALLUVIUM)

2) 2.0'-4.0'; SANDY CLAY (CH); dark yellowish brown, very moist, stiff, high plasticity. (YOUNG ALLUVIUM)

3) 4.0'-6.0'; CLAYEY GRAVELS (GC); dark yellow-brown, very moist, dense, fine to coarse grained. (YOUNG ALLUVIUM)

4) 6.0'-9.0'; SILTY CLAY (CH); dark olive brown, very moist, very stiff to hard, high plasticity. (OLDER ALLUVIUM)

5) 9.0'-12.0'; SANDY CLAY (CL); mottled orange, brown, and gray, very moist, very stiff, medium plasticity, with shale fragments. (RESIDUAL SOIL)

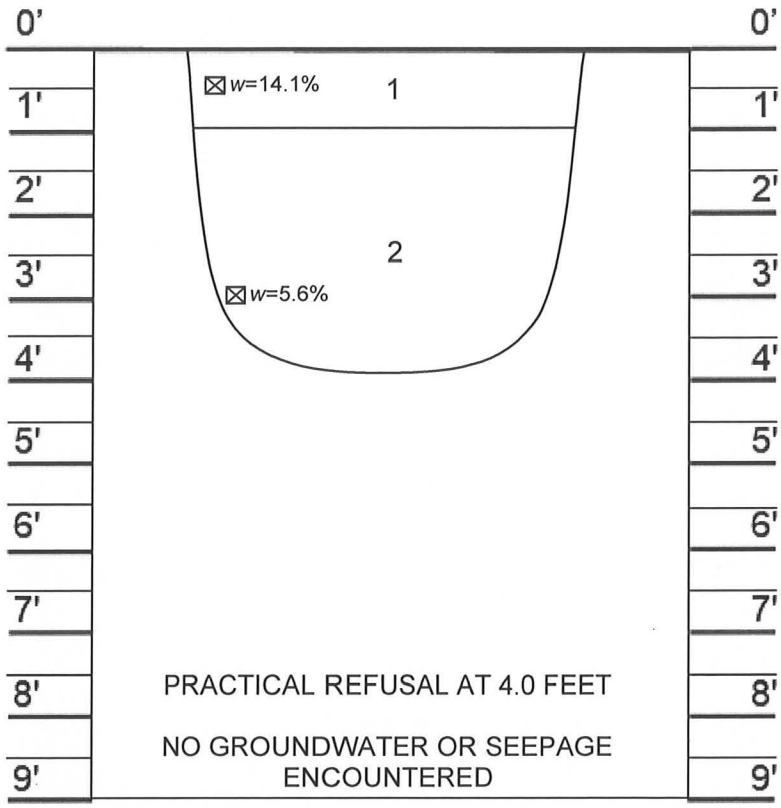



LITHOLOGY

1) 0.0-1.5'; SANDY CLAY (CL); dark yellow-brown, very moist, soft to medium stiff, low plasticity. (YOUNG ALLUVIUM)

2) 1.5'-3.0'; SANDY CLAY (CL); mottled orange, brown, and gray, moist, very stiff, medium plasticity. (RESIDUAL SOIL)

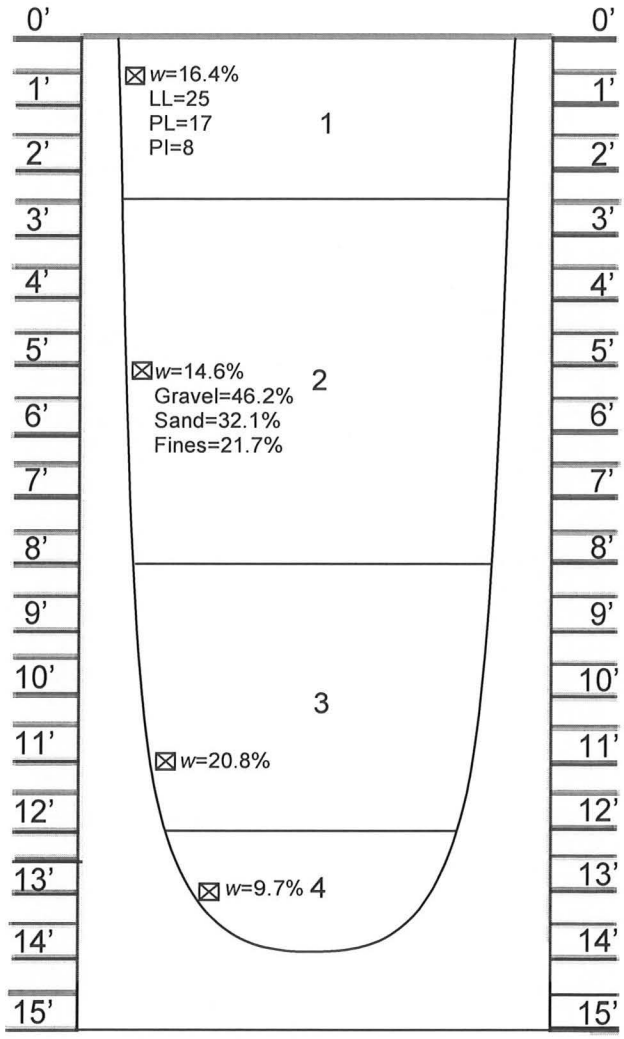
3) 3.0'-4.5'; SHALE; olive brown, slightly hard, friable to moderately strong, highly weathered. (BEDROCK)




LITHOLOGY

1) 0.0-1.0'; SANDY CLAY (CL); olive brown, moist, medium stiff, low plasticity. (YOUNG ALLUVIUM)

3) 1.0'-4.0'; SHALE; yellow-brown and gray, slightly hard, friable to moderately strong, highly weathered, laminated. (BEDROCK)




PRACTICAL REFUSAL AT 14.0 FEET

NO GROUNDWATER OR SEEPAGE ENCOUNTERED

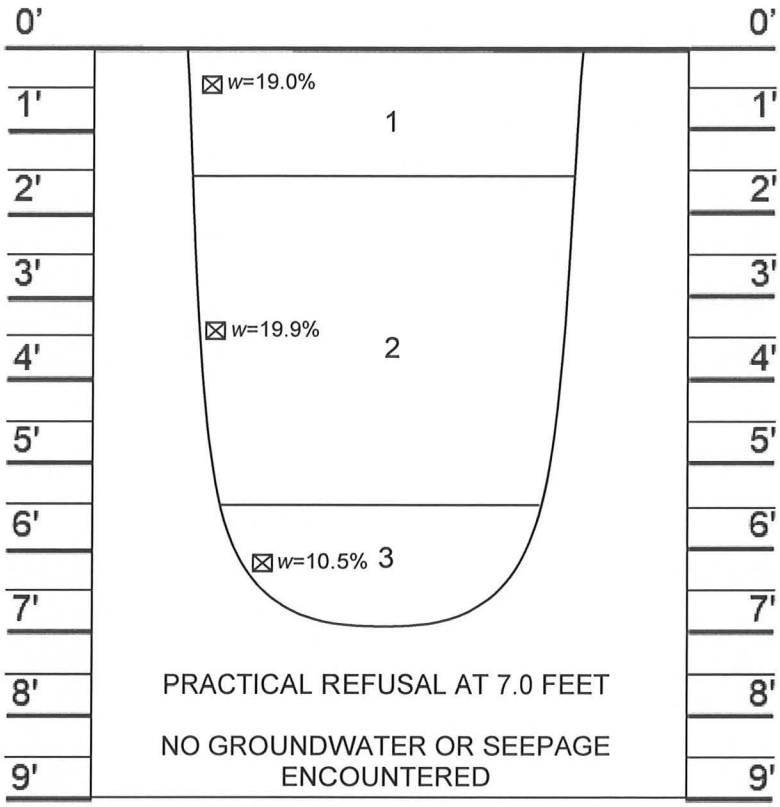
LITHOLOGY

1) 0.0-2.5'; SANDY CLAY (CL); brown, moist to very moist, medium stiff, low plasticity. (YOUNG ALLUVIUM)

2) 2.5'-8.0'; CLAYEY GRAVELS (GC); dark brown, moist to very moist, dense, fine to coarse grained. (YOUNG ALLUVIUM)

3) 8.0'-12.0'; SANDY CLAY (CL); dark yellow brown, moist to very moist, very stiff, medium plasticity, with gravels. (RESIDUAL SOIL)

4) 12.0'-14.0'; SHALE; light grayish brown, slightly hard, friable to moderately strong, highly weathered. (BEDROCK)




LITHOLOGY

1) 0.0-1.5'; SANDY CLAY (CL); light brown, moist, medium stiff, low plasticity. (YOUNG ALLUVIUM)

2) 1.5'-5.5'; SANDY CLAY (CL); mottled orange, brown, and gray, moist to very moist, very stiff, medium plasticity, with gravels. (RESIDUAL SOIL)

3) 5.5'-7.0'; SHALE; medium brown and gray, slightly hard, friable, highly weathered. (BEDROCK)

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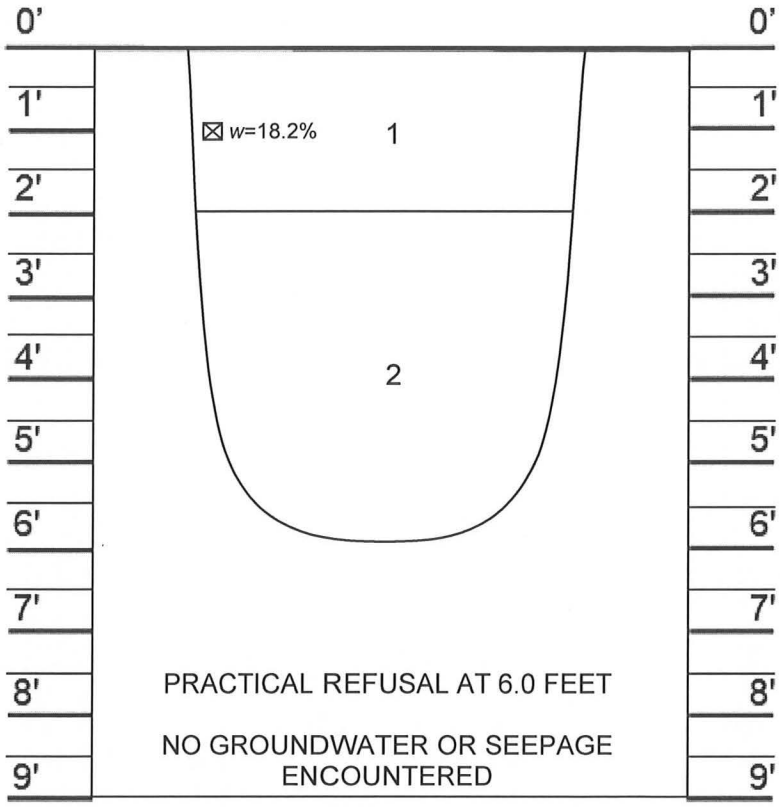
Consulting Engineers & Geologists

LOG OF TEST PIT 7
PROPOSED EAKLE RESERVOIR
4720 HARDIN ROAD
SAINT HELENA, CALIFORNIA

PLATE
11

Proj. No: S2007.01 Date: 11/20 App'd by: AJD




LITHOLOGY

1) 0.0-2.0'; SANDY CLAY (CL); mottled orange, brown, and gray, moist, very stiff, medium plasticity. (RESIDUAL SOIL)

3) 2.0'-6.0'; SHALE; olive brown, soft to slightly hard, friable to moderately strong, highly weathered, fractured to 4 feet. (BEDROCK)

PJC & Associates, Inc.
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LOG OF TEST PIT 8
PROPOSED EAKLE RESERVOIR
4720 HARDIN ROAD
SAINT HELENA, CALIFORNIA

PLATE
12

Proj. No: S2007.01 Date: 11/20 App'd by: AJD

| MAJOR DIVISIONS | | | | | TYPICAL NAMES |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS<br>More than half is larger than #200 sieve | GRAVELS<br>more than half coarse fraction is larger than no. 4 sieve size | CLEAN GRAVELS WITH LITTLE OR NO FINES | GW | | WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES |
| | | | GP | | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES |
| | | GRAVELS WITH OVER 12% FINES | GM | | SILTY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES |
| | | | GC | | CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES |
| | SANDS<br>more than half coarse fraction is smaller than no. 4 sieve size | CLEAN SANDS WITH LITTLE OR NO FINES | SW | | WELL GRADED SANDS, GRAVELLY SANDS |
| | | | SP | | POORLY GRADED SANDS, GRAVEL-SAND MIXTURES |
| | | SANDS WITH OVER 12% FINES | SM | | SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES |
| | | | SC | | CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES |
| FINE GRAINED SOILS<br>More than half is smaller than #200 sieve | SILTS AND CLAYS<br>LIQUID LIMIT LESS THAN 50 | | ML | | INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, VERY FINE SANDS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | CL | | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS OR LEAN CLAYS |
| | | | OL | | ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS<br>LIQUID LIMIT GREATER THAN 50 | | MH | | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| | | | CH | | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | OH | | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| HIGHLY ORGANIC SOILS | | | Pt | | PEAT AND OTHER HIGHLY ORGANIC SOILS |

## KEY TO TEST DATA

LL — Liquid Limit (in %)
PL — Plastic Limit (in %)
G — Specific Gravity
SA — Sieve Analysis
Consol — Consolidation

■ "Undisturbed" Sample
☒ Bulk or Disturbed Sample
□ No Sample Recovery

| | Shear Strength, psf | Confining Pressure, psf | |
|---|---|---|---|
| *Tx | 320 | (2600) | Unconsolidated Undrained Triaxial |
| Tx CU | 320 | (2600) | Consolidated Undrained Triaxial |
| DS | 2750 | (2000) | Consolidated Drained Direct Shear |
| FVS | 470 | | Field Vane Shear |
| *UC | 2000 | | Unconfined Compression |
| LVS | 700 | | Laboratory Vane Shear |

Notes: (1) All strength tests on 2.8" or 2.4" diameter sample unless otherwise indicated
(2) * Indicates 1.4" diameter sample

## ROCK TYPES

 Conglomerate

 Shale

 Metamorphic Rocks
Hydrothermally Altered Rocks

 Sandstone

 Sheared Shale Melange

 Igneous Rocks

 Meta-Sandstone

 Chert

| Bedding Thickness | | Joint, Fracture or Shear Spacing | |
|---|---|---|---|
| Massive | Greater than 6 feet | Very Widely Spaced | Greater than 6 feet |
| Thickly Bedded | 2 to 6 feet | Widely Spaced | 2 to 6 feet |
| Medium Bedded | 8 to 24 inches | Moderately Widely Spaced | 8 to 24 inches |
| Thinly Bedded | 2-1/2 to 8 inches | Closely Spaced | 2-1/2 inches |
| Very Thinly Bedded | 3/4 to 2-1/2 inches | Very Closely Spaced | 3/4 to 2-1/2 inches |
| Closely Laminated | 1/4 to 3/4 inches | Extremely Closely Spaced | Less than 3/4 Inch |
| Very Closely Laminated | Less than 1/4 inch | | |

## HARDNESS

Soft - Pliable, can be dug by hand

Slightly Hard - Can be gouged deeply or carved with a pocket knife

Moderately Hard - Can be readily scratched by a knife Blade; Scratch leaves heavy trace of dust and is readily visible after the powder has been blown away

Hard - Can be scratched with difficulty; scratch produced little powder and is faintly visible

Very Hard - cannot be scratched with pocket knife, leaves metallic streak

## STRENGTH

Plastic- Capable of being molded by hand

Friable - Crumbles by rubbing with fingers

Weak - an unfractured specimen of such material will crumble under light hammer blows

Moderately Strong - Specimen will withstand a few heavy hammer blows before breaking

Strong - Specimen will withstand a few heaving ringing hammer blows and usually yields large fragments

Very Strong - Rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

## DEGREE OF WEATHERING

Highly Weathered - Abundant fractures coated with oxides, carbonates, sulphates, mud, etc., through discoloration, rock disintegration, mineral decomposition

Moderately Weathered - Some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition

Slightly Weathered - A few stained fractures, slight discoloration, little to no effect on cementation, no mineral decomposition

Fresh - Unaffected by weathering agents, no appreciable charge with depth

# APPENDIX C
# LABORATORY INVESTIGATION

## 1. INTRODUCTION

This appendix includes a discussion of test procedures and results of the laboratory investigation performed for the proposed project. The investigation program was carried out by employing currently accepted test procedures of the American Society of Testing and Materials (ASTM).

Disturbed samples used in the laboratory investigation were obtained during the course of the field investigation as described in Appendix A of this report. Identification of each sample is by test pit number and depth.

## 2. INDEX PROPERTY TESTING

In the field of soil mechanics and geotechnical engineering design, it is advantageous to have a standard method of identifying soils and classifying them into categories or groups that have similar distinct engineering properties. The most commonly used method of identifying and classifying soils according to their engineering properties is the Unified Soil Classification System described by ASTM D-2487-83. The USCS is based on a recognition of the various types and significant distribution of soil characteristics and plasticity of materials.

The index properties tests discussed in this report include the determination of natural water content, Atterberg limits and grain-size distribution tests.

a. Natural Water Content. Natural water content was determined on selected disturbed samples. The samples were extruded, visually classified, and accurately weighed to obtain wet weight. The samples were then dried, in accordance with ASTM D-2216-80, for a period of 24 hours in an oven maintained at a temperature of 100 degrees C. After drying, the weight of each sample was determined and the moisture content calculated. The water content results are summarized on the test pit logs, Plates 5 through 12.

b. Atterberg Limits Determination. The liquid and plastic limits of selected soil samples were determined by air drying and breaking down the sample. The results of the limits are shown on Plate 15.

c. Grain-Size Distribution. The gradation characteristics of selected samples were determined in accordance with ASTM D422-63. The samples were soaked in water until individual soil particles were separated and then washed on the No. 200 mesh sieve. That portion of the material retained on the No. 200 mesh sieve was

oven-dried and then mechanically sieved. The results of the grain-size distribution tests are presented on Plates 16 and 17.

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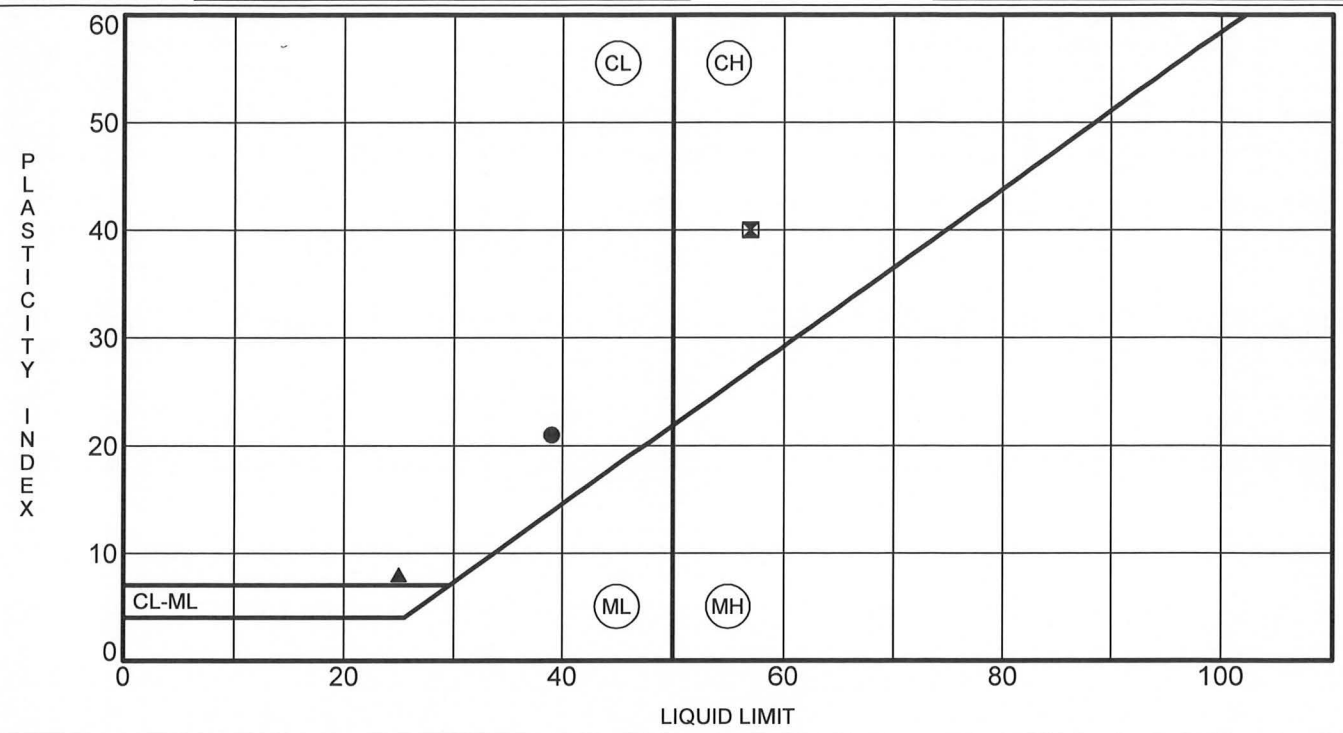
# ATTERBERG LIMITS' RESULTS
# PLATE 15

**CLIENT** BRENT EDWARDS **PROJECT NAME** PROPOSED EAKLE RESERVOIR

**PROJECT NUMBER** S2007.01 **PROJECT LOCATION** 4720 HARDIN ROAD SAINT HELENA, CA.




| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | **BULK** | **0.0** | **39** | **18** | **21** | **77** | **DARK YELLOW BROWN SANDY CLAY (CL)** |
| ⊠ | **TP-1** | **3.0** | **57** | **17** | **40** | | **OLIVE BROWN SANDY CLAY (CH)** |
| ▲ | **TP-6** | **1.0** | **25** | **17** | **8** | | **BROWN SANDY CLAY (CL)** |

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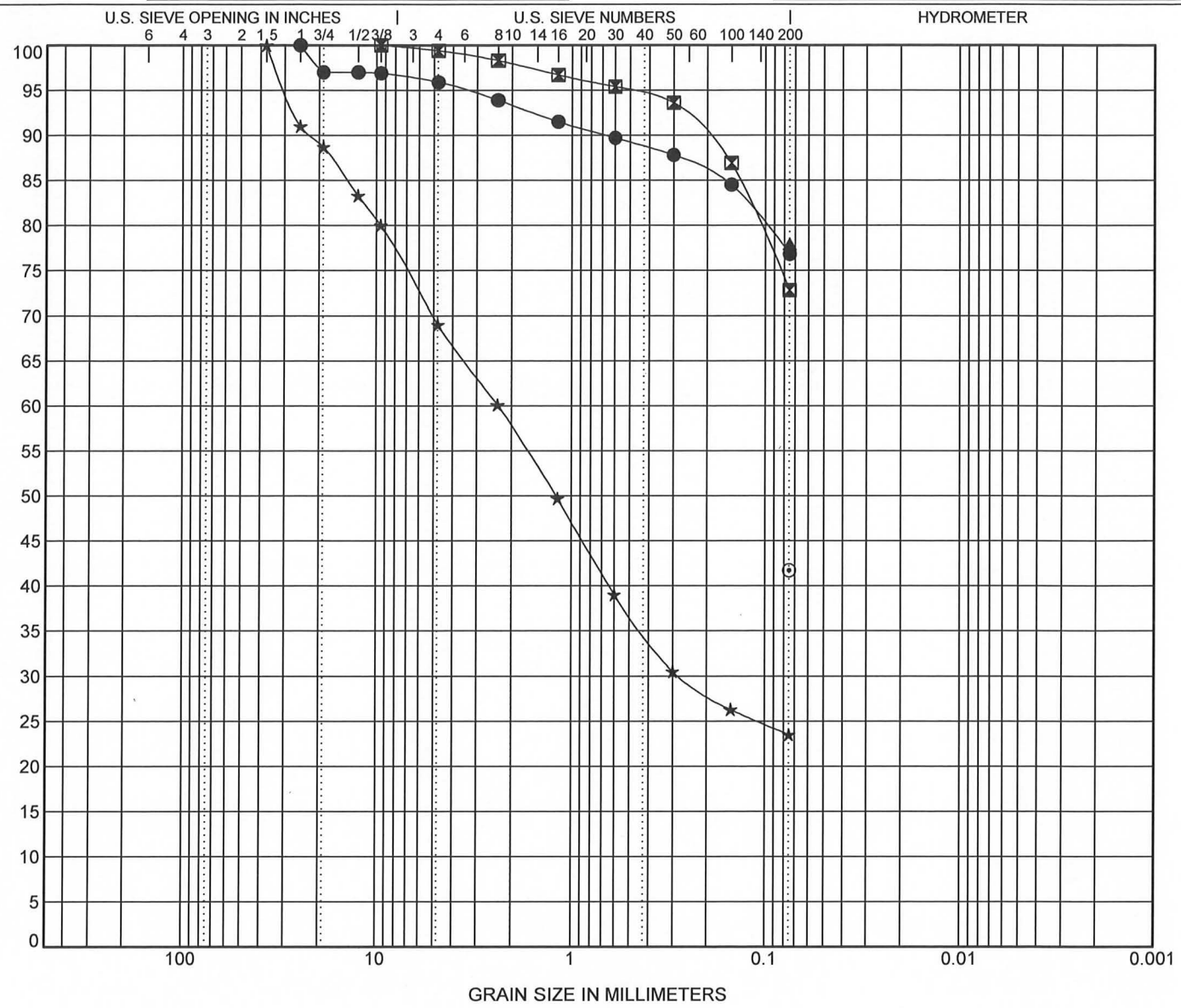
# GRAIN SIZE DISTRIBUTION
# PLATE 16

**CLIENT** BRENT EDWARDS **PROJECT NAME** PROPOSED EAKLE RESERVOIR

**PROJECT NUMBER** S2007.01 **PROJECT LOCATION** 4720 HARDIN ROAD SAINT HELENA, CA.




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | BULK | 0.0 | DARK YELLOW BROWN SANDY CLAY (CL) | 39 | 18 | 21 | | |
| ⊠ | TP-1 | 5.0 | DARK YELLOWISH BROWN SANDY CLAY (CH) | | | | | |
| ▲ | TP-1 | 9.0 | ORANGE BROWN W/ GRAY MOTTLING SANDY CLAY (CH) | | | | | |
| ★ | TP-2 | 2.0 | BROWN CLAYEY SAND (SM) | | | | | |
| ⊙ | TP-3 | 5.0 | DARK YELLOWISH BROWN CLAYEY GRAVEL (GC) | | | | | |

| Specimen Identification | | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | BULK | 0.0 | 25 | | | | 4.1 | 19.1 | 76.8 | |
| ⊠ | TP-1 | 5.0 | 9.5 | | | | 0.6 | 26.6 | 72.8 | |
| ▲ | TP-1 | 9.0 | 0.075 | | | | | | 77.9 | |
| ★ | TP-2 | 2.0 | 37.5 | 2.344 | 0.276 | | 31.0 | 45.5 | 23.5 | |
| ⊙ | TP-3 | 5.0 | 0.075 | | | | | | 41.7 | |

GRAIN SIZE - GINT STD US LAB.GDT - 12/1/20 13:23 - C:\PROGRAM FILES (X86)\GINT\PROJECTS\S2007.01 4720 HARDIN ROAD.GPJ

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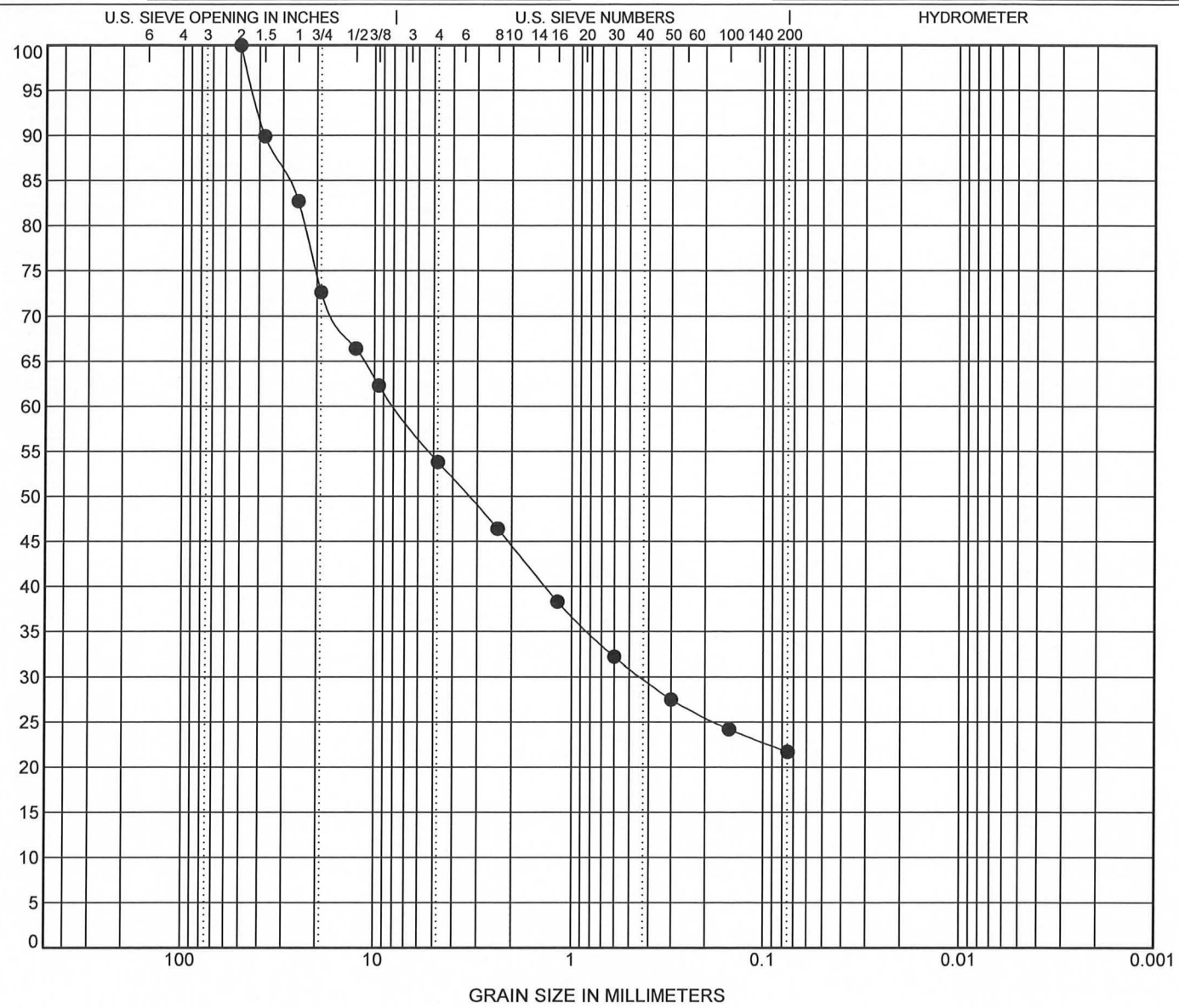
# GRAIN SIZE DISTRIBUTION
# PLATE 17

**CLIENT** BRENT EDWARDS **PROJECT NAME** PROPOSED EAKLE RESERVOIR

**PROJECT NUMBER** S2007.01 **PROJECT LOCATION** 4720 HARDIN ROAD SAINT HELENA, CA.




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● TP-6 | 5.0 | DARK BROWN CLAYEY GRAVEL (GC) | | | | | |

| Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|
| ● TP-6 | 5.0 | 50 | 7.875 | 0.434 | | 46.2 | 32.1 | 21.7 | |

## APPENDIX D
## REFERENCES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