RECLAMATION DISTRICT NO. 1601
TWITCHELL ISLAND
BOARD OF TRUSTEES MEETING
TUESDAY, AUGUST 16, 2022
9:00 AM
ENGINEER'S REPORT

I. AB 360 DELTA LEVEE SUBVENTIONS PROGRAM

A. Review Geotechnical Report from adjacent setback levee and proposed borrow area that was never investigated due to DWR decision.

EXHIBIT A: Geotechnical Report from Neal O Anderson for Levee Improvement Projects along Sevenmile Slough.

EXHIBIT B: Borrow Site Base Map

II. AB 360 DELTA LEVEE SUBVENTIONS PROGRAM

A. Review Base Map showing compliance with Bulletin 192-82 Standard.

EXHIBIT C: Bulletin 192-82 Compliance Base Map from DRAFT 5-year plan.

III. DISTRICTS DRAINAGE PUMP STATIONS

A. Review status to replace motor and pump for Pump No 2.

IV. PLAN REVIEW FOR CARTERS PROPOSED DOCK IN SEVENMILE SLOUGH

A. Review Rick & Linda Carters application for a proposed dock along Sevenmile Slough in front of their residence and seek authorization to approve from the Board of Trustees.

EXHIBIT D: Application and Plan from Rick & Linda Carter

EXHIBIT A

GEOTECHNICAL SERVICES REPORT

SEVENMILE SLOUGH SITES 1, 2, & 3 LEVEE IMPROVEMENTS

TWITCHELL ISLAND

SACRAMENTO COUNTY, CALIFORNIA

REPORT PREPARED FOR:

RECLAMATION DISTRICT 1601

OUR PROJECT NUMBER: LFG-0229

AUGUST 8, 2007

902 Industrial Way • Lodi, CA 95240 • 209.367.3701 • Fax 209.333.8303

NEIL O. ANDERSON
AND ASSOCIATES

GEOTECHNICAL
ENVIRONMENTAL
INSPECTIONS & TESTING
LABORATORY SERVICES
POOL ENGINEERING
POST TENSION DESIGN

August 8, 2007
Our Project Number: LFG-0229

Reclamation District 1601
c/o Jerry Hadley, KSN, Inc.
P.O. Box 844
Stockton, CA 95201-0844

Subject: **Geotechnical Services Report**
Sevenmile Slough Sites 1, 2, & 3 Levee Improvements
Twitchell Island
Sacramento County, California

Dear Mr. Hadley:

The following report presents the findings and conclusions of our geotechnical services performed at the subject site. The purpose of our services was to provide recommendations for the improvements to the existing levee as indicated in our proposal dated September 7, 2006 and accepted October 17, 2006. Recommendations for this project have been provided in the body of the report. Coordination between our office and your grading contractor will help reduce the potential for soil related problems.

Key information regarding this geotechnical services report is presented on the following page. This information sheet has been provided to aid you in assessing the limitations of this geotechnical investigation as well as to indicate when additional information from our office may be required.

We appreciate the opportunity of working with you on this project and look forward to providing our services in the future. Please contact us if you have any questions.

Sincerely,
NEIL O. ANDERSON & ASSOCIATES, INC.

Patrick C. Dell, Principal
Geotechnical Engineer 2186

REGISTERED PROFESSIONAL ENGINEER
PATRICK CRAIG DELL
No. 42018
Exp. 3-31-08
CIVIL
STATE OF CALIFORNIA

AUG 0 8 2007

Troy M. Schiess, Project Engineer
Professional Engineer 71404

REGISTERED PROFESSIONAL ENGINEER
TROY M. SCHIESS
No. 71404
EXP. 12/30/07
CIVIL
STATE OF CALIFORNIA

AUG 0 8 2007

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KEY INFORMATON REGARDING YOUR GEOTECHNICAL REPORT

➢ *The Applicability of Geotechnical Reports is Limited*

Geotechnical reports are written to provide test results, observations, and professional opinions regarding a specific site for a specific project. Reports are tailored to the client and are influenced by each client's risk management strategies, economical constraints, and personal preferences. Since each report is a "custom fit" for a particular client, reports should not be transferred to anyone else without first consulting the geotechnical engineer.

Each geotechnical report considers only the construction information and site boundaries that existed at the time of the investigation. Modification of construction plans, such as a change in the shape, size, weight, location, or intended use of a project, nullifies the recommendations contained in the report, unless the geotechnical engineer indicates otherwise. A geotechnical report can not be used for an adjacent site. Time and money can often be saved by consulting with the geotechnical engineer when circumstances change from those which existed when the report was written.

➢ *Site Conditions Can Change*

The conditions which existed at the time of a geotechnical investigation can change. Investigations can only report conditions at a particular time and place and no guarantee exists to ensure that recommendations will apply after natural or man made changes occur. Examples of some possible changes include: earthquakes, floods, fluctuations in groundwater, construction on or *next* to the site, and the addition or removal of soil. In addition, even the mere passing of time can affect site conditions. Consult with the geotechnical engineer to verify site conditions have not changed since the geotechnical report was completed.

➢ *Geotechnical Findings Are Comprised Primarily of Professional Opinions*

Even if typical 6 inch borings were spaced 5 feet apart across an entire site (typical borehole spacings are on the order of at least 10's or 100's of feet apart), *less than one percent* of the soil or rock on the site would actually be explored. From this limited exploration, the geotechnical engineer is called on to provide an opinion regarding the subsurface conditions across the site, provide appropriate foundation recommendations, and predict the response of subsurface materials to numerous scenarios using information from samples that may or may not be representative of the entire site. Obviously, most of the geotechnical report is based on the professional opinion of the geotechnical engineer. The actual subsurface conditions may significantly differ from those which were encountered during the geotechnical investigation. Consequently, the most effective method of managing the risks associated with a project is to retain the geotechnical engineer who provided the report throughout construction of the project.

➢ *Contact Your Geotechnical Engineer When in Doubt*

Time, money, and confusion can all be saved by simple explanations at critical moments. Please contact your geotechnical engineer whenever there is any doubt regarding subsurface conditions or their effect on part or all of any project.

902 Industrial Way • Lodi, CA 95240 • 209.367.3701 • Fax 209.333.8303

GEOTECHNICAL SERVICES REPORT
SEVENMILE SLOUGH SITES 1, 2, & 3 LEVEE IMPROVEMENTS
TWITCHELL ISLAND
SACRAMENTO COUNTY, CALIFORNIA

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902 Industrial Way • Lodi, CA 95240 • 209.367.3701 • Fax 209.333.8303

August 8, 2007

GEOTECHNICAL SERVICES REPORT

SEVENMILE SLOUGH SITES 1, 2, & 3 LEVEE IMPROVEMENTS

TWITCHELL ISLAND

SACRAMENTO COUNTY, CALIFORNIA

OUR PROJECT NUMBER: LFG-0229

1.0 INTRODUCTION

This report presents the findings, conclusions, and recommendations of our geotechnical services performed for the proposed improvements to the levee along Sevenmile Slough Road on Twitchell Island in Sacramento County, California.

We understand that the proposed project will involve raising and widening the existing levee between stations 174+50 and 191+50 (Site 3) and stations 278+20 and 300+00 (Site 1). The existing road on top of the levee in these sections narrows down to only one lane. The levee crown in these areas will be raised about 1 to 3 feet above the existing levee crown. In addition, the centerline of the levee will be shifted towards the landside of the existing levee. The widened levee will have a 2:1 (2 Horizontal to 1 Vertical) waterside slope and a 3:1 landside slope. The improvements will involve placement of up to about 13 feet of fill in some areas of the improvements. Sevenmile Slough Road will be constructed on top of this widened levee, just as it is now on top of the existing levee. The new levee crown will be about 30 feet wide.

In addition to the widening of the levee for Sites 1 and 3, a new levee will be constructed between existing stations 200+60 and 222+00 (Site 2). The existing section of Twitchell Island Road in this area is steeply banked, narrow, and involves sharp and blind curves. The new levee will cut across an existing agricultural field and help to straighten the road. The top of the new levee will be about 13 feet above the existing ground surface. The waterside slope will have a slope of 2:1 and the landside slope will have a 3:1 slope. The levee crown will be 30 feet wide and Sevenmile Slough Road will be constructed on top of the new section of levee. The ends of this new levee will tie into the existing Sevenmile Slough Road.

The approximate locations of the proposed levee improvement are shown on Plates 1a, 1b, and 1c.

The geotechnical study conducted at this site was prepared for the use of the district engineer for application to the design of the grading plans for the levee improvements and new levee in accordance with generally accepted geotechnical engineering practices. No warranty is expressed or implied. This report presents the results of this study.

2.0 GENERAL GEOLOGIC CONDITIONS

A geologic map of the area was reviewed and indicated the surface soils are described as Holocene Age Intertidal Deposits of mud and peat. The site is located in Seismic Zone 4[1]. The closest active Class B fault is the Greenville fault zone located a distance of 29 kilometers from Site 1. The UBC currently considers **non**-blind thrust faults for seismic design parameters. The closest Class A fault is the Hayward fault located at a distance of 58 kilometers[2] from Site 1.

The California Geological Survey assigns a probabilistic (10% probability of exceeding that motion in a 50 year period) peak horizontal ground acceleration for surface soil at the site of 0.355g based on longitude and latitude coordinates[3]. A liquefaction evaluation was outside the scope of our services, however, due to the moderate site acceleration, the soil types encountered in our borings, high groundwater, and loose soil conditions, the potential for seismically induced surface distress is considered high.

No structures will be constructed as part of this project but the following is a table of the 2001 California Building Code Soil Parameters[2] which may be used if needed for design at the subject sites:

2001 CALIFORNIA BUILDING CODE SEISMIC DESIGN PARAMETERS	
Seismic Zone 4, Z	0.40
Soil Type, S	S_E
Seismic Source Type	B
Seismic Coefficient, Ca	0.44
Seismic Coefficient, Cv	0.64

[1] California Building Code, 2001 Edition, International Conference of Building Officials, Whittier, CA
[2] Blake, T.F., 1998a, UBC Seismic Version 1.03
[3] http://www.consrv.ca.gov/cgs/rghm/pshamap/psha12138.html

3.0 Site Conditions and Levee Geometry and Dredger Spoils

The levees along Sevenmile Slough were constructed by farmers over the last century or more. The levees in the delta were historically constructed by farmers simply pushing up soil to create the levees as well as by using dredged spoils. These levees were not constructed to typical engineering standards in use today. Fill was loosely placed with no or minimal compaction. Foundation soils were not excavated to firm, stable soil before placing fill. Many delta levees have continued to settle over the years due to the soft and highly compressible organic silt and peat soils underlying many of the levees. The approximate locations of the proposed levee improvement are shown on Plates 1a, 1b, and 1c.

At the time of our investigation, Sites 1 and 3 consisted of Sevenmile Slough Road, an asphalt concrete paved road on top of the levee. Site 2 consisted of an open pasture field adjacent to Sevenmile Slough Road. Sevenmile Slough is a shallow waterway with virtually no flow as the water elevation is controlled by gates/pipes at either end. The road is located on the south side of Sevenmile Slough.

The existing levee configurations and elevations cited in this report are based on survey and topographic information provided to us by KSN, Inc. on drawings dated August, 2006.

Within Site 1, a portion of the levee road narrowed down to one lane of traffic only. The crown of the road sloped towards the landside. Numerous cracks in the pavement surface were visible indicating settlement of the levee had occurred. The levee crown along Site 1 varied in elevation from about 6 to 8 feet above mean sea level (MSL). The toe of the levee varied in elevation from about -5 to -14 above MSL along this section of the levee. The waterside slope was nearly vertical in many locations due to erosion of the slope. In other areas, the waterside slope was inclined at a slope of about 2:1. The landside slope along this site was inclined at slopes of about 2:1 to 3:1. Agricultural fields with crops bordered Site 1 on the landside. Several trees along the toe of the existing levee will be removed as part of this project. Also, a siphon pipe will be relocated.

At Site 2, the existing ground is relatively flat. The land is currently used for grazing cattle. This area is also flood irrigated to grow grass for the cattle. A gas well is present near the western end of the proposed cut across levee. A moderate to heavy growth of low grass was present in the field at the time of our field explorations. The existing ground surface elevation at Site 2 varied between about 3 and -4 feet above MSL. An existing siphon pipe will be relocated as part of this project. The new levee will tie into the existing levee at each end.

At Site 3, a portion of the road also narrowed to only one lane. There were several areas of noticeable settlement of the road. Portions of the waterside slope were nearly vertical due to erosion. The landside slope along Site 3 varied from about 2:1 to 4:1. The crown of the levee varied from an elevation of about 6 to 8 feet above MSL along Site 3. The toe of the levee along Site 3 varied from an elevation of about 2 to -2 above MSL. The levee crown sloped towards the landside all along Site 3. Several rural single family homes and associated outbuildings were present near the toe of the slope along Site 3. An orchard and agricultural fields were also present along the landside toe of Site 3. Some of these outbuildings will be relocated as part of this project along with several siphon pipes through the existing levee. Several trees will also be removed as part of this project.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

The field investigation conducted at this site consisted of drilling three exploratory test holes at each site (for a total of 9 borings) carried to depths of about 40 feet below the existing ground surface or levee crown. The test holes were drilled with a truck mounted Mobile B53 drill rig, utilizing the mud rotary drilling method. The locations of the test holes are shown on the Boring Location Maps, Plates No. 1a, 1b, and 1c. The locations of the test holes were determined by pacing from existing site features; hence, accuracy can be implied only to the degree that this method warrants.

Sampling of the drilled test holes was performed at various depths using a California Modified 2.5 inch o.d. split spoon sampler with stainless steel tube liners or an unlined Standard Penetration Sampler. The samplers were driven by a 140 pound hammer with a 30-inch drop. Blow counts required to drive the samplers every 6 inches for a total of 18 inches were recorded. The blow counts for the drilled test holes were corrected from an energy efficiency of approximately 45 percent to a standard cat head efficiency of approximately 60 percent.

Soil samples obtained from the test holes were preserved in stainless steel tubes or sealed in plastic baggies until the samples could be tested in the laboratory. Samples were taken to the laboratory of Neil O. Anderson & Associates, Inc., Lodi, California and used for performing various laboratory tests. Tests performed consisted of unit weights, moisture contents, unconfined compressive strength, gradation analyses, consolidation, Atterberg Limits, and organic content. A summary of the test results are presented on the Log of Boring sheets, Plates 2 through 10.

5.0 SOIL CONDITIONS

Visual classification of each soil stratum encountered according to ASTM D2488 (Visual – Manual Procedure) was made in the field by a representative from our office at the

time the test holes were drilled. The samples obtained were checked in the laboratory by a geotechnical engineer and classification verified according to ASTM D2487. A classification and graphical representation of each soil encountered is presented on the Log of Boring sheets. The test boring legend is presented on Plate No. 11.

The soils encountered during our field investigation varied at each boring and site. A summary of the soils conditions encountered at each boring location is presented below.

At Site 1, in general, the soils consisted of soft clay and silt soils that extended to the maximum depths explored. A few layers of silty sand were encountered in our borings. A more detailed description follows. Boring 4 was drilled near station 294+75 on the south side of the pavement. The upper soils encountered in this boring consisted of stiff to very stiff sandy silt that made up the levee and that extended to a depth of about 10 feet below the top of the levee (btl). This material was underlain by medium stiff to stiff clayey silt with some organics that extended to a depth of 20 feet btl. This soil was underlain by very loose to loose silty sand and soft sandy silt that extended to the maximum depth explored. At boring B5, drilled near station 286+50, the upper levee fill soils consisted of medium stiff to stiff sandy silt that extended to a depth of about 14 feet btl. This soil was underlain by soft to medium stiff organic and sandy silt and silt with peat that extended to a depth of 38½ feet btl. The silt was underlain by very loose silty sand that extended to the maximum depth explored. At boring B6, drilled near station 281+00, the upper levee fill soils consisted of medium stiff to stiff sandy silt and loose silty sand that extended to a depth of about 7 feet btl. These soils were underlain by soft to medium stiff silty clay with a trace of peat that extended to a depth of about 18 feet btl. The clay soil was underlain by very soft sandy silt that extended to the maximum depth explored.

At Site 2, in general the soils consisted mainly of silty sands that extended to the maximum depths explored with an occasional layer of sandy silt and clay. A more detailed description of the soils encountered follows. At boring B1 was drilled near station 2+20 of the new road. The surface soils consisted of medium dense silty sand and gravel fill that extended to a depth of about 6 feet below the existing ground surface (bgs). This fill was likely placed as part of the access road constructed for the nearby gas well located about 400 feet southeast of boring B1. The fill soils were underlain by a layer of medium stiff to stiff silty clay that extended to a depth of 9 feet bgs. The clay was underlain by very loose to loose silty sand that extended to a depth of 14 feet bgs. This was underlain by a 5 foot thick layer of soft to medium stiff sandy silt. The silt was underlain by medium dense sand with silt and sand that extended to the maximum depth explored. At boring B2 drilled near station 7+10, the soils encountered consisted of medium dense silty sand that extended to a depth of about 28½ feet bgs. Medium dense to dense sand with silt extended then to the maximum

depth explored. At boring B3 drilled near station 11+50, the near surface soils consisted of stiff to very stiff sandy silt that extended to a depth of 4 feet bgs. This soil was underlain by layers of medium dense silty sand and sand with silt that extended to the maximum depth explored.

At Site 3, the soils varied significantly between borings. At boring B7 was drilled near station 189+00. The near surface soils consisted of loose to medium dense silty sand that extended to a depth of 4 feet btl. These soils were underlain by medium stiff sandy silt that extended to a depth of 15 btl. This silt soil was underlain by soft sandy silt that extended to a depth of 30 feet btl. Then very loose to medium dense silty sand and sand with silt were encountered to the maximum depth explored. At boring B8, drilled near station 183+50, the upper soils consisted of medium dense silty sand that extended to a depth of about 4 feet btl. The sandy soils were underlain by soft sandy silt that extended to a depth of 25 feet btl. The silt was underlain by very loose to medium dense silty sand and sand with silt that extended to the maximum depth explored. At boring B9, drilled near station 177+50, the upper 4 feet consisted of loose to medium dense silty sand or medium stiff sandy silt. A layer of medium dense silty sand then extended to a depth of 8½ feet btl. Below this soil medium stiff organic silty clay was encountered that extended to a depth of 19 feet btl. This soil was underlain by soft to medium stiff sandy silt that extended to a depth of 40 feet btl. Very loose sand extended to the maximum depth explored.

For additional detailed descriptions of the soils encountered in the test holes see the Logs of Boring sheets.

Test hole logs show subsurface conditions at the date and location indicated and it is not warranted that they are representative of subsurface conditions at other locations and times.

The depth to groundwater was not able to be measured because of the mud rotary drilling method. However, groundwater is expected to be relatively close to the ground surface for Site 2. We also expect the groundwater to be near the existing ground surface at the toe of the levees along Sites 1 and 3 and within the levee sections near the water surface elevation in the adjacent slough. Groundwater conditions in the future could change due to rainfall, water elevation in the adjacent slough, construction activities, irrigation, or other factors. The evaluation of these factors is beyond the scope of this study.

6.0 SLOPE STABILITY ANALYSIS

The stability of the proposed levee improvements were analyzed using the computer program STABL. Assumed soil strength parameters were used in our analysis for the

engineered fill. These values will need to be verified during construction of the levee improvements for the engineered fill. One soil profile from Site 1 and Site 3 were analyzed for overall stability for both static and seismic conditions. Site 2 was not analyzed since the soils consist mainly of medium dense granular soils which should perform well under the levee. The soil parameters used in our analysis are presented in the following table.

Station/Site	Soil Type	Depth, ft.	Moist unit weight, pcf	Saturated unit weight, pcf	Cohesion, psf	Angle of internal friction, ^{0}
286+50, Site 1	Fill, sandy silt	0-15	65	92	250-500	10
	Sandy silt	15-20	50	85	250-500	10
	Sandy silt	20-25	70	100	250-500	10
	Sandy silt	25-40	50	85	250-500	10
	Silty Sand	40-41	100	120	50	30
	Engineered Fill		120	130	200	30
183+50, Site 3	Silty sand	0-4	110	125	100	30
	Sandy Silt	4-25	60	85	200-300	10
	Sand	25-30	105	120	50	35
	Silty sand	30-41	110	125	100	30
	Engineered Fill		120	130	200	30

Based on our analysis the levees should be stable with respect to global stability for the proposed slope configurations under static conditions. The levees will likely experience some failure in the event of a strong seismic event. This failure might be a stability failure or failure due to liquefaction of the underlying sandy and silty soils. The failure surface will likely occur in the soft soils within and underlying the levee and outside of the engineered fill placed as part of this project. The following table presents the results of our stability analysis for Sites 1 and 3. The ranges reflect the range of assumed strengths of the levee soils.

Site	Factor of Safety, static	Factor of Safety, seismic
1	1.37-2.2	0.77-1.28
2	1.45-2.00	0.80-1.15

7.0 DESIGN STUDIES AND RECOMMENDATIONS

From a soil engineering standpoint, our office concludes that the sites are suitable for construction of the proposed improvements to the levees and new levee, however, all of the conclusions and recommendations presented in this report should be incorporated into the design and construction to help reduce the potential for soil

related problems. We have several concerns for the levee improvements along Sevenmile Slough. One is the presence of organic silt and peat within the existing levees and most probably along side portions of the existing levees. These soils are compressible and fill placed over them will settle over a long period. A second concern is the potential for failure of the levees in the event of a strong seismic event either from a stability failure in the underlying soft soils or from liquefaction of the sandy and silty soils. Our recommendations for construction of the improvements and new levee are presented in the following sections.

7.1 Grading

The slopes and all areas to receive fill at all three sites should be initially cleared of all vegetation, trees, roots, debris, and deleterious material as outlined in Appendix A, Engineered Fill Specifications. This will require stripping a minimum of 6 inches from the slopes and areas to receive engineered fill. Voids resulting from the removal of any buried structures (such as irrigation structures or pipes, siphons, foundations, septic systems, etc.) should be cleaned of all loose soil and debris so that they may be backfilled during filling operations. All wells shall be abandoned in accordance with Sacramento County requirements. After clearing operations have been performed, the subgrade thus exposed shall be scarified a minimum of 12 inches and compacted as indicated in Appendix A. Fill placed within the new levee template sections should be placed as engineered fill as recommended in Appendix A.

Fill slopes should be constructed at inclinations no steeper than 3H:1V (Horizontal to Vertical.) We recommend a 3-to 5-foot deep toe key be constructed at the toe of the fill for Sites 1 and 3. The width of the key should be at least half the height of the vertical slope above it or a minimum of 6-feet wide. This key should be excavated a minimum depth of 3 feet into firm, stable soil.

At Site 2, as per California State Department of Water Resources (DWR) standard levee section, we recommend an inspection trench be constructed and be centered beneath the waterside hinge point of the levee crown. As per the DWR standard, this trench should be a minimum of 12 feet wide and 6 feet deep.

Depending on the depth to groundwater, this may require dewatering of the keyway areas to allow for construction of the keyways. The contractor should anticipate dewatering the keyway excavations at all sites. The keyways beneath Sites 1 and 3 should be inclined back towards the existing levee slope at an inclination of about 2 percent. The dewatering should extend to at least 3 feet below the bottom of the excavation. Depending on the soil and groundwater conditions encountered during grading, a deeper depth of dewatering may be required to provide a stable platform on which to construct the keyway.

During construction of the engineered fill at Sites 1 and 3, benches should be cut into the existing slope surface. The benches should be excavated at least 3 feet into firm, stable soil. The benches should be a minimum of 3 feet wide and should be constructed at vertical intervals of 5 feet or less. At the ends of the new levee for Site 2, the fill should be benched into the existing levee as recommended above.

Since most fill slopes are constructed with a loosely or poorly compacted surface, the fill slopes should be slightly overbuilt and trimmed back to firm, compacted soil. Runoff water should not be allowed to run over the slopes. Preventative maintenance of the slopes will reduce the potential for damage to the slopes from runoff.

Fill slopes should be covered with some type of erosion control measure immediately after construction. Erosion control measures can consist of erosion resistant vegetation, jute netting, or geotextile erosion control mats. These should be installed per the manufacturer's specifications. Some minor, relatively shallow erosion should be planned for. Routine maintenance will be required on the fill slopes. Any detected problems should be repaired immediately. It is important that the bottom of all fills be protected from erosion or undercutting that could jeopardize the integrity of the slope. Substantial slope failure could occur if the bottoms of the slopes are not protected from erosion.

We recommend that fill placement be limited to about 3 feet at one time in any one location in order to allow the excess pore pressure, which may build as fill is placed, to dissipate. If the pore pressures increase too much, failure of the underlying foundation soils may occur as the fill is placed. The strength of the foundation soils will increase as the pore pressures dissipate and the soils consolidate under the weight of the fill. Depending on the soil conditions, dissipation of the excess pore pressures may take from 1 or 2 days up to 1 week. The increase and dissipation of excess pore pressures can be monitored by the installation of pore pressure transducers in the native soil beneath the proposed levee template sections. Once the pore pressures dissipate placement of additional fill can proceed. We can install and monitor this instrumentation during construction upon request.

7.2 Settlement

Based on a consolidation test performed on a sample from boring B4 and our experience with similar soils in the delta area, we estimate that the post construction settlement of the levee improvements at Sites 1 and 3 of Sevenmile Slough Road could range between 6 and 10 inches. We anticipate that the majority of the settlement should occur within the first 3 months following construction. However, some ongoing settlement of the levee will likely continue from secondary consolidation due to the soft

soils beneath these levees. This is typical for levees in the delta area. The amount of this settlement is unknown.

At Site 2, because of the predominantly sandy soils and lack of soft compressible soils encountered in our borings, we estimate the settlement of the new levee could range between 3 and 6 inches. We also anticipate the majority of this settlement to occur within the first 3 months following construction.

In order to reduce the potential for post construction settlement of the new and improved levees, we recommend that a geogrid such as Tensar BX1100 or equivalent be placed on the stripped ground surface prior to the placement of any engineered fill and a second layer within the engineered fill. In areas where a keyway is constructed, we recommend the geogrid be placed on the ground surface after the keyway is backfilled. A second layer of geogrid should be placed at about the mid-height of the fill. This second layer should help reduce the potential for differential settlement between the new section of levee and the existing levee. The geogrids should be lapped a minimum of 18 inches.

The geogrid should be placed according to the manufacturer's guidelines. The geogrid will also help provide stability to the base of the levee sections since groundwater is anticipated to be relatively close to the surface.

7.3 Winterization and Construction Equipment Mobilization

The fine grained soils located at these sites can trap moisture from winter rains or flood irrigation within the upper zones of the subgrade. Also, high groundwater is a concern for all 3 sites. These conditions are known to cause unstable "pumping" subgrade conditions which can hinder the movement of grading equipment if construction is occurring in the winter, fall or early spring. This should be taken into consideration when planning the site grading during wet conditions, our office can provide recommendations for subgrade stabilization. Also, each of the sites will need to be dewatered to allow for excavation and construction of the keyway trenches. The contractor should plan his work accordingly.

7.4 Excavation

As indicated previously, sandy, clayey, and silty soils were encountered in our test borings. Consequently, conventional excavating equipment may be utilized on this site. The contractor should plan his work accordingly.

7.5 Testing, Inspections and Review

Our office should be afforded the opportunity of reviewing the completed grading plans to verify that our recommendations have been properly interpreted and incorporated. Unless our office is allowed this opportunity, we disavow any responsibility from problems arising from failure to follow geotechnical recommendations or improper interpretation and implementation of our recommendations.

Our office should be retained to perform the recommended grading observations and compaction testing. We can also perform pore pressure monitoring if needed. Unless we have been retained to provide these services, our office cannot be held responsible for problems arising during or after construction that could have been avoided had these services been performed. The fees for these services are in addition to that associated with this report.

8.0 UTILITY CONSTRUCTION

Based on Occupational Safety and Health Standards, the majority of soils encountered in our test holes classify as Type C soils. Type C soils require a maximum slope of 1½:1 (horizontal to vertical) for excavations less than 20 feet deep. The contractor should have a competent person identify all soils encountered in excavation and refer to OSHA and Cal-OSHA standards to determine appropriate methods to protect individuals working in excavations.

Backfill placed in trenches should be placed in approximately 8 inch lifts in uncompacted thickness. However, thicker lifts may be used, provided the method of compaction is approved by the soil engineer and the required minimum degree of compaction is achieved. Material should be compacted to at least 90 percent of the maximum dry density obtained by the ASTM D1557 test method. The upper 8 inches of trench backfill within pavement areas should be compacted to at least 95 percent relative compaction.

9.0 LIMITATIONS

The recommendations of this report are based on the information provided regarding the proposed construction as well as the subsoil conditions encountered at the test hole locations. If the proposed construction is modified or re-sited, or if it is found during construction that subsurface conditions differ from those described on the test hole logs, the conclusions and recommendations of the report should be considered invalid unless the changes are reviewed and the conclusions and recommendations modified or approved in writing.

The analysis, conclusions and recommendations contained in this report are based on the site conditions as they existed at the time we drilled our test holes. It was assumed that the test holes are representative of the subsurface conditions throughout the site. If there is a substantial lapse of time between the submission of our report and the start of the work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse. This report is applicable only for the project and site studied. This report should not be used after 3 years.

Our professional services were performed, our findings obtained, and our recommendations proposed in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. Test findings and statements of professional opinion do not constitute a guarantee or warranty, expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the soil logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client.

APPENDIX A
Engineered Fill Specifications

SCOPE

Principal items of work included in this section are as follows:

A. Cleaning and Striping

B. Construction of Fill

A. CLEANING AND STRIPPING

Work includes cleaning and stripping of the building pad and surrounding area as indicated on the drawings. From this area remove all debris, irrigation lines, old pavement, trees, brush, roots, and vegetable ruin and grub out all large roots (1/2 inch or greater diameter) to a depth of at least two feet below the footing elevation. The vegetable materials and all materials from the cleaning operation shall be removed from the site.

B. CONSTRUCTION OF FILL

1. Preliminary Operations

   After the cleaning and stripping operation and the cuts have been completed and before any fill is placed in any particular area, the existing surface shall be scarified to a depth of 8 inches and compacted to dry densities in excess of 90 percent of the maximum dry density as obtained by the Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort, ASTM D1557 designation. The soil should be compacted at a moisture content between 1 and 3 percentage points above the optimum moisture content. It may be necessary to adjust the moisture content of the subgrade soil by watering or aeration, to bring the moisture content of the soil near optimum in order that the specified densities can be obtained.

2. Source of Material

   Engineered fill materials (on site or import) shall consist of sandy clay, silty clay, clayey silt, sandy silts, silty sands, or clayey sands. The engineered fill material shall not rocks or cobbles material. The engineered fill shall have 100 percent passing the 1-inch sieve. The material shall have at least 80 percent passing the No. 4 sieve and at least 20 percent passing the No. 200 sieve. The material shall have a minimum Plasticity Index of 8 and a maximum Plasticity Index of 15. The material shall have a maximum Liquid Limit of 45.

At least seven days prior to the placement of any fill, the engineer shall be notified of the source of materials. Samples of the proposed fill shall be obtained to determine the suitability of the materials for use as engineered fill.

3. Placing and Compacting

Fill materials shall be spread in layers and shall have a uniform moisture content that will provide the specified dry density after compaction. If necessary to obtain uniform distribution of moisture, water shall be added to each layer by sprinkling and the soil disked, harrowed, or otherwise manipulated after the water is added. The layers of the fill material shall not exceed 8 inches and each layer shall be compacted with suitable compaction equipment to provide the specified dry densities.

4. Required Densities

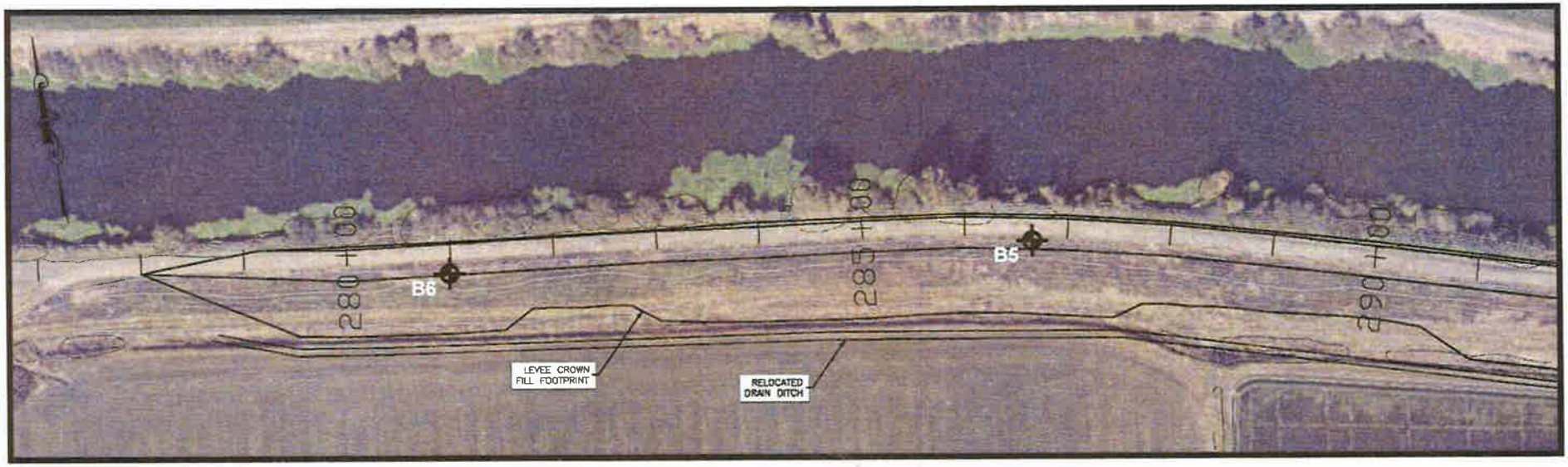
The dry density of the compacted earth shall be at least 90 percent of the maximum dry density obtainable by the ASTM D1557 test method. The optimum moisture content and maximum dry density will be determined by the engineer and this information supplied to the contractor.

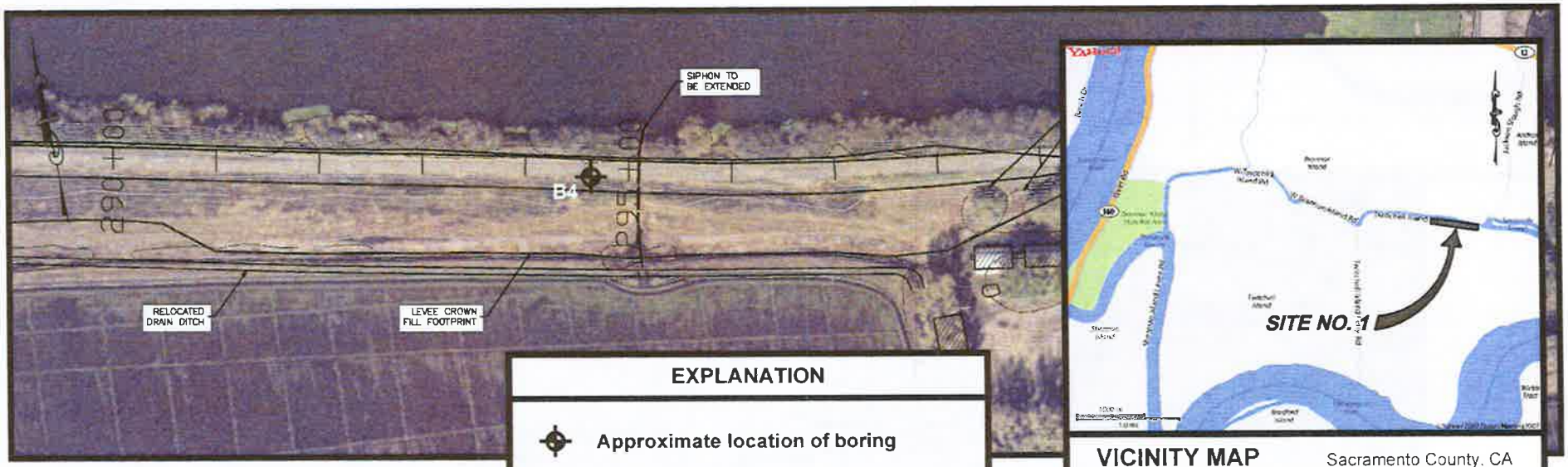
5. Seasonal Limits

No fill shall be placed during weather conditions which will alter the moisture content of the fill materials sufficiently to make adequate compaction impossible. After placing operations have been stopped because of adverse weather conditions, no additional fill material shall be placed until the last layer compacted has been checked and found to be compacted to the specified densities.

6. Control of Compaction

The density of the upper 6 inches of subgrade and of each layer of fill shall be checked by the engineer after each layer has been compacted. Field density tests shall be used to check the compaction of the fill materials. Sufficient tests shall be made on each layer by the engineer to assure adequate compaction throughout the entire area. If the dry densities are not satisfactory, the contractor will be required to increase the weight of the roller, the number of passes of the roller, or manipulate the moisture content as required to produce the specified densities.





EXPLANATION

⊕ Approximate location of boring

VICINITY MAP Sacramento County, CA

Base plan provided by KSN, Inc. Stockton, CA .

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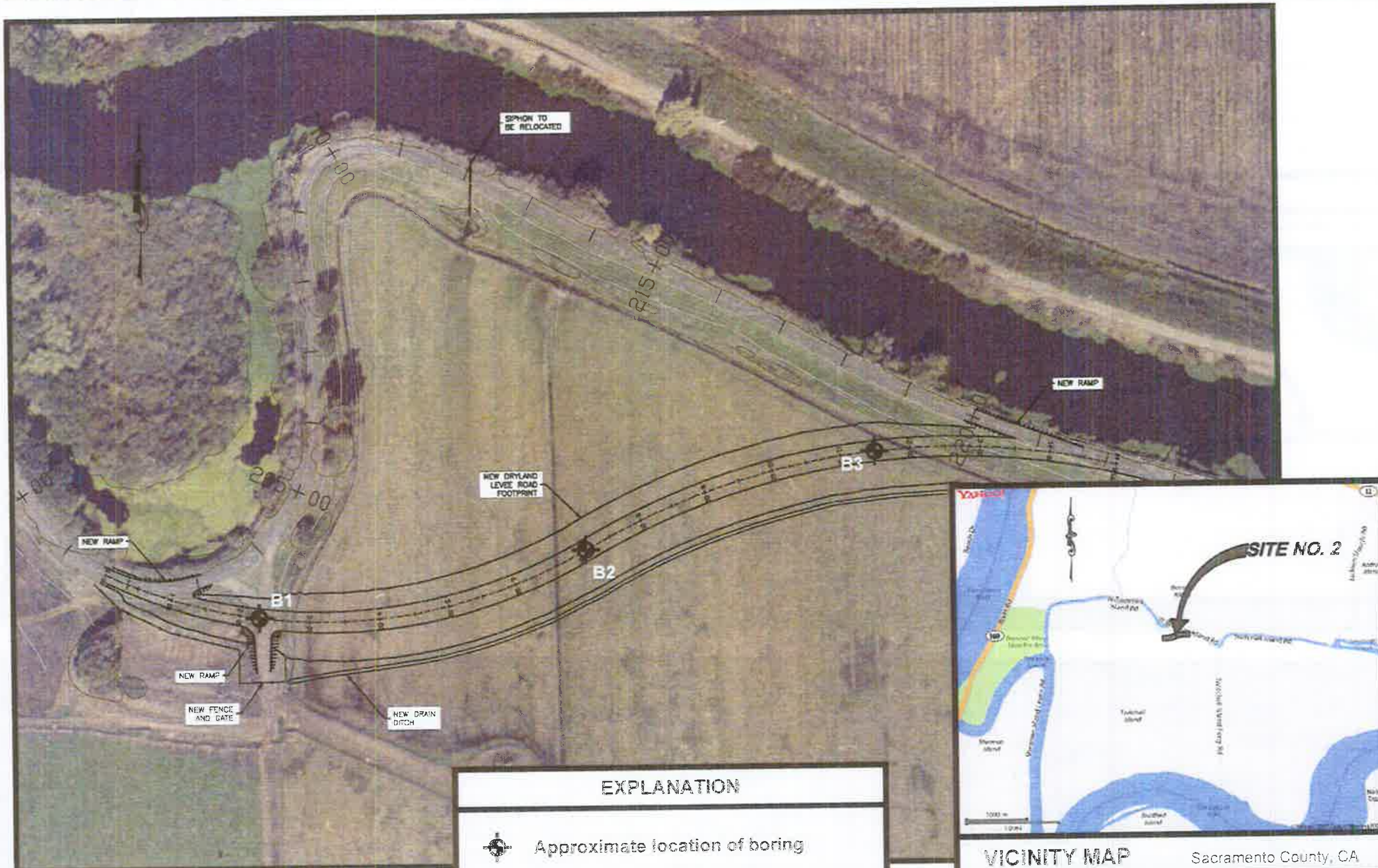
BORING LOCATION MAP
SITE No. 1

TWITCHELL ISLAND
7 MILE SLOUGH LEVEE IMPROVEMENTS
RECLAMATION DISTRICT NO. 1601
SACRAMENTO COUNTY, CA

DATE:	6/25/07
JOB NUMBER:	LFG-0224
SCALE:	NTS
DRAWN BY:	RC
CHECKED BY:	PD
PLATE:	1a



VICINITY MAP Sacramento County, CA

EXPLANATION

Approximate location of boring

Base plan provided by KSN, Inc. Stockton, CA.

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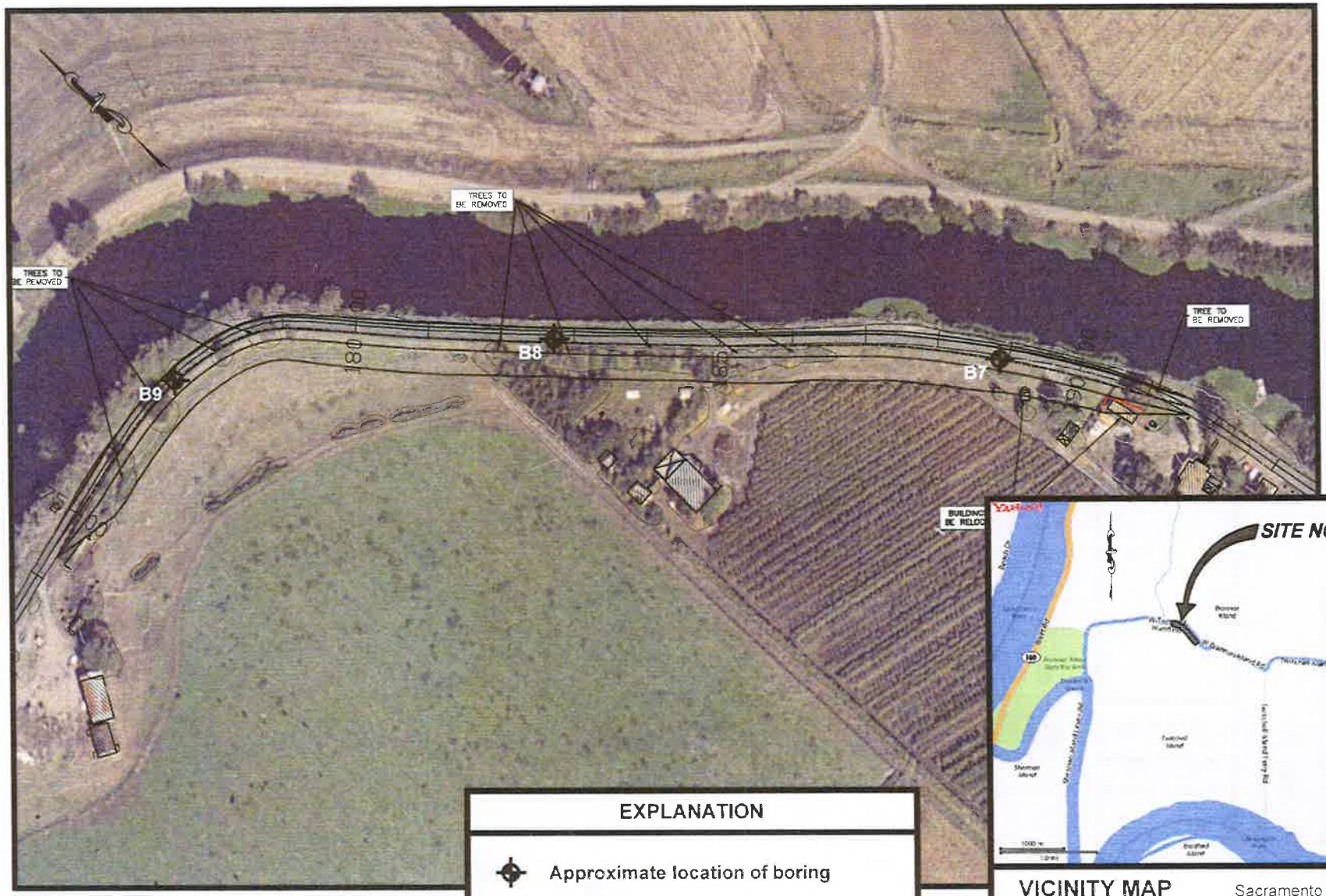
BORING LOCATION MAP
SITE No. 2

TWITCHELL ISLAND
7 MILE SLOUGH LEVEE IMPROVEMENTS
RECLAMATION DISTRICT NO. 1601
SACRAMENTO COUNTY, CA

DATE:	6/25/07
JOB NUMBER:	LFG-0224
SCALE:	NTS
DRAWN BY:	RC
CHECKED BY:	PD
PLATE:	1b



VICINITY MAP Sacramento County, CA

EXPLANATION
⌖ Approximate location of boring

Base plan provided by KSN, Inc. Stockton, CA .

NEIL O. ANDERSON AND ASSOCIATES

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BORING LOCATION MAP
SITE No. 3

TWITCHELL ISLAND
7 MILE SLOUGH LEVEE IMPROVEMENTS
RECLAMATION DISTRICT NO. 1601
SACRAMENTO COUNTY, CA

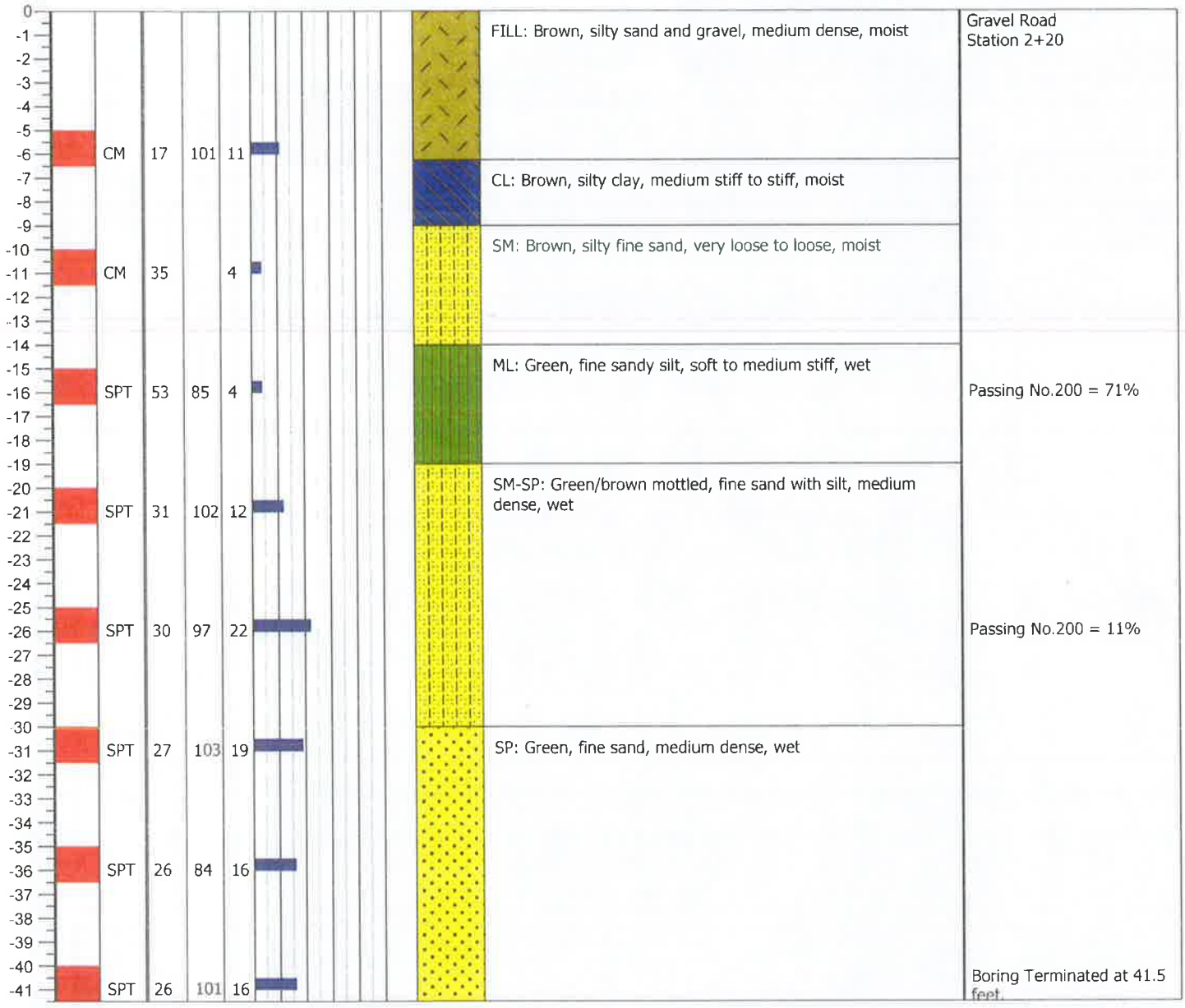
DATE:	6/25/07
JOB NUMBER:	LFG-0224
SCALE:	NTS
DRAWN BY:	RC
CHECKED BY:	PD
PLATE:	1c

Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B1

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1,2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer**

DATE DRILLED: **12-7-06**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 2

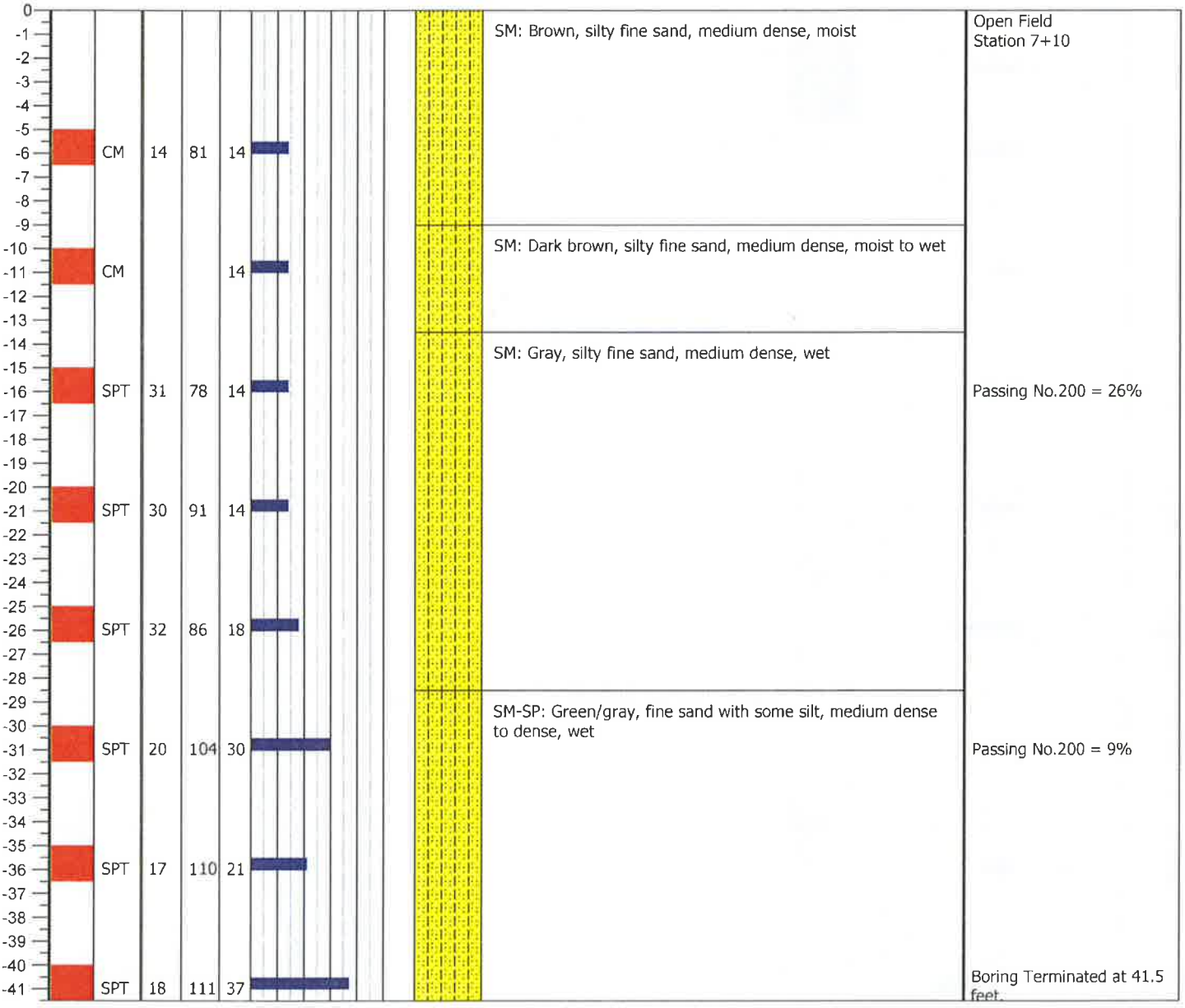


Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B2

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1,2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer**

DATE DRILLED: **12-8-06**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 3

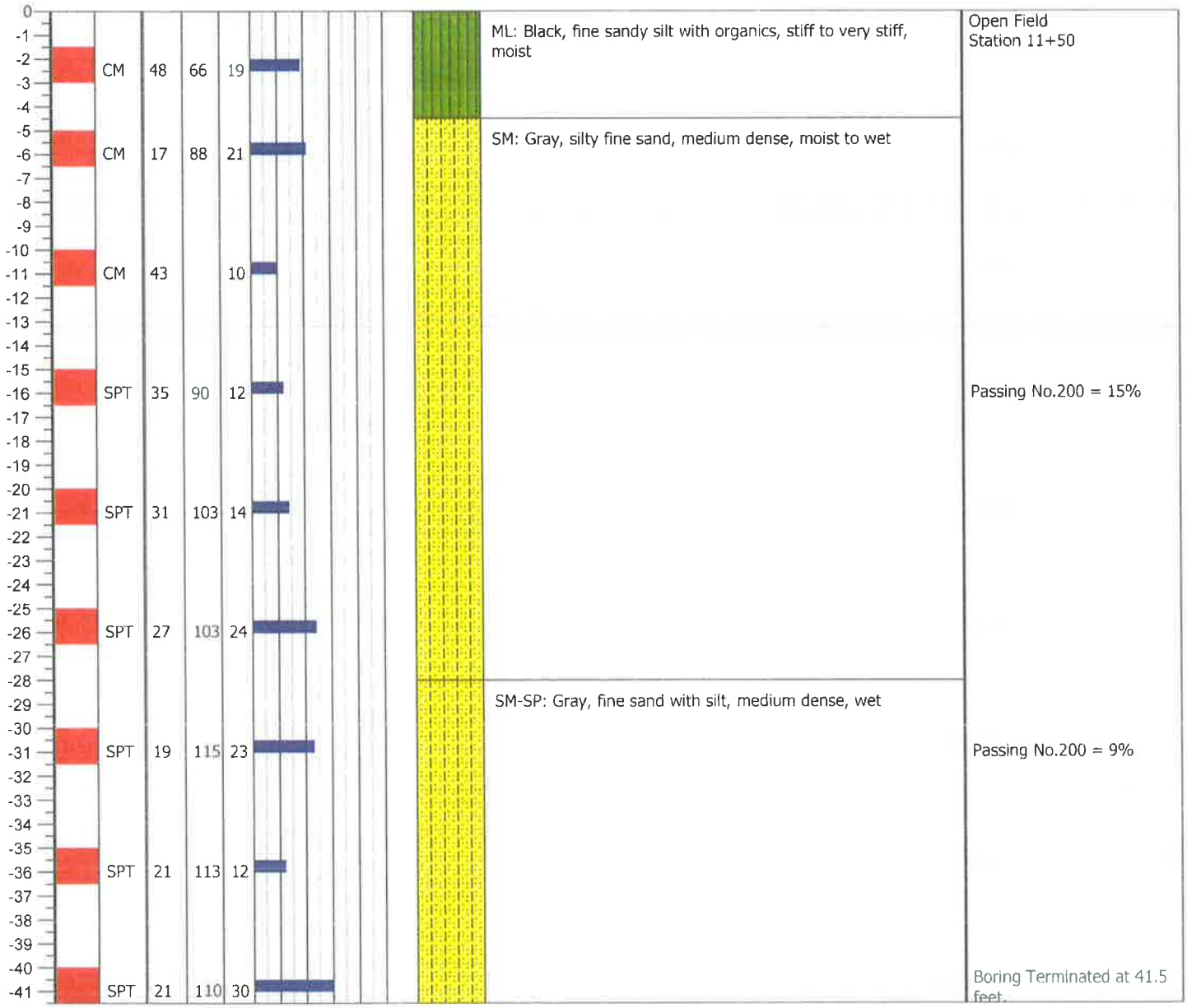


Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B3

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1,2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer**

DATE DRILLED: **12-18-06**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 4



Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	**LOG OF TEST BORING**	**BOREHOLE NUMBER** **B4**

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**

DATE DRILLED: **3-13-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 5

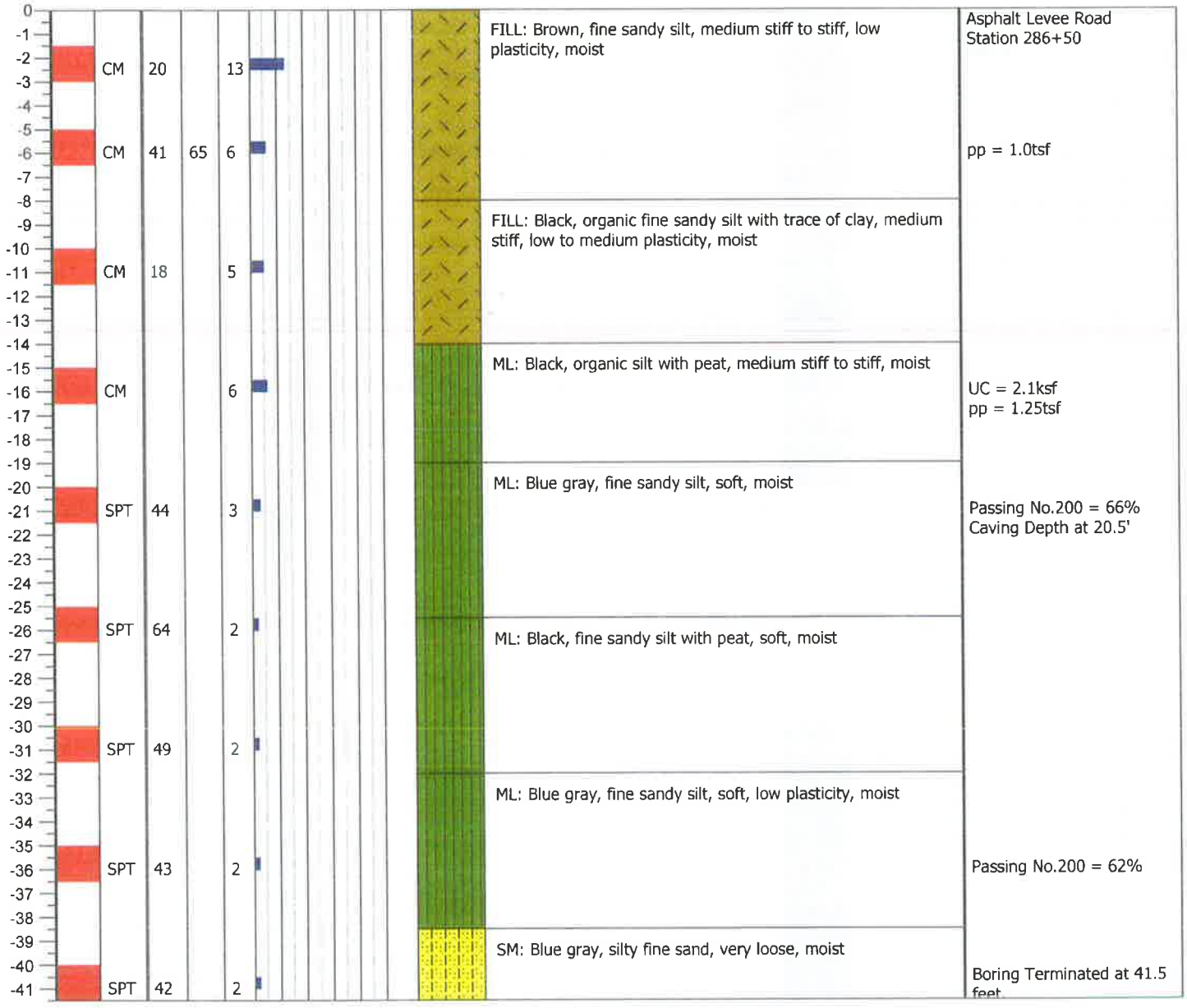
Depth, ft.	Sample	Sampling Method	Moisture, %	Dry Density, pcf	Blow Counts	Blow Count Histogram	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0										
-1										
-2		CM	28	56	15				FILL: Brown, fine sandy silt, stiff to very stiff, moist	Asphalt Levee Road Station 294+75
-3										
-4										
-5										
-6		CM	28	59	6				FILL: Brown, fine sandy silt, medium stiff, non plastic, moist	
-7										
-8										
-9										
-10										
-11		CM	51	67	6				ML: Dark brown, clayey silt with organics, medium stiff, medium to high plasticity, very moist	pp = 1.0tsf
-12										
-13										
-14										
-15										
-16		CM	75	51	8				ML: Dark brown, clayey silt with some organics, medium stiff to stiff, medium to high plasticity, very moist	pp = 1.0tsf
-17										
-18										
-19										
-20										
-21		CM	39	68	9				SM: Blue gray, silty fine sand, loose, wet	Passing No.200 = 42%
-22										
-23										
-24										
-25										
-26		SPT	53		2				SM: Blue gray, silty clayey fine sand, very loose, wet	
-27										
-28										
-29										
-30										
-31		SPT	52		4				ML: Blue gray, fine sandy silt, very soft to medium stiff, wet	
-32										
-33										
-34										
-35										
-36		SPT	56		2					
-37										
-38										
-39										
-40										
-41		SPT	50		3					Boring Terminated at 41.5 feet.

Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B5

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**

DATE DRILLED: **3-13-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 6

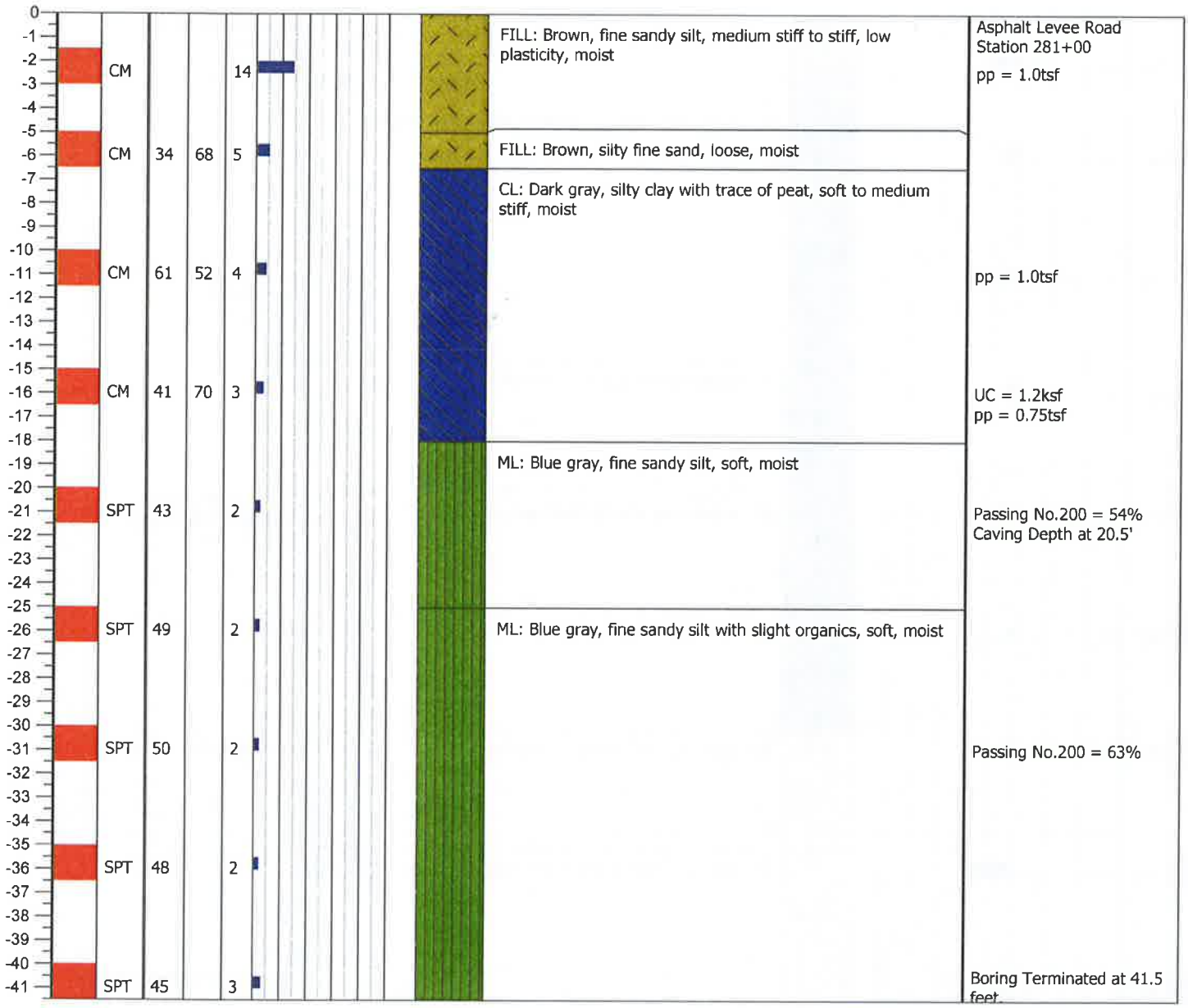


Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	**LOG OF TEST BORING**	**BOREHOLE NUMBER** **B6**

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**

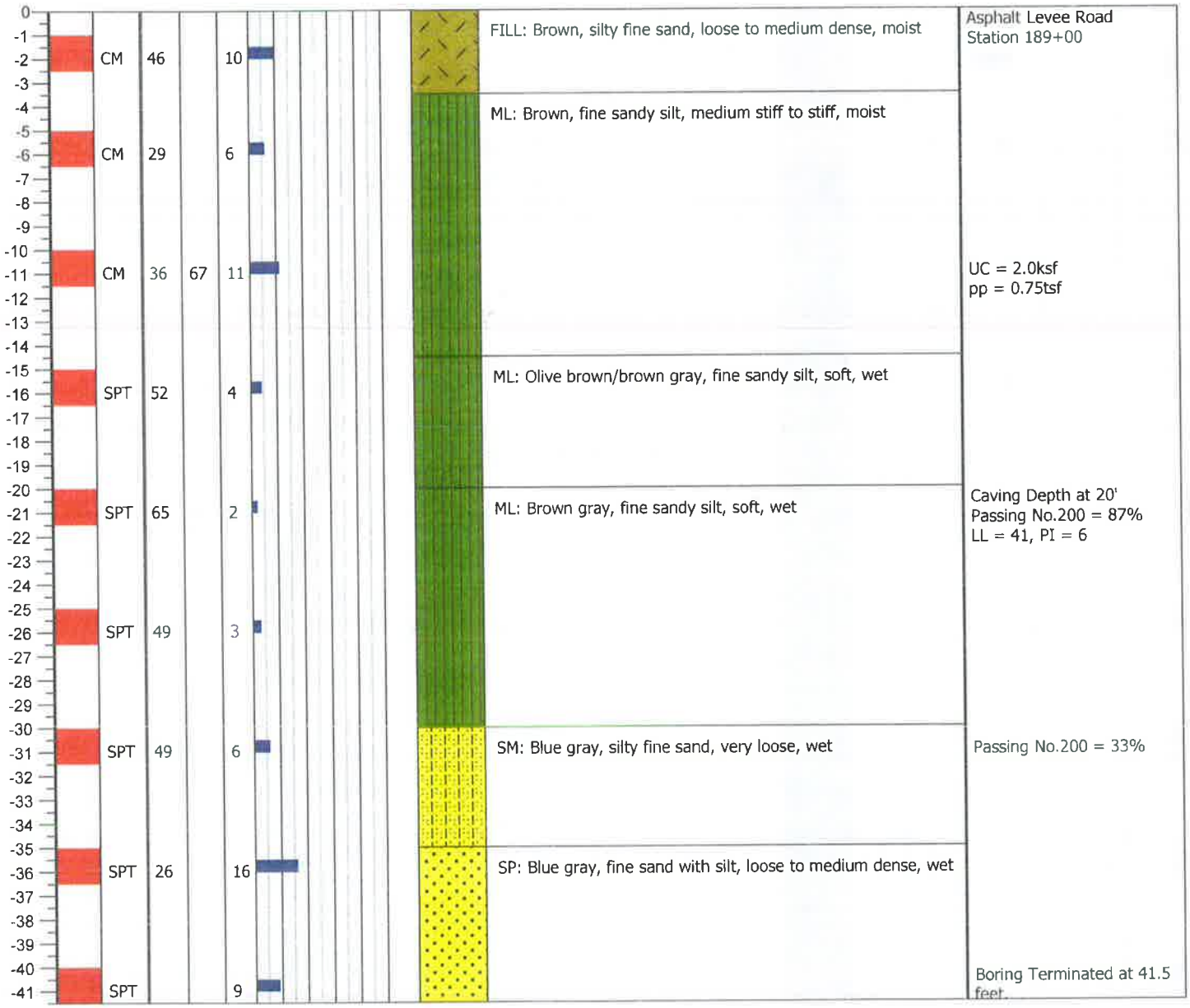
DATE DRILLED: **3-14-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 7



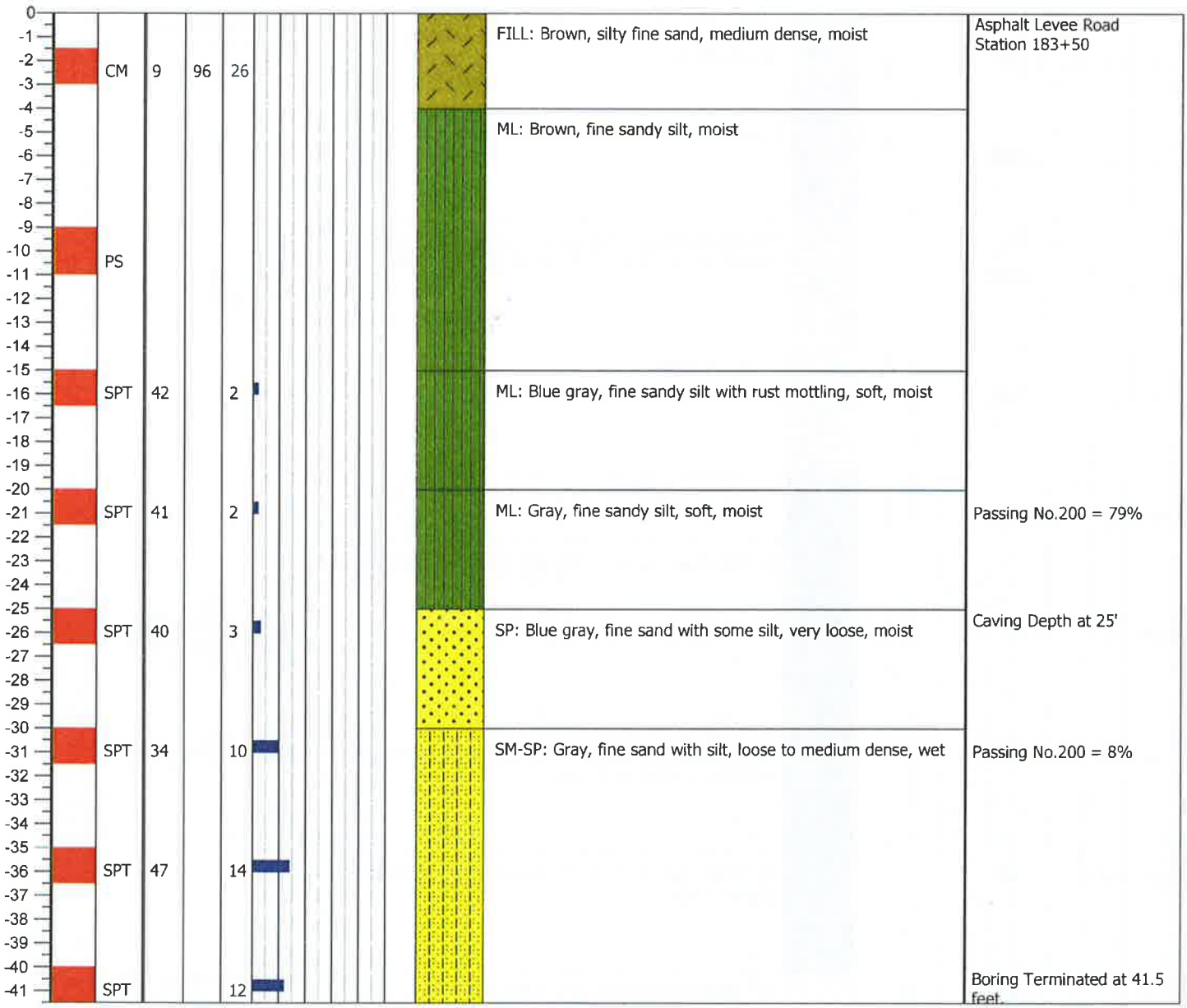
Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B7

PROJECT NUMBER: **LFG-0229**
DATE DRILLED: **3-15-07**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
GROUND SURFACE ELEVATION: **0.0** Feet
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**
PLATE NO. 8



Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	**LOG OF TEST BORING**	**BOREHOLE NUMBER** **B8**

PROJECT NUMBER: **LFG-0229**
DATE DRILLED: **3-15-07**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
GROUND SURFACE ELEVATION: **0.0** Feet
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**
PLATE NO. 9



Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST BORING	BOREHOLE NUMBER B9

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Seven Mile Slough Site 1, 2, & 3 Levee**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Mobile B53 Explorer Mud Rotary**

DATE DRILLED: **3-16-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 10

Depth, ft.	Sample	Sampling Method	Moisture, %	Dry Density, pcf	Blow Counts	Blow Count Histogram	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0 to -2	CM	CM	29	69	10				FILL: Brown, silty fine sand/fine sandy silt, loose to medium dense/stiff, moist	Asphalt Levee Road Station 177+50
-2 to -6	CM	CM	25		12				FILL: Brown, silty fine sand, medium dense, moist	
-6 to -16	CM, CM	CM	39, 34	66, 76	13, 10				OL/OH: Olive brown, organic silty clay with rust mottling, medium stiff to stiff, medium to high plasticity, moist	UC = 1.1ksf pp = 1.0tsf pp = 2.0tsf
-16 to -20									ML: Olive, fine sandy silt, stiff, medium plasticity, moist	
-20 to -25	SPT	SPT	44		11				ML: Blue gray, fine sandy silt, soft, medium plasticity, moist	
-25 to -30	SPT	SPT	50		3					Caving Depth at 25' Passing No.200 = 93% LL = 44, PI = 14
-30 to -35	SPT	SPT	52		5				ML: Blue gray, fine sandy silt with organics, medium stiff, medium to high plasticity, wet	Passing No.200 = 87%
-35 to -40	SPT	SPT	47		6				ML: Blue gray, fine sandy silt, medium stiff, medium to high plasticity, wet	
-40 to -41	SPT	SPT			3				SP: Blue gray, fine sand, very loose, wet	Boring Terminated at 41.5 feet.

UNIFIED SOIL CLASSIFICATION SYSTEM AND BORING LOG SYMBOLS

	DESCRIPTION	MAJOR DIVISIONS		
GW	Well-graded gravels, gravel sand mixtures, little or no fines.	Clean gravels (little or no fines)	Gravel and gravelly soils More than 50% of coarse fraction retained on No. 4 sieve	Coarse grained soils more than 50% larger than No. 200 sieve
GP	Poorly-graded gravels, gravel sand mixtures, little or no fines			
GM	Silty gravels, gravel-sand-clay mixtures	Sands with appreciable amount of fines		
GC	Clayey gravels, gravel-sand-clay mixtures			
SW	Well-graded sands, gravelly sands, little or no fines	Clean sand (little or no fines)	Sands and sandy soils More than 50% of coarse fraction passing No. 4 sieve	
SP	Poorly-graded sands, gravelly sands, little or no fines			
SM	Silty sands, sand-silt mixtures	Sands with appreciable amount of fines		
SC	Clayey sands, sand-silt mixtures			
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Liquid limit less than 50	Silts and clays	Fine grained soils more than 50% smaller than No. 200 sieve
CL	Inorganic clays of low to medium plasticity, gravelly clays, lean clays			
OL	Organic silts and organic silty clays of low plasticity			
MH	Inorganic silts, micacious or diatomaceous fine sand or silty soils	Liquid limit greater than 50	Silts and clays	
CH	Inorganic clays of high plasticity, fat clays			
OH	Organic clays of medium to high plasticity, organic silts			
PT	Peat, humas swamp soils with high organic content	Highly organic soils		

DEPTH (FEET)	SAMPLE	SAMPLE TYPE	TEST TYPE	NOTES
	PS	**Push Sample**	Plasticity Grain Size Analysis Uniformity Coefficient Coefficient of Gradation Coefficient of Consolidation Specific Gravity Shrink/Swell Direct Shear Unconfined Compression Triaxial Compression Pocket Penetrometer Torvane Shear Consolidations	pi gr Cu Cc Cv sg s/s ds uc tx p ts c
	SPT	**Drive Sample**, 2.0" o.d., 1.38" i.d., sampler driven with 140 lb. hammer, 30" drop (Standard Penetration Test, SPT).		
	CM	**Drive Sample**, 2.5" o.d., 1.92" i.d., sampler driven with 140 lb. hammer, 30" drop, with 6" tube liners (California Modified, CM).		
	ES	**Ely Sample**, Used to determine unit weight.		
	HS	**Hand Sampler**, 2.0" o.d. sampler driven with 10 lb. hammer, 18" drop, with 4" tube liners.		
	GS	**Grab Sample**, disturbed sample taken from auger tailings and sealed in plastic bag.		

Plate Number 11

NEIL O. ANDERSON
AND ASSOCIATES

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POST TENSION DESIGN

August 24, 2007
Project Number: LFG-0229

Reclamation District 1601
c/o Jerry Hadley
KSN, Inc.
P.O. Box 844
Stockton, CA 95201-0844

Subject: **Addendum No. 1**
Geotechnical Investigation Report
Sevenmile Slough Levee Improvements
Twitchell Island
Sacramento County, California
Dated August 24, 2007

Dear Mr. Hadley:

At your request, I met with you and Bob Winters from KSN and Rick Carter from the Reclamation District at Site No. 2 of the Sevenmile Slough Levee Improvements on August 24, 2007. The purpose of the site visit was to observe excavation of several test pits within Sites 1 and 2. We excavated the test pits at Site 2 first. The test pits were excavated with a rubber-tired Case backhoe with a 30-inch wide bucket operated by Rick Carter. This addendum presents a summary of those observations. The approximate locations of the test pits are shown on the Test Pit Location Maps, Plates 1a and 1b.

At Site 2, three test pits were excavated along the approximate alignment of the proposed new levee. The field where the new levee will be constructed was being irrigated at the time we excavated the test pits. We excavated the test pits in areas that were not under water but were close to areas with standing water. These three test pits were excavated to depths of about 8 to 9½ feet below the existing ground surface. The soils encountered in the test pits were fairly uniform along the alignment. The upper 3 to 5½ feet consisted of clayey silt with sand that was dry to moist. This soil was underlain by brown silty fine sand that extended to the maximum depths explored. The sandy soils varied from dry to moist, with the moisture increasing with depth. No groundwater was encountered in any of the test borings.

At Site 1, we excavated another three test pits between the landside edge of pavement and the toe ditch at the bottom of the levee. These test pits were located about 25 feet upslope from the toe ditch. These test pits were excavated to depths of between 8 and 9 feet below the existing ground surface. The soils encountered in these test pits were fairly uniform. The upper 2½ to 4 feet consisted of dry to moist sandy and clayey silt. This was underlain by dark brown to gray clayey silt/silty clay with sand that was dry to moist that extended to depths of between 6 and 7 feet below the existing ground surface. Below the clay we encountered blue gray silty sand to the maximum depths explored. The sand was very moist to saturated. An exception was encountered in test pit TP6 where a 1 foot thick layer of blue gray sandy silt was below the dark brown clayey silt/silty clay. Seepage was encountered in test pit TP5 at a depth of about 7 feet below the existing ground surface.

More detailed descriptions of the soils encountered in the test pits are given on the Log of Test Pits sheets, Plates 2 through 7.

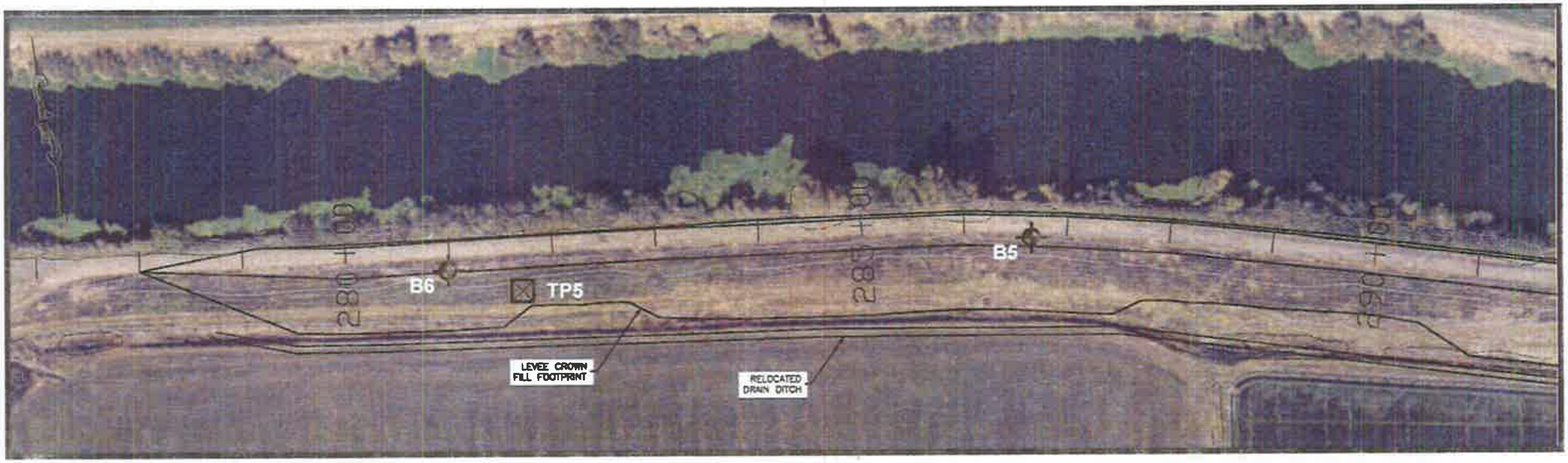
We trust this addendum provides the requested information. If you have any questions or need further assistance, please contact our office.

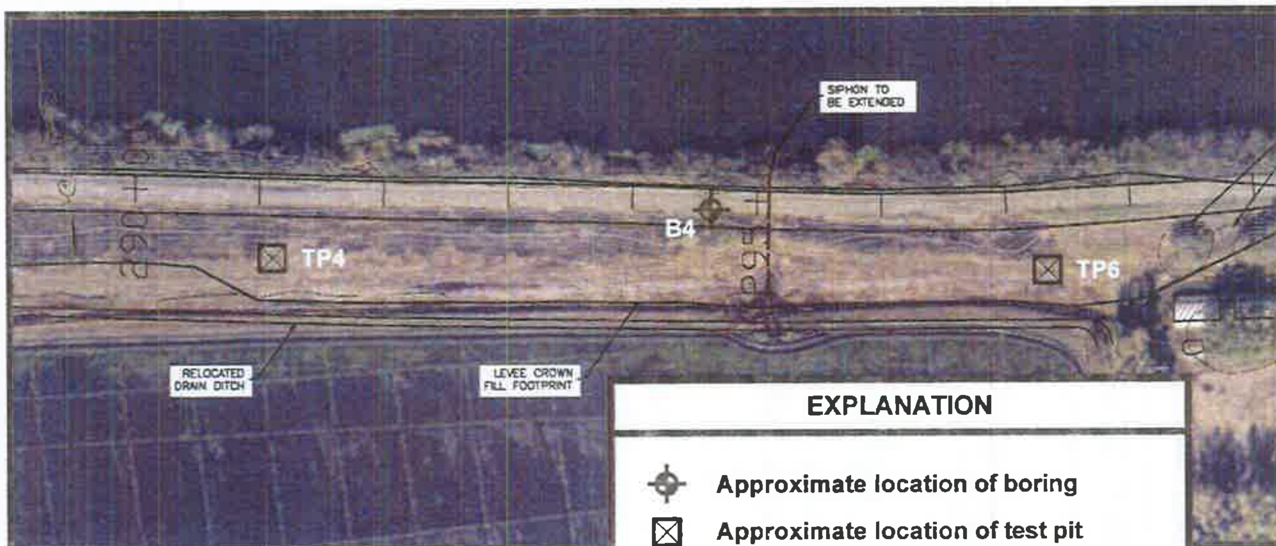
Sincerely,
NEIL O. ANDERSON & ASSOCIATES, INC.

Patrick C. Dell, Principal
Geotechnical Engineer 2186

PROFESSIONAL ENGINEER
PATRICK CRAIG DELL
No. 2186
Exp. 3-31-08
GEOTECHNICAL
STATE OF CALIFORNIA

AUG 27 2007





VICINITY MAP Sacramento County, CA

EXPLANATION

- Approximate location of boring
- Approximate location of test pit

Base plan provided by KSN, Inc. Stockton, CA.

NEIL O. ANDERSON
AND ASSOCIATES

CORPORATE OFFICE
902 INDUSTRIAL WAY
LODI, CALIFORNIA 95240
PHONE: (209) 367-3701
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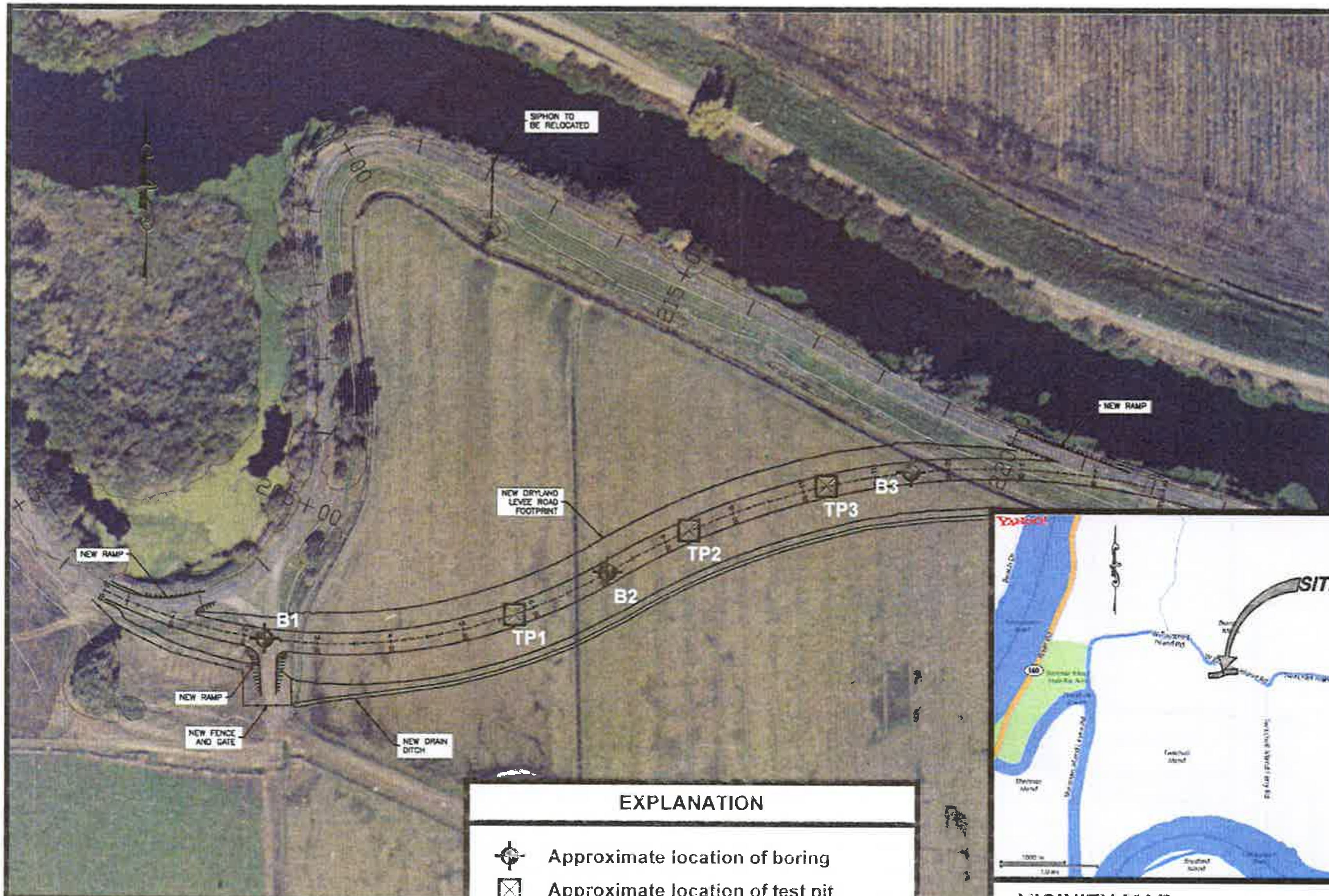
BORING LOCATION MAP
SITE No. 1

TWITCHELL ISLAND
7 MILE SLOUGH LEVEE IMPROVEMENTS
RECLAMATION DISTRICT NO. 1601
SACRAMENTO COUNTY, CA

DATE:	6/25/07
JOB NUMBER:	LFG-0229
SCALE:	NTS
DRAWN BY:	RC
CHECKED BY:	PD
PLATE:	1a



EXPLANATION

- Approximate location of boring
- Approximate location of test pit

Base plan provided by KSN, Inc. Stockton, CA .

VICINITY MAP Sacramento County, CA

NEIL O. ANDERSON AND ASSOCIATES
CORPORATE OFFICE
902 INDUSTRIAL WAY
LODI, CALIFORNIA 95240
PHONE: (209) 367-3701
FAX: (209) 333-8303
SACRAMENTO
MODESTO
RENO
WALNUT CREEK
GEOTECHNICAL
ENVIRONMENTAL
GROUNDWATER
INSPECTIONS & TESTING
LABORATORY SERVICES
POOL ENGINEERING
POST TENSION DESIGN
www.noanderson.com

BORING LOCATION MAP
SITE No. 2

TWITCHELL ISLAND
7 MILE SLOUGH LEVEE IMPROVEMENTS
RECLAMATION DISTRICT NO. 1601
SACRAMENTO COUNTY, CA

DATE:	6/25/07
JOB NUMBER:	LFG-0229
SCALE:	NTS
DRAWN BY:	RC
CHECKED BY:	PD
PLATE:	1b

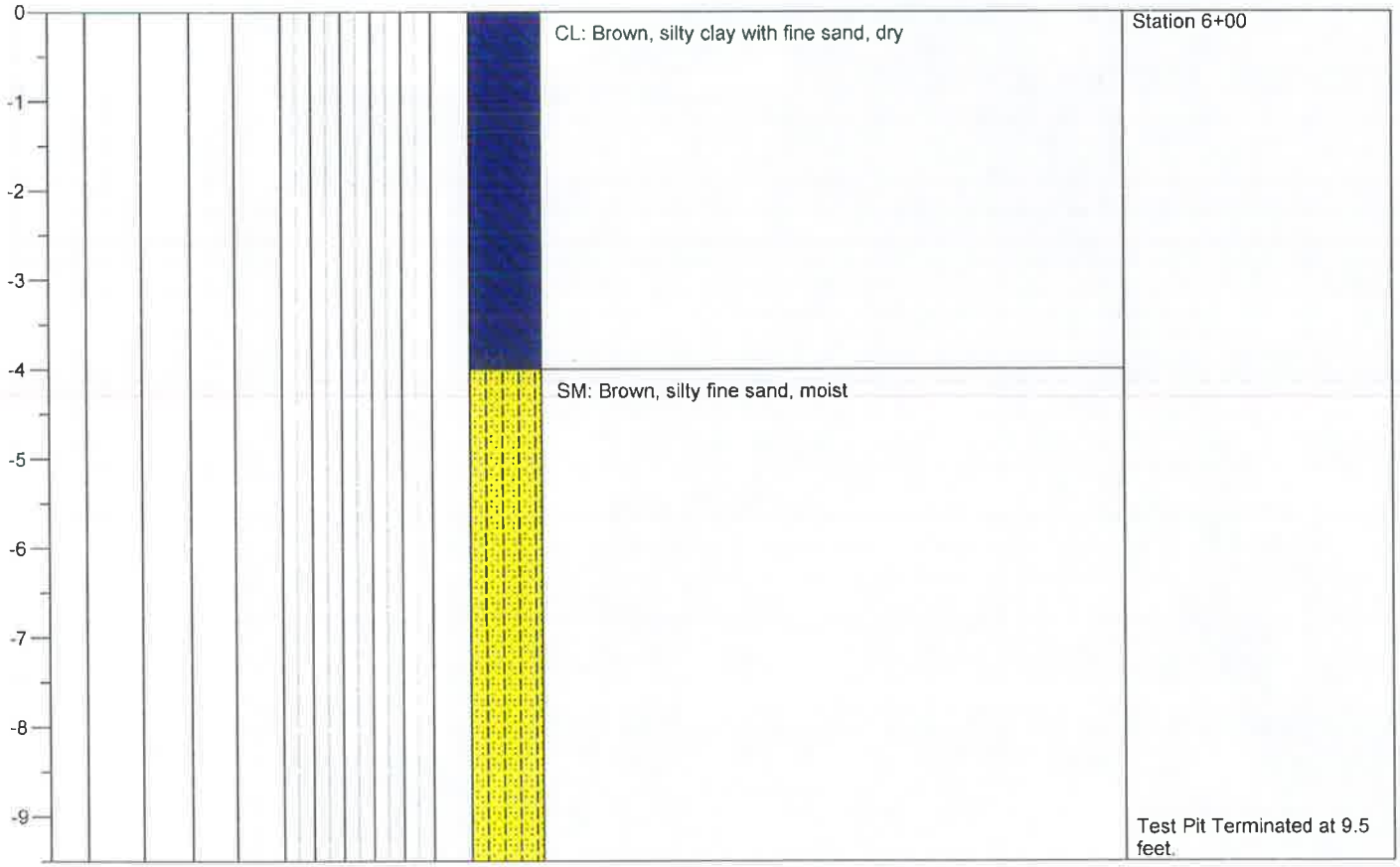
Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST PIT	TEST PIT NUMBER TP-1

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 2

Depth, ft.	Sample	Sampling Method	Moisture, %	Dry Density, pcf	Blow Counts	Blow Count Histogram	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0									CL: Brown, silty clay with fine sand, dry	Station 6+00
-4									SM: Brown, silty fine sand, moist	
-9										Test Pit Terminated at 9.5 feet.



Neil O. Anderson & Assoc., Inc.
902 Industrial Way, Lodi, CA 95240
(209)367-3701 Fax (209)333-8303

LOG OF TEST PIT

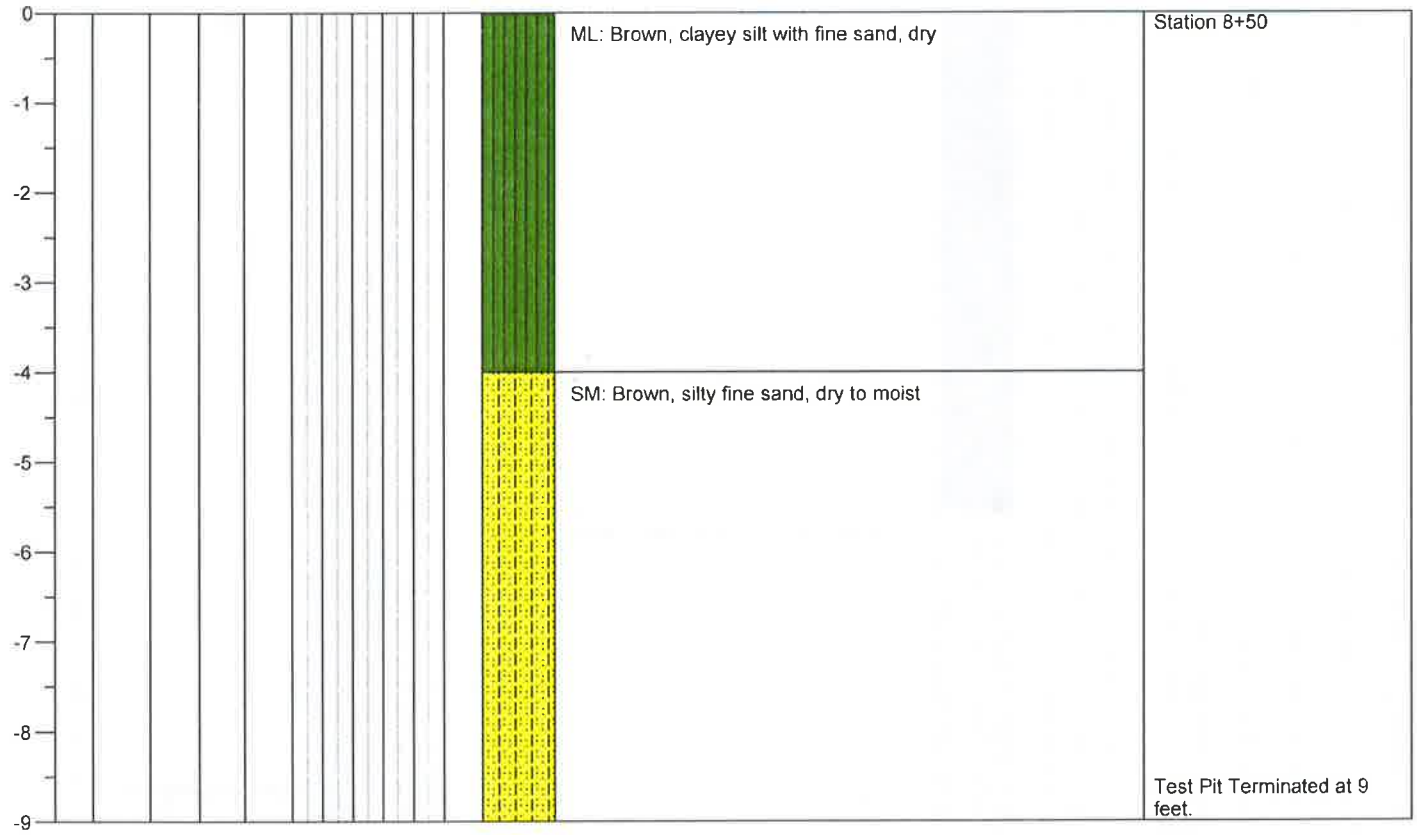
TEST PIT NUMBER

TP-2

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 3



Neil O. Anderson & Assoc., Inc.
902 Industrial Way, Lodi, CA 95240
(209)367-3701 Fax (209)333-8303

LOG OF TEST PIT

TEST PIT NUMBER

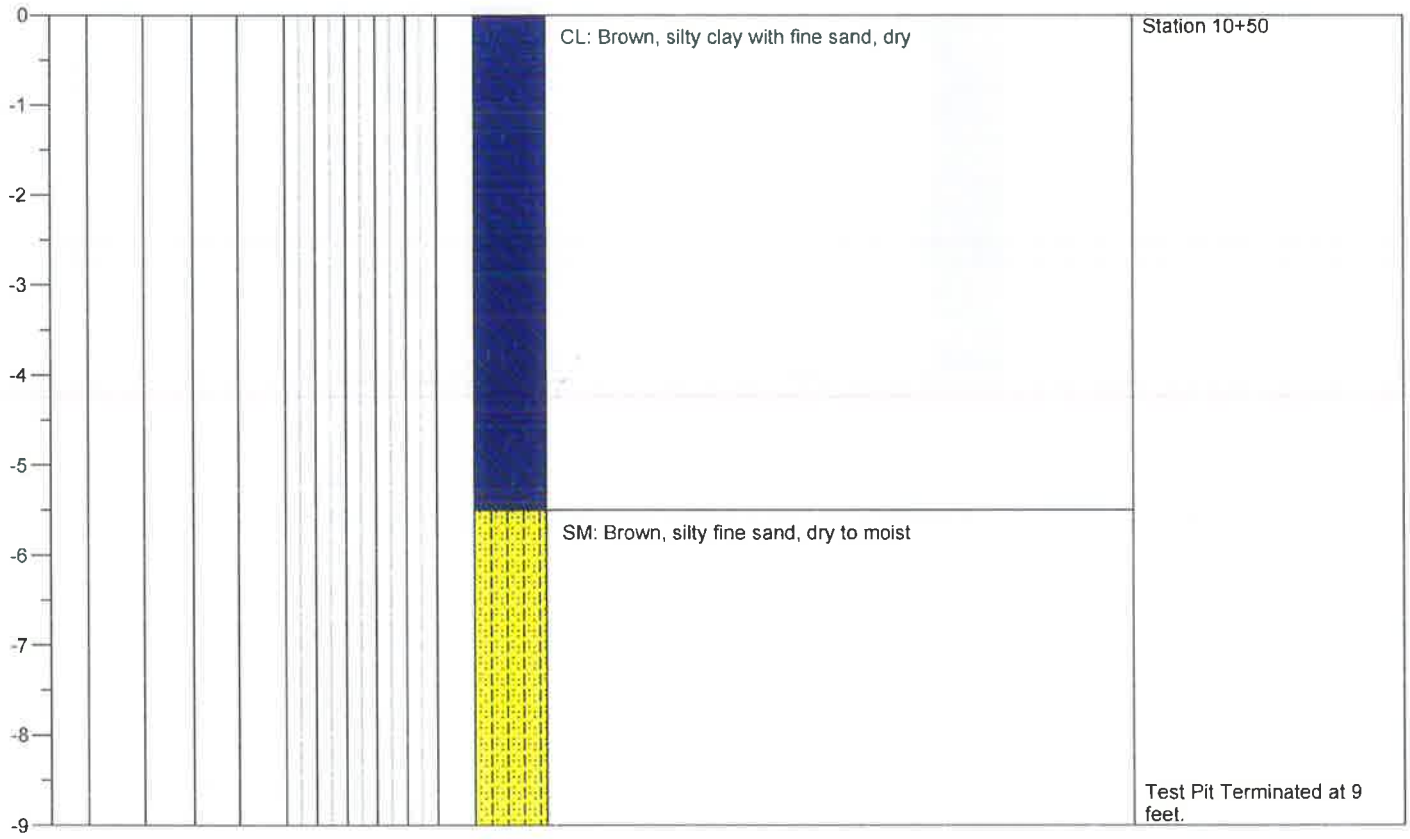
TP-3

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 4

Depth, ft.	Sample	Sampling Method	Moisture, %	Dry Density, pcf	Blow Counts	Blow Count Histogram	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0 to -5.5									CL: Brown, silty clay with fine sand, dry	Station 10+50
-5.5 to -9									SM: Brown, silty fine sand, dry to moist	Test Pit Terminated at 9 feet.



Neil O. Anderson & Assoc., Inc.
902 Industrial Way, Lodi, CA 95240
(209)367-3701 Fax (209)333-8303

LOG OF TEST PIT

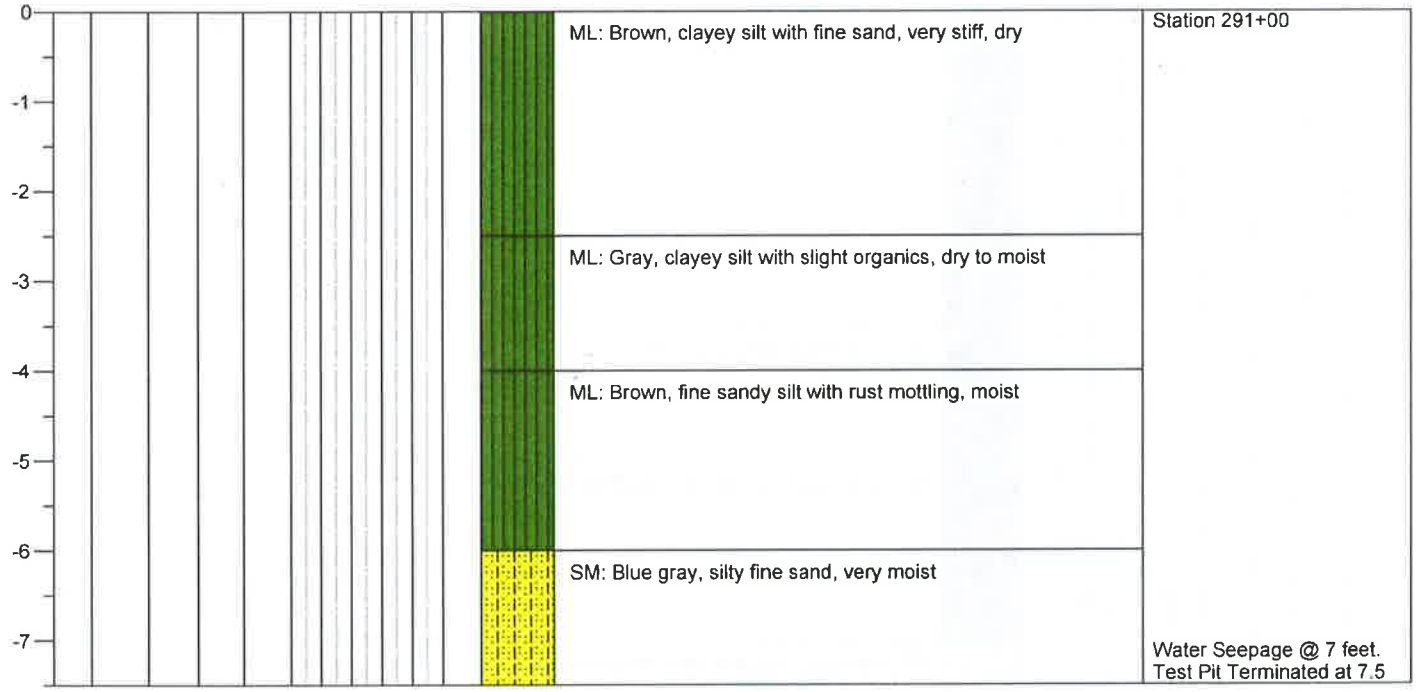
TEST PIT NUMBER

TP-4

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 5

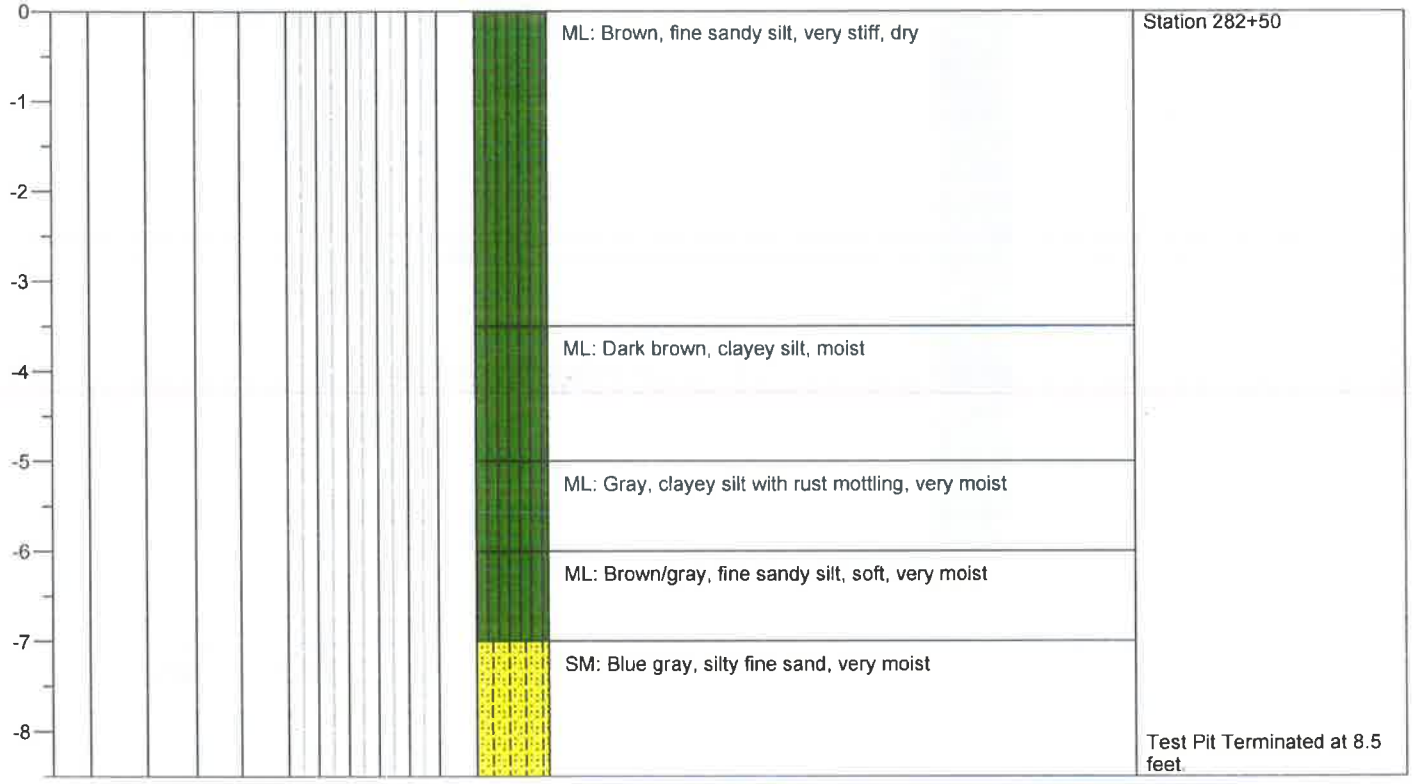


Neil O. Anderson & Assoc., Inc. 902 Industrial Way, Lodi, CA 95240 (209)367-3701 Fax (209)333-8303	LOG OF TEST PIT	TEST PIT NUMBER TP-5

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 6



Neil O. Anderson & Assoc., Inc.
902 Industrial Way, Lodi, CA 95240
(209)367-3701 Fax (209)333-8303

LOG OF TEST PIT

TEST PIT NUMBER

TP-6

PROJECT NUMBER: **LFG-0229**
PROJECT NAME: **Twitchell Island**
LOCATION: **Sacramento County, CA**
DRILLING EQUIP.: **Case Backhoe with 30 inch Bucket**

DATE EXCAVATED: **8-8-07**
GROUND SURFACE ELEVATION: **0.0** Feet

PLATE NO. 7

Depth, ft.	Sample	Sampling Method	Moisture, %	Dry Density, pcf	Blow Counts	Blow Count Histogram	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0 to -3									ML: Brown, fine sandy silt, very stiff, dry	Station 296+50
-3 to -4									ML: Dark brown/brown, clayey silt, dry to moist	
-4 to -6									ML/SM: Blue gray, fine sandy silt/silty fine sand, very soft, very moist	
-6 to -8									SM: Blue gray, silty fine sand with rust mottling, wet	Test Pit Terminated at 8 feet.

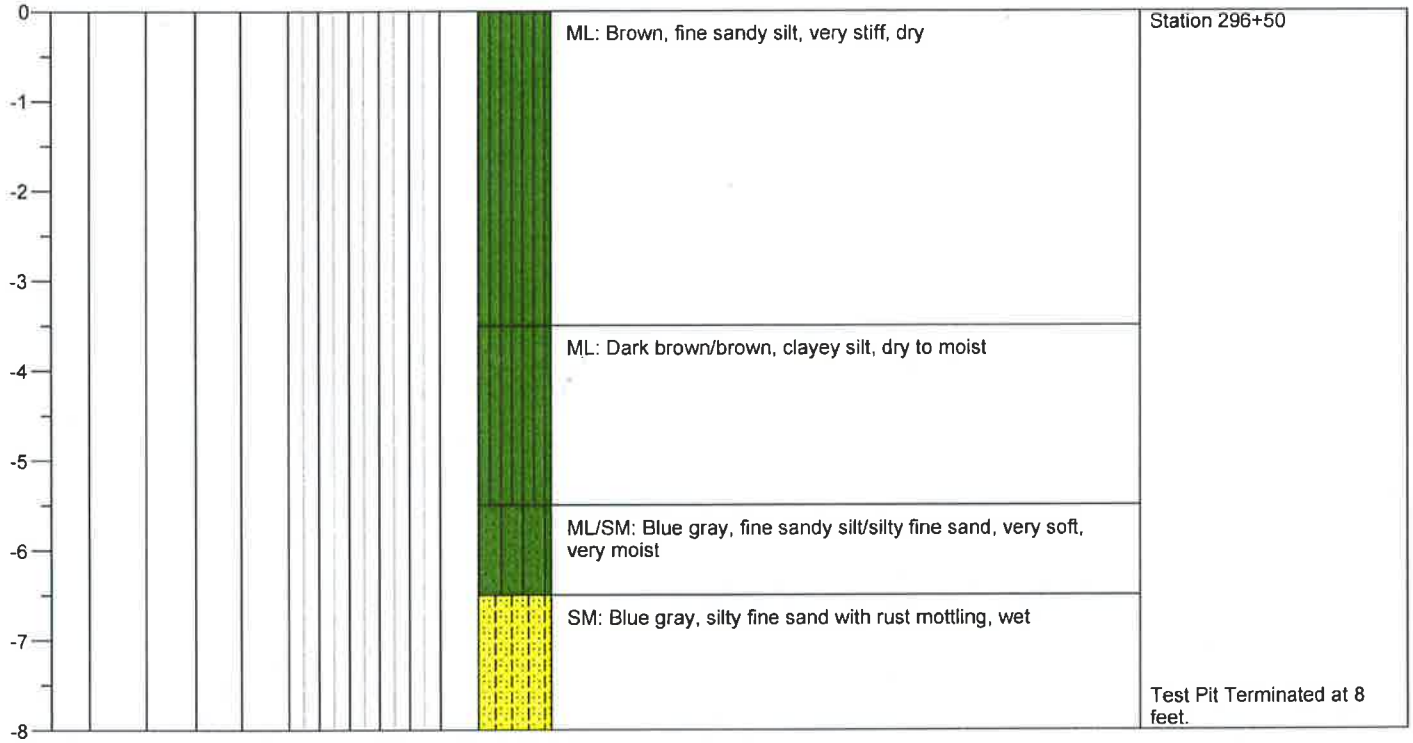
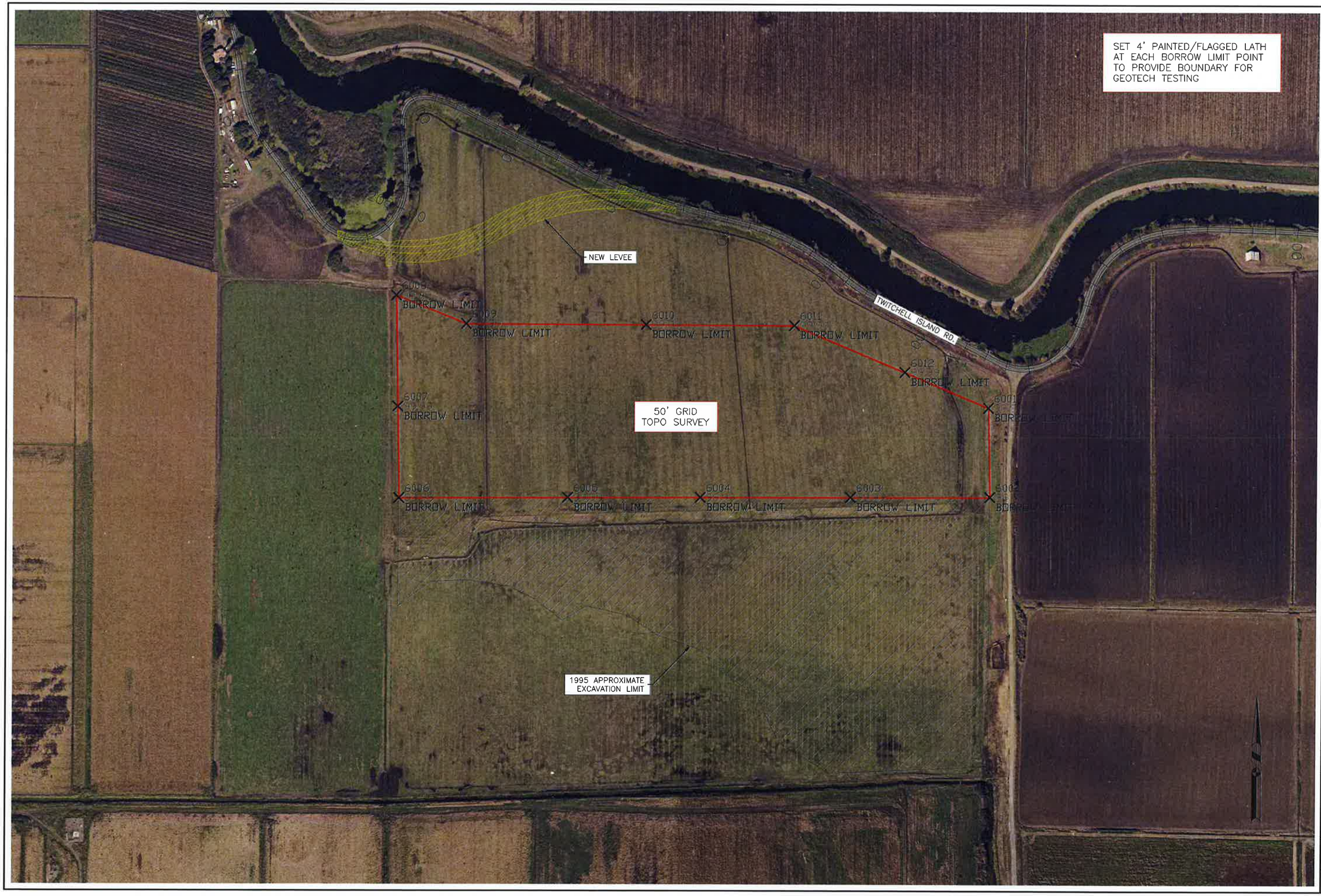


EXHIBIT B



Design

Drawn JAM

Check JLH

Revisions				
No.	Description	Date	By	Apvd By

KJELDSEN SINNOCK NEUDECK INC.
Consulting Engineers and Land Surveyors
Post Office Box 844
711 N. Pershing Avenue
Stockton, CA 95201-0844
Office: (209) 946-0268
Faxes: (209) 946-0296
E-mail: KSN@ksninc.com

RECLAMATION DISTRICT NO. 1601
TWITCHELL ISLAND

7 MILE SLOUGH LEVEE IMPROVEMENTS

BORROW SITE MAP

Date
JANUARY 2008

Scale
NOT TO SCALE

Original Drawing Scale
0 ½" 1"

Sheet Number
1 Of 1

Project File No.
1110-0540

EXHIBIT C

WATER SURFACE ELEVATIONS	
DESCRIPTION	ELEVATION (FT) (NAVD88)
BFE	8.9 TO 10.1
300-YR WSE	9.1 TO 10.4
HMP	9.9 TO 11.1
BULLETIN 192-82	10.6 TO 11.9

NOTES:
1. HMP = BFE + 1.0'
2. BULLETIN 192-82 = 300-YR WSE + 1.5'

DATA SOURCES:

EXISTING GROUND (EG) ELEVATIONS ARE BASED ON 2017 DWR LiDAR DATA.

BASE FLOOD ELEVATIONS (BFE) ARE BASED ON 1992 USACE SACRAMENTO-SAN JOAQUIN DELTA HYDROLOGY SPECIAL STUDY.

HATCH LEGEND

BULLETIN 192-82 NON-COMPLIANT

HMP NON-COMPLIANT

NORTH ORIENTATION

PROJECT ENGINEER

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DESCRIPTION	DATE	APPR.

DESIGN BY

DRAWN BY MSK

CHECK BY CHN

HORIZONTAL DATUM CCS83, ZONE 3

VERTICAL DATUM NAVD88

DRAWING SCALE 1" = 900'

ORIGINAL DRAWING SCALE 0 ½" 1"

KSN inc. KJELDSEN SINNOCK NEUDECK
CIVIL ENGINEERS & LAND SURVEYORS
www.ksninc.com
711 N. Pershing Avenue
Stockton, CA 95203
209-946-0268
1550 Harbor Blvd., Suite 212
West Sacramento, CA 95691
916-403-5900

RECLAMATION DISTRICT NO. 1601
FIVE YEAR PLAN EXISTING CONDITIONS
SACRAMENTO COUNTY COUNTY, CA

BASE MAP

DATE APRIL 28, 2020

SHEET IDENTIFICATION V-101
SHEET 2 OF 30

KSN PROJECT FILE NO. 1110-0940

FILE SPEC: P:\1110_Twitchell_Island\0940_17-18_DWR_5_Year_Plan\08_Civil\400_Plans\020_CAD\Sheets\Existing\V-101.dwg
PLOT DATE: Sep 16, 2020 - 3:12pm

EXHIBIT D

RECLAMATION DISTRICT NO. 1601
TWITCHELL ISLAND

2360 West Twitchell Island Road
Rio Vista, CA 94571
(916) 777-6992

APPLICATION FOR ENCROACHMENT PERMIT

Application No.

1. Name of Applicant | Address - Zip Code | Telephone No.

Rick & Linda Carter 2360 W. Twitchell Isl. Rd. 94571 916 257-4241

2. Description of encroachment
Install a dock on the waterside at Station 195+00 +or- in front of residence.

3. Location - Assessor's Parcel No. 157-0130-023

4. Required Exhibits - Please check items submitted.

a. Location or vicinity map, to scale, showing location of proposed work in relation to known topographic features, to allow visitation to site and inspection of work.
b. A complete plan of the proposed work to scale, showing dimensions, and relationship of the proposed work to adjacent levee or waterway.
c. One or more cross sections of the levee, berm and waterway area with dimensions and elevations of the levee crown, levee toes, flood plane, low water, etc., reference to a District identified bench mark should be indicated. Reference may be made to the District levee survey, where applicable.
d. Profile of existing or proposed levees, fills, or other obstructions on the levee or in the waterway or overflow area with reference to a known datum.
e. Additional plans, sections, details which might be pertinent or useful in regard to the review of this application.
f. Proposed construction schedule. IN August of 2022

Applicant is advised to contact the District Engineer regarding encroachment limitations prior to preparation of this application.

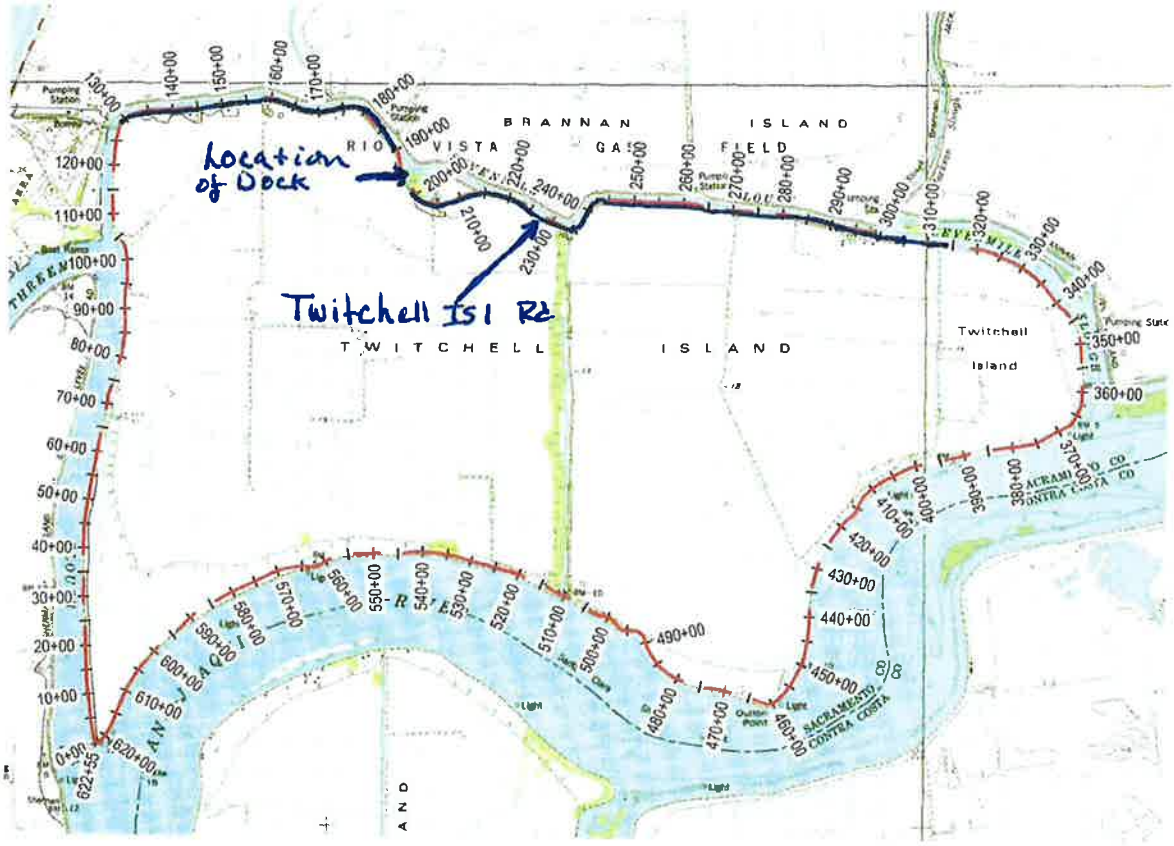
Rick Carter Sr
Applicant Signature

Date: July 27, 2022

Reclamation District No. 1601, Twitchell Island

LEVEE INSPECTION REPORT

Delta Levees Subventions Program



INSPECTION ITEMS IDENTIFIED ON THIS INSPECTION

Draw line from task to project location on map, provide detail below.

- Encroachment
- Erosion
- Pumps
- Rodent Control
- Roads
- Seepage / Boils
- Toe Drains
- Vegetation
- Other: _____

PROJECT SUPERVISION

Draw line from task to project location on map provide detail below.

- Encroachment Removal
- Erosion Repairs
- Road Repairs
- Debris Cleanup
- Toe Drains
- Vegetation Control
- Other:

INSPECTION DATES: _____

OBSERVATIONS (attach photos if available):

_____

_____

_____

_____

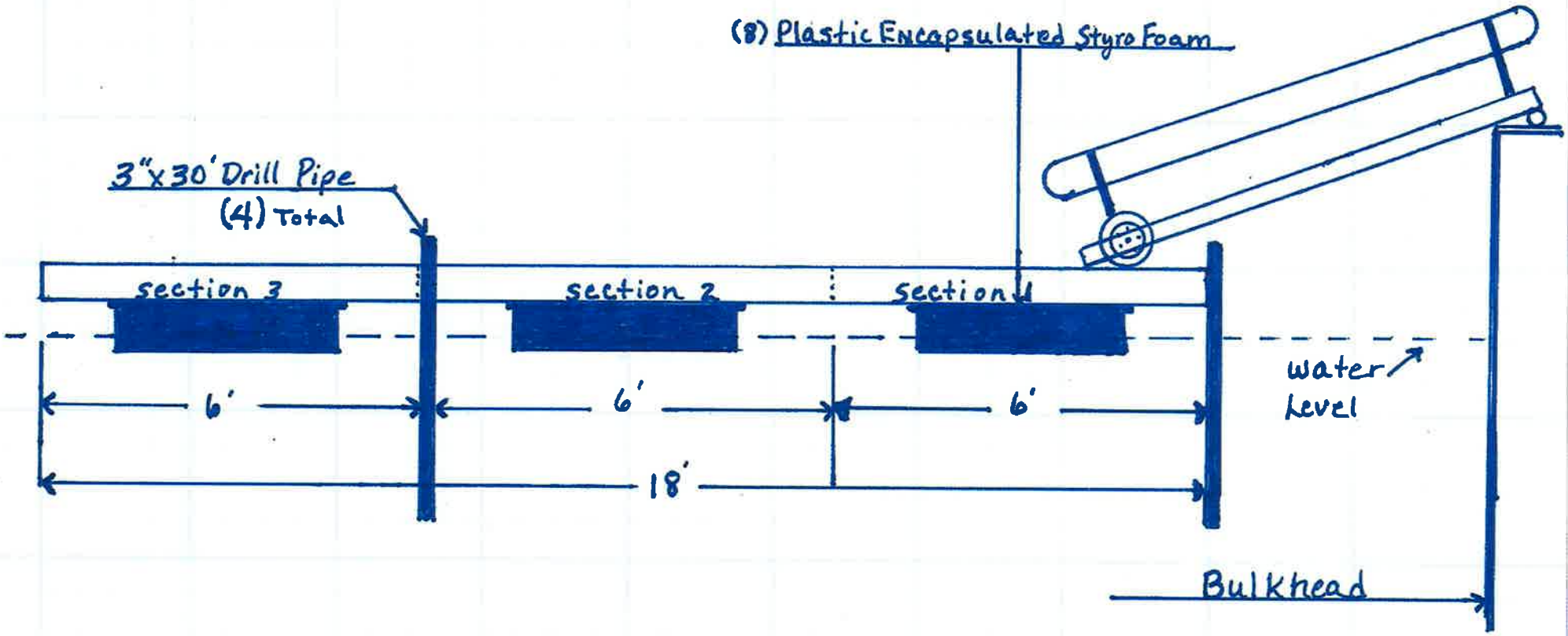
_____

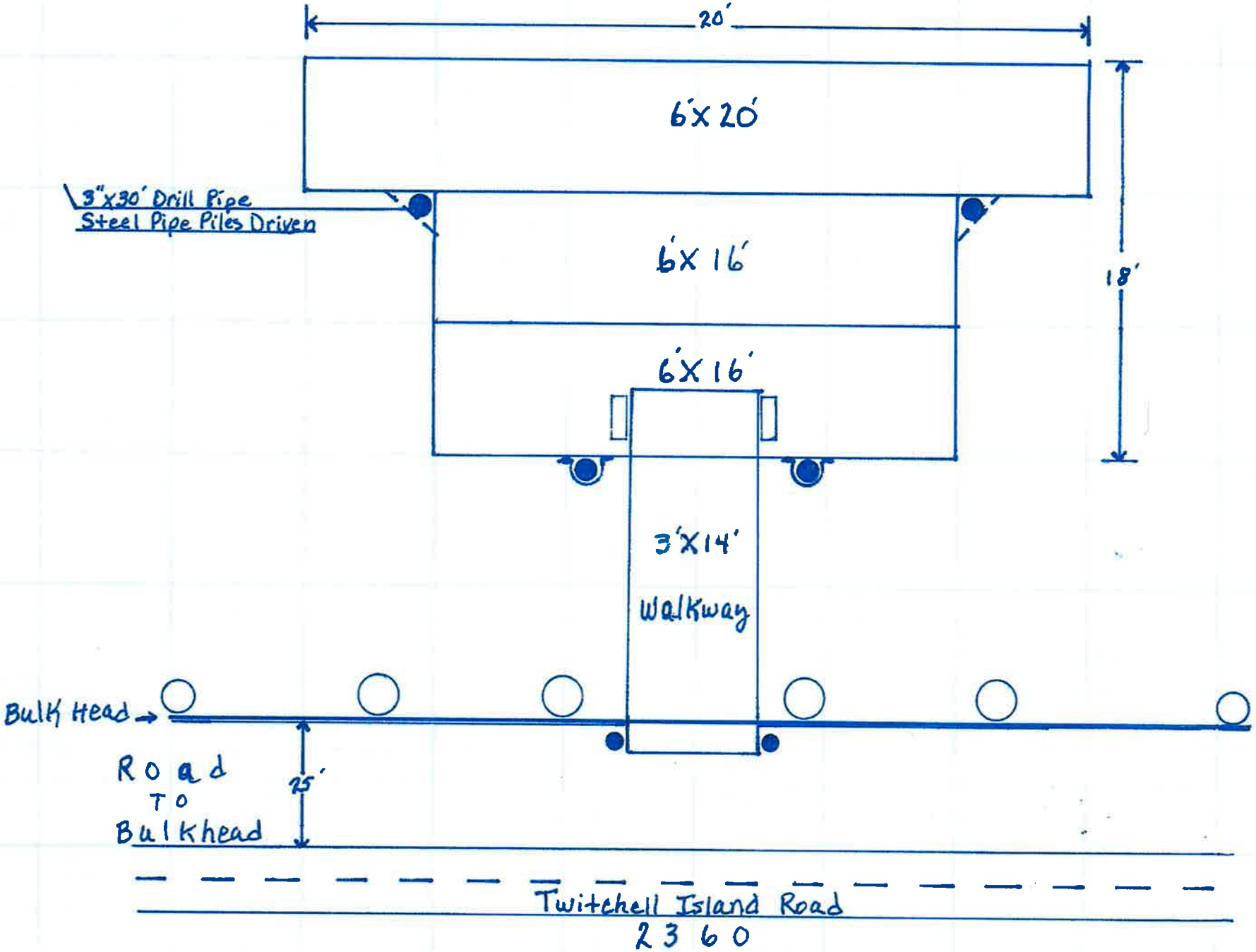
_____

_____

ENTIRE LENGTH OF INSPECTION: Start Station: _____ **End Station:** _____

INSPECTOR NAME: _____ **DATE:** _____


(8) Plastic Encapsulated Styro Foam
3"x30' Drill Pipe
(4) Total
section 3
section 2
section 1
6'
6'
6'
18'
water level
Bulkhead


20'
6'X 20'
3"X30' Drill Pipe
Steel Pipe Piles Driven
6'X 16'
18'
6'X 16'
3'X14'
Walkway
Bulk Head
Road
TO
Bulkhead
25'
Twitchell Island Road
2360