TO: COMMITTEE MEMBERS

FROM: DON SPAGNOLO
GENERAL MANAGER

DATE: AUGUST 5, 2010

AGENDA ITEM
2

AUGUST 9, 2010

REVIEW STATUS OF SOUTHLAND WWTF UPGRADE PROJECT

ITEM

Review status of Southland WWTF Upgrade Project [Receive Report].

BACKGROUND

Attached is the latest Monthly Design Status Report from AECOM. AECOM completed the Southland WWTF Master Plan Amendment that was authorized by the Board and has submitted an administrative draft concept report to staff for review.

Fugro West Inc. completed the hydrogeologic assessment of the Pasquini property and submitted a report to the District. See Agenda Item 3.

Doug Wood and Associates (DWA) is proceeding with preparation of the Draft Environmental Impact Report. AECOM's schedule includes the updated EIR schedule.

It should be noted that the Board has already funded the proposed Phase 1 project and the District already owns the land for construction for the Phase 1 project.

RECOMMENDATION

Staff recommends that the Committee receive AECOM's presentation and ask questions as appropriate.

ATTACHMENT

- MONTHLY STATUS REPORT

T:\BOARD MATTERS\BOARD MEETINGS\BOARD LETTER\2010\COMMITTEES\SOUTHLAND UPGRADE\100809 MEETING\100809ITEM2.DOC

AECOM

AECOM
1194 Pacific Street
Suite 204
San Luis Obispo, CA 93402
www.aecom.com

805 542 9840 tel
805 542 9990 fax

Memorandum

To	Don Spagnolo, PE, General Manager - NCSD	Page	1
CC	Peter Sevcik, Jon Hanlon, Eileen Shields		
Subject	Southland WWTF Upgrade Project – Design Phase Status Report		
From	Michael K. Nunley, PE		
Date	August 4, 2010		

The Project Team has completed the following items this month:

1. AECOM presented the Draft Master Plan Amendment to the Project Committee and to the Board of Directors.
2. Fugro completed revisions to the Draft Geotechnical Report and submitted the final report. Copies were provided to District staff.
3. AECOM submitted the administrative draft Concept Design Report to District staff for review and comment on July 27th.

Schedule

The Project Schedule, updated to reflect current design and EIR status, is attached

Budget Status

The Invoice Summary is attached. The Invoice Summary indicates an amount invoiced which is consistent with the work completed to date. The project cost opinion has been updated based on the WWTF Master Plan Amendment.

Yours Sincerely

Michael K. Nunley

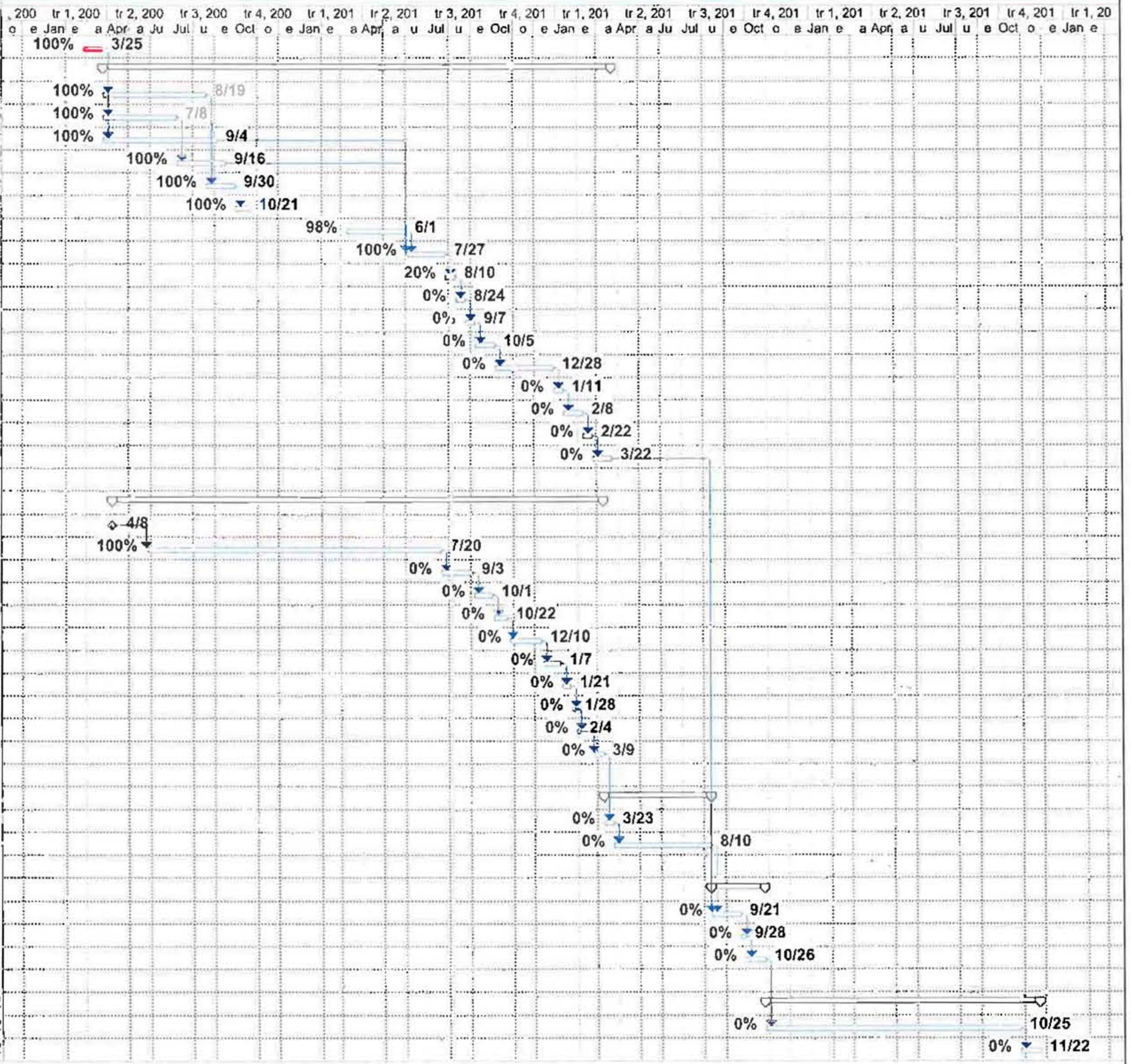
Michael K. Nunley, PE

Enclosures: Project Schedule
Invoice Summary
Project Budget Summary

Southland WWTF Upgrades Design Schedule

Wed 8/4/10

ID	Task Name	% Work Complete	Duration	Start	Finish
1	Negotiation and Notice to Proceed	100%	20 days	Thu 2/26/09	Wed 3/25/09
2	**Design**	**0%**	**519 days**	**Thu 3/26/09**	**Tue 3/22/11**
3	Survey	100%	105 days	Thu 3/26/09	Wed 8/19/09
4	Preliminary Soils Report	100%	75 days	Thu 3/26/09	Wed 7/8/09
5	Draft Site Plan	100%	117 days	Thu 3/26/09	Fri 9/4/09
6	Draft Soils Report	100%	50 days	Thu 7/9/09	Wed 9/16/09
7	Draft Operations Plan - TM 1	100%	30 days	Thu 8/20/09	Wed 9/30/09
8	Revised Draft Soils Report	100%	15 days	Thu 10/1/09	Wed 10/21/09
9	Facility Master Plan Amendment #1	98%	12 wks	Wed 3/10/10	Tue 6/1/10
10	Administrative Draft Concept Report	100%	8 wks	Wed 6/2/10	Tue 7/27/10
11	District Review	20%	10 days	Wed 7/28/10	Tue 8/10/10
12	Draft Concept Report	0%	10 days	Wed 8/11/10	Tue 8/24/10
13	District / Peer Review	0%	10 days	Wed 8/25/10	Tue 9/7/10
14	Final Concept Report	0%	20 days	Wed 9/8/10	Tue 10/5/10
15	60% Plans, Specifications, and Estimates	0%	60 days	Wed 10/6/10	Tue 12/28/10
16	District / Peer Review	0%	10 days	Wed 12/29/10	Tue 1/11/11
17	95% Plans, Specifications, and Estimates	0%	20 days	Wed 1/12/11	Tue 2/8/11
18	District / Peer Review	0%	10 days	Wed 2/9/11	Tue 2/22/11
19	Final Plans, Specifications, and Estimates	0%	20 days	Wed 2/23/11	Tue 3/22/11
20					
21	**Environmental Impact Report**	**0%**	**501 days**	**Wed 4/8/09**	**Wed 3/9/11**
22	Notice of Award	100%	1 day	Wed 4/8/09	Wed 4/8/09
23	Completion of subconsultant analyses	100%	15 mons	Wed 5/27/09	Tue 7/20/10
24	Administrative Draft EIR	0%	33 days	Wed 7/21/10	Fri 9/3/10
25	District Review	0%	4 wks	Mon 9/6/10	Fri 10/1/10
26	Preparation of Public Draft EIR	0%	3 wks	Mon 10/4/10	Fri 10/22/10
27	EIR Public Review Period	0%	33 days	Wed 10/27/10	Fri 12/10/10
28	Preparation of Administrative Final EIR/Responses to Comments	0%	4 wks	Mon 12/13/10	Fri 1/7/11
29	Completion and Receipt of Comments from District on Final EIR	0%	2 wks	Mon 1/10/11	Fri 1/21/11
30	Completion of Final EIR	0%	1 wk	Mon 1/24/11	Fri 1/28/11
31	Finding of Facts	0%	1 wk	Mon 1/31/11	Fri 2/4/11
32	Public Hearings/EIR Certification	0%	2 wks	Thu 2/24/11	Wed 3/9/11
33					
34	**RWQCB Permitting**	**0%**	**110 days**	Thu 3/10/11	**Wed 8/10/11**
35	Prepare ROWD	0%	2 wks	Thu 3/10/11	Wed 3/23/11
36	RWQCB review and issuance of WDRs	0%	5 mons	Thu 3/24/11	Wed 8/10/11
37					
38	**Bid Phase**	**0%**	**55 days**	**Thu 8/11/11**	**Wed 10/26/11**
39	Advertisement	0%	30 days	Thu 8/11/11	Wed 9/21/11
40	Bid Opening	0%	5 days	Thu 9/22/11	Wed 9/28/11
41	Bid Review and Notice of Award	0%	20 days	Thu 9/29/11	Wed 10/26/11
42					
43	**Construction**	**0%**	**281 days**	**Thu 10/27/11**	**Thu 11/22/12**
44	Construct	0%	261 days	Thu 10/27/11	Thu 10/25/12
45	Startup & Testing	0%	20 days	Fri 10/26/12	Thu 11/22/12



Project: Southland Design 8 03 09
Date: Wed 8/4/10

Task	Baseline Milestone ◇	Rolled Up Milestone	Rolled Up Progress	Project Summary
Progress	Summary	Baseline Summary	Split	Group By Summary
Baseline	Rolled Up Task	Rolled Up Baseline	Baseline Split	Deadline
Milestone ◆	Rolled Up Critical Task	Rolled Up Baseline Milestone	External Tasks	

Project Budget Summary

8/4/2010

Engineering Services for NCSD - Southland WWTF Upgrade **Nipomo CSD**

	Total Budget	Amount Previously Invoiced	Current Invoice Amount	% of Budget Earned to date	% of Work Complete
Task Group 1 - Concept Design Phase	$195,123.00	$151,776.85	$23,616.36	90%	90%
Task Group 2 - Construction Documents	$478,948.00	$16,301.25	$4,542.48	4%	4%
Task Group 3 - Project Management	$68,787.00	$29,625.75	$5,622.75	51%	51%
Task Group 4 - Assistance During Bid	$39,539.00	$0.00	$0.00	0%	0%
Task Group 5 - Office Engineering Services	$147,198.00	$0.00	$0.00	0%	0%
Task Group 7 - Amendment 1 Facility MP	$37,020.00	$35,606.25	$1,525.50	100%	100%
Total	$966,615.00	$233,310.10	$35,307.09	28%	28%

Date Printed 8/4/2010

Nipomo CSD
Southland WWTF Upgrades
Project Budget

Date Printed: 8/4/2010

Item	Description	Budgeted Amount Jan 2009 Master Plan (1)(2)(3)	Updated Amount 2010 MP Amendment (11)(12)
1	Frontage Road sewer upgrade (street to influent pump station)	$366,000 (4)(5)	-- (13)
2	Influent pump station upgrade	$670,900	$571,600
3	Influent screening system	$327,400	$371,600
4	Grit removal system	$402,700	$284,100 (14)
5	Phase I Extended Aeration + Secondary Clarifiers	$3,877,500	$3,671,300
6	Phase I Sludge digesters	$67,700	$166,300 (15)
7	Phase I Sludge drying beds	$1,160,700	$992,300
8	Controls and Blower Building		$232,600 (16)
9	Non-Potable Plant Water System		$191,200 (16)
10	Site Piping		$642,000 (17)
	Construction Subtotal	**$6,872,900**	**$7,123,000**
11	Contingency	$2,061,870 (6)	$1,780,750 (18)
12	Design-Phase Engineering	$923,093	$923,093
13	Construction Management	$1,138,777 (7)	$1,138,777 (7)
14	Environmental Mitigation	-- (8)	-- (8)
15	Environmental Monitoring	-- (8)	-- (8)
16	Permitting Fees	-- (8)	-- (8)
	WWTF PROJECT TOTAL (Rounded to 1000)	**$10,997,000**	**$10,966,000**

17	Frontage Rd Sewer Upgrade Project	$1,658,600 (9)(10)	$1,726,932 (19)(20)
18	Frontage Rd Sewer Upgrade Project Contingency	$331,720 (9)(10)	$259,040 (21)
	FRONTAGE RD SEWER PROJECT TOTAL (Rounded to 1000)	**$1,991,000** (9)(10)	**$1,986,000**

Notes:

(1) ENR CCI: November 2008 = 8602
(2) Costs are from the January 2009 Southland WWTF Master Plan.
(3) Costs are escalated by 4 % per year to anticipated midpoint of construction (assumed January 2011).
(4) The Frontage Rd Sewer Upgrade project includes the sewer main from Division St. to the influent pump station. The portion between the street and the influent pump station is currently included in the Southland WWTF Upgrades project scope of work, but may be moved to the Waterline Intertie Project for expedited construction.
(5) The cost for this portion of Frontage Rd was estimated by prorating the cost opinion for the Frontage Road Sewer Upgrade (based on linear footage) to arrive at the 2008 Construction Cost Opinion. A 4% per year escalation was used to arrive at the 2011 midpoint of construction cost opinion.
(6) Contingency is estimated at 30% of construction subtotal.
(7) To be updated by CM Team, assumed to be 30% of MP construction subtotal minus the engineering fee.
(8) Costs to be developed with EIR process
(9) The Frontage Road Sewer Upgrade Project plans are being developed as part of the Waterline Intertie Project effort, but construction will be paid for using separate sewer funds, not supplemental water funds
(10) Costs based on the 90% plans and specifications for Bid Package #2 of Waterline Intertie Project (October 2009)
(11) ENR CCI: April 2010 = 8677
(12) Costs are from the August 2010 Southland WWTF Master Plan Amendment #1.
(13) The Frontage Road Sewer Upgrade Project has been developed separately.
(14) One of two grit removal systems is required for Phases 1 and 2. A second grit removal system is budgeted for Phase 3.
(15) The design recommendations changed from sludge holding lagoons to digesters in the MP Amendment to provide a reduction in the amount of dry sludge hauled. Earthen berms were added to provide operational flexibility.
(16) Line item has been added since the January 2009 Master Plan.
(17) Site piping was moved to its own line item for accuracy in developing the cost opinion.
(18) Contingency is estimated at 25% of construction subtotal.
(19) Includes 1100 LF of 24-in sewer and manholes from Southland Street to WWTP Lift station, which was not previously included in project scope.
(20) Construction cost opinion has been updated based on Draft Final Plans and Specifications for Waterline Intertie Project Bid Package #2 (April 2010)
(21) Contingency has been adjusted to 15%.

TO: COMMITTEE MEMBERS

FROM: DON SPAGNOLO
GENERAL MANAGER

DATE: AUGUST 5, 2010

AGENDA ITEM
3

AUGUST 9, 2010

PASQUINI HYDROGEOLOGIC INVESTIGATION

ITEM

Discuss Pasquini Hydrogeologic Investigation Final Report [Receive Report and Provide Policy Direction].

BACKGROUND

The Board selected Fugro West Inc. to provide hydrogeologic services to investigate the feasibility of the Pasquini property as an alternate effluent disposal site for the Southland Wastewater Treatment Facility (WWTF). Fugro issued a draft report in February 2010 that identified the potential existence of two additional low permeability layers at depths below the sampling methods previously utilized. Fugro recommended that the presence and nature of these deep layers be investigated. The field work involved the drilling of three deep boreholes to investigate the presence and lateral continuity of the deep clay layers utilizing the sonic drilling method. This method allowed the collection of "undisturbed" soil samples at the required depths.

Fugro completed the necessary field work, developed a groundwater model to simulate effluent disposal at the site, and prepared the attached final report. The major finding of the report is that the potential exists for groundwater breakout at the bluff face and day-lighting at the ground surface adjacent to the bluff at the planned constant long-term wastewater discharge rate of 1.23 million gallons per day. Furthermore, the report suggests that alternative discharge strategies could possibly mitigate these potential results.

Staff requested a proposal from Fugro to perform supplemental groundwater modeling to determine the appropriate discharge rate and schedule for the site. Fugro submitted the attached proposal and can provide the necessary professional consulting services for a not to exceed amount of $9,600.

RECOMMENDATION

Staff recommends that the Committee receive Fugro's presentation, ask questions as appropriate and submit a recommendation to the Board to approve Fugro's proposal for supplemental groundwater modeling of the Pasquini Property.

ATTACHMENT

- Final Report Hydrogeologic Assessment of the Pasquini Property dated July 2010
- Fugro West Inc. Proposal dated July 16, 2010

FUGRO WEST, INC.

660 Clarion Court, Suite A
San Luis Obispo, California 93401
Tel: (805) 542-0797
Fax: (805) 542-9311

July 16, 2010
Proposal No. 2010.298

Nipomo Community Services District
Post Office Box 326
Nipomo, California 93444

Attention: Mr. Peter Sevcik

Subject: Proposed Scope of Work and Fee Estimate
Supplemental Groundwater Modeling for the Hydrogeologic Assessment of the Pasquini Property, Nipomo, California

Dear Mr. Sevcik:

As requested, Fugro has prepared a scope of work and cost estimate to perform supplemental groundwater modeling as part of the hydrogeologic assessment of the Pasquini property as a site for a future percolation pond system. The proposed pond system would be part of the planned upgrade and expansion of the Nipomo Community Services District (District) Southland Wastewater Treatment Facility. A meeting was held on July 16, 2010 between representatives of the District, AECOM, and Fugro to discuss the results documented in a draft report entitled "*Final Report, Hydrogeologic Assessment of the Pasquini Property, Nipomo, California*" (dated July 12, 2010). The major finding of the report was that the potential exists for groundwater breakout at the bluff face and daylighting at the ground surface of the adjacent Santa Maria River alluvium given the long-term discharge of treated wastewater effluent in the proposed pond system at the planned constant rate of 1.23 million gallons per day (mgd). However, the report also recommended that an alternative effluent discharge rate and disposal schedule to the planned constant discharge rate of 1.23 mgd might exist that would mitigate against the potential for breakout along the bluff face and daylighting in the alluvium. Consequently, the District has requested Fugro to perform two additional tasks towards the determination of an appropriate discharge rate and schedule at the site.

The first task is to estimate the maximum long-term constant discharge rate that can be achieved at the pond system site without breakout at the bluff face or daylighting in the alluvium. The second task is to evaluate the groundwater mounding impacts in the underlying dune sands for three different seasonal discharge periods (i.e., 3 months, 6 months, and 9 months) each at a constant discharge rate of 1.23 mgd. During the 3-month discharge period, for example, the pond system would receive discharge at a constant rate of 1.23 mgd and for the remaining 9 months of the year the pond system would be inactive (i.e., receive no discharge). The purpose of the second task is to determine whether the proposed pond system could be operated on a long-term seasonal basis (i.e., without the occurrence of breakout or daylighting) for any of the three evaluated seasonal discharge periods. The two tasks would be performed through an iterative computational process using the numerical transient groundwater flow model developed in MODFLOW for the hydrogeologic assessment of the Pasquini property. The results of the two tasks will be summarized in a brief technical letter submitted to the District by August 4, 2010. The estimated cost to perform this work is $9,600.

If you have any questions, please do not hesitate to call us.

Sincerely,
FUGRO WEST, INC.

Paul A. Sorensen

Paul A. Sorensen, P.G., C.Hg.
Principal Hydrogeologist

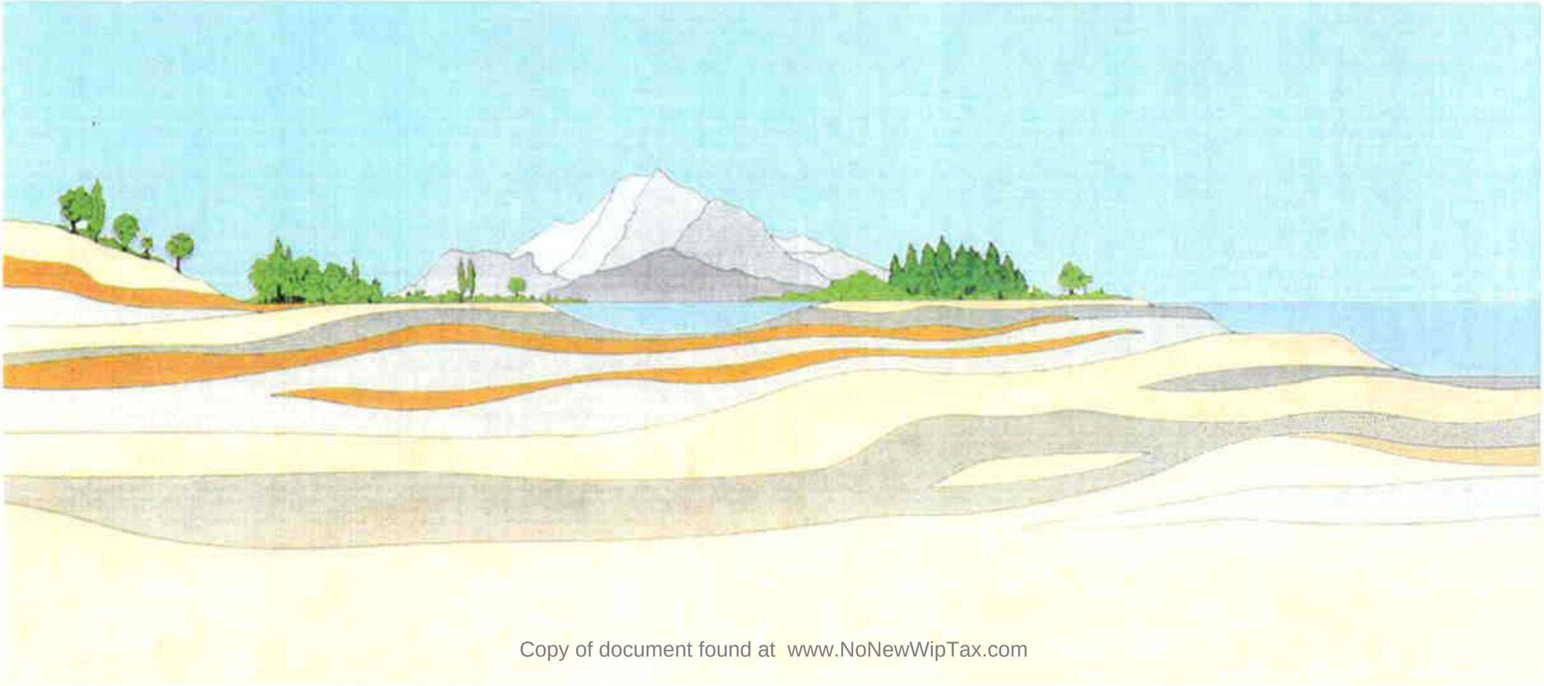
FUGRO WEST, INC.

FINAL REPORT
HYDROGEOLOGIC ASSESSMENT OF THE PASQUINI PROPERTY
NIPOMO, CALIFORNIA

Prepared for:
NIPOMO COMMUNITY SERVICES DISTRICT

Prepared by:
FUGRO WEST, INC.

July 2010



FUGRO WEST, INC.

660 Clarion Court, Suite A
San Luis Obispo, California 93401
Tel: (805) 542-0797
Fax: (805) 542-9311

July 16, 2010
Project No. 3596.005.02

Nipomo Community Services District
Post Office Box 326
Nipomo, California 93444

Attention: *Mr. Peter V. Sevcik*
District Engineer

Subject: **Final Report**
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

Dear Mr. Sevcik:

Fugro West Inc. is pleased to submit this Final Report that summarizes the results of a hydrogeologic assessment of the Pasquini property that was performed as part of the planned upgrade and expansion of the Nipomo Community Services District's Southland Wastewater Treatment Facility (WWTF). In the future, the District is anticipating the need to discharge an additional volume of 1.23 million gallons per day (mgd) of treated wastewater effluent in its disposal pond system. The purpose of this assessment was to determine the feasibility of the Pasquini property as a supplemental treated wastewater effluent disposal site (i.e., percolation pond system). The major findings of the study are summarized in a brief Executive Summary and the details of the hydrogeologic assessment comprise the main body of this report.

To evaluate the feasibility of the site, two major tasks were completed. First, the percolation capacity of the near-surface sediments on the proposed site was evaluated during field investigations to determine whether those sediments can infiltrate the treated effluent at a rate of 1.23 mgd. Second, the hydraulic properties of the subsurface sediments underlying the proposed site were evaluated in other field investigations and computer modeling was performed to simulate the groundwater mounding behavior in the subsurface due to long-term discharge of the treated effluent. In particular, the potential for breakout of the groundwater mound along the bluff face and daylighting of the effluent discharge mound at the ground surface of the Santa Maria River alluvium were evaluated.

For the first task, the results of the percolation capacity analysis found that the near-surface sediments of the proposed site are sufficient to infiltrate the treated wastewater effluent at the design rate of 1.23 mgd.

For the second task, our understanding of the site hydrogeology and the results of the modeling indicate that the potential for breakout along the bluff face and for daylighting in the Santa Maria River alluvium is high.

It is conceivable that a reduced effluent discharge rate and alternative disposal schedule might be developed that would mitigate against the potential for breakout along the bluff face or daylighting in the alluvium. Such an alternative discharge strategy was not evaluated in this study. We recommend that the District evaluate alternative discharge strategies in order to determine the feasibility of using the Pasquini property as a percolation pond facility for effluent disposal.

We appreciate the opportunity to conduct this important study and understand the need to appropriately evaluate the feasibility of this project. If you have any questions, please do not hesitate to call.

Sincerely,

FUGRO WEST, INC.

Timothy A. Nicely, P.G., C.Hg.
Project Hydrogeologist

Nels C. Ruud, PhD
Project Hydrogeologist

Paul A. Sorensen

Paul A. Sorensen, P.G., C.Hg.
Principal Hydrogeologist
Project Manager

CONTENTS

TABLES

PLATES
(following text)

APPENDICES

EXECUTIVE SUMMARY

The Nipomo Community Services District (District) is planning to upgrade and expand its Southland Wastewater Treatment Facility (WWTF). As part of the planned expansion, the District is considering the construction of a percolation pond system on a nearby 192-acre Pasquini parcel (APN 090-311-001). The pond system would be located within a 35-acre sub-area located in the northeastern corner of the property and will need to be capable of receiving and percolating up to 1.23 million gallons per day (mgd) of treated wastewater effluent from the WWTF.

The Pasquini property is located on the southern end of the Nipomo Mesa. The western boundary of the property nearly coincides with a very steep westward-facing bluff that separates the Nipomo Mesa from the lower-lying Santa Maria River Basin (Basin). In general, the Pasquini property is between 115 to 150 feet higher in elevation than the Basin. The proposed pond system site on the property is located approximately 2,200 feet from a bluff face.

Field investigations reveal the presence of a thick, relatively impermeable deep clay layer between 180 to 200 feet below ground surface (bgs). Between the ground surface and the deep clay layer, several intermediate zones of silty sand sediments of indeterminate lateral continuity were also observed. Given the relative close proximity of the proposed site to the bluff face and the Basin alluvium, it was important to evaluate whether continuous long-term discharge of treated wastewater effluent in a pond system could potentially lead to the development of a groundwater mound either on the shallow silty sand zones or on the deep clay layer. Furthermore, the potential existed that the Santa Maria River Fault, which is located approximately 1,200 feet east of the proposed pond site, would act as a horizontal barrier to flowing groundwater originating from effluent discharged into the ponds. The potential therefore exists for mound breakout at the bluff face and mound daylighting at the ground surface of the Basin alluvium.

To evaluate the feasibility of the proposed site as a percolation pond system for the WWTF, two major tasks were conducted in this hydrogeologic assessment. The first task was to quantify the percolation capacity of the near-surface sediments underlying the proposed site for infiltrating up to 1.23 mgd. The second task was to evaluate the potential for discharged effluent to break out either at the bluff face or to daylight at the ground surface of the Basin alluvium.

For the percolation capacity analysis, the constant-head test of the prototype percolation pond test indicates that the near-surface sediments possess a steady-state percolation capacity of 15 gallons per day per square feet (gpd/ft^2; equivalent to 2 feet/day). Given a pond system area of 24 acres, the steady-state percolation rate of 2 feet/day would be sufficient to infiltrate the design rate of 1.23 mgd.

For the shallow silty sand layer zone that is observed at 65 to 90 feet bgs, we conclude that the resulting mound that may build up on the silty sand layer would neither break out through the bluff face nor intersect the Basin alluvium ground surface.

For the deep clay layer, a numerical transient groundwater flow model was developed to evaluate the potential mounding effect atop the clay. The results of the modeling show that the potential exists for mound breakout at the bluff face. We also conclude that daylighting of the mound at the ground surface of the Santa Maria River Basin alluvium is also predicted.

Based on our understanding of the site hydrogeology and the results of this study, it is our conclusion that, at the proposed effluent discharge rate of 1.23 mgd, the potential exists for groundwater breakout in the nearby bluff face as well as potential daylighting of the mound at the ground surface on the Basin floor. It is possible, however, that an alternative effluent discharge rate and schedule exists that would mitigate against these results. Such an alternative discharge strategy was not evaluated in this study. Therefore, we recommend that the District evaluate the feasibility of operating a percolation pond system on the Pasquini property using an alternative effluent discharge rate and schedule to the original planned discharge of 1.23 mgd.

BACKGROUND AND SETTING

The Nipomo Community Services District (District) is planning to upgrade and expand its Southland Wastewater Treatment Facility (WWTF). As part of the planned expansion, the District is considering the construction of a percolation pond system on a nearby 192-acre parcel (APN 090-311-001) referred to here as the 'Pasquini property' (Plate 1). The pond system would be located within a 35-acre sub-area located in the northeastern corner of the property (Plate 2) and will need to be capable of receiving and percolating up to 1.23 million gallons per day (mgd) of treated wastewater effluent from the WWTF.

The Pasquini property is located on the southern end of the Nipomo Mesa. The western boundary of the property nearly coincides with a very steep westward-facing bluff that separates the Nipomo Mesa from the lower-lying Santa Maria River Basin alluvium. A schematic shown on Plate 3 illustrates the relative (i.e., not to scale) spatial positions of the proposed pond system, the bluff face, and the Basin alluvium. In general, the ground surface elevation of the Pasquini property varies from about 320 feet (MSL) near the proposed pond site to 285 feet (MSL) at the top of the bluff face. The ground surface elevation drops from 285 feet (MSL) at the top of the bluff to about 180 feet (MSL) at the base of the bluff over a horizontal distance of about 250 feet (i.e., an approximate 40 percent grade). The ground surface elevation of the Basin at a distance between 800 to 900 feet from the base of the bluff is about 140 feet (MSL). At its nearest point, the top of the bluff face is about 2,200 feet from the center location of the proposed pond system site.

A preliminary hydrogeologic and geotechnical assessment of the Pasquini property was conducted by Fugro and documented in a report entitled "*Hydrogeologic and Geotechnical Assessment of AP 090-311-001, Nipomo, California*" (Fugro, 2008). For that assessment, 11 cone penetrometer tests (CPTs) and 3 hollow-stem auger borings were performed at locations throughout the 192-acre property to characterize the vertical distribution of the underlying lithology (Plate 4). Based on an analysis of the CPTs, boring logs, and well completion reports for two agricultural production wells located on the southwestern edge of the property (Well A and Well B), a thick unsaturated zone beneath the proposed site was found to contain about five major zones of fine-grained sediments at different depths from the ground surface to the regional water table: a zone of silty sand (SM) near the ground surface, a deep fat clay (FC) layer, and three intermediate zones of silty sand (SM) (Plate 3). The lithology of the sediments between the zones of silty sand (SM) consists of coarser grained sand with silt (SP-SM) and sand (SP) (Plate 3).

Since the CPTs, borings, and agricultural wells only provide relatively continuous characterization of the aquifer sediments in the vertical direction, the lateral continuity of these zones of fine-grained sediments cannot be known with absolute certainty. The existence of significant lateral continuity for any of these intermediate zones beneath the pond site may cause that zone to behave as a perching layer. In that situation, long-term discharge of effluent in the pond would percolate downward through the underlying sediments and form a groundwater mound on the perching layer. The mound of discharge would be expected to continue percolating through the perching layer, although at a much slower rate than through the overlying sediments, while spreading out laterally on top of the perching layer. Of particular concern, therefore, in the planning and long-term operation of the pond system is the potential for breakout of discharged effluent along the bluff face due to lateral spreading of the mound on top of a perching layer. In other words, the width of the mound would increase over time, eventually reaching the bluff face and seeping through it.

Daylighting of a groundwater mound in the Basin alluvium is also a concern in the management of the percolation pond system. In this situation, long-term discharge would form a mound on the deep clay layer. Over time, the groundwater levels in the tail region of the mound might increase and eventually rise to the ground surface of the shallow Basin alluvium. Consequently, the effluent discharge rate and pond system configuration must be designed to avoid seepage through the bluff face of a laterally spreading mound or daylighting of the mound at the ground surface of the Basin alluvium.

Several faults traverse the Nipomo Mesa and the Santa Maria River Basin. In particular, the Santa Maria River Fault is located approximately 1,200 feet to the east and northeast of the Pasquini property. The vertical and horizontal extent of this fault and its hydraulic properties are not entirely known. However, it is generally considered to be a hydraulic barrier, or at least a leaky barrier, to horizontal groundwater flow and could potentially impact the shape and flow dynamics of a groundwater mound that forms due to the long-term discharge of the effluent in a pond system.

SCOPE OF WORK

The hydrogeologic assessment of the Pasquini property involved the completion of two major tasks. The first task was to quantify the percolation capacity of the near-surface sediments underlying the proposed site. This involved the performance of a series of conventional percolation tests, excavation of four exploratory test pits, and the construction and field evaluation of a prototype percolation pond. These tests were performed to evaluate whether the near-surface sediments could infiltrate the discharged effluent at the planned rate of 1.23 mgd.

Once the percolation capacity was determined to be sufficient, the second task was to evaluate the potential for the formation of a groundwater mound that might result from the long-term discharge of treated wastewater effluent in the pond system to either breakout along the bluff face or to daylight at the ground surface in the Basin alluvium. To achieve this task, three additional deep borings were performed using the sonic drilling method. The lithologic descriptions of the borings and laboratory analyses of sediment samples from the borings were used to further characterize the hydraulic properties of the underlying sediments and determine their vertical and horizontal distribution beneath the property. In particular, the silty sand zone between 65 to 80 feet bgs and the deep clay layer at 180 to 200 feet bgs were identified as the primary potential perching layers of concern (Plate 3).

The hydrogeologic data generated from the field investigations were used as input into groundwater models to evaluate the mounding potential on both the shallow silty sand zone and on the deep clay layer. This analysis included an evaluation of the mounding potential over expected ranges of horizontal hydraulic conductivity for the aquifer and for the Santa Maria River Fault.

The following sections of this report therefore discuss: 1) the percolation capacity analysis of the near-surface sediments, 2) the character of the subsurface sediments and their hydraulic properties, and 3) the potential mounding on the shallow silty sand zone and the deep clay layer using groundwater modeling. Finally, the report concludes by summarizing the results of the hydrogeologic assessment and by providing recommendations concerning the feasibility of the Pasquini property as a site for the proposed percolation pond system for disposal of treated wastewater effluent.

PERCOLATION CAPACITY ANALYSIS

The first major task of this study was to evaluate the percolation capacity of the near-surface sediments underlying the proposed site for infiltrating up to 1.23 mgd of treated wastewater effluent discharge. Assessment of the percolation capacity was conducted through the performance of three different field investigations: 1) conventional percolation testing, 2) test pit exploration, and 3) prototype percolation pond testing. As described previously, the proposed pond system is planned to be located within a 24-acre region of the 35-acre sub-area of the Pasquini property (AECOM, 2009; Appendix A). Consequently, the conventional percolation test sites, test pits, and prototype percolation pond were located approximately within the 24-acre area (Plate 2).

CONVENTIONAL PERCOLATION TESTING

Conventional percolation tests are designed to be performed over relatively short time periods (e.g., several hours) and at fairly shallow depths (e.g., 5 to 10 feet bgs). These tests are essentially falling-head permeability tests that are performed in situ. As such, these tests can be performed at different locations in an area to provide a rapid assessment of the spatial variability of near-surface infiltration rates. The results of the conventional percolation tests were subsequently used to design the more comprehensive prototype percolation pond test described later. Between August 27 and September 3, 2009, conventional percolation tests were performed at seven locations within the 35-acre sub-area of the property (Plate 2). A summary of the test locations and results are provided in Table 1 (following page).

The seven conventional percolation tests were performed in general accordance with County requirements for percolation testing. Six of the tests were performed at a depth of 5 feet bgs and one test was performed at a depth of 11 feet bgs (Table 1). Each percolation test was performed by first digging a 6-inch diameter hole to a depth of either 5 feet or 11 feet and then emplacing a slotted thin-wall PVC casing to the bottom of the hole.

Prior to testing, the site was heavily irrigated in preparation for planting of strawberries. The resulting soil moisture from the irrigation was regarded as pre-saturation of the hole which is required per testing protocol. Next, the bottom of each hole was filled with gravel to a depth of several inches. Each hole was then filled with potable water to a depth 1 foot to several feet below the ground surface. A pressure transducer was installed at the bottom of each hole and programmed to record water levels at 20-second intervals for a period of at least 3 hours. Using the water level data, a hydrograph of each percolation test was created from which percolation rates were calculated at several water level depths. The hydrographs for the seven conventional percolation tests are displayed on Plates 5 through 11.

In general, percolation rates vary proportionally with water depth (i.e., high water levels generate higher percolation rates than lower water levels). For the design water level of 18 inches, the measured percolation rates were higher than those at the 12-inch water level (see Plates 5 through 11). However, the percolation rates measured for the 18-inch water level were also believed to be unreasonably higher than the steady-state percolation rates expected during the long-term operation of the pond system at the site. Consequently, the percolation rates for the 12-inch water level are reported from the conventional percolation tests. Inspection of the hydrographs indicates that percolation rates for the 12-inch water level ranged between 20 and 50 gpd/ft^2 (2.7 to 6.7 feet/day) (Table 1).

Table 1. Summary of Conventional Percolation Test Results

Site	Hole Depth, (feet)	General Location	Percolation Rate, 12-inch depth, (gpd/ft2)	Percolation Rate, 12-inch depth, (feet/day)
Site 1	5	Northern corner	40	5.3
Site 2	11	Central	20	2.7
Site 5	5	Northeastern edge	40	5.3
Site 6	5	Southwestern edge	29	3.9
Site 7	5	Eastern central	20	2.7
Site 8	5	Southern corner	50	6.7
Site 9	5	Southeastern edge	50	6.7

The conventional percolation tests are essentially short-term falling-head tests of sediment permeability. As described later, the prototype percolation pond test included a constant-head test that was preceded by a falling-head test. Falling-head tests that proceed immediately after the performance of a constant-head test generally yields percolation rates that are smaller than those from short-term falling-head tests that are performed alone, such as the conventional percolation tests. Moreover, the conventional percolation tests are more likely to yield percolation rates that are higher than the steady-state percolation rates estimated from longer term constant-head tests. Therefore, the range of estimated percolation rates at the 12-inch depth by the conventional percolation tests were useful for indicating the relative magnitude of the percolation rates that would be estimated by the constant-head test in the prototype percolation pond test at the 18-inch design water level.

TEST PIT EXPLORATION

Four exploratory test pits were excavated in the vicinity of the prototype percolation pond (Plate 2). The purpose of the test pits was to characterize the sediments to a depth below the design bottom elevation of the pond system. Each of the four test pits was excavated with a backhoe to a depth between 14 to 15 feet bgs. Fugro staff logged each test pit, photographed the exposed sediments, and collected multiple bulk sediment samples from each pit. Descriptions of the test pits sediments are included in Appendix A and photographs of the test pits are presented in Appendix B.

Sediments from the test pits consisted primarily of silty sand and sand. Generally, silty sand was present at the surface and underlain by pale yellowish sand with interbeds of silty sand below depths of 6 to 10 feet bgs. Sediments were moist to depths of 8 to 15 feet bgs and wetter below these depths (likely reflecting the results of irrigation return flows of the strawberry operation). Overall, the texture of the sediments from the test pits are consistent with those found in the upper 10 feet of sediments in the CPTs and borings from the previous hydrogeologic and geotechnical assessment of the property (Fugro, 2008).

PROTOTYPE PERCOLATION POND TESTING

Based on the conventional percolation testing results, a prototype percolation pond was constructed near the center of the site. The prototype percolation pond was excavated on September 2 and constructed on September 3, 2009. Given an anticipated percolation rate in the range of 10 to 50 gpd/ft^2 (i.e., 1.3 to 6.7 feet/day), a pond 400 square foot pond was constructed (i.e., 20-feet by 20-feet) with a depth of 2 feet. Sediments from the excavation consisted entirely of silty sand. A metered supply of pumped water from the on-site agricultural water wells was used to fill the pond. The pumped water was delivered through the irrigation system to a 21,000 gallon tank installed temporarily adjacent the percolation pond. Gate valves and one float valve were installed to control water levels and inflow rates. A dedicated pressure transducer was installed in the percolation pond to measure and record water levels at 5-minute intervals throughout the entire test program. A staff gauge was also installed to monitor the water level in the pond. Photographs of the constructed pond are provided in Appendix B.

On September 15, the pond was filled with water to a stage of approximately 18 inches. A constant head above the base of the pond was controlled with the use of the float valve. Throughout the entire test period, water levels in the test pond were monitored and automatically recorded at 5-minute intervals. A hydrograph of the water level in the test pond is presented on Plate 12. Inspection of Plate 12 indicates that after about three days of initial filling and pre-saturation, the inflow rate varied narrowly between 4.3 gallons per minute (gpm) (days 3 through 6) and 3.9 gpm (days 6 through 9). Assuming a relatively constant inflow rate of 4 gpm throughout the test, the percolation rate in the near-surface sediments underlying the test pond was approximately 15 gpd/ft^2 (2 feet/day).

On September 25, 2009, after 10 days of testing, inflow to the pond was switched off and the test terminated. A falling head test was then conducted by recording the declining water level in the test pond until the pond emptied. On September 28, the partially full tank was then drained into the pond. On September 30, after the tank had completely emptied into the pond, a second falling head test was conducted by again recording the declining water level in the pond for several hours. Hydrographs of the two falling head tests are presented on Plates 13 and 14.

The falling head tests started on September 25 (Plate 13) and September 30 (Plate 14) indicate that the percolation rate was between 7.5 gpd/ft^2 and 12.7 gpd/ft2 (1 to 1.7 feet/day). These rates are consistent with reported hydraulic conductivity values for "silt" and "silty sands" (Freeze and Cherry, 1979), for "silt and loess" (Driscoll, 1986), and for "silt" and "fine sand" (Roscoe Moss Company, 1990). The range of values indicates that the later test had a lower percolation rate, likely due to algal growth within the pond and associated minor clogging. For the proposed full-scale percolation ponds, algal and turbidity-related clogging will need to be addressed, both of which can decrease percolation rates significantly.

In summary, the constant-head test of the prototype percolation pond test indicates that the near-surface sediments possess a steady-state percolation capacity of 15 gpd/ft^2 (2 feet/day). Given a pond system area of 24 acres, the steady-state percolation rate of 2 feet/day is sufficient to infiltrate the design rate of 1.23 mgd.

SUBSURFACE CHARACTERIZATION

The Pasquini property is located at the southern end of the Nipomo Mesa. The subsurface sediments underlying the Nipomo Mesa are generally characterized as unconfined dune sands that extend from the ground surface to depths between 150 to 250 feet bgs (S.S. Papadopulos & Associates, 2004). The Santa Maria River Basin alluvium is located adjacent to and west of the Nipomo Mesa at an elevation between 115 to 150 feet below the ground surface elevation of the Pasquini property. The Paso Robles Formation underlies both the dune sands of the Nipomo Mesa and the shallow alluvium of the Santa Maria River Basin. In this study, the sediments underlying the Pasquini property and the alluvial sediments in the region of the Basin adjacent to the bluff face were characterized by the performance of field investigations, laboratory analyses of collected sediment samples, and review of data from previous reports. Characterization of the underlying sediments in this section includes: 1) results of the field investigations performed on the property, 2) a conceptualization of the subsurface stratigraphy, 3) estimation of the sediment hydraulic conductivity, 4) description of local and regional groundwater levels, and 5) a water quality analysis of groundwater from the Paso Robles Formation, which is the primary water-producing aquifer in the area.

FIELD INVESTIGATIONS

Field investigations were conducted for the purpose of characterizing the vertical and horizontal distribution of sediments in the subsurface and to quantify their hydraulic properties. In the previous hydrogeologic and geotechnical assessment conducted on the Pasquini property, 11 CPTs and 3 hollow-stem auger borings were performed (Fugro, 2008) (Plate 4). During 2008, two agricultural wells (Well A and Well B) were drilled in the southeastern corner of the property and completed to depths of 400 feet bgs (Plate 4). Of particular note, the well completion report for Well A shows a 34-foot layer described as 'gray clay' at a depth interval of 180 to 214 feet bgs whereas the well completion report for Well B indicates a 5-foot 'clay' layer between 190 to 195 feet bgs.

Both agricultural wells are located in the southeastern corner of the property. In order to assess the lateral extent of the deep clay layer in other areas of the property, three additional deep borings were performed along a transect extending from the prototype percolation pond area to the bluff face (see Plate 4). These borings were performed with the sonic drilling method, which produces relatively undisturbed core samples from the ground surface to the total depth of the boring. The deep boring nearest to the bluff face is referred to as 'Site 1', the deep boring intermediate between Site 1 and the pond area is 'Site 2', and the deep boring in the pond area is 'Site 3' (Plate 4).

A summary of the exploration logs for the three sonic boring sites is presented in Table 2 and the actual logs are presented in Appendix C. The drilling of each boring was terminated when a uniform dark gray fat clay of substantial thickness was encountered, which occurred in all three holes at more or less the target depths. The depths to the top of this fat clay layer was 195, 184, and 187 feet bgs for Sites 1, 2, and 3, respectively (Table 2). The samples of clay collected at the three sites were each 10 to 12 feet in length, uniformly moist, and very stiff. (It's noteworthy that a test hole was drilled near Site 1 in June 2010 by the landowner as a possible location for a third agricultural production well. The results of the test hole drilling also show the presence of the deep clay at a depth consistent with that of Site 1.) Otherwise, the sediments between the ground surface and the top of the deep clay layer consisted almost entirely of mixtures of sand (SP), sand with silt (SP-SM) and silty sand (SM). These sediment lithologies are consistent with those observed in the CPTs and hollow-stem auger borings (Fugro, 2008). The sand fractions of these mixtures were entirely fine- to medium-grained. With the exception of a 6-inch layer of clay observed at Site 2 and Site 3, the sandy sediments were notably absent of gravel and clay.

Table 2. Summary of Sonic Drilling Method Boring Data

Exploration	General Location	Surface Elevation (feet, MSL)	Total Depth (feet)	Depth of Clay (feet)	Elevation of Clay (feet, MSL)
Site 1	South at Top of Bluff	305	205	195	110
Site 2	Central Staging Area	308	196	184	124
Site 3	Access Road to North	320	196	187	133

The Santa Maria River Basin alluvium is located directly adjacent and west of the bluff face. The ground surface elevation of the Basin alluvium in the vicinity of the Pasquini property varies from about 180 feet (MSL) at the base of the bluff to 140 feet (MSL) about 800 to 900 feet west of the bluff face. The top elevation of the deep clay layer at Site 1 is 110 feet (MSL). Assuming that the deep clay layer is relatively flat beneath the Basin alluvium within 900 feet of the bluff face implies that the thickness of the alluvial sediments on the Basin floor range from

30 to 70 feet. The upper 30 to 40 feet of sediments in the Basin adjacent to the bluff face are described in test pit and drill hole logs as silts (ML), silty fine sand (SM), and fine- to medium-grained sands (SP) (Fugro, 2006). Similarly, the 50 feet of sediments at Site 1 that overlie the top of the deep clay layer (i.e., at an elevation of 110 feet (MSL)) consist of sand with silt (SP-SM) and sand (SP) (see Appendix C). Therefore, the sediments overlying the deep clay layer at Site 1 (i.e., underlying the Pasquini property) are consistent with those found in the drill holes located in the Basin alluvium at similar elevations and suggest lateral continuity of sediment texture between the Nipomo Mesa and the Basin alluvium.

CONCEPTUALIZATION OF SUBSURFACE STRATIGRAPHY

In the previous hydrogeologic and geotechnical assessment, four geologic cross sections in the northeast to southwest directions were generated using CPT and hollow-stem auger boring logs (see Plates 3 through 6 in Fugro, 2008). The three sonic drilling method borings were added to cross section B-B' and this updated cross section is displayed on Plate 15 of this report. A conceptualization of the subsurface stratigraphy underlying the Pasquini property based on cross section B-B' is shown on Plate 3.

Each of the hollow-stem auger and sonic drill borings on Plate 15 indicate the presence of a zone extending from the ground surface to a depth between 10 to 20 feet bgs that is comprised of thin layers of silt interbedded with sandy sediments (Plate 15). This near-surface zone of silty sand (SM) would be largely removed during the construction of a percolation pond at this site. Several thicker zones of silty sand (SM) material were identified at approximately 65 to 80 feet bgs, 100 to 105 feet bgs, and 145 to 160 feet bgs. The lateral continuity of these silty sand zones from the pond site to the bluff face is uncertain (Plate 15). Nevertheless, these silty sand sediments have lower hydraulic conductivities in comparison to the coarser-grained sand with silt (SP-SM) and sand (SP) sediments and may therefore impede the downward migration of discharged effluent. The abundance of silty sand (SM) material in the zones defined at the different depth intervals merits their evaluation as potential perching layers for the discharged wastewater.

The well completion report for Well A indicated a 34-foot layer described as 'gray clay' at a depth interval of 180 to 214 feet bgs and the well completion report for Well B indicated a 5-foot 'clay' layer between 190 to 195 feet bgs. The three borings extracted using the sonic drilling method also indicated the presence of significant thicknesses of fat clay (FC) at depths of 195, 184, and 187 feet bgs at Sites 1, 2, and 3, respectively. The ground surface elevations of Sites 1, 2, and 3 are 305, 308, and 320 feet (MSL), respectively, and result in corresponding clay layer top elevations of 110, 124, and 133 feet (MSL). Site 1 is located nearest to the edge of the bluff. Assuming that the elevation at the base of the bluff face is 180 feet (MSL), the distance separating the bluff base and the top of the clay layer is about 70 feet. Assuming that the lowest elevation of the Basin alluvium in the vicinity of the bluff face is 140 feet (MSL), the distance separating the ground surface of the Basin alluvium and the top of the clay layer is about 30 feet (Plate 3).

ESTIMATION OF SEDIMENT HYDRAULIC CONDUCTIVITY

Laboratory permeability tests were performed on sediment samples from the hollow-stem auger and sonic borings at different depths; these results are summarized in Table 3 (laboratory calculation sheets and results are provided in Appendix D). The estimated permeabilities in Table 3 are representative of the vertical hydraulic conductivities of the associated sediments. These results suggest a range of 1 to 1.5 feet/day for the vertical hydraulic conductivity of silty sand (SM) sediments. In general, the vertical hydraulic conductivity of loamy soils, which are similar in texture to silty sand (SM), ranges from 0.3 to 3 feet/day (EPA, 2006). Consequently, the lab permeability test estimates of vertical hydraulic conductivity for the silty sand (SM) samples are consistent with the reported range for loamy soils (Table 3).

Table 3. Summary of Laboratory Permeability Test Results

Boring No.	Depth (feet)	Classification	Vertical Hydraulic Conductivity (feet/day)
B-102	10	Silty sand (SM)	1.2
B-102	50	Sand (SP), poorly graded	28.3
B-102	70	Sand with silt (SP-SM)	26.6
B-103	10	Silty sand (SM)	1.0
B-103	20	Sand (SP), poorly graded	34.0
B-103	70	Silty sand (SM)	1.5
Site 1	197	Fat Clay (FC)	3.7×10^{-7}
Site 2	186	Fat Clay (FC)	2.3×10^{-6}
Site 3	191	Fat Clay (FC)	9.4×10^{-7}

A reported range of vertical hydraulic conductivity for a 'deep clay bed' was 3×10^{-8} to 0.03 feet/day (EPA, 2006). The measured vertical hydraulic conductivities of the deep fat clay (FC) from the sonic drilling cores at Site 1, Site 2, and Site 3 were 3.7×10^{-7}, 2.3×10^{-6}, and 9.4×10^{-7} feet/day (Table 3). Consequently, the lab permeability test estimates of vertical hydraulic conductivity for the fat clay (FC) samples are also consistent with the reported lower end of the range for a deep clay bed (Table 3).

The sediment texture of dune sands is generally characterized as fine- to medium-grained sand. The 50-foot bgs and 70-foot bgs sediment samples in B-102 were classified as sand (SP) and sand with silt (SP-SM), respectively (Table 3). The 20-foot bgs sediment sample in B-103 was also classified as sand (SP). Permeability tests conducted on these sandy samples resulted in a range of vertical hydraulic conductivity estimates of 26.6 to 34 feet/day (Table 3). The vertical hydraulic conductivity of fine sand is reported to vary from 3 to 16 feet/day, whereas the range for medium sand is 16 to 66 feet/day (EPA, 2006). The lab permeability test estimates of vertical hydraulic conductivity for the three sandy samples were therefore consistent with the reported ranges for fine to medium sand (Table 3).

The anisotropy ratio is equal to the ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity. Dune sand deposits are generally well sorted and are characterized by low anisotropy ratios in the range of 2 to 5. Applying this anisotropy ratio range to the estimated vertical hydraulic conductivities for the three sandy samples (i.e., sand with silt (SP-SM) and sand (SP)) yields an overall horizontal hydraulic conductivity range of approximately 50 to 170 feet/day for sands with silt (SP-SM) and sand (SP). The corresponding horizontal hydraulic conductivities of the sediment samples described as silty sand (SM) are therefore in the range of 2 to 7.5 feet/day. As shown in the CPT logs, the thickness between the ground surface and the top location of the shallow silty sand zone starting at 65 feet bgs consists predominantly of sand (SP), sands with silt (SP-SM), and thin layers of silty sands (SM). The effective or average horizontal hydraulic conductivity in the upper 65 feet of the subsurface can be estimated as a thickness-weighted average of the horizontal hydraulic conductivities of the sands and sands with silt (50 to 170 feet/day) and silty sands (2 to 7.5 feet/day). Similar effective horizontal hydraulic conductivities can be estimated from the ground surface and the deep clay layer between 180 to 200 feet bgs.

As discussed later, the horizontal hydraulic conductivity of the upper stratum of sediments underlying the proposed pond site and above a potential perching layer will control the mound height beneath the pond and above the perching layer. Therefore, a reasonable range of horizontal hydraulic conductivity values for the upper stratum in the mounding analysis conducted in this study was chosen to be 10 to 100 feet/day. The lower end value of 10 feet/day is considered conservative and is likely more representative of the upper stratum between the ground surface and the deep clay layer at 180 feet bgs. The upper end value of 100 feet/day is probably more representative of the upper stratum between the ground surface and the shallow silty sand zone at 65 feet bgs. The application of the horizontal hydraulic conductivity range of 10 to 100 feet/day in the groundwater models is described later in the groundwater mounding analysis section of this report.

LOCAL AND REGIONAL GROUNDWATER LEVELS

The two agricultural wells in the southeastern portion of the property are screened in the Paso Robles Formation that exists beneath the deep clay layer. The well completion reports for the two wells indicate depths to groundwater of 250 and 255 feet bgs during 2008 when they were drilled. The ground surface elevations of these wells likely vary between 279 to 295 feet (MSL). Consequently, the water table elevation associated with these wells is approximately 30 to 50 feet (MSL). Water level contour maps of groundwater elevations during the spring seasons of 1995, 2000, and 2002 show groundwater elevations beneath the property in the range of 50 to 100 feet (MSL) (S.S. Papadopulos & Associates, 2004). The observed groundwater levels of the two wells are therefore consistent with the reported range of water levels observed between 1995 to 2002.

The sonic borings indicate moist to wet sediments at various depths above the deep clay layer. The observed wetness of these partially saturated sediments is likely due to long-term deep percolation of precipitation through the unsaturated zone. Although the dune sands underlying the Pasquini property are not considered to possess a substantial saturated thickness in which a production well could be screened and operated, it is nevertheless probable that a thin layer (e.g., perhaps several feet) of saturation overlies the top boundary of the deep clay layer.

WATER QUALITY ANALYSIS

For the prototype percolation pond test, the supply water was pumped from the two on-site agricultural production wells and delivered to the pond through the irrigation distribution system. The wells are approximately 500 feet apart and are located in the southern portion of the site adjacent to the bluff face (Plates 1 and 4). Both wells are also perforated between 220 and 380 feet bgs within the Paso Robles Formation. The well completion details are documented on State of California Well Completion Reports provided in Appendix E.

To assess the water quality of the supply water for the percolation test and for future assessment of the potential water quality of the receiving aquifer should a disposal facility be built on the site, a water quality sample was collected and submitted to an analytical laboratory. The sample was analyzed for general mineral, general physical, and inorganic constituents, and the results are presented in Table 4 and Appendix E.

Table 4. Water Quality Analysis of Paso Robles Formation Groundwater
(Units in milligrams per liter, unless otherwise noted)

Constituent	On-Site Well September 25, 2009
Total dissolved solids	660
pH (pH units)	7.4
Calcium	79
Magnesium	35
Sodium	63
Potassium	3.3
Alkalinity, Total (as $CaCO_3$)	200
Chloride	83
Sulfate	180
Fluoride	0.36
Nitrate as $N0_3$	4.9
Hardness (as $CaCO_3$)	320
Iron	0.11
Manganese	0.18

Review of the summarized water quality results in Table 4 indicates that the underlying groundwater is calcium sulfate to calcium bicarbonate in chemical character with a total dissolved solids concentration of 660 milligrams per liter (mg/l). Although a deep clay layer of significant lateral continuity and thickness is thought to separate the dune sands from the productive regions of the Paso Robles Formation, it is theoretically possible that discharged effluent could percolate through the deep clay layer over a very long period of time and recharge the Paso Robles Formation. To the extent that this deep percolation could occur, the Paso Robles Formation represents a receiving aquifer for the effluent discharged in the overlying dune sands.

GROUNDWATER MOUNDING ANALYSIS

The second major task of this study was to evaluate the groundwater mounding potential above the shallow silty sand zone at 65 feet bgs and above the deep clay layer (Plate 3). Due to long-term discharge of effluent in the pond system, the shallowest silty sand zone (i.e., from 65 to 80 feet bgs) may act as a perching layer with the formation of a groundwater mound on its upper boundary. The effluent would continue percolating through the shallow silty sand zone, although at a much slower rate than through the overlying coarser-textured sediments, while spreading out laterally on top of this perching layer. Of particular concern in the planning and long-term operation of the pond system is the potential for breakout of discharged effluent along the bluff face due to lateral spreading of the mound on top of such a perching layer.

Based on the sonic borings and the two well completion reports, the deep clay layer appears to be laterally continuous between the pond site and the bluff face (Plate 15). Measured vertical hydraulic conductivities of sediment samples from the deep clay layer are in the low end of the range of reported values for clay (Table 3). These extremely low permeabilities suggest that the deep clay layer would prevent significant downward percolation of the effluent from the dune sands into the underlying Paso Robles Formation. As such, the effluent would be expected to form a mound on the top of the clay layer and spread laterally. Similar to the shallow silty sand zone, the potential exists for the mound on the clay layer to either breakout along the base of the bluff face or rise to the ground surface of the Santa Maria River Basin alluvium at some distance away from the bluff.

In this study, mounding on the shallow silty sand zone and on the deep clay layer is evaluated separately using different methods. For the shallow silty sand zone, an analytical method developed by Khan et al. (1976) is used to evaluate the groundwater mounding potential on this zone to the extent that it acts as a perching layer. For the deep clay layer, the long-term infiltration of precipitation into the overlying dune sands has likely resulted in the formation of a relatively thin layer (i.e., several feet) of saturation on the top surface of the clay. The existence of a layer of saturation is partially confirmed by the observation of wet sediments in the sonic logs. Consequently, a numerical groundwater flow model was developed in MODFLOW (Harbaugh, 2000) and used to evaluate the groundwater mounding behavior on the deep clay layer. The model is developed based on the assumption that a mound will form on the thin layer of saturation that is believed to exist on the surface of the deep clay layer.

EVALUATION OF GROUNDWATER MOUNDING ON THE SHALLOW SILTY SAND ZONE

The potential for breakout along the bluff face was evaluated for the shallow sandy silt zone (i.e., from 65 to 80 feet bgs) using an analytical solution to a mathematical problem describing the formation of a groundwater mound on a perching layer under steady-state conditions (Khan et al., 1976). A schematic displaying the shallow silty sand zone is displayed on Plate 3. In this problem, recharge is applied at the ground surface at a constant rate. The underlying aquifer is composed of an upper stratum and a lower stratum. In this study, the lower stratum is the shallow silty sand zone starting at 65 feet bgs and the upper stratum consists of the overlying coarser-grained sediments between the pond bottom and the top of the shallow silty sand zone (Plate 3). The upper stratum is assumed to have a horizontal hydraulic conductivity (K_1) that is significantly greater than the vertical hydraulic conductivity (K_2) of the lower stratum (e.g., K_1/ K_2=50, 100, ..., 1000). The actual infiltration rate (q) (i.e., volumetric recharge rate divided by recharge area) is assumed to be less than the saturated vertical hydraulic conductivity of the upper stratum and significantly greater than the vertical hydraulic conductivity of the perching layer. Based on the results of the percolation capacity analysis (Table 1), an infiltration capacity of 2 feet/day was assumed for the near-surface sediments at the proposed site. Given a constant recharge rate, a groundwater mound with a steady-state shape would form on the lower stratum, which acts as the perching layer. The water table in the problem is assumed to be located at a significant distance below the top of the perching layer. As part of the analytical solution to the shape of the steady-state perched groundwater mound, Khan et al. (1976) developed the following relationship:

$$w_{\max} = L\frac{K_2}{q} \qquad (1)$$

where $w_{\max}$ is the maximum half-width of the recharge area and L is the distance from the center of the pond to the edge of the mound. For design purposes, equation (1) can be used to evaluate the feasibility of a proposed pond system given information describing the vertical hydraulic conductivity of any potential perching layers as well as anticipated effluent discharge rates and pond areas. For the proposed pond system on the Pasquini property, equation (1) will be used to determine whether the assigned hydraulic conductivities of the shallow silty sand zone beneath the site may potentially generate a groundwater mound that will eventually reach and seep through the bluff face.

Mound height (H) above the perching layer at any horizontal distance (x) from the center of the pond system can be estimated using the following equations derived from Dupuit-Forchheimer seepage theory by Khan et al. (1976):

$$H = w\left[\frac{K_2}{K_1}\left(\frac{q}{K_2}-1\right)\left(\frac{q}{K_2}-\frac{x^2}{w^2}\right)\right]^{1/2} \quad 0 \le x < w \qquad (2)$$

$$H = w\left(\frac{K_2}{K_1}\right)^{1/2}\left[\frac{q}{K_2} - 1\right] \qquad x = w \qquad (3)$$

$$H = w\left(\frac{K_2}{K_1}\right)^{1/2}\left[\frac{q}{K_2} - \frac{x}{w}\right] \qquad w < x \le L \qquad (4)$$

Equation (2) estimates mound height for a horizontal distance less than the half-width of the pond system; equation (3) estimates mound height at a horizontal distance equal to the half-width of the pond system; and equation (4) estimates mound height for horizontal distances from the pond center greater than the half-width and less than or equal to the distance of the mound edge.

The Khan method was used to estimate the mounding height on the shallow silty sand zone as a function of the distance from the pond system center towards the bluff face. For this, a vertical hydraulic conductivity of 0.1 was assigned to the silty sand zone. This assigned value is chosen to be just below the low end range value of 0.3 feet/day for loamy soils and is conservative in comparison to the lab permeability test estimates of vertical hydraulic conductivity for silty sands (Table 3). The mound height was then estimated using equations (2) to (4) by varying the horizontal hydraulic conductivity of the upper stratum (i.e., coarser sediments overlying the shallow silty sand zone) over the values of 10, 20, 50, and 100 feet/day.

Plate 16 shows the estimated mound height as a function of horizontal distance from the pond center for the silty sand layer (K_2=0.1 feet/day) and for the four different values of horizontal hydraulic conductivity of the upper stratum (K_1=10, 20, 50, and 100 feet/day). The results of the mounding analysis for the silty sand layer are also summarized in Table 5 (following page). For K_2=0.1 feet/day and for each value of K_1, the maximum mound height beneath the center of the pond was estimated to be below the ground surface (Plate 16 and Table 5). Given a constant value of K_2, the lower the value of the horizontal hydraulic conductivity of the upper stratum, the greater the mound height. Consequently, K_1=10 feet/day generated the greatest mound height beneath the pond. However, as discussed previously, K_1=10 feet/day represents a conservatively low value of horizontal hydraulic conductivity for the upper stratum, particularly in comparison to lab permeability test estimates of vertical hydraulic conductivity for sands and sands with silt in the range of 26.6 to 34 feet/day (Table 3).

The distance of the mound edge from the pond center is controlled by the vertical hydraulic conductivity of the low-permeable perching layer. Therefore, the distance of the mound edge from the center of the pond for a value of K_2=0.1 feet/day was 674 feet. The values of horizontal hydraulic conductivity for the upper stratum and the vertical hydraulic conductivity of the shallow silty sand layer evaluated by the Khan method did not result any breakout of the mound at the bluff face approximately 2,200 feet from the pond center (Table 5).

Table 5. Sensitivity Analysis of Mounding on the Shallow Silty Sand Zone

Silty Sand Shallow Layer Vertical Hydraulic Conductivity (feet/day)	Upper Stratum Horizontal Hydraulic Conductivity (feet/day)	Maximum Mound Height (feet)	Depth to Mound beneath Pond Site (feet, bgs)	Distance from Pond Center Mound Edge (feet)	Mound Height at Bluff Face (feet)	Mound Breakout at Bluff Face?
0.1	10	63	2	674	0	No
0.1	20	44	21	674	0	No
0.1	50	28	37	674	0	No
0.1	100	20	45	674	0	No

The results of the mounding analysis presented in Table 5 are theoretically applicable to the other three silty sand zones displayed on Plate 3. The horizontal hydraulic conductivity of the upper stratum above each of these other three silty sand zones could be regarded as possessing an effective horizontal hydraulic conductivity that is an average of the horizontal hydraulic conductivities of the different zones or layers that lie above it For example, the upper stratum above the shallowest silty sand at 65 feet bgs is largely coarse-grained (i.e., ignoring the surficial silty sand sediments that would largely be removed during construction of the pond system). Therefore this upper stratum might possess a horizontal hydraulic conductivity in the upper range of values presented in Table 5 (e.g., 50 to 100 feet/day). For the silty sand zone at 145 to 160 feet bgs, the overlying upper stratum consists of both silty sand zones and coarser-grained zones of sand and sand with silt (Plate 3). Consequently, the upper stratum above the silty sand zone at 145 to 160 feet bgs would possess a lower average or effective horizontal hydraulic conductivity value (e.g., 10 to 20 feet/day). Therefore, the range of horizontal hydraulic conductivities for the upper stratum presented in Table 5 and evaluated by the Khan method is applicable for the evaluation of the mounding behavior of each silty sand zone shown on Plate 3 given the assumption that each of these silty sand zones has the same vertical hydraulic conductivity of 0.1 feet/day.

EVALUATION OF GROUNDWATER MOUNDING ON THE DEEP CLAY LAYER

The potential for mound breakout along the bluff face or mound daylighting at the ground surface of the Santa Maria River Basin alluvium was evaluated for the deep clay layer using a transient groundwater flow model developed in MODFLOW (Harbaugh, 2000). In this model, treated wastewater effluent was discharged in a representative, simulated pond system at a constant rate of 1.23 mgd for a period of 20 years. The 20-year simulation period was considered to be an appropriate long-term evaluation period for the proposed percolation pond project. The model domain is 20,705 acres in size with the pond situated approximately at its center and on the Pasquini property. The large area of the model domain was chosen in order to minimize the influence of the perimeter boundary conditions on the simulated groundwater levels (i.e., effluent mound) that result from the long-term discharge of the treated wastewater effluent in the pond. The subsurface was modeled as a single unconfined aquifer with a specific yield value of 0.08. The deep clay layer was assumed to underlie the unconfined aquifer over the entire model domain and was further assumed to be flat with an elevation of 110 feet (MSL) (i.e., the elevation of the top of the fat clay observed at sonic boring Site 1). As a conservative assumption, the deep clay layer represents the base of the permeable sediments of the Nipomo Mesa dune sands and the Basin alluvium and is therefore considered impermeable in the model. Despite the extremely low permeability of the deep clay layer based on laboratory tests, however, deep percolation through the clay layer in reality would be expected to occur although at an exceptionally slow rate. The transient groundwater model does not really evaluate whether a mound will occur on the deep clay but rather whether the assumed hydraulic conductivity of the overlying aquifer will dissipate the mound without breakout along the bluff face or daylighting at the ground surface of the Basin alluvium. Finally, the Santa Maria River Fault is potentially a significant barrier to horizontal groundwater flow in the Nipomo Mesa aquifer. Consequently, this fault was represented in the model using the MODFLOW Horizontal Flow Barrier package.

Three sets of simulations were performed to evaluate mounding on the deep clay layer. First, the model was executed for four possible values of horizontal hydraulic conductivity for the entire overlying aquifer ($K_{aquifer}$=10, 20, 50, and 100 feet/day). For this set, the fault barrier was assigned a conservative horizontal hydraulic conductivity value of 0.01 feet/day. In the second set of simulations, the horizontal hydraulic conductivity of the overlying aquifer was assigned a value of 20 feet/day and the model was executed for four possible values of the fault barrier horizontal hydraulic conductivity (K_{fault}=0.001, 0.01, 0.1, and 1.0 feet/day). Finally, in the third set of simulations the model was again executed for four possible values of horizontal hydraulic conductivity for the overlying aquifer ($K_{aquifer}$=10, 20, 50, and 100 feet/day) but the Santa Maria fault was not considered to be a hydraulic barrier to groundwater flow (i.e., the fault barrier was removed from the model).

Plate 17 shows the estimated mound height as a function of horizontal distance from the pond center towards the bluff face for four different values of horizontal hydraulic conductivity of the aquifer ($K_{aquifer}$=10, 20, 50, and 100 feet/day) and a value for the fault barrier of 0.01 feet/day. The results of the four simulations are also summarized in Table 6 (following page). For each assumed value of the aquifer horizontal hydraulic conductivity, the maximum mound height beneath the center of the pond was estimated to be below the ground surface (Table 6). The simulated depths to the top of the mound beneath the pond ranged from 53 to 154 feet bgs as the aquifer horizontal hydraulic conductivity varied from 10 to 100 feet/day.

Table 6. Sensitivity Analysis of Mounding on the Deep Clay Layer for Variable Horizontal Hydraulic Conductivity of the Upper Stratum

Aquifer Horizontal Hydraulic Conductivity (feet/day)	Fault Barrier Horizontal Hydraulic Conductivity (feet/day)	Mound Elevation at Pond Site (feet, MSL)	Depth to Mound at Pond Site (feet)	Mound Elevation at Bluff Face (feet, MSL)	Mound Elevation in River Alluvium (feet, MSL)	Mound Breakout at Bluff Face?	Mound Daylight in Basin Alluvium?	Breakout Time at Bluff Face (years)	Daylight Time in River Alluvium (years)
10	0.01	267	53	208	194	Yes	Yes	6.0	3.6
20	0.01	226	94	187	177	Yes	Yes	12.2	3.3
50	0.01	188	132	164	158	No	Yes	--	4.3
100	0.01	166	154	150	146	No	Yes	--	7.6

The deep clay layer is located approximately 70 feet below the ground surface at the base of the bluff face (i.e., 180 feet (MSL)). As such, the mound height beneath the base of the bluff face would have to rise at least 70 feet above the top surface of the deep clay layer to break out at the ground surface. Similarly, the deep clay layer is assumed to be approximately 30 feet below the Santa Maria River Basin alluvium elevation of 140 feet (MSL). Breakout of the mound at the bluff face occurred for aquifer horizontal hydraulic conductivity values of 10 and 20 feet/day but not for 50 and 100 feet/day (Table 6). Daylighting of the mound at the ground surface of the Basin alluvium occurred for all four values of horizontal hydraulic conductivity.

These results suggest that the long-term operation of the percolation pond at the constant effluent discharge rate of 1.23 mgd will eventually result in the daylighting of a groundwater mound at the ground surface of the Basin alluvium. Assuming that the overlying aquifer possesses a horizontal hydraulic conductivity between 10 and 20 feet/day and the fault barrier a value of 0.01 feet/day, the numerical model predicts that breakout at the bluff face will occur within 6 to 12.2 years of operating the facility at a rate of 1.23 mgd. Daylighting of the mound in the Basin alluvium will occur between 3.3 and 7.6 years.

Plate 18 shows the estimated mound height as a function of horizontal distance from the pond center towards the bluff face for four different values of horizontal hydraulic conductivity for the fault barrier (K_{fault}=0.001, 0.01, 0.1 and 1 feet/day) and a value for the aquifer of 20 feet/day. The results of the four simulations are also summarized in Table 7 (following page). For each assumed value of the fault barrier horizontal hydraulic conductivity, the maximum mound height beneath the center of the pond was estimated to be below the ground surface (Table 7). The simulated depths to the top of the mound beneath the pond ranged from 91 to 110 feet bgs as the fault barrier horizontal hydraulic conductivity varied from 0.001 to 1 feet/day. Breakout of the mound at the bluff face occurred for fault barrier horizontal hydraulic conductivity values of 0.001 and 0.01 feet/day but not for 0.1 and 1 feet/day (Table 7). Daylighting of the mound at the ground surface of the Basin alluvium occurred for all four values of horizontal hydraulic conductivity evaluated for the fault barrier.

These results again suggest that the long-term operation of the percolation pond at the constant effluent discharge rate of 1.23 mgd will eventually result in the daylighting of a groundwater mound at the ground surface of the Basin alluvium. Assuming that the fault barrier possesses a horizontal hydraulic conductivity between 0.001 and 0.01 feet/day and the aquifer has a hydraulic conductivity value of 20 feet/day, the numerical model predicts that breakout at the bluff face will occur between 10 and 12.2 years. Daylighting of the mound in the Basin alluvium will occur between 3.3 and 4.4 years.

Table 7. Sensitivity Analysis of Mounding on the Deep Clay Layer for Variable Horizontal Hydraulic Conductivity of the Santa Maria River Fault

Aquifer Horizontal Hydraulic Conductivity (feet/day)	Fault Barrier Horizontal Hydraulic Conductivity (feet/day)	Mound Elevation at Pond Site (feet, MSL)	Depth to Mound at Pond Site (feet)	Mound Elevation at Bluff Face (feet, MSL)	Mound Elevation in River Alluvium (feet, MSL)	Mound Breakout at Bluff Face?	Mound Daylight in Basin Alluvium?	Breakout Time at Bluff Face (years)	Daylight Time in River Alluvium (years)
20	0.001	229	91	190	180	Yes	Yes	10.0	3.3
20	0.01	226	94	187	177	Yes	Yes	12.2	3.3
20	0.1	216	104	176	168	No	Yes	--	3.6
20	1	210	110	171	162	No	Yes	--	4.4

For the third set of simulations, the hydraulic barrier in the model representing the Santa Maria River Fault was removed (i.e., the fault was assumed to not be a barrier to groundwater flow). In these simulations, breakout at the bluff face only occurred for the aquifer horizontal hydraulic conductivity value of 10 feet/day. However, daylighting of the mound at the ground surface of the Basin alluvium still occurred for each of the four values of aquifer horizontal hydraulic conductivity evaluated (i.e., $K_{aquifer}$=10, 20, 50, and 100 feet/day).

Overall, the results of the simulations indicate that breakout along the bluff face is likely to occur due to the long-term operation of the percolation pond at the planned effluent discharge rate of 1.23 mgd. Daylighting of the mound at the Basin alluvium ground surface is even more likely given the range of hydraulic parameters evaluated by the numerical model.

CONCLUSIONS AND RECOMMENDATIONS

In this study, a hydrogeologic assessment of the Pasquini property was performed to evaluate the property as a potential site for a percolation pond system that will be capable of receiving and infiltrating up to 1.23 mgd of treated wastewater effluent from the WWTF. The assessment consisted of two major tasks: 1) the performance of a series of field tests to quantify the percolation capacity of the near-surface sediments at the site, and 2) evaluation of the groundwater mounding behavior above a shallow silty sand zone and a deep clay layer in order to assess whether the recharge mound formed by operation of the facility would break out (daylight) in the nearby bluff face or whether the mound would daylight in the Basin alluvium.

For the percolation capacity analysis, the constant-head test of the prototype percolation pond test indicates that the near-surface sediments possess a steady-state percolation capacity of 15 gpd/ft^2 (2 feet/day). Given a pond system area of 24 acres, the steady-state percolation rate of 2 feet/day is sufficient to infiltrate the design rate of 1.23 mgd.

For the shallow silty sand layer zone that is observed at 65 to 80 feet bgs, the analysis indicates that the resulting mound would neither break out through the bluff face nor intersect the Basin alluvial ground surface. The horizontal distance of the mound edge from the pond center was estimated to be 674 feet (at an assumed vertical hydraulic conductivity of the silty sand zone of K_2=0.1 feet/day). As noted earlier, K_2=0.1 feet/day was chosen to be just below the low end range value of 0.3 feet/day for loamy soils (EPA, 2006) and is conservative in comparison to the lab permeability test estimates of vertical hydraulic conductivity for silty sands.

For the deep clay layer, simulations of the site using a numerical transient groundwater flow model shows that the potential exists for mound breakout at the bluff face for a horizontal hydraulic conductivity of the dune sand sediments between 10 to 20 feet/day. Daylighting of the mound at the ground surface of the Santa Maria River Basin alluvium was predicted for the entire range of potential values of horizontal hydraulic conductivity evaluated for the overlying aquifer.

Based on our understanding of the site hydrogeology and the results of the mounding analysis performed in this study, it is our opinion that a percolation pond system at the planned long-term treated wastewater effluent discharge rate of 1.23 mgd is not feasible without risking effluent breakout in the bluff face or daylighting of the mound in the Santa Maria River Basin alluvium.

It is possible, however, that an alternative effluent discharge rate and schedule exists that would mitigate against the potential for mound breakout along the bluff face or mound daylighting in the Basin alluvium. Such an alternative discharge strategy was not evaluated in this study, but could be simulated using alternative effluent discharge rates and operational schedules. The additional recommended work would involve supplementary model runs using alternative discharge rates to determine the quantity of effluent that could be discharged at the site without risking effluent breakout in the bluff face or daylighting of the mound in the Santa Maria River Basin alluvium.

REFERENCES

AECOM (2009), "Draft Conceptual Percolation Pond Layout, Pasquini Property (APN 090-311-001)", June, 2009.

Driscoll, F.G. (1986), Groundwater and Wells, Johnson Division., St. Paul, Minnesota, pg. 1021

Environmental Protection Agency (EPA) (2006), Process Design Manual, Land Treatment of Municipal Wastewater Effluents, EPA/625/R-06/016, 194 pages.

Freeze, R.A, and Cherry, J.A. (1979), Groundwater, Englewood Cliffs, New Jersey, Prentice-Hall, Inc.

Fugro (2006), *Preliminary Geotechnical Report Nipomo-Santa Maria Intertie, Nipomo, California*, prepared for Boyle Engineering, October 2006.

Fugro (2008), *Hydrogeologic and Geotechnical Assessment of APN 090-311-001, Nipomo, California*, prepared for Nipomo Community Services District, July 2008.

Harbaugh, A.W. (2000), MODFLOW 2000, The U.S. Geological Survey Modular Ground-Water Model - User Guide to Modularization Concepts and the Ground-water Flow Process, U.S. Geological Survey Open-File Report 00-92, Reston, Virginia

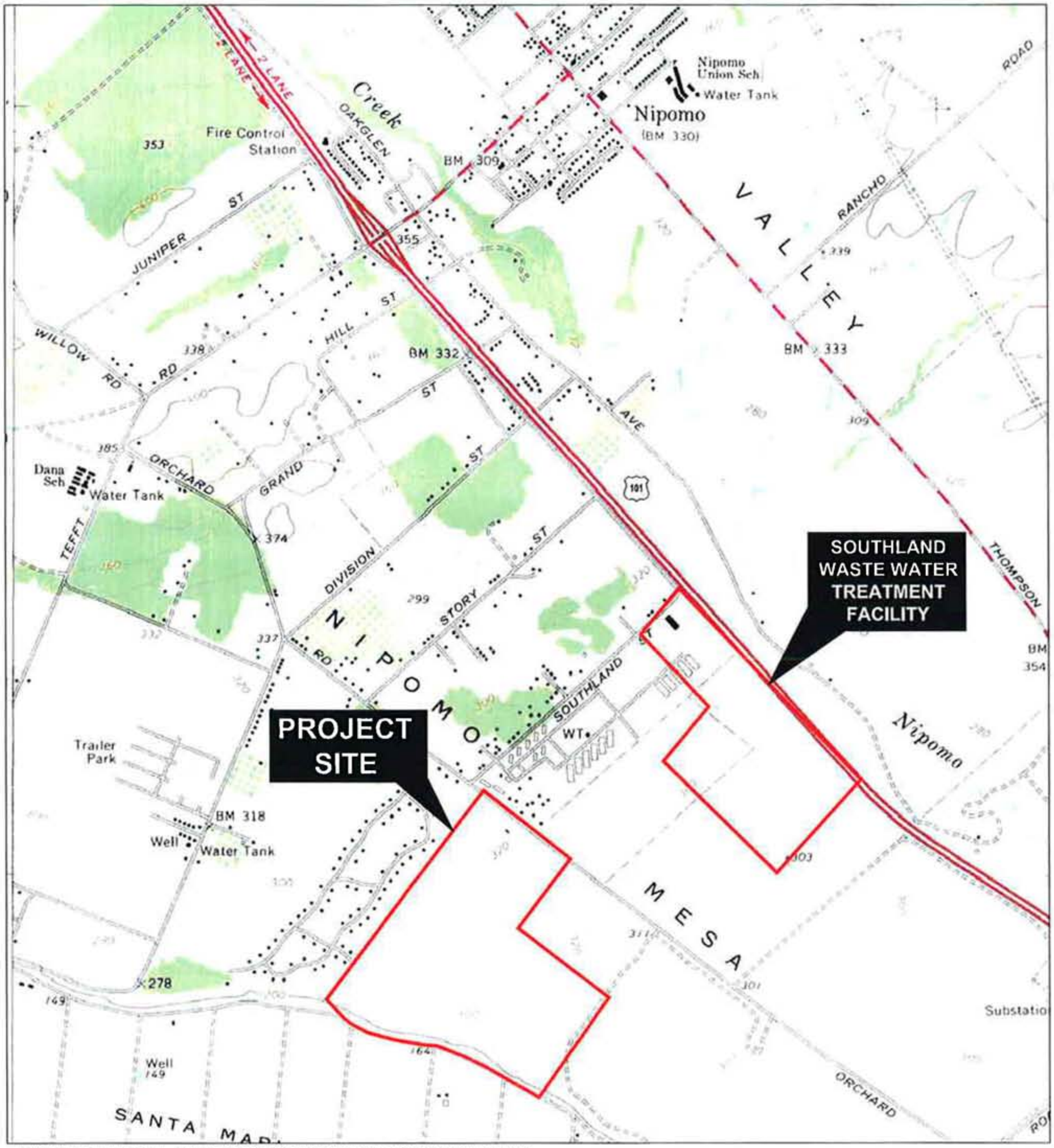
Khan, M.Y. and Kirkham, D. (1976), Shapes of Steady State Perched Groundwater Mounds, *Water Resources Research*, Vol. 12, No. 3, pp. 429-36.

Roscoe Moss Company (1990), *Handbook of Ground Water Development*, John Wiley & Sons, Los Angeles, California.

S.S. Papdopulos & Associates, Inc. (2004), *Nipomo Mesa Groundwater Resource Capacity Study, San Luis Obispo County, California*, prepared for San Luis Obispo County, March 2004.

United States Geological Survey (1965), *Oceano Quadrangle, San Luis Obispo County, California, 7.5 Minute Series (Topographic)*, Scale 1:24000, revised 1994.

PLATES



BASE MAP SOURCE: USGS NIPOMO QUADRANGLE TOPOGRAPHIC MAP

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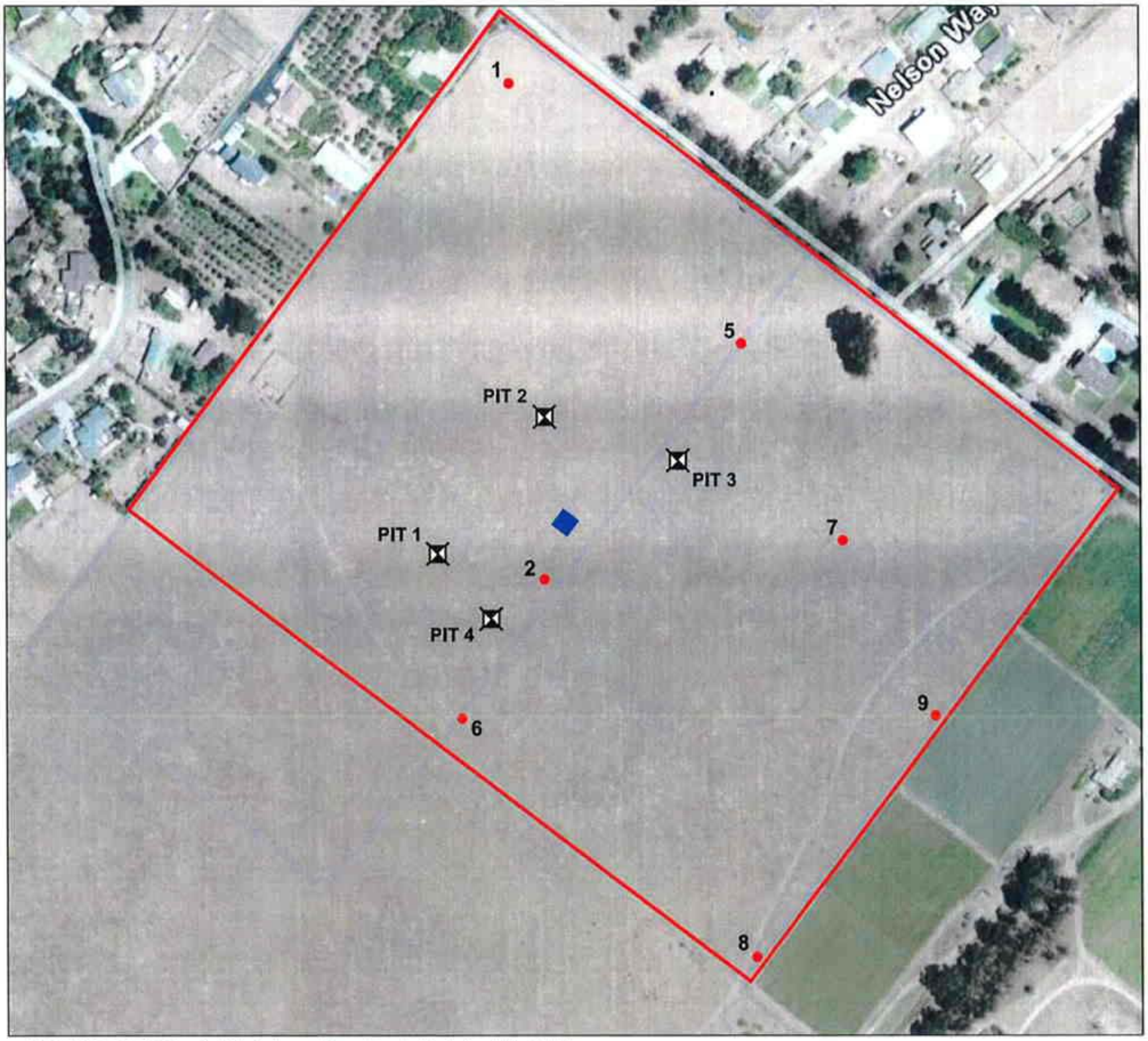
VICINITY MAP
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

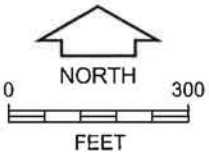
PLATE 1



BASE MAP SOURCE: Aerial photograph from Google Earth Pro (July 2007).

LEGEND

9 ●	Conventional Percolation Test Location
🟦	Prototype Percolation Pond (dimensions of approximately 20 feet by 20 feet).
PIT 1 ☒	Exploration Pit Location
▬	Access Roads
▬	Area of Investigation



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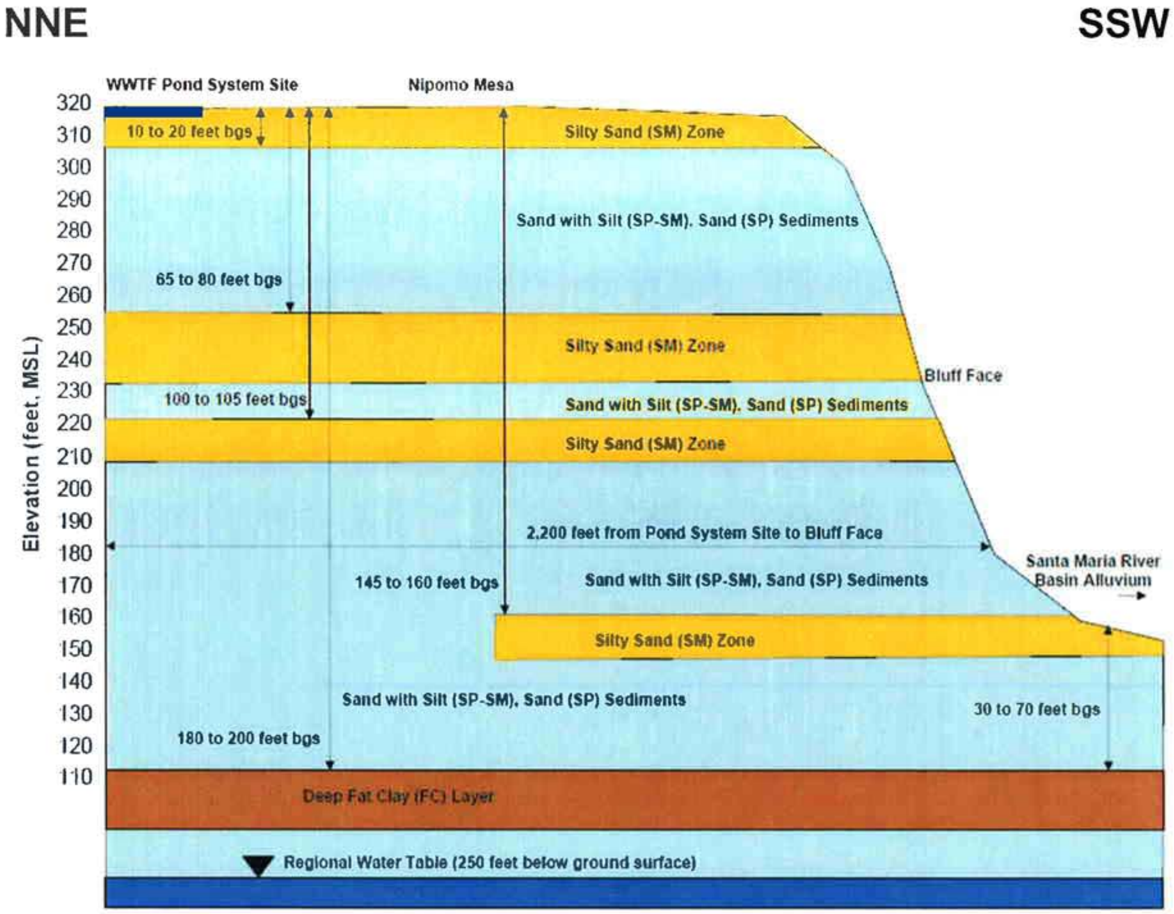
SITE MAP, NORTHERN PORTION

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 2



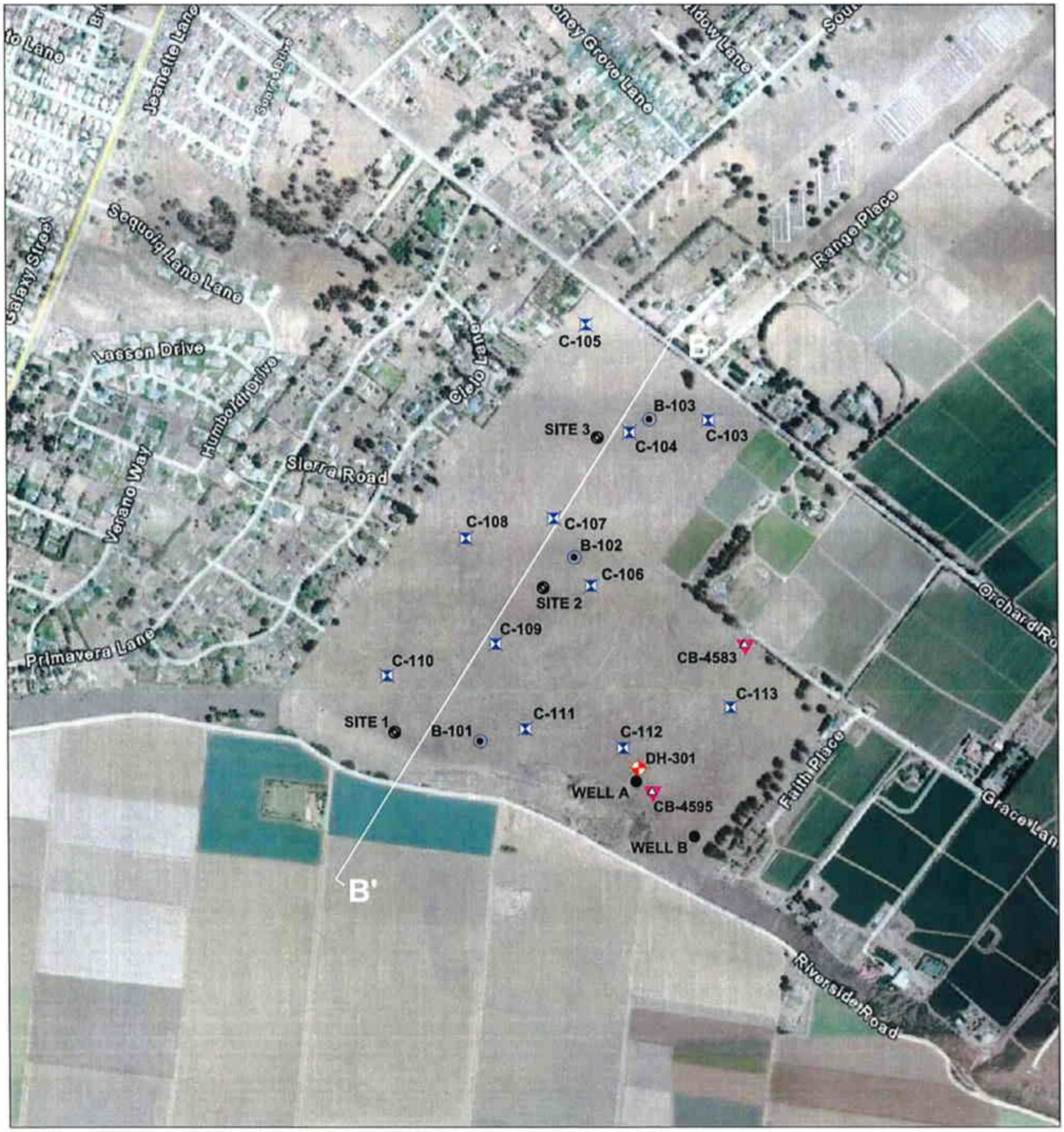
NOT TO SCALE

CONCEPTUALIZATION OF SUBSURFACE STRATIGRAPHY

Hydrogeologic Assessment of the Pasquini Property

Nipomo, California

Nipomo Community Services District
Project No. 3596.005.02



BASE MAP SOURCE: Google Earth Pro 2007 Image.

LEGEND

C-113	Approximate Location of CPT Soundings
B-103	Approximate Location of Borings
CB-4595	Approximate Location of CPT Soundings from previous investigation
DH-301	Approximate Location of Boring from previous investigation
B B'	Approximate Location of Cross Sections
SITE 3	Approximate Location of Sonic Exploration
WELL B	Approximate Location of Well

NORTH

0 1000
FEET

SITE MAP AND EXPLORATION LOCATIONS

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 4

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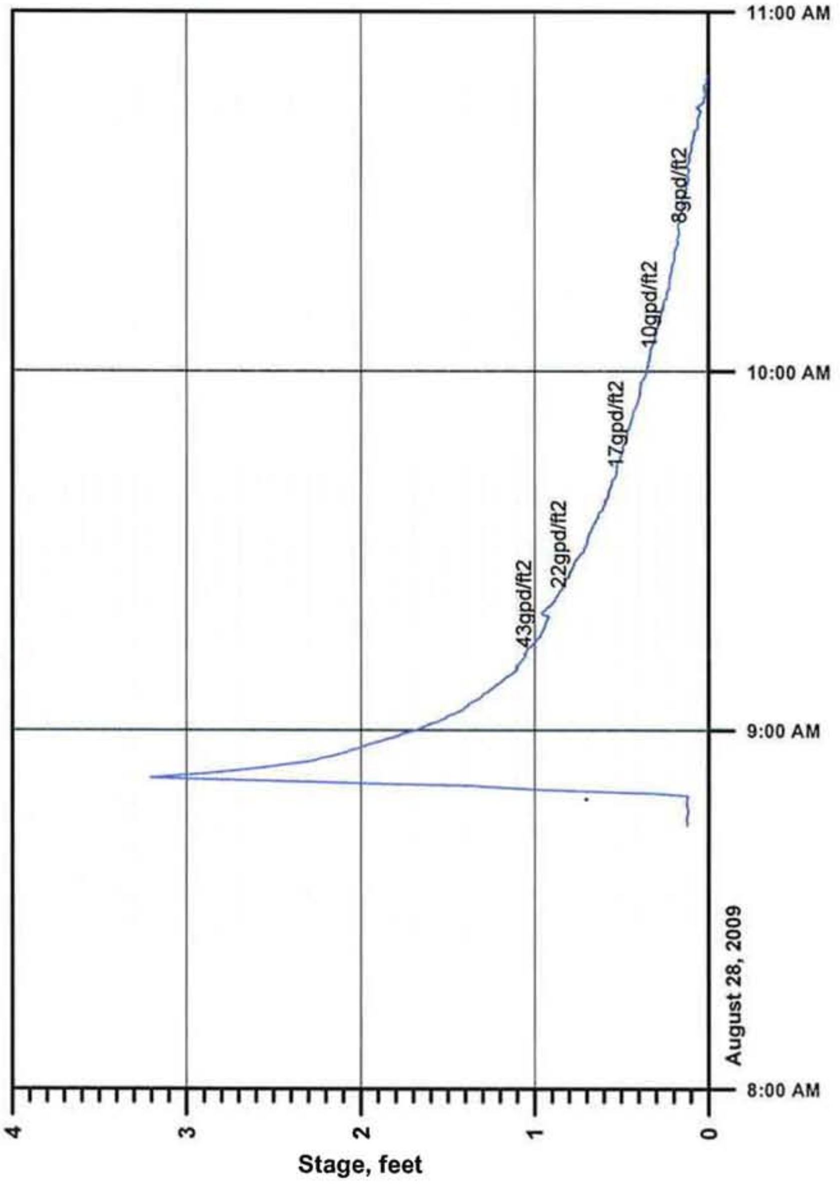
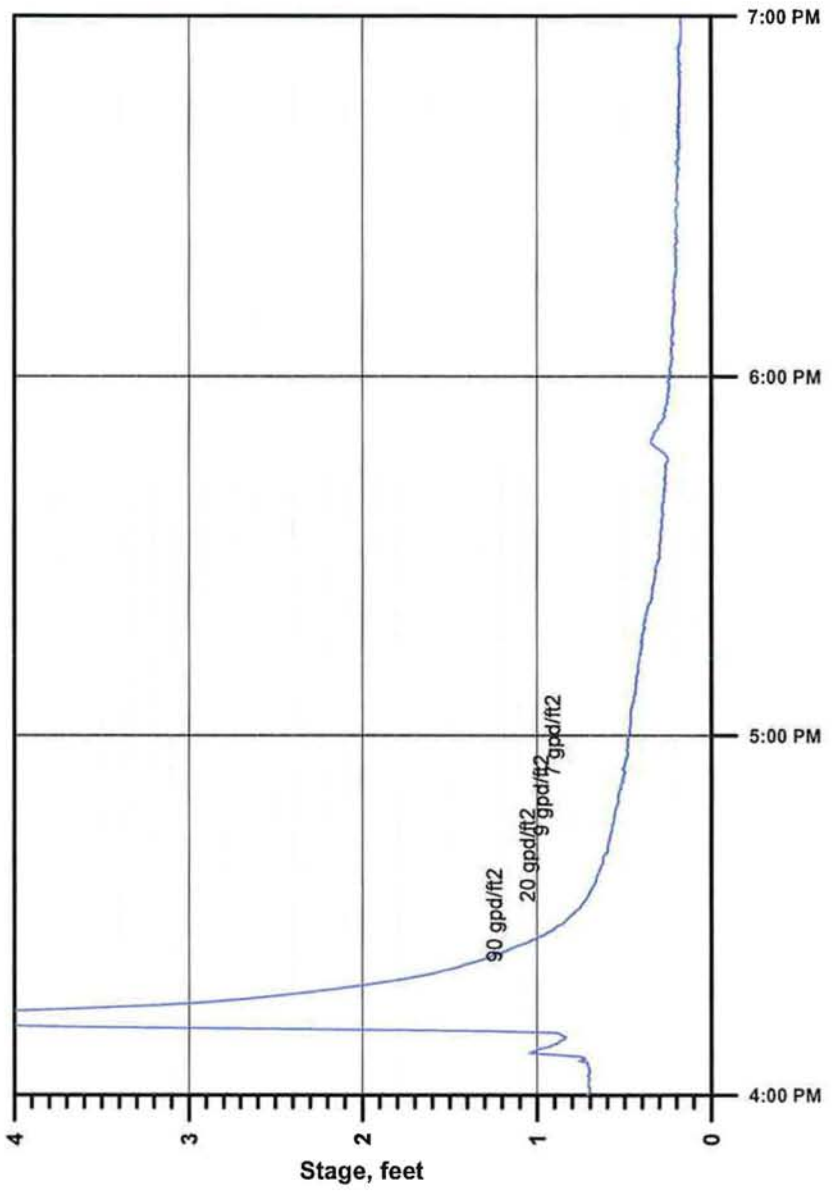
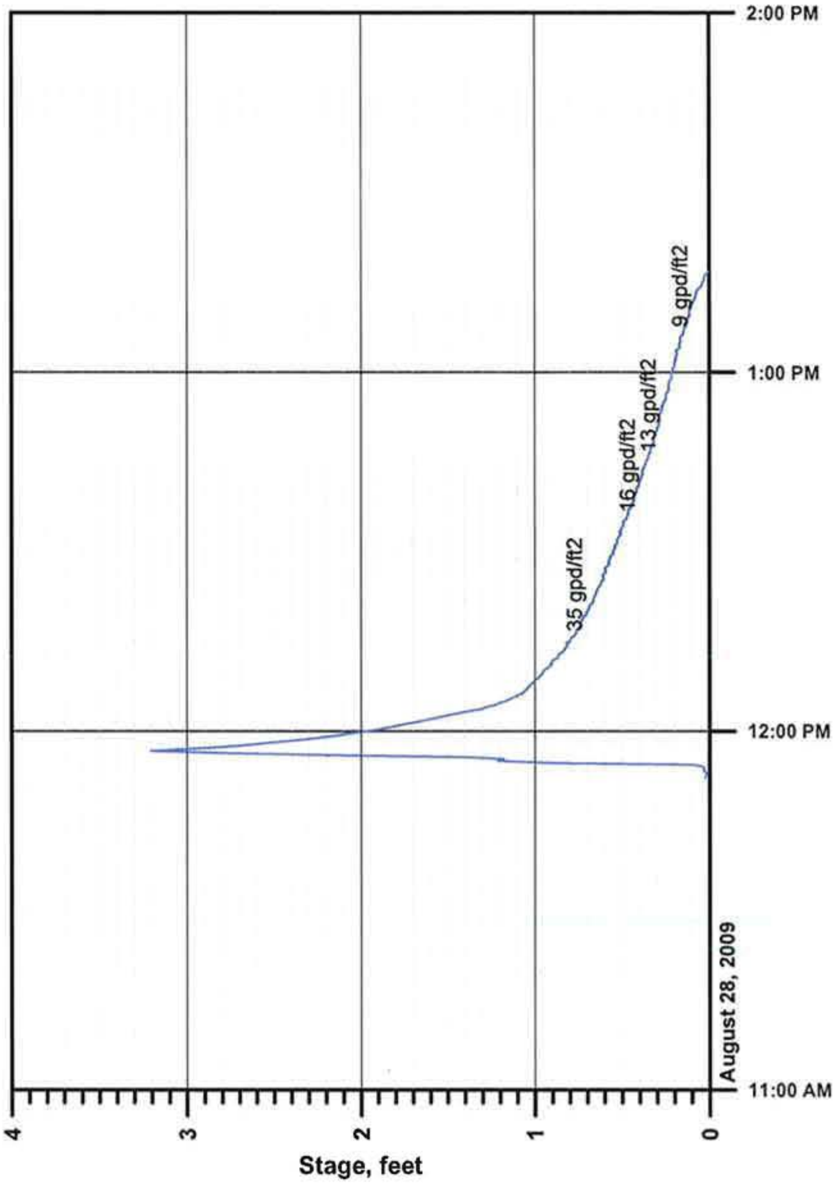


CONVENTIONAL PERCOLATION TEST, SITE 1
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California



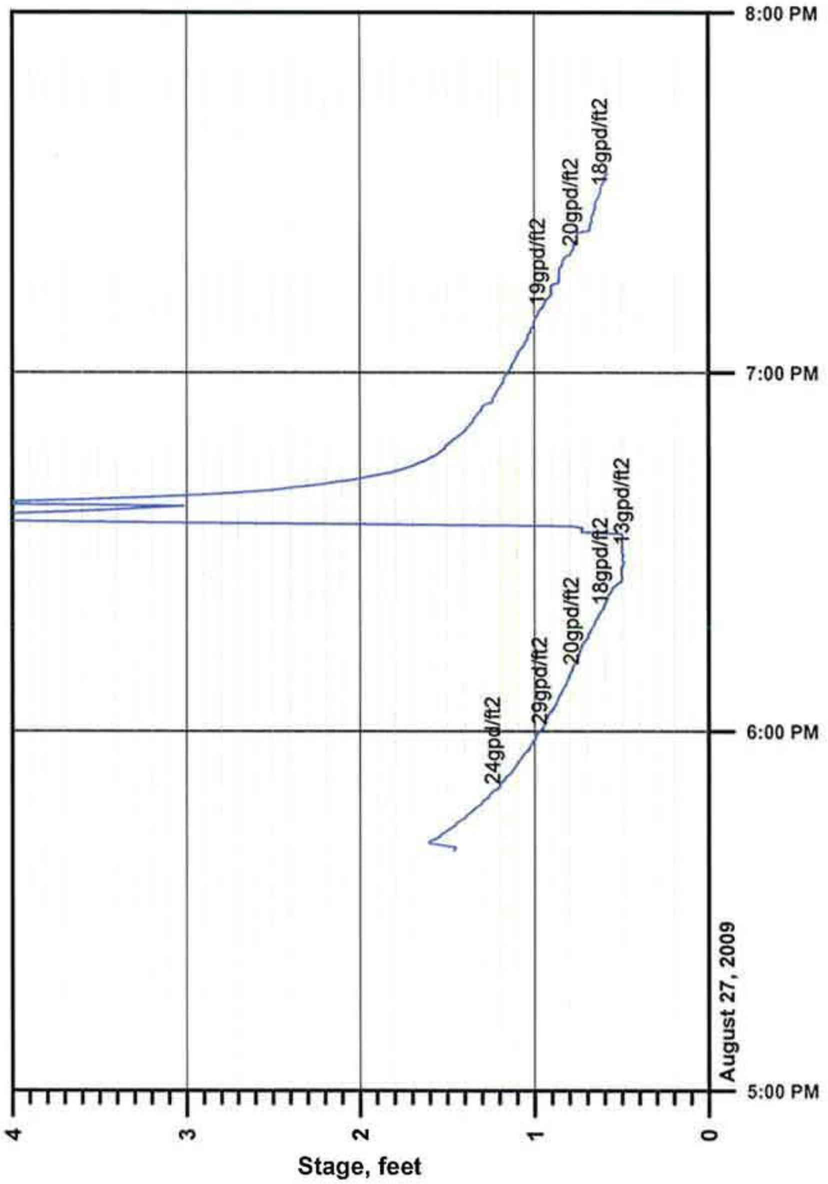
CONVENTIONAL PERCOLATION TEST, SITE 2
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 6

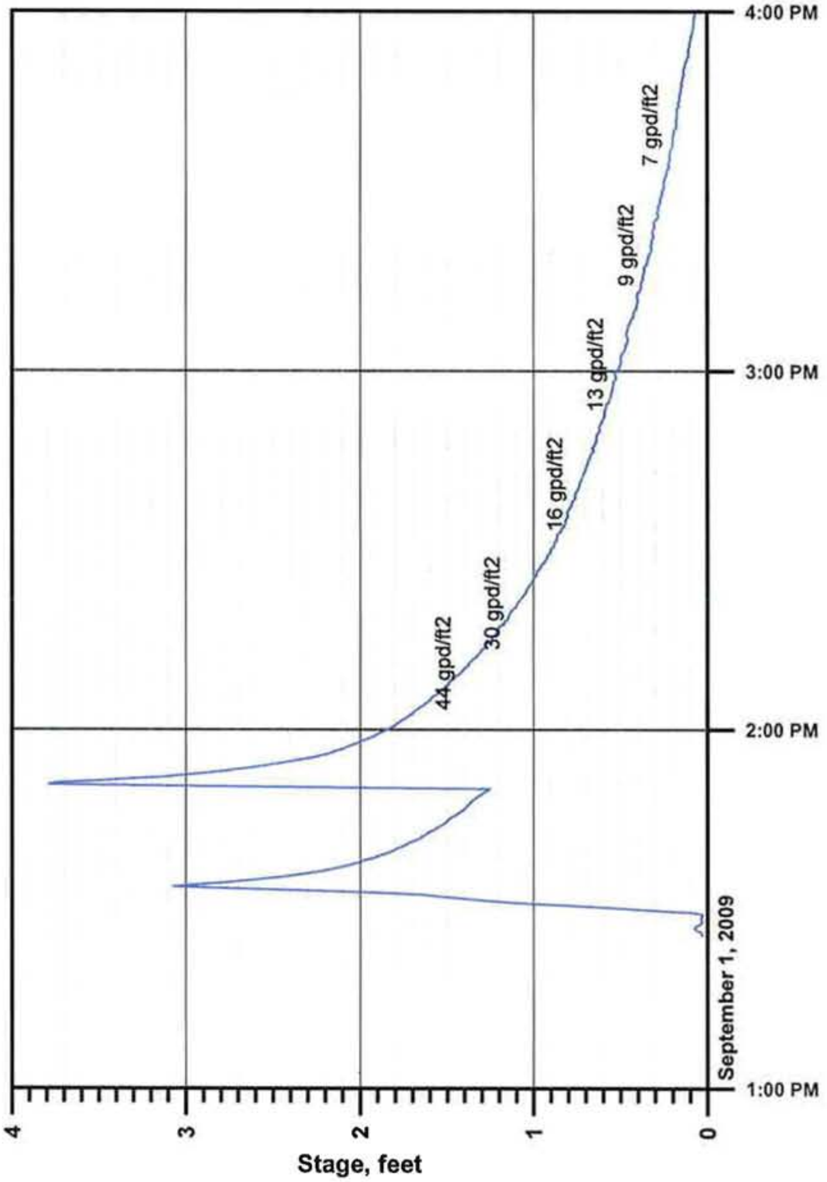


CONVENTIONAL PERCOLATION TEST, SITE 5
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

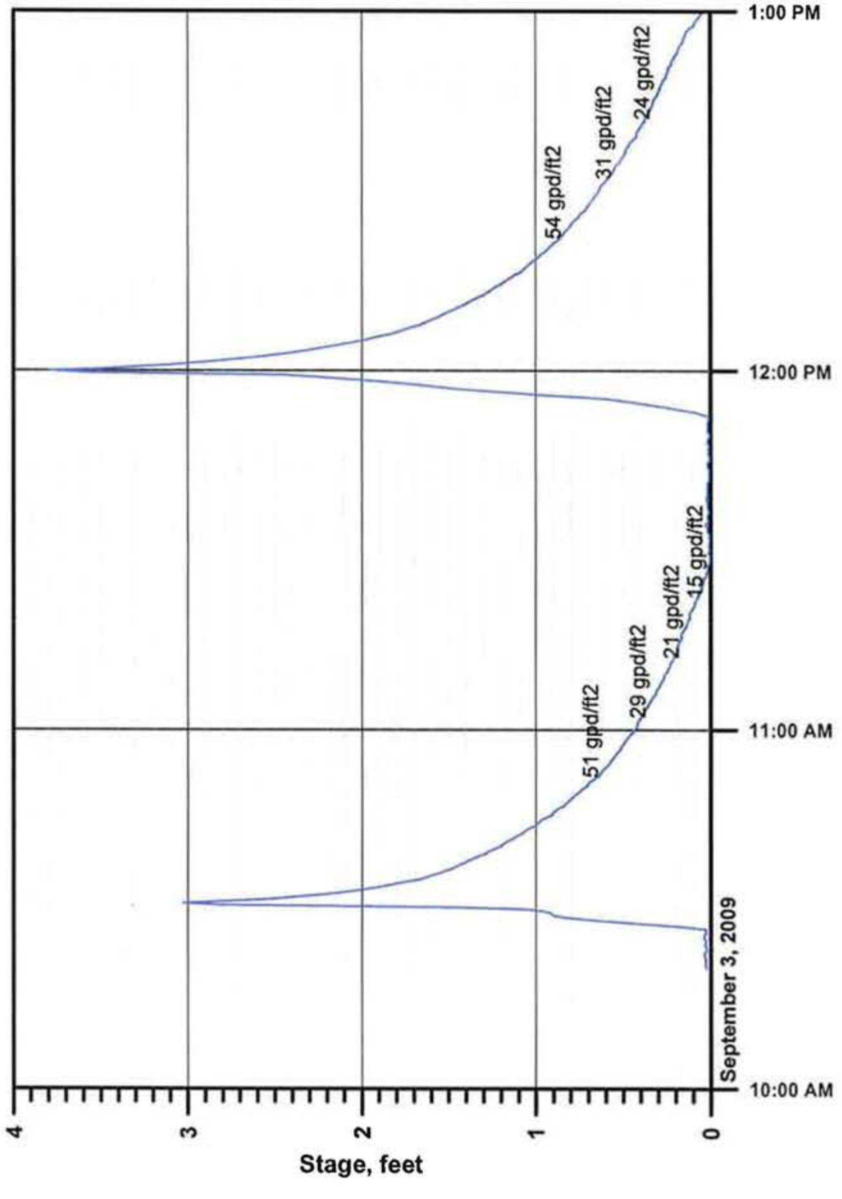
PLATE 7



CONVENTIONAL PERCOLATION TEST, SITE 6
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

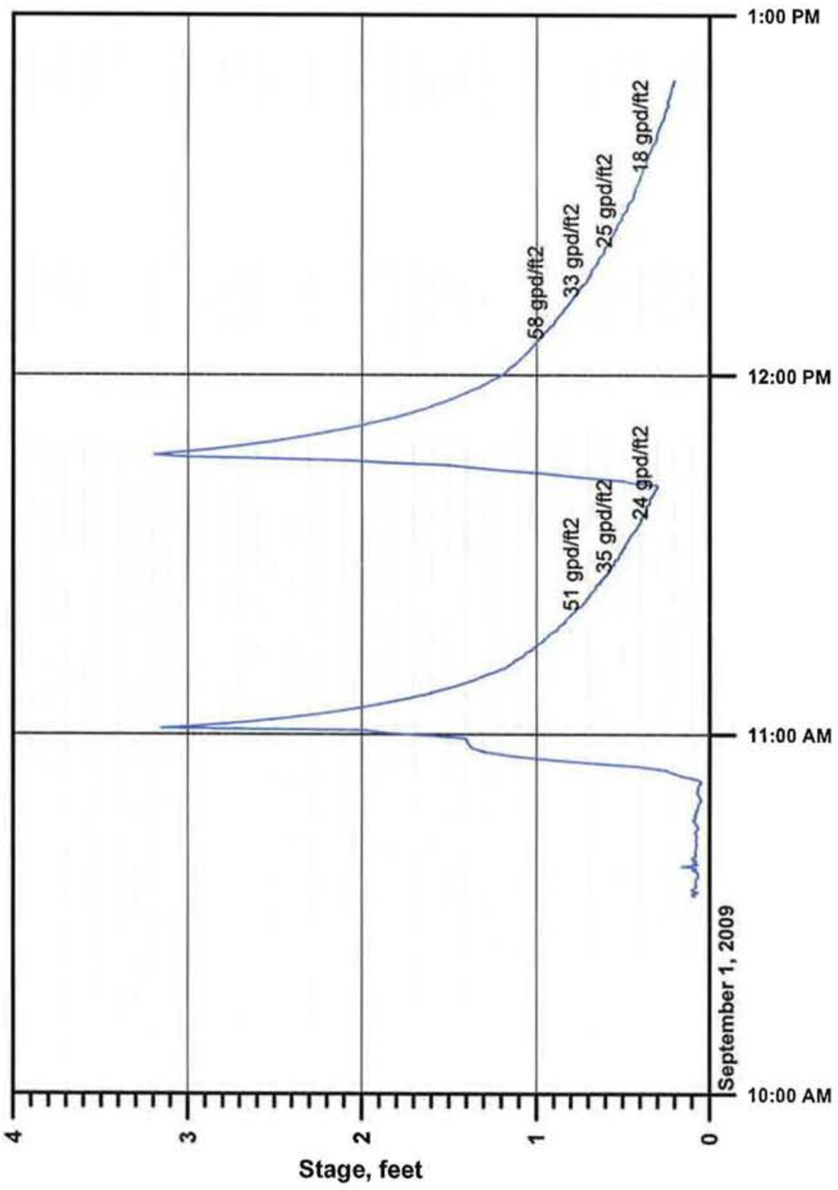


CONVENTIONAL PERCOLATION TEST, SITE 7
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California



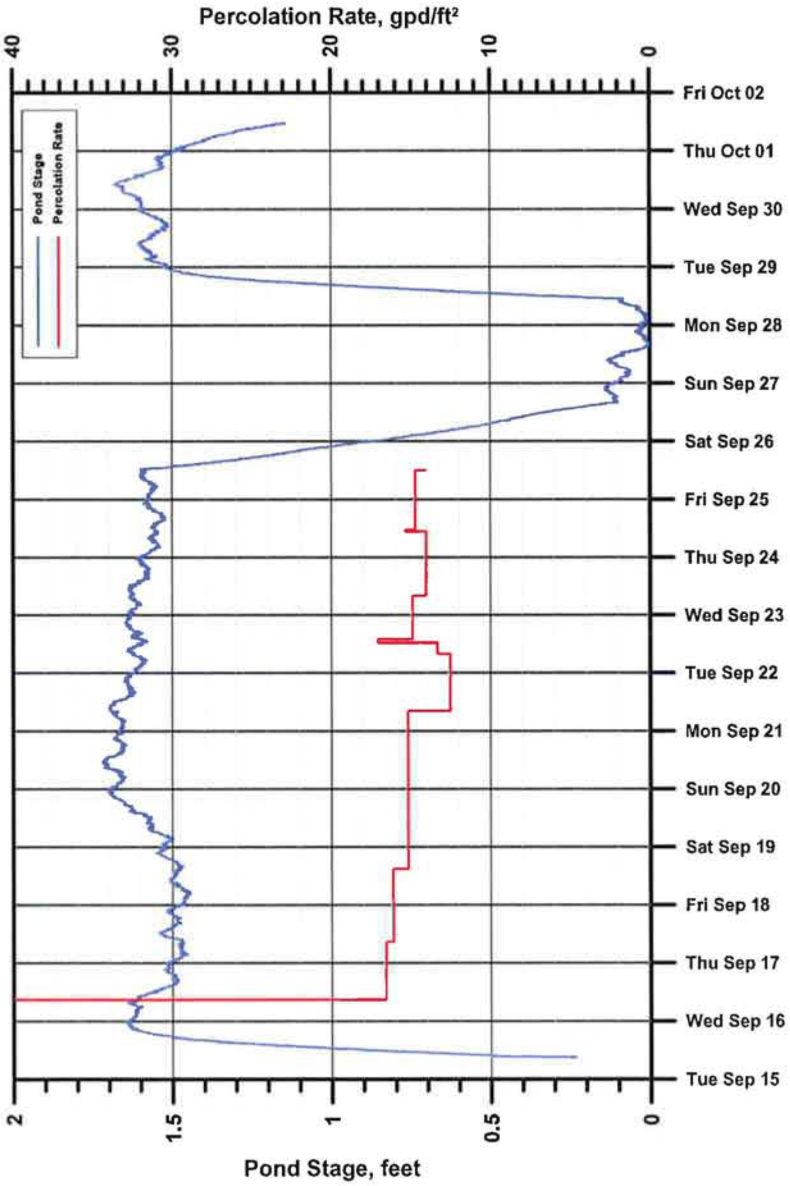
CONVENTIONAL PERCOLATION TEST, SITE 8
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 10



CONVENTIONAL PERCOLATION TEST, SITE 9
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

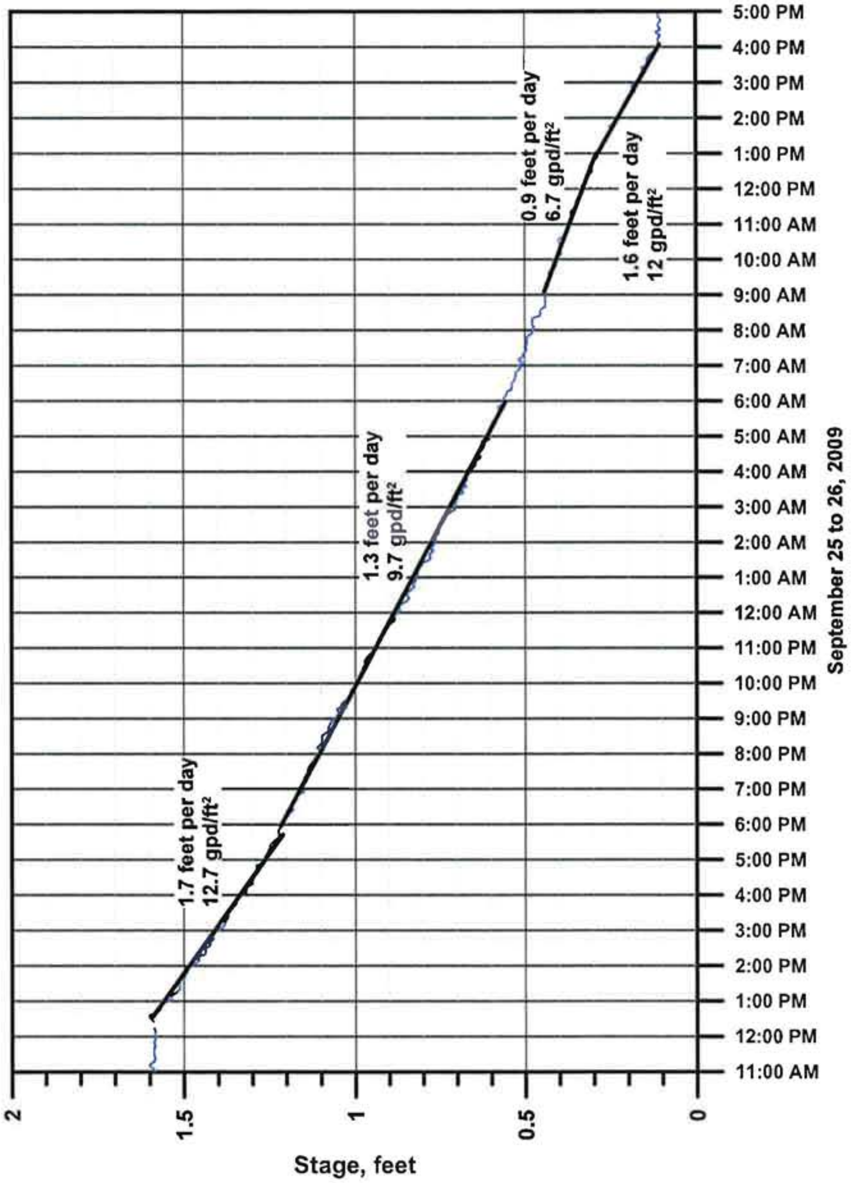
PLATE 11



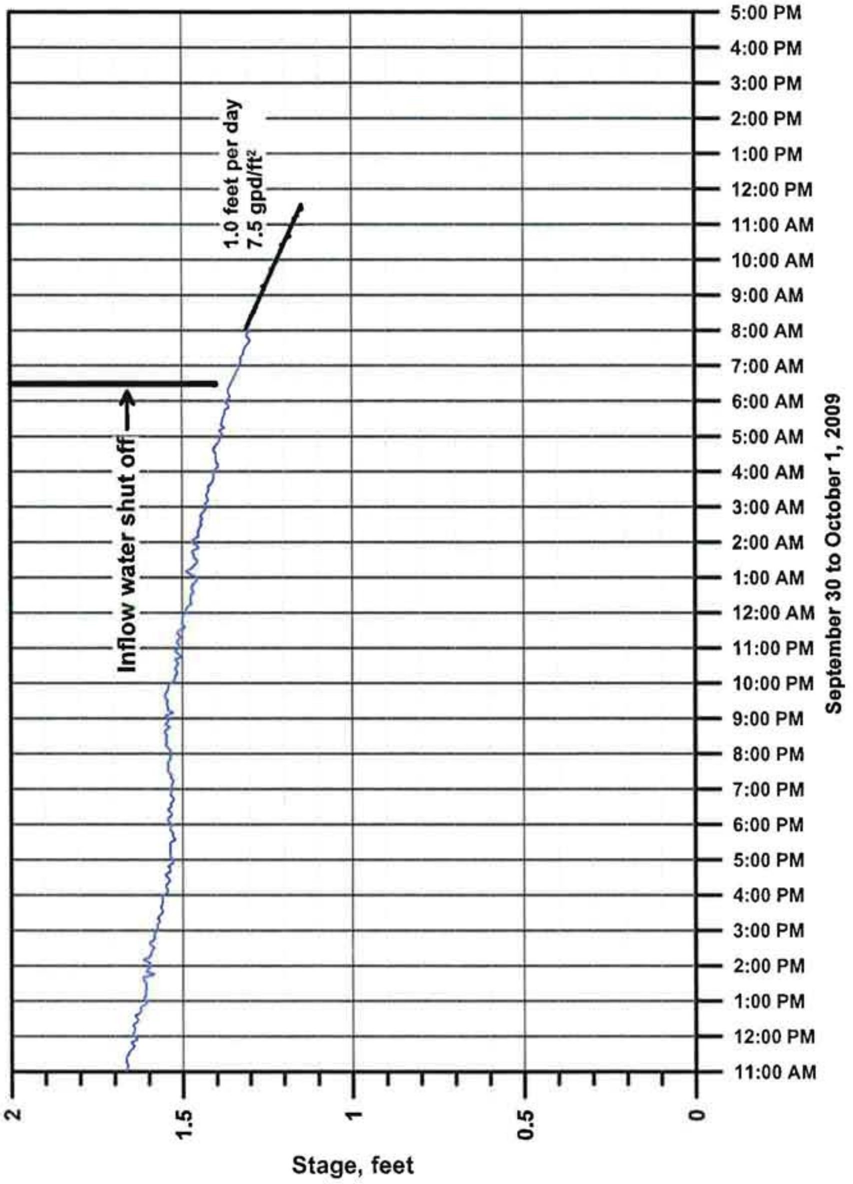
PROTOTYPE PERCOLATION BASIN HYDROGRAPH

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 12



PROTOTYPE PERCOLATION BASIN FALLING HEAD TEST
September 25 to 26, 2009
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California



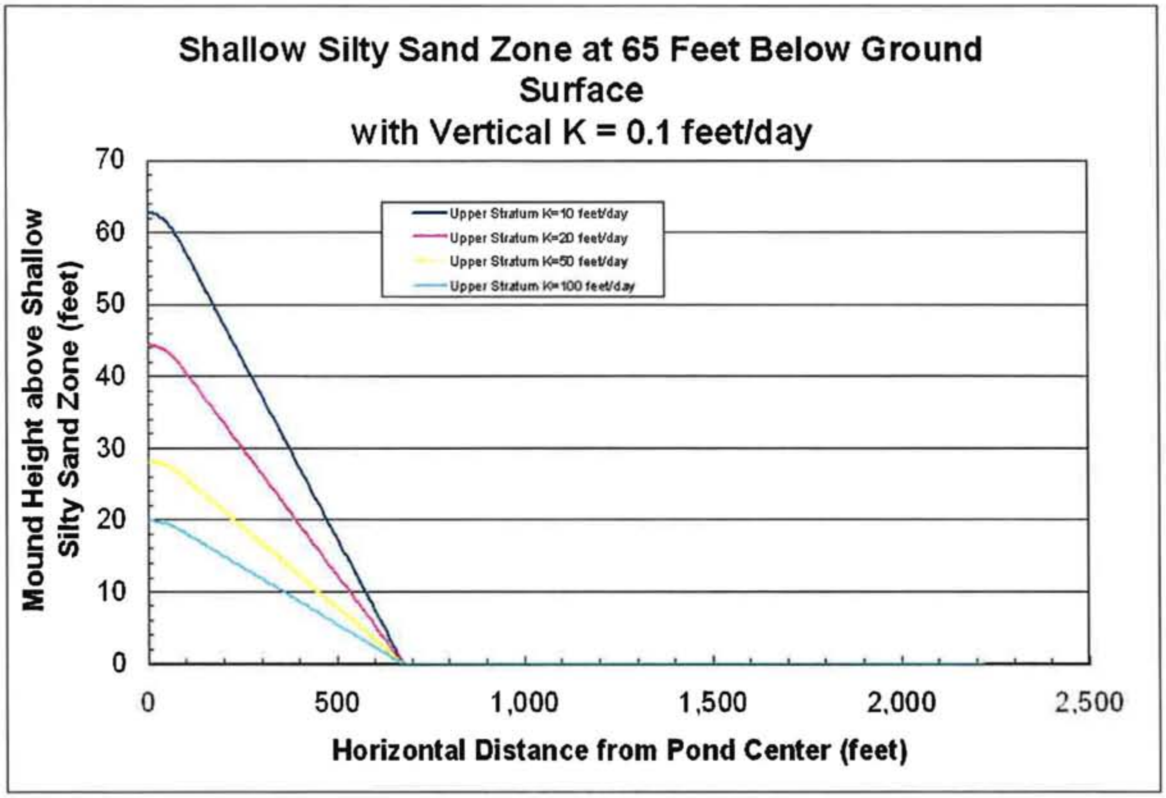
PROTOTYPE PERCOLATION BASIN FALLING HEAD TEST

September 30 to October 1, 2009

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

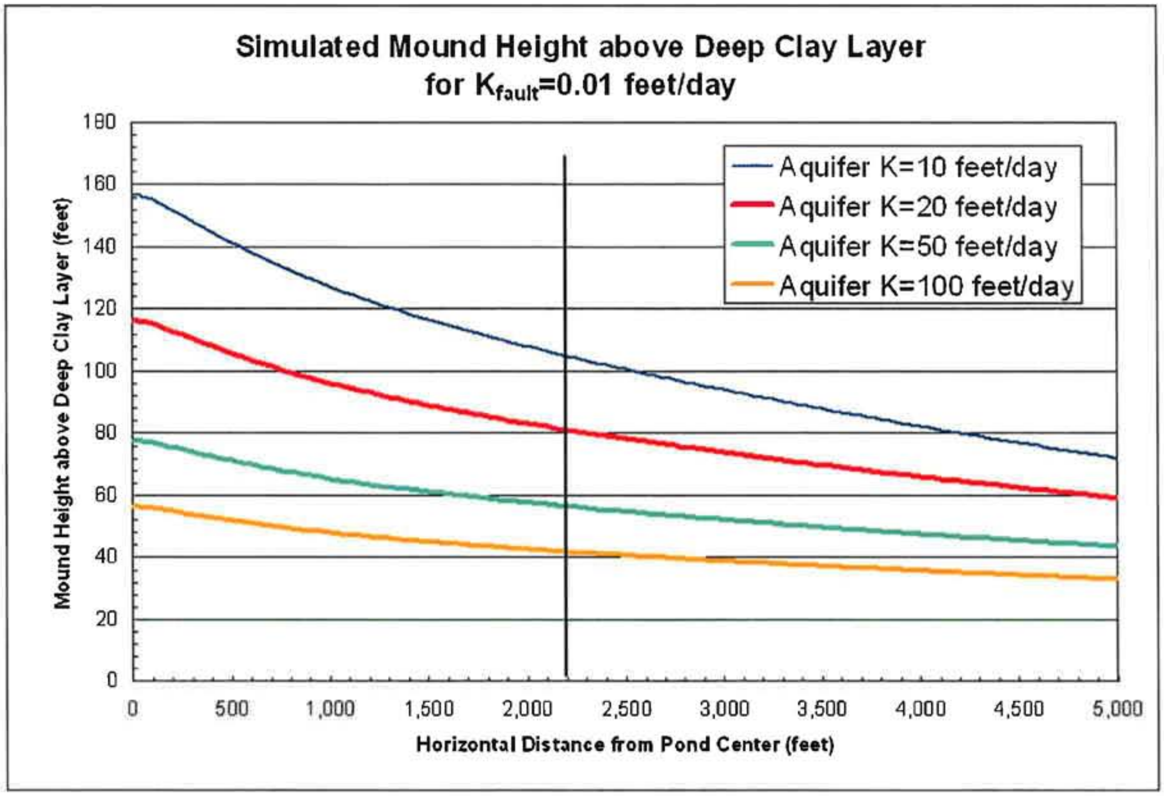
CROSS SECTION B-B'
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 15



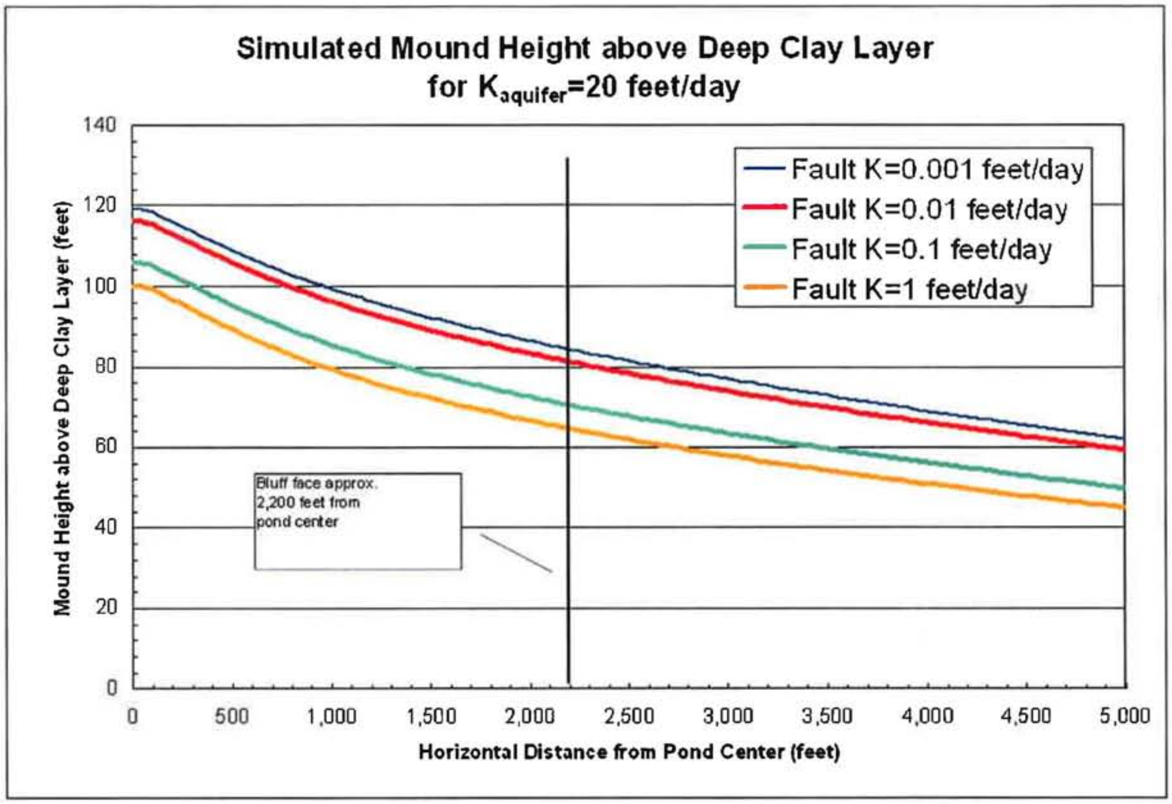
GROUNDWATER MOUND HEIGHT ABOVE SHALLOW SILTY SAND ZONE
FOR VARIABLE UPPER STRATUM HORIZONTAL HYDRAULIC CONDUCTIVITY
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE 16



GROUNDWATER MOUND HEIGHT ABOVE DEEP CLAY LAYER FOR VARIABLE AQUIFER HYDRAULIC CONDUCTIVITY

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California



GROUNDWATER MOUND HEIGHT ABOVE DEEP CLAY LAYER FOR VARIABLE SANTA MARIA RIVER FAULT HYDRAULIC CONDUCTIVITY

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

APPENDIX A

August 27, 2009 Pasquini

Comparison of percolation test methods:
SLO County: Presoak until water level stabilizes (?). No pre-saturation is required if 6 inches drop in 25 minutes twice, then test run for 1 hour. Final 10 minutes is used for percolation rate.
Otherwise, pre-soak overnight,
Ventura County: no soaking needed if, after filling twice to 12 inches, water seeps away in less than 10 minutes. Then, if final 6 inches dprops in 30 minutes, run for 1 hour.

3:40 pm
Perc hole 6 (5 feet deep, all silty sand)
4:30 pm filled with 12 inches of water (24 inches from top.
Drop 19.5 to 13.5 inches (0.5 feet):
To 18.5: 1.25 minutes, (75 seconds)
To 17.5: 3.0 minutes, (105 seconds)
To 16.5: 4.75 minutes, (105)
15.5: 7 minutes, (135 seconds)
14.5: 9 mins, 35 seconds (155 seconds)
13.5: 13 mins, 35 seconds (240 seconds)

4:50
Drop 1 inch to marker at top of pipe: 3 minutes, 56 seconds (236 seconds).

5:05
Drop 1 inch: 4 minutes, 32 seconds (272 seconds). +15 percent.

5:12
Drop 1 inch: 5 minutes, 7 seconds (307 seconds). +13 percent.

Filled to within 1 foot of surface.
Installed transducer at 5:20, recording water levels at 20 second intervals to record drop of final foot.

Dug hole at 5 and 2.
Site 5: Silty sand to 5 feet, moist below 3 feet.

6:35 or so, filled site 6 to near ground surface. 6:45 pm. Filled uncased hole at site 5.
7 pm. Left site.

Nicely, Tim [FWI]

August 28, 2009 Pasquini
7:30 am Removed equipment from site 6.

Site 2 not accesible by vehicle and at topographic high, a location less preferred for testing because it is likely to be removed.

Moved to Site 1, dug to 5 feet (silty sand to depth). Installed 6-inch casing to 5 feet bgs. Installed transducer at 20 second interval.

8:50 am. Filled to about 3 feet depth with water.
Removed transducer at 10:50 am. About 3.25 inches (of inital 36) left in hole.
Stopped test and moved to site 5.

Site 5
Filled hole and performed test to 5 feet.

Site 2, 11 feet deep. Performed test by filling with water at ~4 pm.

September 1, 2009 Pasquini
Nipomo CSD, Pasqini Phase 2 Investigation
9:00 am
Ended test at deeper percolation hole, dug and tested site 9 and site 7, met with Bryan Gresser and Peter Sevcik, refilled site 7. Entire site is recently irrigated. Left site at 2 pm.

Nicely, Tim [FWI]

September 2, 2009 Pasquini

Nipomo CSD, Pasquini Site
Backhoe operator, Pat with R. Baker, on site to dig 20 by 20 foot hole for test basin to 2 feet. Pat is going to seperate top 1 to 1.5 feet of soil from bottom-most soil, to ultimately replace it whereis. The 60 by 60 foot work area is located at northwest corner of central intersection. The 20 by 20 foot pit will be located approximately 3 feet from the northwest corner of the work area. A tank, if needed will be located in the southwest corner of the work area.

Sprinklers on eastern side of site are on.

10:00 Pat started digging. Area has been irrigated on Monday and sprinklers removed.
Top 12 to 16 inches is moist moderate yellowish brown fine silty sand.

11:00 Completed hole to 12 to 16 inches.
12:15 Completed digging with backhoe.
Leveling.
Base of test pond is moist and quite compactable, therefore walking within pond is to be avoided. Pat will scarify / scrape bottom. Construction can be performed from without.
Walls are 2 to 3 feet high and base is level. Length of a wall is 20 feet, 2 inches, so Pat is going to widen length and width slightly.

Dug step at high side of hole.

Dug Pit 1, located ~200 feet southwest of southwest corner of pond.

Dark yellowish brown silty sand to 4 feet,
Reddish brown silty sand to 8 to 9 feet,
Pale yellowish brown sand with silt to 10 feet,
Pale yellow sand to 14 feet.
All moist.

Pit 2 ~200 ft NW of NW corner of pond.
Dark yellowish brown silty sand to 4
To reddish brn to 8 or 9 feet wet at 8
Pale yellowish sand 9 to 15 feet, beds of silty sand, dyb. Wet.

Pit 4 is 200 ft S of SE corner.
Dyb silty sand to 4 ft
Pale sand w silt to 6 ft wet
Pale yellow sand w minor color changes to 12 ft, moist to wet
11 to interbedded with silty sand, moist

Pit 3 is 250 NNE of NE corner of pond
Dyb silty sand to 5 feet

Pale yellow silty sand to 9 moist wet at 10 ft
Pale yellow sand w minor silt 11 to 13.
Off site at 4:45 pm.

Nicely, Tim [FWI]

September 3, 2009 Pasquini
Purchased equipment for and constructed the shoring for the test basin.

10:30 or so: performed Perc test at Site 7, at southeast corner of site.

4:30 pm or so: built 4-inch solid pipe percolation test pushed 3 inches into the base of the test pond; filled with water.

September 4, 2009 Pasquini

7:00 On site to meet delivery of 21,000 gallon tank for test pond
7:30 Valve is 4x3 gheen, which the ranch manager offered to supply.
8:00 Tank is installed along and parallel to the north-south road.
Water source is 4-inch male pvc, which needs to rise about 10.5 feet, then flow 30 feet across tank to inlet.
Outflow is either 2-inch male or 4-inch female. 45 degree, 20 feet, 45 degree, 15 feet to NE corner of test pond.

Bought plumbing supplies except 4-inch pipe. 1 inch meter accurate between 0.75 (3%) to 50 gpm (1.5%). 3/4 inch meter accurate 0.5 (3%) to 30 gpm (1.5%).

Nicely, Tim [FWI]

September 10, 2009 Pasquini

Nipomo CSD Pasquini
Discussed irrigation schedules and fittings with Bryan Gresser. We are going to plumb and fill the tank and start the test Monday. Will rent 3-inch VEO valve in AG.

Nicely, Tim [FWI]

September 14, 2009 Pasquini
Nipomo Pasquini Site. Completed plumbing for tank. Left site. Returned at 4 pm to start test.

Pasquini site
5:30 pm. Although the water was supposed to be ready to fill the 21,000 gallon tank, alas, the operator Steve is not ready because of problems with the well pump and valves. They will be ready tomorrow at 8 am.
Left site.

September 15, 2009 Pasquini

8 am on site. Steve will be ready for me to open my 4-inch valve to fill tank at 8:50 am.

8:45 am to 10:15 filled tank to overflowing. Gauge on side of tank doesn't work.

524,230 gallons
Opened at 9:46 am
10:00 am 524,404 gallons, 13 gpm
10:15 am 524,609 gallons, 13.7 gpm 15 minute average
At 12 gpm, tank would
10:30 left site.

2:30 on site
3:00 pm 528,301 gallons, 1-minute rate of 11.5 gpm, pond filled to over one foot and up to float.

Topped off tank, slowly (1 turn) 3 pm to 3:20 pm.

3:05 water depth 1.16 feet deep.

September 18, 2009 Pasquini

2:30 at Pasquini to fill tank
2:37 pm 550,761 gallons (4.5 gpm)
Tank water level down 3 feet 5 inches from top, which is approximately 14,640 gallons left, according to label on side of tank.

Alas, Steve's irrigators are not available, so Steve assures me that he will fill it tomorrow morning and again Monday morning.

3:03 pm 550,872 gallons: 4.3 gpm

Nicely, Tim [FWI]

September 25, 2009 Pasquini

9:50 left office

11:45 On-site at Southland WTP
Meter at 12:00 pm: 591,560 gallons. 1 minute rate: 4.2 gpm. 1.55 feet stage. (0.45 ft below top of wall).

12:10 Tank down 2 ft, 7 inches (2.6 ft or 31 inches). Volume based on side label: 15,494 gallons.

12:20 Downloaded diver. All data looks fine.

12:30 Stopped inflow into pond. Flow: 3.8 gpm (1 minute). Meter: 591,678 gallons. Test is hereby ended. Average rate between 9/19 and end of test: 4.2 gpm.
1 pm left site.

October 1, 2009 Pasquini

6:30 to 7:15 am remove piping and drain tank. Tank is empty and water is not flowing in to the test pond. About 15 inches of water is in the pond.
Meter: 605,794 gallons.

Nipomo Community Services District
Pasquini Property Test Percolation Pond, September 15 to 25, 2009

Date and Time	Elapsed time (minutes)	Meter (Gallons)	Total Meter (Gallons)	Flow Rate (av. gpm)	Flow Rate (gpm)	K (gpd/ft2)	K (ft/d)	Notes	Tank Status
9/15/09 9:46 AM	0.1	524,230						Started filling Test Pond	Filling from empty
9/15/09 3:00 PM	314	528,301	4,071.0	13.0	12	47	6.2	3:05 1.16 ft depth	Down ~2 feet, topping off
9/16/09 8:56 AM	1,390	535,778	11,548.0	6.9	5.2	25	3.3	About 2 ft pond depth	1/2 to 2/3 full
9/17/09 8:55 AM	2,829	542,440	18,210.0	4.6	4.2	17	2.2	Tank quite low	Filled tank to full by 10:30 am
9/17/09 9:52 AM	2,886				6.5			Manual Reading	
9/18/09 2:37 PM	4,611	550,761	26,531.0	4.7	4.5	16	2.2	Steve can't fill today, will tomorrow morning	3 feet 5 inches: 14,600 gallons
9/18/09 3:03 PM	4,637	550,872	26,642.0	4.3	4.5	16	2.2		
9/19/09 9:00 AM	5,714							Steve filled in our absence	
9/20/09 9:00 AM	7,154							Steve filled in our absence	
9/21/09 8:24 AM	8,558	567,510	43,280.0	4.2		15	2.0		
9/22/09 8:03 AM	9,977	573,126	48,896.0	4.0	3.5	13	1.7	Filled tank	Tank 1/3 full
9/22/09 12:41 PM	10,255	574,160	49,930.0	3.7		13	1.8		
9/22/09 2:07 PM	10,341	574,570	50,340.0	4.8	6.1	17	2.3	Tank full	Full
9/23/09 8:07 AM	11,421	579,060	54,830.0	4.2	4.0	15	2.0		
9/24/09 10:38 AM	13,012	585,300	61,070.0	3.9	3.7	14	1.9		1/4 to 1/3 full
9/24/09 11:20 AM	13,054	585,480	61,250.0	4.3	5.5	15	2.1	Tank full	Full
9/25/09 12:00 PM	14,534	591,560	67,330.0	4.1	4.2	15	2.0		31 Inches: 15,494 gallons
9/25/09 12:30 PM	14,564	591,678	67,448.0	3.9	3.8	14	1.9	Ended Test	
				4.2					
9/29/09 8:30 AM					2.3				71 inches: 7000

DRAFT

AECOM

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Mr. Bruce Buel
Nipomo Community Services District
PO Box 326
Nipomo, CA and 93444

June 5, 2009

Dear Mr. Buel,

Subject: DRAFT Conceptual Percolation Pond Layout, Pasquini Property (APN 090-311-001)

At the request of the District, AECOM has prepared a conceptual layout for percolation ponds on the Pasquini Property, APN 090-311-001. The property is one of several in the area being investigated for feasibility for percolation of treated effluent from Southland Wastewater Treatment Facility.

The Pasquini property is a 192-acre parcel southwest of Orchard Road, extending approximately 3,500 feet to Riverside Road. The southern edge of the property is formed by the Santa Maria River Valley floodplain, creating a naturally steep bluff face, 80 to 130 feet high.

In May 2008, Fugro West performed a hydrogeologic and geotechnical assessment of the property and submitted their findings and analysis in a report dated July 30, 2008 (Hydrogeologic and Geotechnical Assessment of APN 090-31-001, Nipomo, California). The purpose was to assess the appropriateness of the property for percolation (i.e., estimate percolation capacity of the soils, and investigate the potential for the presence of aquitards), and evaluate the potential for percolated water to daylight on the bluff.

The Fugro report contained several conclusions and recommendations, briefly summarized as follows:

- Discharge of treated wastewater within the northerly third of the Pasquini property (adjacent to and immediately south of Orchard Road within an approximate 35-acre area) would be at a sufficient distance from the bluff of the floodplain, and would not daylight on the slope face. This conclusion should be confirmed with supplemental field work.
- Soils could be expected to percolate at a rate of 10 gallons per day per square foot (gpd/ft^2) of clean water. This conclusion should be confirmed with supplemental field work.
- Percolation ponds within the northern 35 acres area considered are unlikely to adversely impact the existing bluff face, provided that groundwater elevations remain below the base of the bluff.
- Stability of the bluff face is predominately influenced by erosion that has resulted from groundwater daylighting on the slope during high groundwater periods and storm events. Surface drainage should be controlled such that surface water does not run towards or over the bluff slope.
- To assess the percolation capacity of the surficial soils, Fugro recommends a series of conventional percolation tests be performed (approximately 1 test per every 2 acres of proposed percolation basin area).
- A small, on-site pilot test is recommended by Fugro. A 10- to 20- foot square percolation basin, constructed onsite would allow additional tests to more closely estimate the percolation capacity of the soils.
- Construction of four monitoring wells will provide water level data and background water quality information. Water level data is needed to estimate fate and transport of percolation water. Water quality data can ultimately be used to satisfy Regional Water Quality Control Board requirements

DRAFT

should the site be used for the proposed project in the future.

- A groundwater flow model could be constructed from the data gathered to better predict the fate and transport of treated wastewater discharged into the percolation basins.

To assist with the site testing, a conceptual layout was prepared for potential future percolation basins at the Pasquini property (Figure 1, attached). The following assumptions were used to prepare the layout:

- Site soils have a percolation rate of 10 gpd/ft^2 for clean water. Assuming a de-rating of 50% for treated wastewater, the conceptual percolation rate is assumed to be 5 gpd/ft^2 for treated wastewater
    - Percolation Rate = 5 gpd/ft^2
- Future (2030) WWTF influent flow rates = 1.8 MGD, based on the maximum monthly flow (MMF) from the January 2009 NCSD Southland WWTF Master Plan (AECOM).
    - Hydraulic Loading = 1.8 MGD (future MMF)
- Dividing the hydraulic loading by the percolation rate, a net percolation area of 8.3 acres is needed.

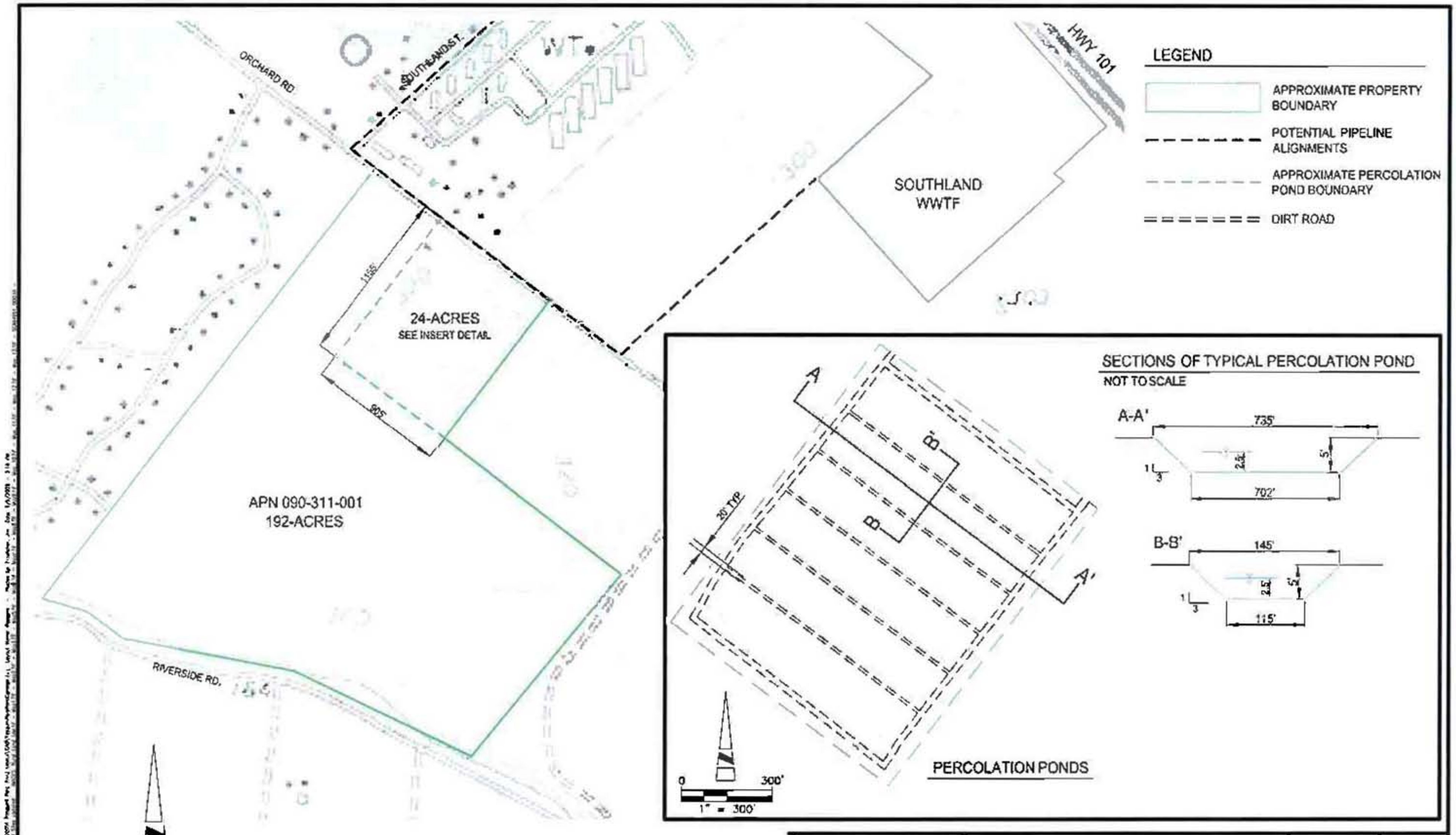
The attached conceptual layout shows 6 percolation basins contained in a gross area of 24 acres. Basin floors are approximately 115 feet by 702 feet, providing just over 11 acres of percolation area. The total pond depth is 5 feet with a minimum freeboard of 2.5 feet. During max month flows, three ponds could handle the percolation without creating standing water. Periodically operations will cycle to the other three ponds, allowing the first three to dry completely. Once dried, the ponds should be scarified with a rake or light disc to maintain percolation rates. An operations and maintenance schedule should be developed based on results of the site-specific percolation tests.

Yours sincerely,

Eileen Shields

Eileen Shields, EIT

CC: Peter Sevcik (NCSD), Josh Reynolds (AECOM), Mike Nunley (AECOM), Paul Sorensen (Fugro)



AECOM

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www.aecom.com

NIPOMO COMMUNITY SERVICES DISTRICT

CONCEPTUAL PERCOLATION POND LAYOUT
PASQUINI PROPERTY

AECOM PROJECT NO
60100054

FIGURE
1

APPENDIX B

8/27/2009 3:33:48 PM

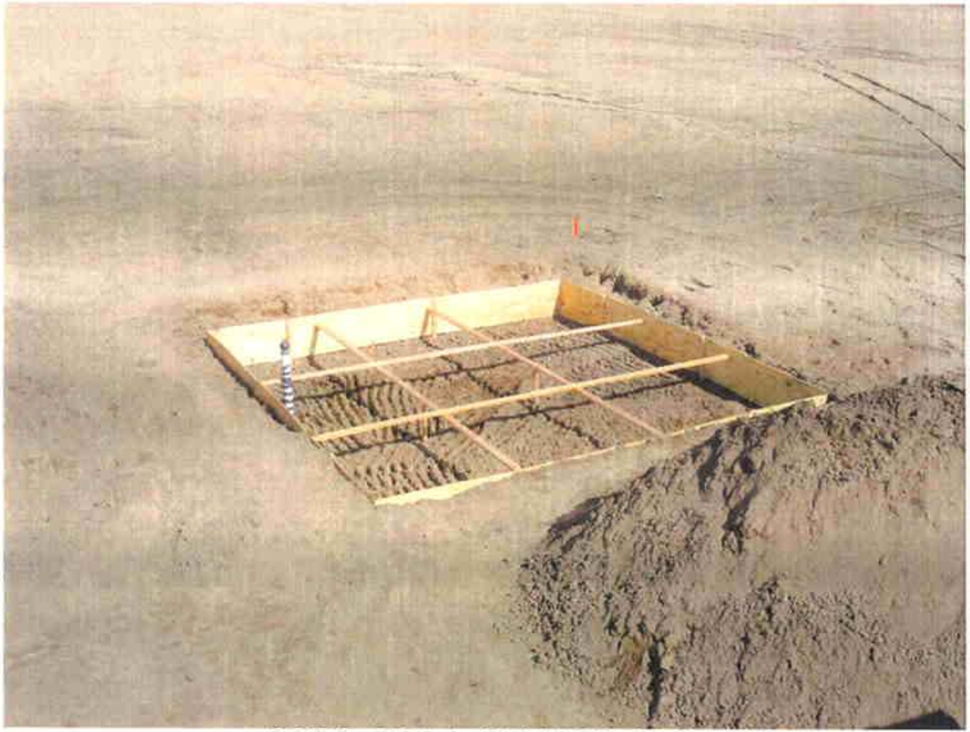
8/27/2009 4:04:17 PM

9/2/2009 10:58:41 AM

9/2/2009 10:59:18 AM

9/3/2009 10:44:48 AM

9/3/2009 10:44:55 AM



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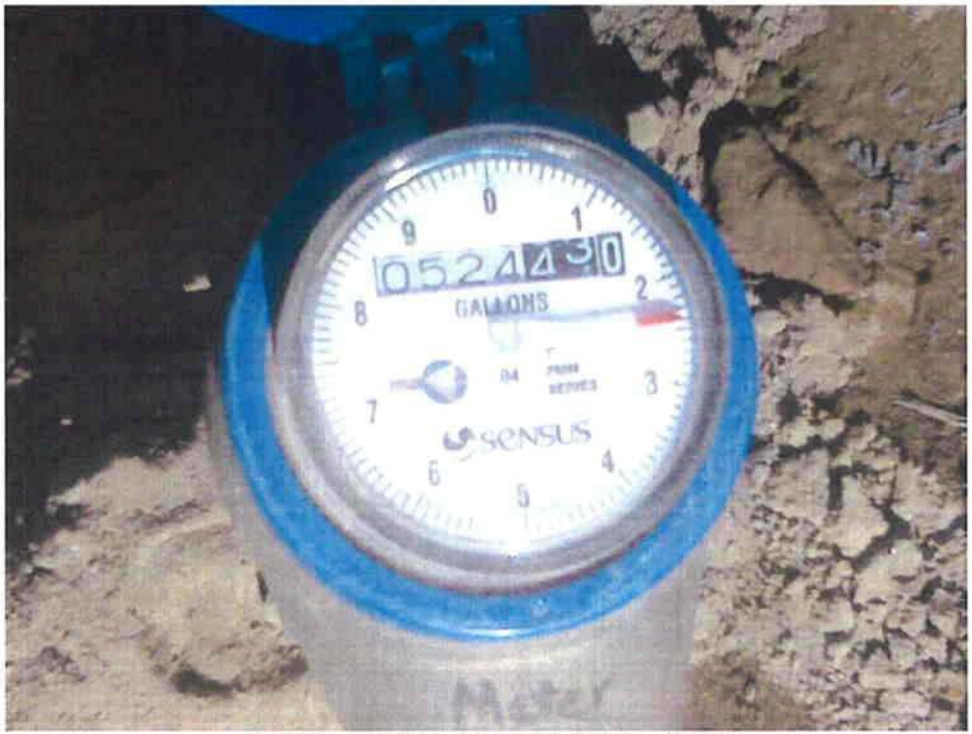

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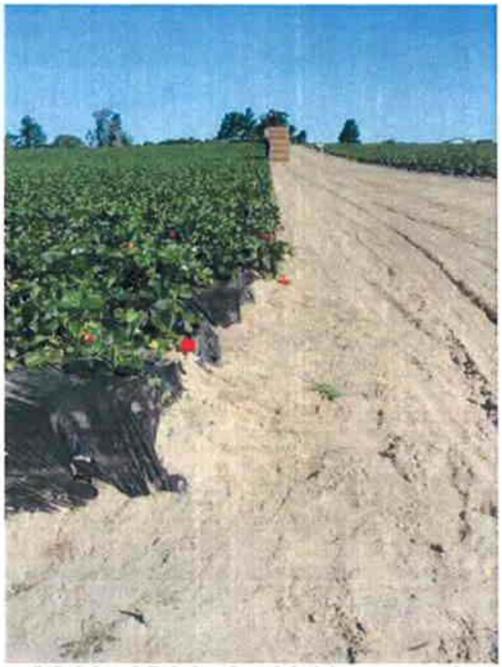

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APPENDIX C

LOCATION: N 3,876,828 E 729,567 WGS 84, UTM Zone 10N, meters

SURFACE EL: 305 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
304	2					Silty SAND (SM): dark yellowish brown, moist, fine							
302	4												
300	6												
298	8												
296	10					SAND with silt (SP-SM): dark yellowish brown, moist, fine							
294	12												
292	14					SAND (SP): light yellowish brown, moist, fine							
290	16												
288	18												
286	20												
284	22												
282	24												
280	26												
278	28					Silty SAND (SM): dark yellowish brown							
276	30					SAND (SP): yellow, moist, fine							
274	32												
272	34												
270	36					yellowish brown, moist, with pockets of Silty Sand (SM)							
268	38												
266	40					very dense							
264	42												
262	44												
260	46					yellow, moist, interbedded with Sand with Silt (SP-SM)							
258	48												
256	50												
254	52												
252	54												
250	56												
248	58												
246	60												
244	62												
242	64												
240	66												
238	68												
236	70												
234	72												
232	74												
230	76					Silty SAND (SM): yellowish brown, moist, fine							
228	78					SAND (SP): yellow, moist, interbedded with Sand with Silt (SP-SM)							
226	80												
224	82												
222	84												
220	86												
218	88					SAND with silt (SP-SM): yellow, moist, interbedded with Sand (SP)							
216	90												
214	92					very fine							
212	94												
210	96												
208	98					very dense							
206													

COMPLETION DEPTH: 205.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 18, 2010

LOG OF SITE 1

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-1a

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: N 3,876,828 E 729,567 WGS 84, UTM Zone 10N, meters SURFACE EL: 305 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
204	102												
202	104												
200	106												
198	108												
196	110					Silty SAND (SM): brownish yellow, moist, fine							
194	112					SAND with silt (SP-SM): brownish yellow, fine				17			
192	114												
190	116					SAND (SP): very pale brown, fine							
188	118												
186	120					reddish yellow, with manganese inclusions							
184	122												
182	124												
180	126					yellow							
178	128												
176	130												
174	132												
172	134					brownish yellow, wet, fine							
170	136												
168	138												
166	140												
164	142												
162	144												
160	146					Silty SAND (SM): very pale brown, moist, very fine							
158	148												
156	150					brownish yellow				9			
154	152												
152	154												
150	156					SAND with silt (SP-SM): very pale brown, moist, very fine							
148	158												
146	160												
144	162												
142	164												
140	166												
138	168												
136	170					SAND (SP): gray							
134	172					SAND with silt (SP-SM): very pale brown, moist, very fine							
132	174												
130	176												
128	178												
126	180												
124	182												
122	184												
120	186												
118	188												
116	190												
114	192												
112	194												
110	196					Fat CLAY (CH): very stiff, dark gray, moist							
108	198												
106													

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 205.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 18, 2010

LOG OF SITE 1
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-1b

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: N 3,876,828 E 729,567 WGS 84, UTM Zone 10N, meters SURFACE EL: 305 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
104	202	▨											
102	204	▨											
100	206												
98	208												
96	210												
94	212												
92	214												
90	216												
88	218												
86	220												
84	222												
82	224												
80	226												
78	228												
76	230												
74	232												
72	234												
70	236												
68	238												
66	240												
64	242												
62	244												
60	246												
58	248												
56	250												
54	252												
52	254												
50	256												
48	258												
46	260												
44	262												
42	264												
40	266												
38	268												
36	270												
34	272												
32	274												
30	276												
28	278												
26	280												
24	282												
22	284												
20	286												
18	288												
16	290												
14	292												
12	294												
10	296												
8	298												
6													

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 205.0 ft
DEPTH TO WATER: Not Encountered

DRILLING DATE: May 18, 2010

DRILLING METHOD: 4-inch-dia. Sonic

LOG OF SITE 1

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-1c

LOCATION: N 3,877,130 E 729,866 WGS 84, UTM Zone 10N, meters

SURFACE EL: 308 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
306	2					Silty SAND (SM): dark brown, moist, fine							
304	4												
302	6												
300	8												
298	10					SAND with silt (SP-SM): yellowish brown, moist, fine							
296	12												
294	14					mottled with dark yellowish brown							
292	16												
290	18												
288	20												
286	22					SAND (SP): yellowish brown, moist, fine							
284	24												
282	26												
280	28												
278	30					SAND with silt (SP-SM): very pale brown, dry, fine							
276	32												
274	34					pockets of Silty SAND (SM), dark yellowish brown, fine							
272	36					pockets absent							
270	38												
268	40												
266	42												
264	44					very dense, white (baked), dry							
262	46					very pale brown, slightly moist, very fine to fine							
260	48					Silty SAND (SM): very pale brown, moist, fine, minor black inclusions							
258	50					SAND with silt (SP-SM): yellowish brown, moist, fine							
256	52												
254	54					SAND (SP): white, dry, friable							
252	56					SAND with silt (SP-SM): yellowish brown, moist, fine							
250	58												
248	60												
246	62					very pale brown							
244	64												
242	66												
240	68												
238	70					yellow							
236	72												
234	74												
232	76					brownish yellow				28			
230	78												
228	80					SAND (SP): brownish yellow, slightly moist, very fine to fine							
226	82					SAND with silt (SP-SM): yellow, moist, very fine							
224	84												
222	86												
220	88												
218	90												
216	92												
214	94					SAND (SP): yellowish brown, moist, very fine							
212	96					SAND with silt (SP-SM): very pale brown, moist							
210	98												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 196.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 20, 2010

LOG OF SITE 2

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-2a

LOCATION: N 3,877,130 E 729,866 WGS 84, UTM Zone 10N, meters

SURFACE EL: 308 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
206	102												
204	104												
202	106					Silty SAND (SM): yellow, moist, fine, with Sand with Silt (SP-SM) pockets				27			
200	108					SAND (SP): very pale brown, moist, very fine							
198	110					SAND with silt (SP-SM): brownish yellow, moist, very fine							
196	112												
194	114												
192	116					Silty SAND (SM): yellow, fine				19			
190	118					SAND with silt (SP-SM): very pale, wet, fine							
188	120												
186	122												
184	124					SAND (SP): very pale brown, wet, to Sand with Silt (SP-SM)							
182	126												
180	128					SAND with silt (SP-SM): very pale brown, wet, to Sand (SP)							
178	130												
176	132												
174	134												
172	136												
170	138												
168	140												
166	142												
164	144												
162	146												
160	148												
158	150												
156	152												
154	154												
152	156												
150	158					Silty SAND (SM): very pale brown, wet, fine, mottled with brownish yellow							
148	160												
146	162												
144	164												
142	166												
140	168					Fat CLAY (CH): dark gray, moist							
138	170					SAND with silt (SP-SM): very pale brown, wet, densified?							
136	172												
134	174												
132	176												
130	178												
128	180												
126	182												
124	184					Fat CLAY (CH): very stiff, dark gray, moist							
122	186												
120	188												
118	190												
116	192												
114	194												
112	196												
110	198												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 196.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 20, 2010

LOG OF SITE 2

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-2b

LOCATION: N 3,877,438 E 729,969 WGS 84, UTM Zone 10N, meters

SURFACE EL: 320 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
318	2					Silty SAND (SM): firm, dark yellowish brown, moist							
316	4												
314	6												
312	8					yellowish brown, mottled with yellowish brown							
310	10					SAND with silt (SP-SM): yellow, moist, interbeds of Sand (SP)							
308	12												
306	14					layer of reddish brown and dark gray							
304	16					pockets of Silty Sand (SM), reddish brown, mottled							
302	18					SAND (SP): soft, yellow, moist, fine							
300	20												
298	22												
296	24												
294	26												
292	28					to medium							
290	30					fine							
288	32												
286	34					to medium							
284	36					fine							
282	38					Silty SAND (SM): yellow, wet, very fine							
280	40					SAND (SP): yellow, wet, very fine							
278	42												
276	44					SAND with silt (SP-SM): yellowish brown to brownish yellow, to Silty Sand (SM), fine							
274	46												
272	48					wet, fine to medium							
270	50					brownish yellow							
268	52												
266	54					yellowish brown to brownish yellow							
264	56												
262	58												
260	60												
258	62												
256	64												
254	66												
252	68					Silty SAND (SM): brownish yellow, moist, fine							
250	70												
248	72									20			
246	74					SAND with silt (SP-SM): brownish yellow, moist, very fine, to Sand (SP)							
244	76												
242	78												
240	80												
238	82												
236	84												
234	86												
232	88												
230	90												
228	92												
226	94												
224	96					very pale brown							
222	98					Silty SAND (SM): brownish yellow, moist, very fine							

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 196.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 21, 2010

LOG OF SITE 3
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-3a

LOCATION: N 3,877,438 E 729,969 WGS 84, UTM Zone 10N, meters

SURFACE EL: 320 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
218	102												
216	104					SAND with silt (SP-SM): very pale brown, moist, very fine							
214	106					CLAY (CL): gray, moist							
212	108					Silty SAND (SM): brownish yellow, moist, very fine							
210	110					SAND with silt (SP-SM): very pale brown, moist, very fine							
208	112												
206	114					Silty SAND (SM): brownish yellow, moist, very fine							
204	116					SAND with silt (SP-SM): very pale brown, moist, very fine							
202	118					Silty SAND (SM): brownish yellow, moist, very fine							
200	120					SAND with silt (SP-SM): soft, yellow, moist to wet, fine							
198	122												
196	124												
194	126					Silty SAND (SM): brownish yellow, moist, very fine to fine							
192	128					very pale brown							
190	130												
188	132					SAND with silt (SP-SM): brownish yellow, moist, very fine to fine							
186	134												
184	136												
182	138												
180	140												
178	142												
176	144												
174	146												
172	148					very fine							
170	150												
168	152												
166	154												
164	156												
162	158					very pale brown, mottled with gray							
160	160												
158	162					very pale brown							
156	164												
154	166												
152	168												
150	170												
148	172												
146	174												
144	176												
142	178												
140	180												
138	182					Fat CLAY (CH): dark gray, moist, mottled with brownish yellow							
136	184												
134	186					SAND with silt (SP-SM):							
132	188					Fat CLAY (CH): very stiff, dark gray, moist							
130	190												
128	192												
126	194												
124	196												
122	198												

COMPLETION DEPTH: 196.0 ft
DEPTH TO WATER: Not Encountered

DRILLING METHOD: 4-inch-dia. Sonic

DRILLING DATE: May 21, 2010

LOG OF SITE 3
Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE C-3b

APPENDIX D

GRAIN-SIZE ANALYSIS

Test performed in general accordance with ASTM or California test procedures

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

Boring #:	Site 1	Sample #:		Depth (ft):	148
Soil Description:	Silty SAND (SM): very pale brown				

Grading Information

Tray # before Wash:	Wet Mass of Soil + Tray before Wash (g):	Water Loss Minus #4:	Dry Mass of Soil (g):
SA-8	205.59	6.02	114.94
Tray Mass (g):	Dry Mass of Soil + Tray before Wash (g):	Moisture %:	Dry Mass after Wash & before Sieve (g):
84.63	199.57	5.2%	104.70

SIEVE		Mass of Soil Retained (g)	Cumulative Mass of Soil Retained (g)	Cumulative % Retained	% Passing
No.	Size, mm				
4 in *	101.60		0.0	0.0	100.0
3 in *	76.20		0.0	0.0	100.0
2 1/2 in *	63.50		0.0	0.0	100.0
2 in *	50.80		0.0	0.0	100.0
1 1/2 in *	38.10		0.0	0.0	100.0
1 in *	25.40		0.0	0.0	100.0
3/4 in *	19.05		0.0	0.0	100.0
1/2 in *	12.70		0.0	0.0	100.0
3/8 in *	9.50		0.0	0.0	100.0
No. 4 *	4.75		0.0	0.0	100.0
No. 8	2.36		0.0	0.0	100.0
No. 16	1.180		0.0	0.0	100.0
No. 30	0.600		0.0	0.0	100.0
No. 50	0.300	0.40	0.4	0.3	99.7
No. 100	0.150	73.40	73.8	64.2	35.8
No. 200	0.075	30.70	104.5	90.9	9.1
Pan	Pan	0.10	104.6 | 100%	ASTM Sieve Continuity:	PASS

% Gravel = 0.0
% Sand = 90.9
% Fines = 9.1

Tested By:	NL	Date:	6/4/10	Checked By:	

SIEVE 2

GRAIN-SIZE ANALYSIS

Test performed in general accordance with ASTM or California test procedures

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

Boring #:	Site 2	Sample #:		Depth (ft):	td
Soil Description:	Silty SAND (SM): very pale brown				

Grading Information

Tray # before Wash:	Wet Mass of Soil + Tray before Wash (g):	Water Loss Minus #4:	Dry Mass of Soil (g):
SA-27	244.05	8.36	148.97
Tray Mass (g):	Dry Mass of Soil + Tray before Wash (g):	Moisture %:	Dry Mass after Wash & before Sieve (g):
86.72	235.69	5.6%	109.80

SIEVE		Mass of Soil Retained (g)	Cumulative Mass of Soil Retained (g)	Cumulative % Retained	% Passing
No.	Size, mm				
4 in *	101.60		0.0	0.0	100.0
3 in *	76.20		0.0	0.0	100.0
2 1/2 in *	63.50		0.0	0.0	100.0
2 in *	50.80		0.0	0.0	100.0
1 1/2 in *	38.10		0.0	0.0	100.0
1 in *	25.40		0.0	0.0	100.0
3/4 in *	19.05		0.0	0.0	100.0
1/2 in *	12.70		0.0	0.0	100.0
3/8 in *	9.50		0.0	0.0	100.0
No. 4 *	4.75		0.0	0.0	100.0
No. 8	2.36		0.0	0.0	100.0
No. 16	1.180		0.0	0.0	100.0
No. 30	0.600	0.00	0.0	0.0	100.0
No. 50	0.300	8.70	8.7	5.8	94.2
No. 100	0.150	69.10	77.8	52.2	47.8
No. 200	0.075	31.00	108.8	73.0	27.0
Pan	Pan	1.20	110 | 100%	ASTM Sieve Continuity:	PASS

% Gravel =	0.0
% Sand =	73.0
% Fines =	27.0

Tested By:	NL	Date:	6/4/10	Checked By:	

SIEVE 3

GRAIN-SIZE ANALYSIS

Test performed in general accordance with ASTM or California test procedures

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

Boring #:	Site 1	Sample #:		Depth (ft):	110
Soil Description:	Silty SAND (SM): brownish yellow, moist				

Grading Information

Tray # before Wash:	Wet Mass of Soil + Tray before Wash (g):	Water Loss Minus #4:	Dry Mass of Soil (g):
SA-1	242.20	12.98	145.75
Tray Mass (g):	Dry Mass of Soil + Tray before Wash (g):	Moisture %:	Dry Mass after Wash & before Sieve (g):
83.47	229.22	8.9%	121.70

SIEVE		Mass of Soil Retained (g)	Cumulative Mass of Soil Retained (g)	Cumulative % Retained	% Passing
No.	Size, mm				
4 in *	101.60		0.0	0.0	100.0
3 in *	76.20		0.0	0.0	100.0
2 1/2 in *	63.50		0.0	0.0	100.0
2 in *	50.80		0.0	0.0	100.0
1 1/2 in *	38.10		0.0	0.0	100.0
1 in *	25.40		0.0	0.0	100.0
3/4 in *	19.05		0.0	0.0	100.0
1/2 in *	12.70		0.0	0.0	100.0
3/8 in *	9.50		0.0	0.0	100.0
No. 4 *	4.75		0.0	0.0	100.0
No. 8	2.36		0.0	0.0	100.0
No. 16	1.180		0.0	0.0	100.0
No. 30	0.600	0.00	0.0	0.0	100.0
No. 50	0.300	15.10	15.1	10.4	89.6
No. 100	0.150	82.70	97.8	67.1	32.9
No. 200	0.075	23.20	121.0	83.0	17.0
Pan	Pan	0.40	121.4 100%	ASTM Sieve Continuity: PASS	

% Gravel =	0.0
% Sand =	83.0
% Fines =	17.0

Tested By:	NL	Date:	6/4/2010	Checked By:	

SIEVE 4

GRAIN-SIZE ANALYSIS

Test performed in general accordance with ASTM or California test procedures

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

Boring #:	Site 2	Sample #:		Depth (ft):	115
Soil Description:	Silty SAND (SM): very pale brown, moist				

Grading Information

Tray # before Wash:	Wet Mass of Soil + Tray before Wash (g):	Water Loss Minus #4:	Dry Mass of Soil (g):
SA-16	266.14	25.41	152.6
Tray Mass (g):	Dry Mass of Soil + Tray before Wash (g):	Moisture %:	Dry Mass after Wash & before Sieve (g):
88.13	240.73	16.7%	125.10

SIEVE		Mass of Soil Retained (g)	Cumulative Mass of Soil Retained (g)	Cumulative % Retained	% Passing
No.	Size, mm				
4 in *	101.60		0.0	0.0	100.0
3 in *	76.20		0.0	0.0	100.0
2 1/2 in *	63.50		0.0	0.0	100.0
2 in *	50.80		0.0	0.0	100.0
1 1/2 in *	38.10		0.0	0.0	100.0
1 in *	25.40		0.0	0.0	100.0
3/4 in *	19.05		0.0	0.0	100.0
1/2 in *	12.70		0.0	0.0	100.0
3/8 in *	9.50		0.0	0.0	100.0
No. 4 *	4.75		0.0	0.0	100.0
No. 8	2.36		0.0	0.0	100.0
No. 16	1.180		0.0	0.0	100.0
No. 30	0.600		0.0	0.0	100.0
No. 50	0.300	1.20	1.2	0.8	99.2
No. 100	0.150	81.70	82.9	54.3	45.7
No. 200	0.075	41.50	124.4	81.5	18.5
Pan	Pan	0.80	125.2 100%	ASTM Sieve Continuity:	PASS

% Gravel =	0.0
% Sand =	81.5
% Fines =	18.5

Tested By:	NL	Date:	6/4/2010	Checked By:	

GRAIN-SIZE ANALYSIS

Test performed in general accordance with ASTM or California test procedures

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

Boring #:	Site 3	Sample #:		Depth (ft):	72
Soil Description:	Silty SAND (SM): brownish yellow, moist				

Grading Information

Tray # before Wash:	Wet Mass of Soil + Tray before Wash (g):	Water Loss Minus #4:	Dry Mass of Soil (g):
SA-33	258.48	17.63	153.53
Tray Mass (g):	Dry Mass of Soil + Tray before Wash (g):	Moisture %:	Dry Mass after Wash & before Sieve (g):
87.32	240.85	11.5%	123.30

SIEVE		Mass of Soil Retained (g)	Cumulative Mass of Soil Retained (g)	Cumulative % Retained	% Passing
No.	Size, mm				
4 in *	101.60		0.0	0.0	100.0
3 in *	76.20		0.0	0.0	100.0
2 1/2 in *	63.50		0.0	0.0	100.0
2 in *	50.80		0.0	0.0	100.0
1 1/2 in *	38.10		0.0	0.0	100.0
1 in *	25.40		0.0	0.0	100.0
3/4 in *	19.05		0.0	0.0	100.0
1/2 in *	12.70		0.0	0.0	100.0
3/8 in *	9.50		0.0	0.0	100.0
No. 4 *	4.75		0.0	0.0	100.0
No. 8	2.36		0.0	0.0	100.0
No. 16	1.180		0.0	0.0	100.0
No. 30	0.600	0.00	0.0	0.0	100.0
No. 50	0.300	1.60	1.6	1.0	99.0
No. 100	0.150	85.80	87.4	56.9	43.1
No. 200	0.075	35.50	122.9	80.0	20.0
Pan	Pan	0.10	123 | 100%	ASTM Sieve Continuity:	PASS

% Gravel = 0.0
% Sand = 80.0
% Fines = 20.0

Tested By:	NL	Date:	6/7/2010	Checked By:	

-200 INPUT 1

PERCENT PASSING No. 200 SIEVE

Test performed in accordance to ASTM D1140

Job #:	3596.005.02	Job Name:	Paquini Property Investigation
Lab Job #:	0	Client:	Nipomo Community Services District

SPECIMEN INFORMATION AND MEASUREMENTS

Boring	Sample No.	Depth (ft)	Soil Description	Tare No.	Tare Weight (g)	Wet mass + Tare (g)	Dry Mass + Tare (g)	Initial Water Content (%)	Initial Dry Mass of Soil (g)	Dry Mass of soil after washing and shaking over No. 200 Sieve (g)	Percent Passing No. 200 Sieve
Site 2		75	Silty SAND (SM): brownish yellow, moist	SA-17	87.42	232.54	225.28	5.3	137.86	99.14	28.1
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!
								#DIV/0!	0		#DIV/0!

Tested By:		Date:		Checked By:	

SAMPLE ID

Boring Number	Site 1
Sample Number	NA
Sample Depth, ft	197
Classification	Fat CLAY (CH): dark olive gray, moist

SAMPLE PROPERTIES

	Intial	Final
Mass, g	186.47	188.47
Water Content, %	41.6%	43.1%
Dry Density, pcf	78.2	78.5
Saturation, %	96%	100%
Void Ratio	1.19	1.19
Diameter, in	2.39	2.39
Height, in	1.43	1.43
Area, in^2	4.49	4.49
Volume, in^3	6.42	6.39

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
No. 4 (4.75mm)	---	Plastic Limit	---
No. 10 (2.0mm)	---	Plasticity Index	---
No. 30 (0.6mm)	---	Estimated Gs	2.75
No. 100 (0.150mm)	---		
No. 200 (0.075mm)	---		

TEST SUMMARY

Sample Type	Sonic Core
Permeant	Deaired Tap-Water
Pipette Area, cm^2	0.0314
Annulus Area, cm^2	0.7671
k_{avg} 20°C, cm/s	1.3E-10
Tested By	JC

REMARKS

Test Method: ASTM D5084 (Method F)

PERMEATION DATA

Trial	Date	Time, sec	Temp$_{Avg}$, °C	σ', ksf	μ, ksf	i_o	i_f	k_t, cm/s
1	6/4/10	259200	24.9	15.1	4.2	28.9	25.7	1.4E-10
2	6/9/10	270562	24.7	15.1	4.2	30.0	26.4	1.4E-10
3								
4								
5								
6								

SAMPLE IMAGES

HYDRAULIC CONDUCTIVITY

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE D-1

SAMPLE ID

Boring Number	Site 2
Sample Number	NA
Sample Depth, ft	0
Classification	Fat CLAY (CH): dark olive gray, moist

SAMPLE PROPERTIES

	Intial	Final
Mass, g	270.82	282.70
Water Content, %	34.9%	40.8%
Dry Density, pcf	83.9	81.0
Saturation, %	92%	100%
Void Ratio	1.05	1.12
Diameter, in	2.82	2.88
Height, in	1.46	1.45
Area, in^2	6.25	6.51
Volume, in^3	9.12	9.45

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
No. 4 (4.75mm)	---	Plastic Limit	---
No. 10 (2.0mm)	---	Plasticity Index	---
No. 30 (0.6mm)	---	Estimated Gs	2.75
No. 100 (0.150mm)	---		
No. 200 (0.075mm)	---		

TEST SUMMARY

Sample Type	Sonic Core
Permeant	Deaired Tap-Water
Pipette Area, cm^2	0.0314
Annulus Area, cm^2	0.7671
k_{avg} 20°C, cm/s	8.0E-10
Tested By	JC

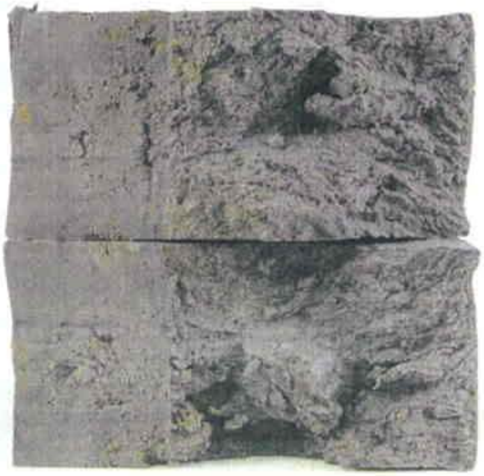
REMARKS

Test Method: ASTM D5084 (Method F)

PERMEATION DATA

Trial	Date	Time, sec	Temp$_{Avg}$, °C	σ', ksf	μ, ksf	i_o	i_f	k_t, cm/s
1	6/2/10	61221	22.4	16.3	4.2	28.4	22.0	8.8E-10
2	6/3/10	84681	22.2	16.3	4.2	28.4	20.6	8.0E-10
3								
4								
5								
6								

SAMPLE IMAGES



HYDRAULIC CONDUCTIVITY

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE D-2

SAMPLE ID

Boring Number	Site 3
Sample Number	NA
Sample Depth, ft	191
Classification	Fat CLAY (CH): dark olive gray, moist

SAMPLE PROPERTIES

	Intial	Final
Mass, g	340.30	351.39
Water Content, %	31.7%	36.0%
Dry Density, pcf	89.4	86.3
Saturation, %	95%	100%
Void Ratio	0.92	0.99
Diameter, in	2.83	2.88
Height, in	1.75	1.75
Area, in^2	6.29	6.51
Volume, in^3	11.01	11.40

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
No. 4 (4.75mm)	---	Plastic Limit	---
No. 10 (2.0mm)	---	Plasticity Index	---
No. 30 (0.6mm)	---	Estimated Gs	2.75
No. 100 (0.150mm)	---		
No. 200 (0.075mm)	---		

TEST SUMMARY

Sample Type	Sonic Core
Permeant	Deaired Tap-Water
Pipette Area, cm^2	0.0314
Annulus Area, cm^2	0.7671
k_{avg} 20°C, cm/s	3.3E-10
Tested By	JC

REMARKS

Test Method: ASTM D5084 (Method F)

PERMEATION DATA

Trial	Date	Time, sec	$Temp_{Avg}$, °C	σ', ksf	μ, ksf	i_o	i_f	k_t, cm/s
1	6/7/10	81530	24.9	12.9	4.2	30.0	26.6	3.7E-10
2	6/8/10	85485	24.7	12.9	4.2	29.7	26.2	3.8E-10
3								
4								
5								
6								

SAMPLE IMAGES

HYDRAULIC CONDUCTIVITY

Hydrogeologic Assessment of the Pasquini Property
Nipomo, California

PLATE D-3

APPENDIX E

CAPCO
Analytical Services, Inc.
Environmental and Analytical Services-Since 1994

Client: Fugro West, Inc.
Sample ID: Pesquini Irrigation Water
CAS LAB NO: 09240001
Analyst: ABE/AN/GM/AJ

Date Sampled: 09/25/09
Date Received: 09/25/09
Sample Matrix: Water

GENERAL MINERAL ANALYSIS SUMMARY

COMPOUND	RESULT	UNITS	DF	PQL	METHOD	ANALYZED
Alkalinity ($CaCO_3$)	200	mg/L	1	10	2320 B	09/28/09
Bicarbonate ($CaCO_3$)	200	mg/L	1	10	2320 B	09/28/09
Carbonate ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
Hydroxide ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
pH	7.4	S.U.	1	--	4500-$^{H+}$B	09/25/09
Total Hardness	320	mg/L	1	10	130.2	09/25/09
Chloride	83	mg/L	1	0.2	300.0	09/25/09
Fluoride	0.36	mg/L	1	0.1	300.0	09/25/09
Nitrate (as N)	4.9	mg/L	1	0.1	300.0	09/25/09
Sulfate	180	mg/L	1	0.5	300.0	09/25/09
Spec. Conductivity	1010	umhos/cm	1	1	120.1	09/28/09
T.D.S.	660	mg/L	1	10	2540 C	09/28/09
MBAS Surfactants	BQL	mg/L	1	0.1	5540 C	09/25/09
Boron	0.36	mg/L	1	0.1	200.7	09/29/09
Calcium	79	mg/L	1	0.1	200.7	09/29/09
Copper	0.064	mg/L	1	0.02	200.7	09/29/09
Iron	0.11	mg/L	1	0.1	200.7	09/29/09
Magnesium	35	mg/L	1	0.1	200.7	09/29/09
Manganese	0.18	mg/L	1	0.005	200.7	09/29/09
Potassium	3.3	mg/L	1	0.2	200.7	09/29/09
Sodium	63	mg/L	1	0.5	200.7	09/29/09
Zinc	BQL	mg/L	1	0.05	200.7	09/29/09

T.D.S.: Total Dissolved Solids
PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

AMJac
Principal Analyst

Client: Fugro West, Inc.
Sample ID: Method Blank
CAS LAB NO: 092400-MB

Sample Matrix: Water
Analyst: ABE/AN/AJ/GM

GENERAL MINERAL ANALYSIS SUMMARY

COMPOUND	RESULT	UNITS	DF	PQL	METHOD	DATE ANALYZED
Alkalinity ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
Bicarbonate ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
Carbonate ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
Hydroxide ($CaCO_3$)	BQL	mg/L	1	10	2320 B	09/28/09
Total Hardness	BQL	mg/L	1	10	130.2	09/25/09
Chloride	BQL	mg/L	1	0.2	300.0	09/25/09
Fluoride	BQL	mg/L	1	0.1	300.0	09/25/09
Nitrate (as N)	BQL	mg/L	1	0.1	300.0	09/25/09
Sulfate	BQL	mg/L	1	0.5	300.0	09/25/09
T.D.S.	BQL	mg/L	1	10	2540 C	09/28/09
MBAS Surfactants	BQL	mg/L	1	0.1	5540 C	09/18/09
Boron	BQL	mg/L	1	0.1	200.7	09/29/09
Calcium	BQL	mg/L	1	0.1	200.7	09/29/09
Copper	BQL	mg/L	1	0.02	200.7	09/29/09
Iron	BQL	mg/L	1	0.1	200.7	09/29/09
Magnesium	BQL	mg/L	1	0.1	200.7	09/29/09
Manganese	BQL	mg/L	1	0.005	200.7	09/29/09
Potassium	BQL	mg/L	1	0.2	200.7	09/29/09
Sodium	BQL	mg/L	1	0.5	200.7	09/29/09
Zinc	BQL	mg/L	1	0.05	200.7	09/29/09

T.D.S.: Total Dissolved Solids
PQL: Practical Quantitation Limit
BQL: Below Practical Quantitation Limit

AMJAY
Principal Analyst

Fax from : 8185434604

ORIGINAL
File with DWR 11N 34W 24

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 1082553

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Page ____ of ____
Owner's Well No. 1
Date Work Began 8-12-08 , Ended 11-29-08
Local Permit Agency San Luis Obispo
Permit No. 2008-197 Permit Date 7-24-08

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ____ HORIZONTAL ____ ANGLE ____ (SPECIFY)
DRILLING METHOD Rotary FLUID Mud

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	180	Brown Sand
180	214	Gray Clay
214	220	Brown Clay With Gravel
220	250	Gravel
250	267	Brown Clay
267	280	Gravel & Brown Sand
280	295	Gray Clay
295	345	Gray Gravel & Sand & Strips Of Clay
345	400	Gray Clay & Sand Streaks
400	420	Gray Clay With Sea Shells

TOTAL DEPTH OF BORING 420 (Feet)
TOTAL DEPTH OF COMPLETED WELL 400 (Feet)

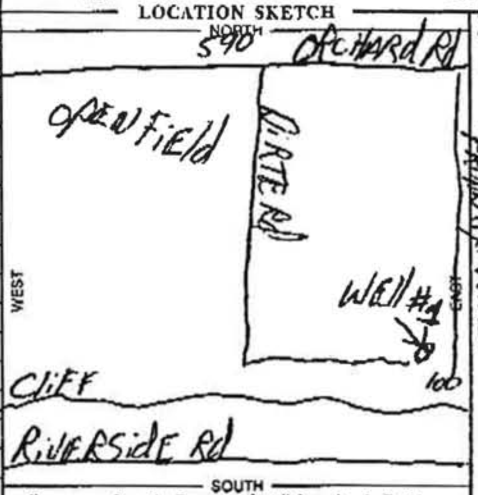
WELL OWNER

Name Charile PasQuini
Mailing Address 238 Brant St
Arroyo Grande Calif 93420
CITY STATE ZIP

WELL LOCATION

Address 590 Orchard Rd Nipomo Ca
City Nipomo Calif
County San Luis Obispo
APN Book ______ Page ______ Parcel 090-311-001
Township ______ Range ______ Section ______
Lat ____ DEG. ____ MIN ____ SEC. N Long ____ DEG. ____ MIN. ____ SEC. W

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
____ Deepen
____ Other (Specify)
DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY
____ Domestic ____ Public
____ Irrigation ____ Industrial
MONITORING ____
TEST WELL ____
CATHODIC PROTECTION ____
HEAT EXCHANGE ____
DIRECT PUSH ____
INJECTION ____
VAPOR EXTRACTION ____
SPARGING ____
REMEDIATION ____
OTHER (SPECIFY) ____

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 255 (Ft.) & DATE MEASURED 9-10-08
ESTIMATED YIELD * 600 (GPM) & TEST TYPE Pump
TEST LENGTH 24 (Hrs.) TOTAL DRAWDOWN 95 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	220	22	X				Pvc	12	Sdr-21	
220	380	22		X			Pvc	12	Sdr-21	032
380	400	22	X				Pvc	12	Sdr-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	52	X			
					Montery

ATTACHMENTS (✓)

____ Geologic Log
____ Well Construction Diagram
____ Geophysical Log(s)
____ Soil/Water Chemical Analyses
____ Other ______

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Ron Taylor Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2801 Mahoney Rd Santa Maria Calif 93455
ADDRESS CITY STATE ZIP

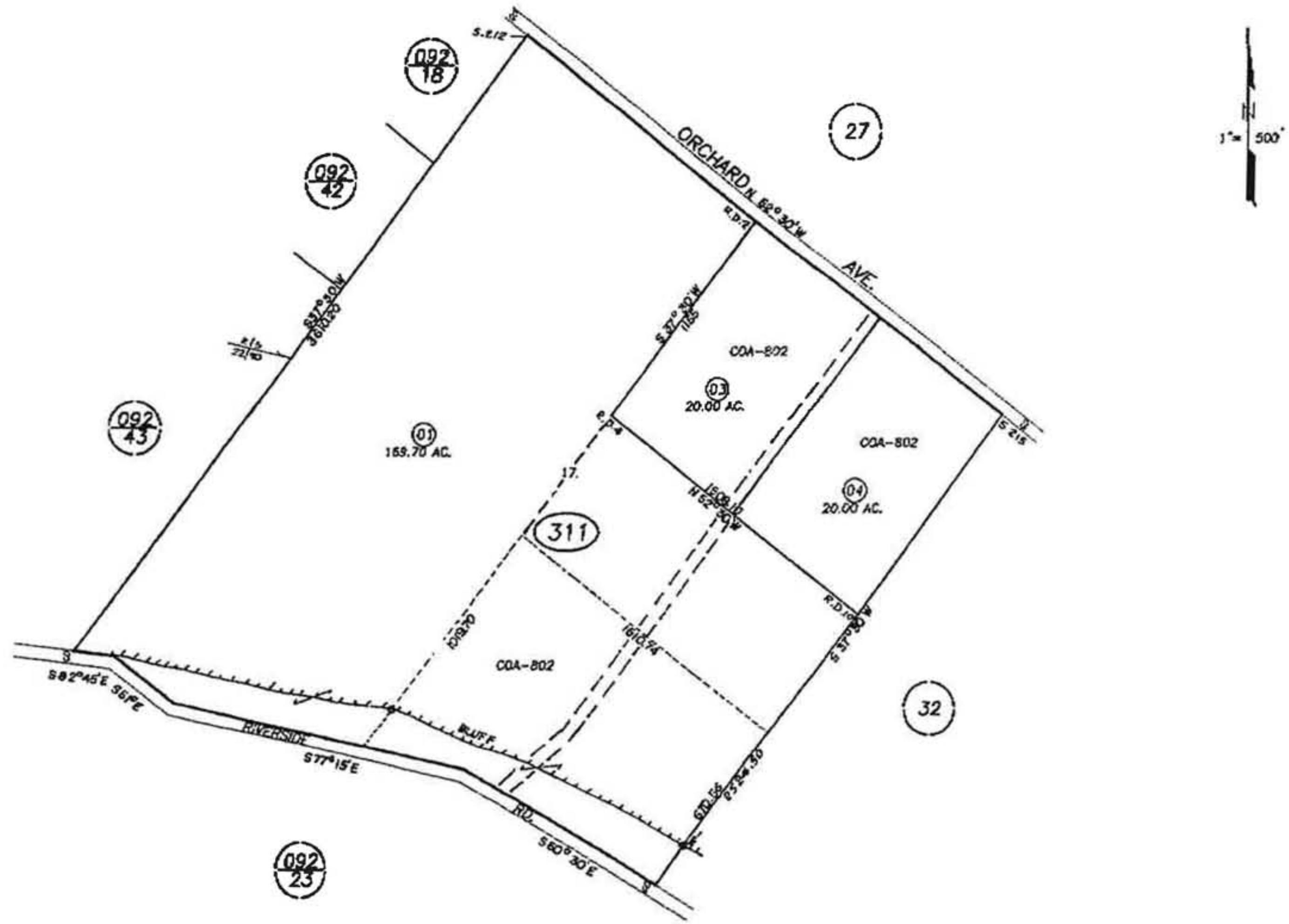
Signed ______ C-57 LICENSED WATER WELL CONTRACTOR
10330-08 DATE SIGNED
523-858 C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

OSP 03 781

090-31



REVISIONS	
TECH	DATE
JAW	03-25-03

250' 0 500' 1000'

JAY 03-25-03 THIS MAP IS PREPARED FOR ASSESSMENT PURPOSES ONLY.

SUBDIVISIONS OF THE RANCHO NIPOMO, R.M. Bk. A, Pg. 13.

NIPOMO
ASSESSOR'S MAP, COUNTY OF SAN LUIS OBISPO, CA.
BOOK 090 PAGE 31

ORIGINAL 11N 34W 21
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 1082554

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Page ___ **of** ___
Owner's Well No. 2
Date Work Began 9-4-08, Ended 11-08-08
Local Permit Agency San Luis Obispo
Permit No. 2008-248 Permit Date 9-2-08

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Mud

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	60	Sand & Gravel
60	70	Sand
70	100	Gravel
100	120	Sand
120	150	Brown Clay With Gravel
150	190	Gravel
190	195	Clay
195	220	Small Gravel
220	237	Clay
237	268	Small Gravel
268	300	Sand
300	330	Clay
330	360	Sand & Gravel Blue
360	410	Sand & Clay Stringers With
		Sea Shells

TOTAL DEPTH OF BORING 410 (Feet)
TOTAL DEPTH OF COMPLETED WELL 400 (Feet)

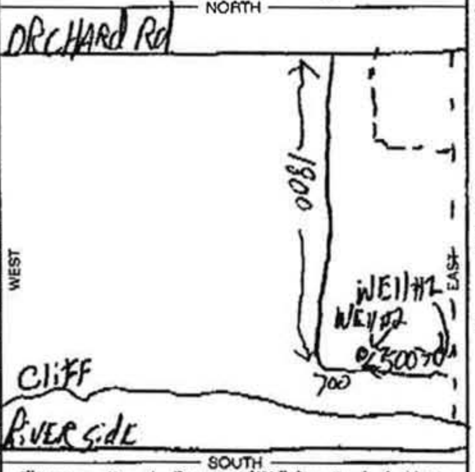
WELL OWNER

Name Charile Pasquini
Mailing Address 2381 Brant st
Arroyo Grande Calif 93420
CITY STATE ZIP

WELL LOCATION

Address 590 Orchard Rd
City Nipomo Calif
County San Luis Obispo
APN Book ___ Page ___ Parcel 090-311-001
Township ___ Range ___ Section ___
Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 250 (Ft.) & DATE MEASURED 11-02-08
ESTIMATED YIELD * 650 (GPM) & TEST TYPE Pump
TEST LENGTH 24 (Hrs.) TOTAL DRAWDOWN 87 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	220	26	X				Pvc	12	Sdr-21	
220	380	26		X			Pvc	12	Sdr-21	032
380	400	26	X				Pvc	12	Sdr-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	50	X			
					Montery

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Ron Taylor Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2801 Mahoney Santa Maria Calif 93455
ADDRESS CITY STATE ZIP

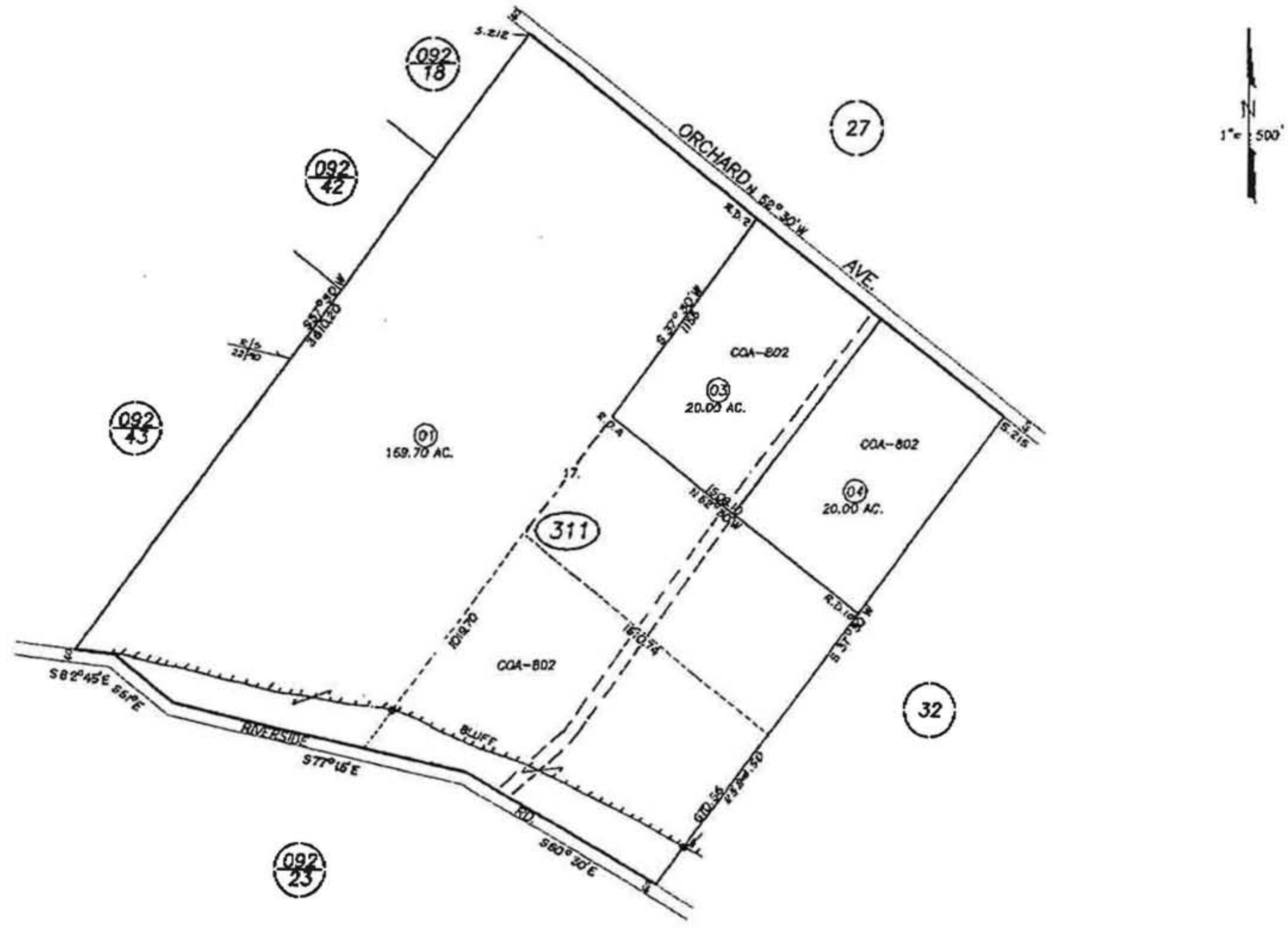
Signed Ron Taylor
C-57 LICENSED WATER WELL CONTRACTOR

11-30-08
DATE SIGNED

523-858
C-57 LICENSE NUMBER

DWR 188 REV 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM OSP 03 78881

090-31



REVISIONS	
TECH	DATE
JAW	03-25-03

250' 0 500' 1000'

JAW 03-25-03 THIS MAP IS PREPARED FOR ASSESSMENT PURPOSES ONLY.

SUBDIVISIONS OF THE RANCHO NIPOMO, R.M. Bk. A, Pg. 13.

NIPOMO
ASSESSOR'S MAP, COUNTY OF
SAN LUIS OBISPO, CA
BOOK 090 PAGE 31

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FACSIMILE TRANSMITTAL SHEET

TO: Tim Nicely	**FROM:** Michael Van Raalte
COMPANY: Fugro West	**DATE:** 12/2/09
FAX NUMBER: 805 650-7010	**FAX NUMBER:** 818.543.4604
PHONE NUMBER: 289 -3836	**PHONE NUMBER:** 818.500.1645 EXT.
RE: WCR's	**TOTAL NO. OF PAGES INCLUDING COVER:** 5

☐ URGENT ☐ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY

NOTES/COMMENTS:

STATE OF CALIFORNIA

Michael Van Raalte
Water Resources Technician I
Groundwater Section

Department of Water Resources
DPLA
Southern District
770 Fairmont Avenue, Suite 102
Glendale, CA 91203-1035

Office (818) 500-1645 Ext. 233
Fax (818) 543-4604
mvanraal@water.ca.gov
www.sd.water.ca.gov

AGENDA ITEM
4

AUGUST 9, 2010

TO: COMMITTEE MEMBERS

FROM: DON SPAGNOLO
GENERAL MANAGER

DATE: AUGUST 5, 2010

SET NEXT COMMITTEE MEETING

ITEM

Set next committee meeting [Set Date/Time].

BACKGROUND

The Committee usually meets on the Monday preceding the first Board meeting of the month as necessary.

RECOMMENDATION

Staff recommends that the Committee tentatively set a meeting at 2 pm on Tuesday, September 7, 2010 since Monday, September 6, 2010 is a holiday. If staff does not have policy issues to bring to the committee at that time, the meeting can be deferred to the following month with Committee member concurrence.

ATTACHMENT- NONE

T:\BOARD MATTERS\BOARD MEETINGS\BOARD LETTER\2010\COMMITTEES\SOUTHLAND UPGRADE\100809 MEETING\100809ITEM4.DOC