

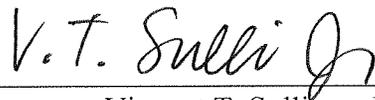


# REMEDIATION START-UP AND AS-BUILT REPORT

Plant Operations Yard  
Humboldt State University  
1 Harpst Street  
Arcata, California

LOP No. 12405

Prepared for:  
Humboldt State University  
1 Harpst Street  
Arcata, California



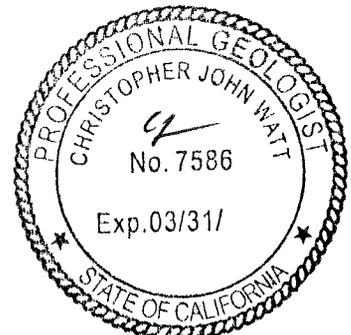
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Vincent T. Sullivan, E.I.T.



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Christopher J. Watt, P.G. 7586, Exp. 3/31/08



**LACO ASSOCIATES**  
CONSULTING ENGINEERS  
21 W. 4th St. • PO 1023 • Eureka, CA 95502 • 707.443.5054

May 15, 2006  
LACO Project No. 5376.02



# REMEDIATION START-UP AND AS-BUILT REPORT

Plant Operations Yard, Humboldt State University

1 Harpst Street, Arcata, California

LOP No. 12405, LACO Project No. 5376.02

## EXECUTIVE SUMMARY

The subject property is located within the Plant Operations yard at Humboldt State University (HSU) in Arcata, California (Figures 1 and 2). LACO ASSOCIATES (LACO) was retained by HSU as an engineering consultant to perform professional services required by the Humboldt County Division of Environmental Health (HCDEH), including the installation, operation, and maintenance of an *in-situ* chemical oxidation (ISCO) remedial system onsite. This work was approved in HCDEH correspondence dated November 18, 2005. The ISCO system was constructed between December 7, 2005 and January 9, 2006, and was installed within the Plant Operations Yard and an adjacent landscaped area. Sampling for constituents of concern (COCs) and possible by-products resulting from ICSCO activities have been conducted monthly for the first quarter and will be conducted quarterly thereafter.

## INTRODUCTION

Historical subsurface investigations at the site have identified a secondary source of total petroleum hydrocarbons as gasoline (TPHg); benzene, toluene, ethylbenzene, and total xylenes (BTEX); and methyl tertiary butyl ether (MTBE) within the landscaped slope west of the Plant Operations Yard. As stated in LACO's August 2005 *Interim Remedial Action Plan* (IRAP), the preferred remedial technology to reduce the on-site secondary source mass is ISCO, using a propriety hydrogen peroxide/ozone (perozone) sparging system.

## SYSTEM START-UP CHRONOLOGY

December 7 to December 13, 2005: LACO installed eleven sparge points.

December 12 to December 14, 2005: Julien Construction installed the distribution network and the control cabinet.

January 9, 2006: System startup was initiated.

## INSTALLATION

### Sparge Well Installation

On December 7 to December 13, 2005, LACO installed eleven sparge wells (SP1 through SP11). The locations of the sparge wells are illustrated in Figure 2. The sparge points are a proprietary technology supplied by Kerfoot Technologies (Kerfoot). The locations, dimensions, and construction details of the sparge well installations are detailed below in Table A. Sparge point installation verification forms are included as Attachment 1, and a figure illustrating a single-point sparge well detail is included as Figure 3.

Table A: Sparge Point Installation Details			
Sparge Point Number	Length (inches)	Installation Method	Approximate Depth of Point (feet bgs to bottom of point)
SP1	16.5	RHSA	8.5
SP2	16.5	RHSA	7.5
SP3	15	RHSA	13.75
SP4	15	RHSA	11.5
SP5	16.5	HA	5.5
SP6	16.5	HA	5.5
SP7	15	HA	9
SP8	15	HA	6.75
SP9	16.5	HA	6
SP10	15	HA	6
SP11	15	HA	7.75

Note: All sparge wells are 2-in diameter  
Key to Abbreviations:  
RHSA = rotary hollow stem auger  
HA = hand auger

The depth of the sandy/silty clay perching layer was confirmed with the hand auger. A table of general site stratigraphy is included below as Table B.

<b>Table B: General Site Stratigraphy</b>	
Depth (feet, bgs)	Soil Type
0	Asphalt, concrete, or topsoil
0.75	Silty sand and gravel
2	Silt, sand, clay mixtures
7	Sandy/silty clay
Note: Substantial sandy/silty clay encountered at approximately 11.5 - 13.75 feet bgs in sparge points SP4 and SP3, respectively	

Underground utility clearance was confirmed by the property owner, the Underground Services Alert notification system, and by using a hand auger to approximately 5 feet below ground surface (bgs) during the installation of sparge points SP1 through SP4. The sparge points and annular materials of sparge wells SP1 through SP4 were installed using a rotary hollow stem auger (RHSA) drill rig. The sparge points and annular materials of sparge wells SP5 through SP11 were installed using a hand auger. Annular materials are detailed in Table C, included below.

<b>Table C: Annular Materials Installation Details</b>				
Sparge Point Number	Approximate Sand Pack Interval (feet bgs)	Sand Pack Type	Approximate Sanitary Seal Interval (feet bgs)	Sanitary Seal Type
SP1 <sup>1</sup>	5.9 - 8.5	#60	1.5 - 5.9	cement slurry
SP2	5 - 8	#60	1.5 - 5	bentonite
SP3 <sup>1</sup>	11.5 - 13.75	#60	1.5 - 11.5	bentonite
SP4 <sup>1</sup>	9.2 - 12	#60	1.5 - 9.2	bentonite
SP5 <sup>1</sup>	3 - 6	#60	1.5 - 3	bentonite
SP6	3.2 - 7	#60	1.5 - 3.2	bentonite
SP7 <sup>1</sup>	7 - 9.5	#60	1.5 - 7	bentonite
SP8 <sup>1</sup>	4.5 - 7	#60	1.5 - 4.5	bentonite
SP9 <sup>1</sup>	3.4 - 6	#60	1.5 - 3.4	bentonite
SP10	3.75 - 6	#60	1.5 - 3.75	bentonite
SP11 <sup>1</sup>	5.5 - 8	#60	1.5 - 5.5	cement slurry
NOTES				
<sup>1</sup> These sparge points were installed with a sanitary seal or sand pack interval beneath the sparge point. See Attachment A for specific details.				

The ozone supply line riser (consisting of 1/2-inch Schedule 80 PVC) was attached to the upper fitting of the sparge points using PVC primer, glue, and a 1/2-inch male pipe thread (MPT) Schedule 80 socket adapter. In the sparge points utilizing hydrogen peroxide, the hydrogen peroxide supply lines (consisting of 1/4-inch Teflon tubing) are connected to the sparge points using a 1/4-inch Gyrolock compression fitting supplied by the vendor. The flexible Teflon hydrogen peroxide line was secured to the exterior of the sparge point's PVC riser using zip ties.

Inside the well boxes, the sparge point's riser was glued to a PVC 'T' assembly comprising of a PVC male adapter (1/2-inch MPT x Schedule 80 socket), PVC threaded 'T' (1/2-inch MPT Schedule 80), Kynar 1/2-inch inline check valve, and Kynar female coupling tube to female pipe thread ([FPT] 3/8-inch compression x 1/2-inch FPT). The PVC 'T' assembly is connected to a 316 SS Gyrolock to male connector or 1/2-inch threaded PVC plug. All threaded fittings were wrapped with Teflon tape to ensure a secure fit, and care was taken to ensure that compression fitting nuts were tightened per specifications supplied by the manufacturer.

### **Distribution Network Installation**

Individual supply lines from the 3-foot by 3-foot steel control cabinet to each sparge point head are contained within low-density polyethylene tubing (7/8-inch outside diameter [OD] sheath and 3/8-inch OD Teflon-lined inner tubing [ozone] or 7/8-inch OD sheath and 1/4-inch OD Teflon-lined inner tubing [hydrogen peroxide]). The supply lines to sparge points SP1, SP2, and SP4 were placed 10 to 12 inches below grade in a trench, covered by 6 inches of 2-sack slurry, and finished with 6 inches of hot asphalt. The supply line for sparge point SP3 was placed 10 to 12 inches below grade in a trench, covered by 6 inches of 2-sack slurry, and finished with 6 inches of traffic-rated concrete. The initial supply line lengths of sparge points SP5 through SP11 were placed as described for sparge point SP3, and buried by native topsoil where the supply lines extended through the unpaved, landscaped area west of the hazardous waste handling facility (Figure 2). A figure depicting details of the trench components is included as Figure 4.

At each sparge point head, the tubing from the distribution trench is delivered into the well box by a 3/4-inch rigid PVC sweep. Inside each well box, the ozone and hydrogen peroxide supply

lines are connected as described above.

Access to the landscaped, unpaved area west of the hazardous waste handling facility was provided by HSU grounds personnel, who cleared the unpaved area west of the hazardous waste handling facility of branches and debris before the trench network was installed. The trench network was installed from December 12 through December 14, 2005, by Julien Construction, a licensed general contractor. The trench system contains the tubing from each individual sparge well to the control cabinet, where each supply tube can be connected to LACO's mobile remediation unit (MRU). The layout of the trench network is illustrated in Figure 2. A map showing trench locations and sparge wells will be posted inside the control cabinet and will be placed on file at the HCDEH. A survey of the sparge points, trench system, and control cabinet will be performed by a licensed surveyor following the monitoring well installation proposed in LACO's August 2005 IRAP.

### **Ozone Generation Equipment**

Ozone will be generated and supplied to the site's distribution network by the MRU. The MRU houses the following components: 1) an 8-port master panel to generate and distribute ozone at a rate of up to 60 grams per hour; 2) a compressor that sends pressurized ozone to the sparge wells; and 3) an oxygen concentrator which feeds a pair of ozone generators. The MRU is self-contained in that it can operate using shore power or the MRU's diesel generator.

### **Hydrogen Peroxide Equipment**

Technical-grade hydrogen peroxide is delivered to the site in 55-gallon drums at a concentration of 35 percent, and mixed with filtered water to achieve the desired injected concentration of approximately 10 percent. The 10 percent hydrogen peroxide solution is pumped to the laminar sparge points using peristaltic pumps, which are located in the hazardous waste handling facility.

## **TESTING AND OPTIMIZATION**

### **Start-Up Test**

On January 10, 2006, a LACO technician checked for leaks at the well head connections and

performed a start-up test by supplying air to each point. All leaks were repaired, and during this time period the system was also checked for loose wires. Distribution pressures were monitored to ensure sparge points were not clogged and that they functioned properly. Additionally, a pressure test was performed by supplying air to each sparge point for several minutes. Line pressures ranged from 14 to 42 pounds per square inch (psi).

### **Sparge Well Development**

To prevent the creation of fractures in the formation that would result in preferential pathways limiting the remedial system's effectiveness, development of the sparge wells was performed. The sparge wells were developed by slowly increasing the remedial system's gas flow, which initially results in an increase in remedial system pressure until formation fines surrounding the sparge points are mobilized. As formation fines are mobilized, a pressure decrease is seen in the system that is a result of reduced resistance to gas flow. This sequence is repeated until a change in formation pressure loss of less than 2 psi is observed over 30 minutes, or the predetermined pressure is reached. Field notes illustrating the pressures observed in the treatment array on January 10, 2006, are included as Attachment 2.

### **MONITORING AND REPORTING**

Performance monitoring for COCs in the treatment array monitoring wells is being conducted monthly for the first quarter and quarterly thereafter, and intrinsic parameters pH, dissolved oxygen (DO), conductivity (EC<sub>w</sub>), temperature (T), and oxidation reduction potential (ORP) will be monitored bimonthly. Operation and maintenance system checks will be performed bimonthly or as required. Analysis for the following potential ozonation by-product will be performed quarterly:

- Tertiary Butyl Formate (TBF) by EPA Method 8260B

Performance monitoring for COCs in the key and perimeter monitoring wells is being conducted monthly for the first quarter and quarterly thereafter for the following analytes:

- TPH<sub>g</sub> by EPA Method 8260B
- BTEX by EPA Method 8260B

- Fuel oxygenates MTBE, Tertiary Amyl Methyl Ether (TAME), Ethyl Tertiary Butyl Ether (ETBE), Di-isopropyl Ether (DIPE), and Tertiary Butyl Alcohol (TBA) by EPA Method 8260B

## **FUTURE WORK**

Monthly treatment utilizing the MRU and consisting of 6- to 8-hour treatments, occurring on consecutive days over a 5-day week, will occur for the duration of the treatment. As discussed in LACO's August 2005 IRAP, the life span of this remediation is projected at approximately 2.9 years, assuming the MRU is onsite for the monthly treatment period described above. Intrinsic parameters pH, DO, EC<sub>w</sub>, T, and ORP will also be monitored as part of the monitoring activities.

## **LIST OF FIGURES AND ATTACHMENTS**

- Figure 1      Location Map
- Figure 2      Site Map
- Figure 3      Single-Point Sparge Well Detail
- Figure 4      Trench Detail

Attachment 1: Sparge Point Installation Verification Forms

Attachment 2: Field Notes, Sparge Well Development

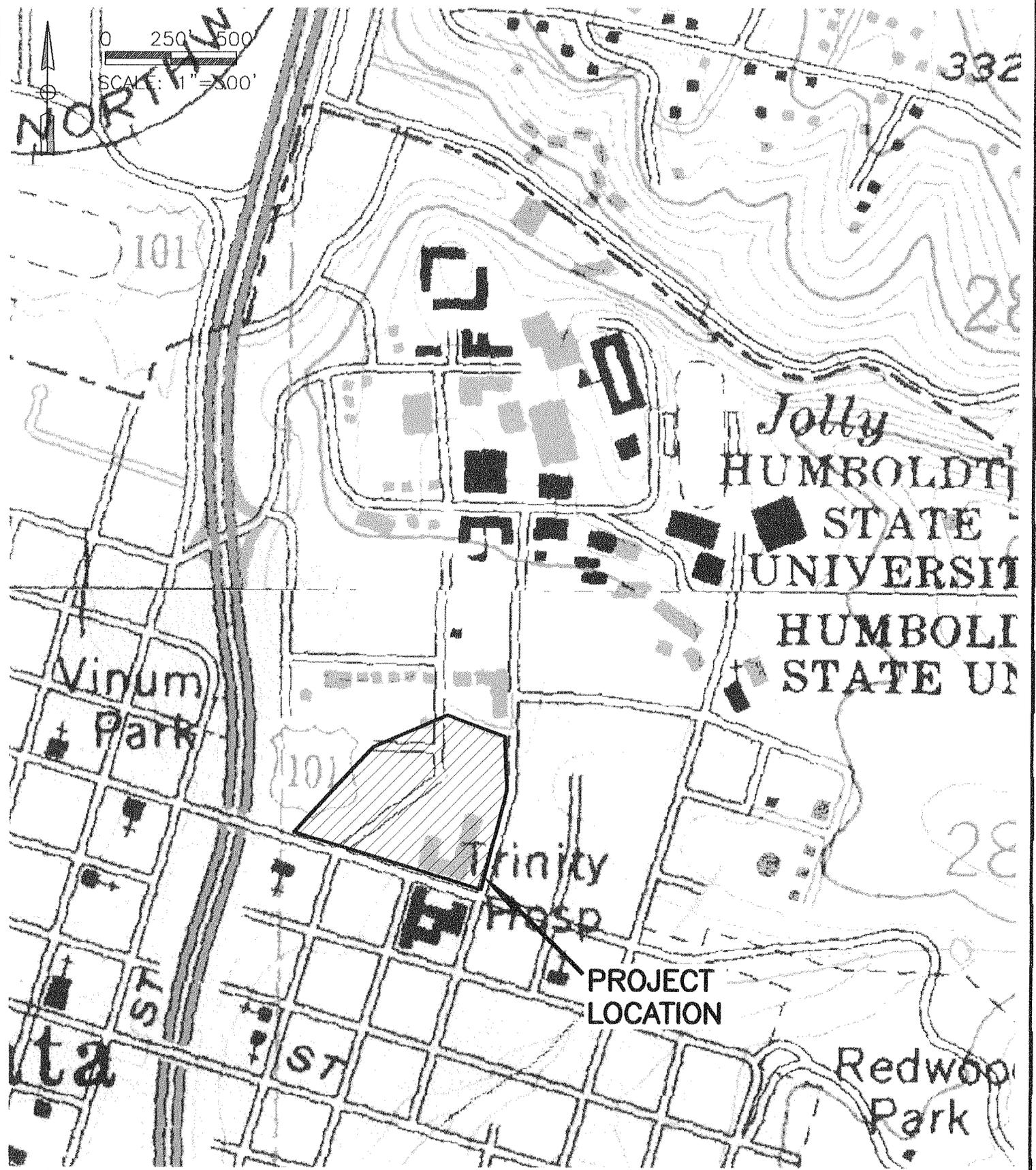
VTS:jg

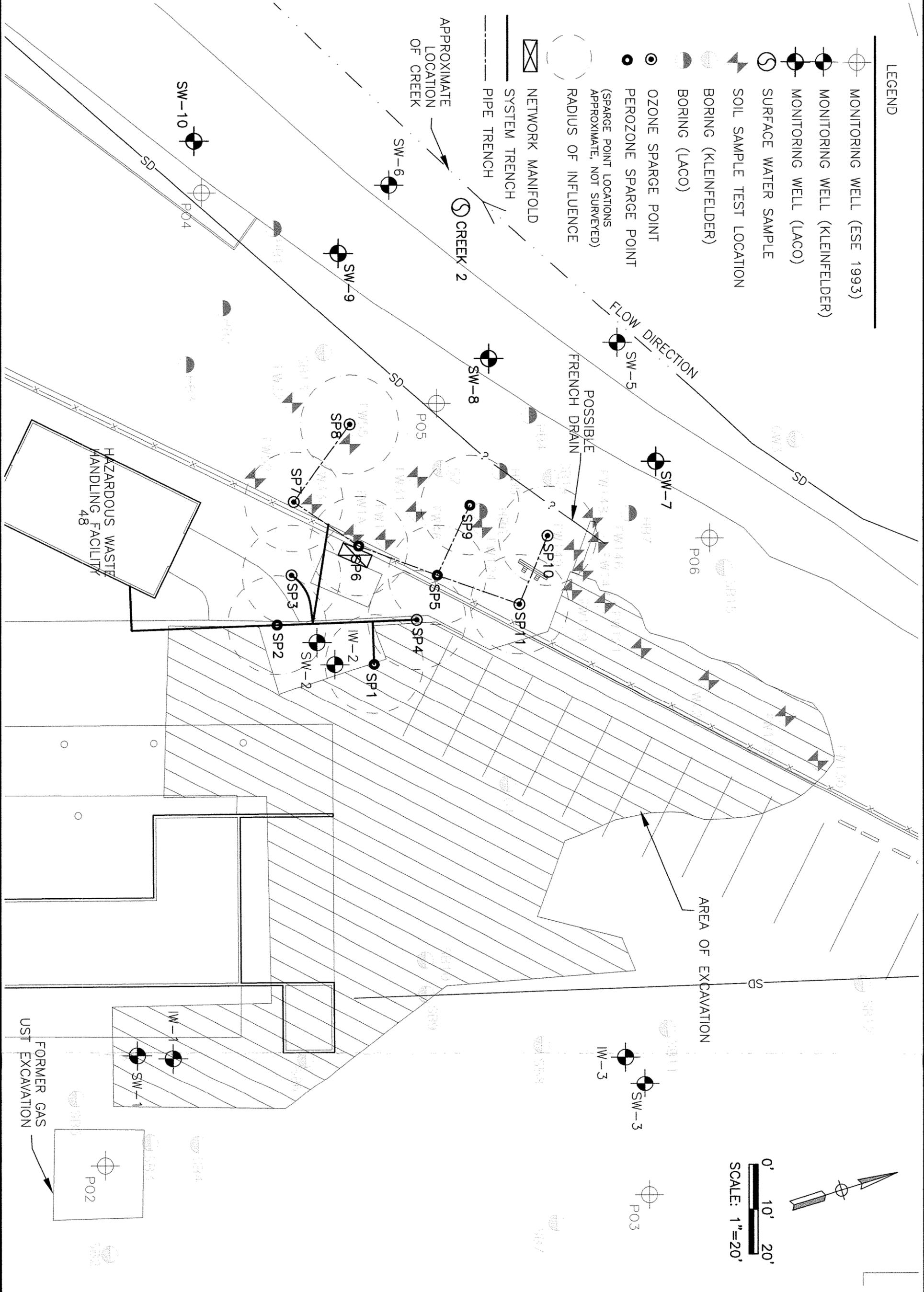
P:\5300\5376 HSU Wells\SUBMITTALS\Reports of Findings\12-05 remedial system installation ROF\5376.02 HSU Start up report.doc



**LACO ASSOCIATES**  
CONSULTING ENGINEERS  
21 W 4TH ST. EUREKA, CA 95501 (707)443-5054

PROJECT	REMEDATION START-UP/AS-BUILT REPORT	BY	BAB	FIGURE	1
CLIENT	HUMBOLDT STATE UNIVERSITY	DATE	5/02/06	JOB NO.	5376.02
LOCATION	PLANT OPERATIONS YARD	CHECK	<i>g</i>		
	LOCATION MAP	SCALE	1"=500'		





LEGEND

- MONITORING WELL (ESE 1993)
- MONITORING WELL (KLEINFELDER)
- MONITORING WELL (LACO)
- SURFACE WATER SAMPLE
- SOIL SAMPLE TEST LOCATION
- BORING (KLEINFELDER)
- BORING (LACO)
- OZONE SPARGE POINT
- PEROZONE SPARGE POINT
- (SPARGE POINT LOCATIONS APPROXIMATE, NOT SURVEYED)
- RADIUS OF INFLUENCE
- ⊠ NETWORK MANIFOLD
- SYSTEM TRENCH
- - - PIPE TRENCH
- APPROXIMATE LOCATION OF CREEK

SCALE	1"=20'
DRAWN	BAB
CHECK	VTS
APPVD	<i>[Signature]</i>
DATE	5/02/06
JOB NO.	5376.02
FIGURE	2

**REMEDATION START-UP / AS-BUILT REPORT**  
**SITE MAP**  
**HUMBOLDT STATE UNIVERSITY**  
**PLANT OPERATIONS YARD**

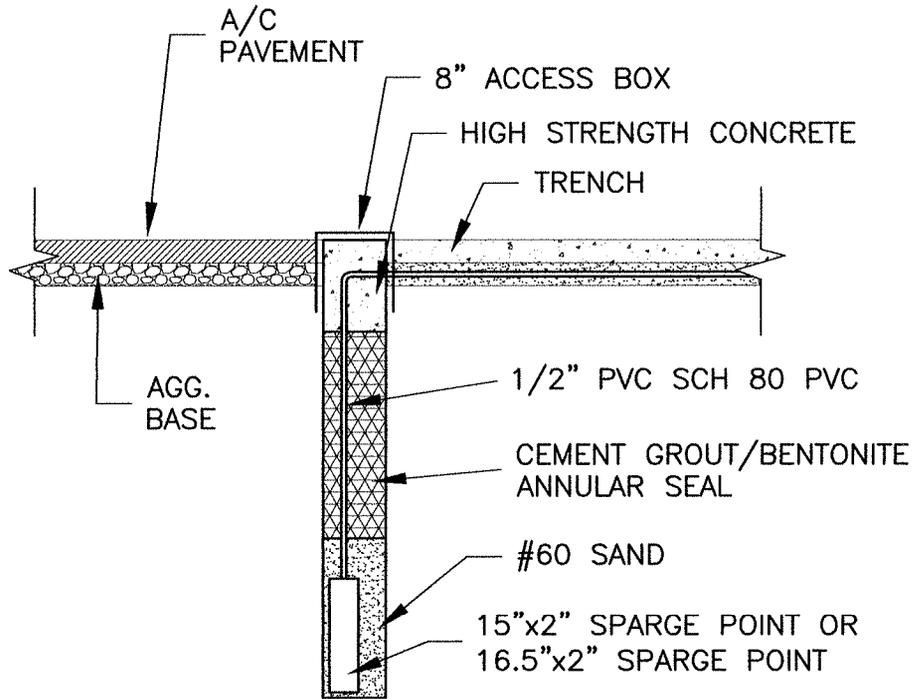
NO.	REVISION	BY	CHK	DATE

**LACO ASSOCIATES**  
 CONSULTING ENGINEERS  
 21 W 4TH ST. EUREKA, CA 95501 (707)443-5054



**LACO ASSOCIATES**  
 CONSULTING ENGINEERS  
 21 W 4TH ST. EUREKA, CA 95501 (707)443-5054

PROJECT	REMEDATION START-UP & AS-BUILT REPORT	BY	BAB	FIGURE	3
CLIENT	HUMBOLDT STATE UNIVERSITY	DATE	5/02/06		
LOCATION	PLANT OPERATIONS YARD	CHECK	<i>ej</i>	JOB NO.	5376.02
	SINGLE-POINT SPARGE WELL DETAIL	SCALE	N.T.S.		



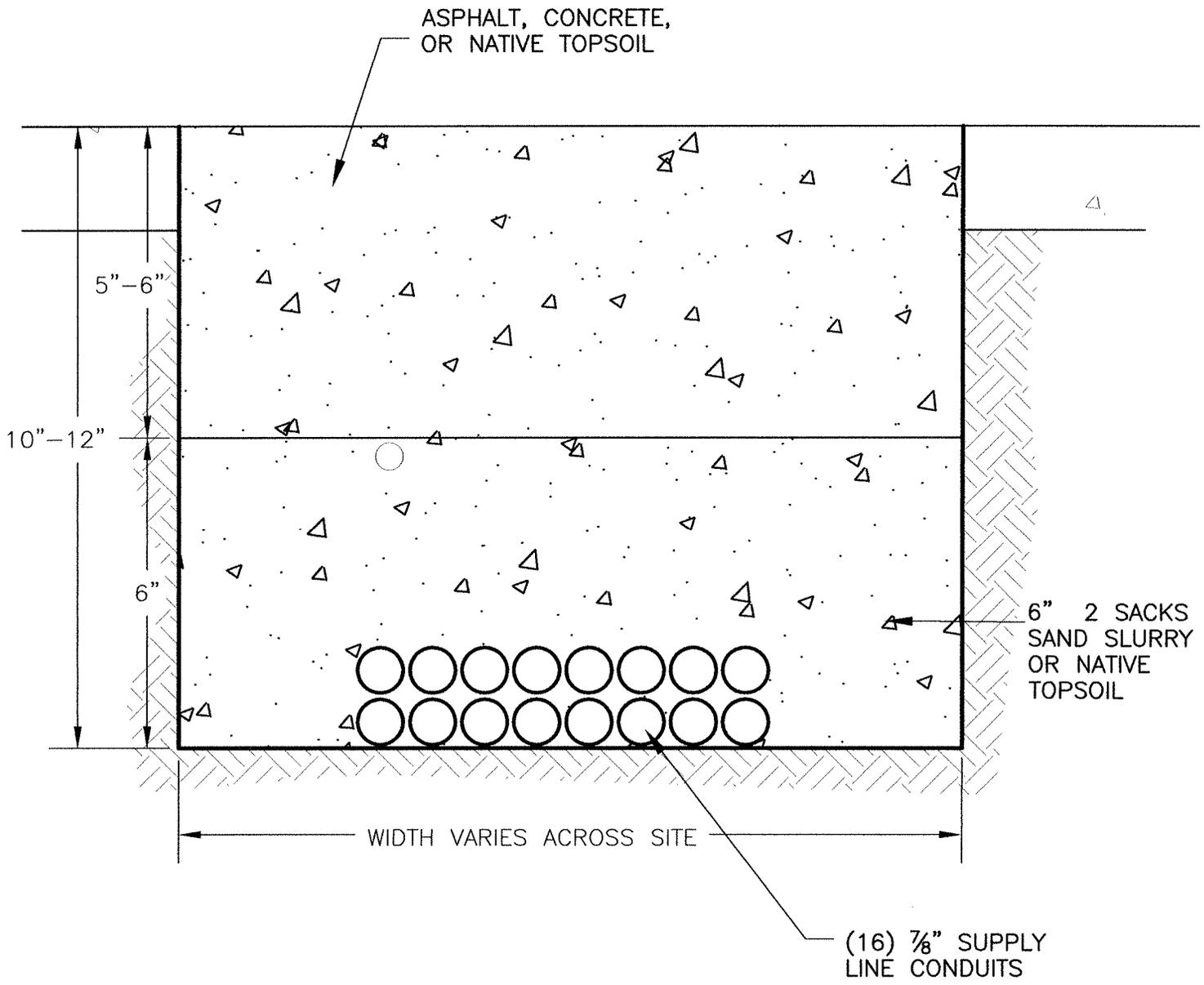
NOT TO SCALE

NOTE: SPARGE POINT AND ANNULAR MATERIAL INSTALLATION DETAILS ARE INCLUDED IN REPORT TABLES A & B, RESPECTIVELY.



**LACO ASSOCIATES**  
CONSULTING ENGINEERS  
21 W 4TH ST. EUREKA, CA 95501 (707)443-5054

PROJECT	REMEDATION START-UP & AS-BUILT REPORT	BY	BAB	FIGURE	4
CLIENT	HUMBOLDT STATE UNIVERSITY	DATE	5/02/06		
LOCATION	PLANT OPERATIONS YARD	CHECK	<i>[Signature]</i>	JOB NO.	5376.02
	TRENCH DETAIL	SCALE	1/4" = 1"		



NOTE: SUPPLY LINE INSTALLATION DETAILS ARE INCLUDED IN THE REPORT SECTION TITLED "DISTRIBUTION NETWORK INSTALLATION"

# **Attachment 1**



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *TBB*

Driller: *DRL*

Project No.: *5376.02*

Sparge Point ID No.: *SP1*

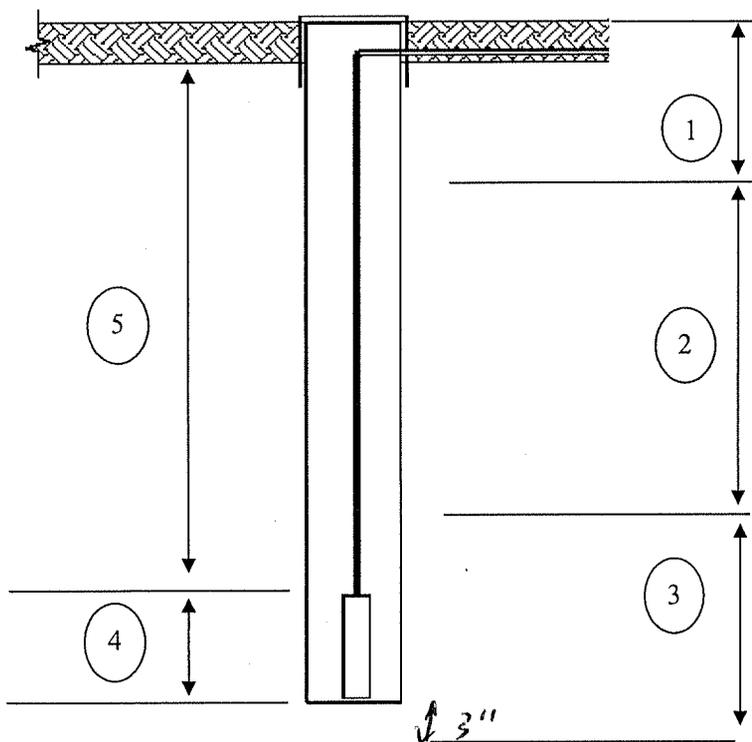
Date: *12/7/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

(3) Sand Pack Interval and Type: *≈ 53" slurry*

(4) Length of Sparge Point: *≈ 31" # 60*

(5) Length of PVC Riser: *16.5"*

Cored Interval Depth(s): *≈ 86" / 1/4" ≈ 90"*

Riser Material and Diameter: *1/2 Sched. 80 PVC*

Drilling Method: *RHSA*

NOTES:

*total depth ≈ 9'; top of clay ≈ 8.5*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: Hsu Wells

Tech: TBB Driller: DRL

Project No.: S376.02

Sparge Point ID No.: SP2

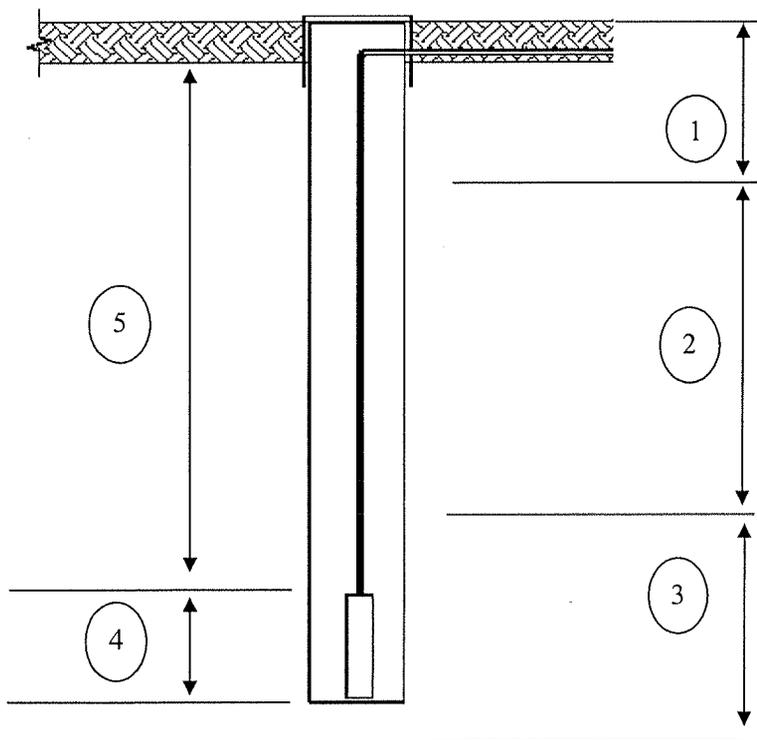
Date: 12/7/05

Start Time:

PM: CSM

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type: 3.5' bent.

(3) Sand Pack Interval and Type: 1.5' (6" below 3' 1' above)

(4) Length of Sparge Point: 16.5'

(5) Length of PVC Riser: 6'8"

H<sub>2</sub>O<sub>2</sub>: 7'

Cored Interval Depth(s):

Riser Material and Diameter: 1/2" sch 80 PVC

Drilling Method: RHA

NOTES: Total depth ≈ 8'



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSA Wells*

Tech: *JLS*

Driller: *DRL*

Project No.: *5376.02*

Sparge Point ID No.: *SP3*

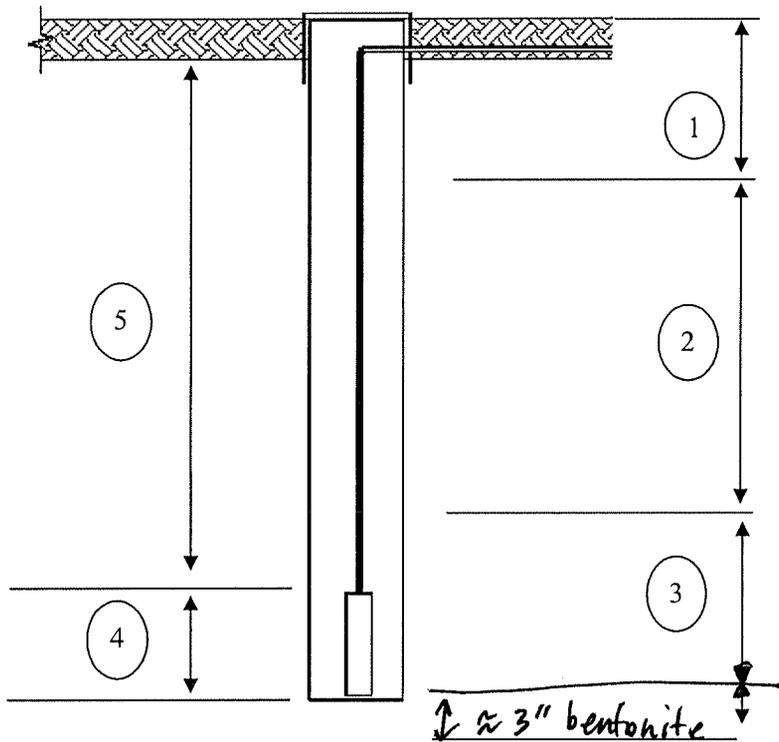
Date: *12/8/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

*bentonite  $\approx 10'$*

(3) Sand Pack Interval and Type:

*#60  $\approx 27''$*

(4) Length of Sparge Point:

*15''*

(5) Length of PVC Riser:

*12.5'*

Cored Interval Depth(s):

Riser Material and Diameter:

*1/2" sch 80 PVC*

Drilling Method:

*RHSA*

NOTES:

*total depth  $\approx 14'$*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *JLS/TBB* Driller: *DRL*

Project No.: *5376.02*

Sparge Point ID No.: *SP4*

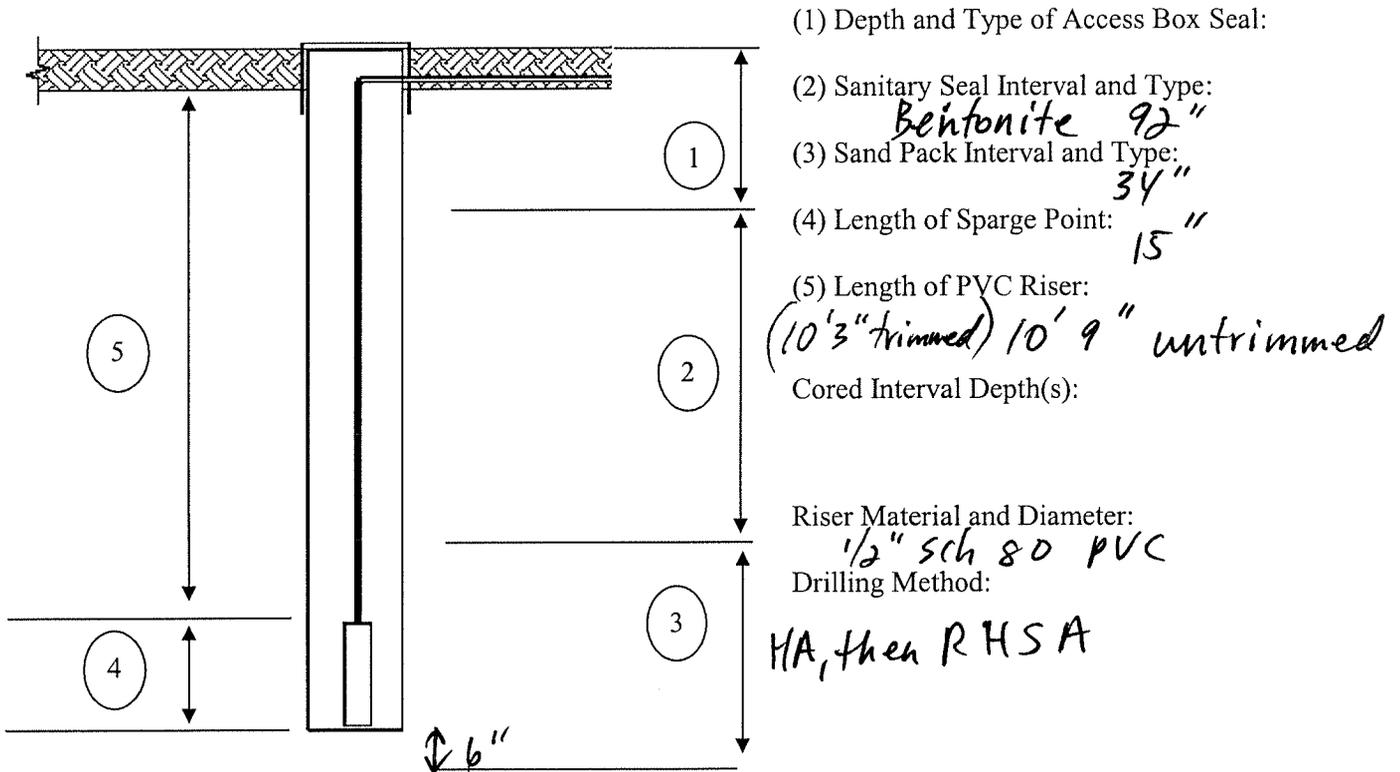
Date: *12/9/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



NOTES:

- total depth  $\approx$  12'

- hole started 12/8, finished 12/9/05

1/17/05 : No boring log. VTS & TBB agree that point is installed within fill (gravelly) and silty sand above clay @  $\approx$  12' bgs.



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: Hsu Wells

Tech: JPB Driller: JPB

Project No.: 5376.02

Sparge Point ID No.: SP/65 (vs)

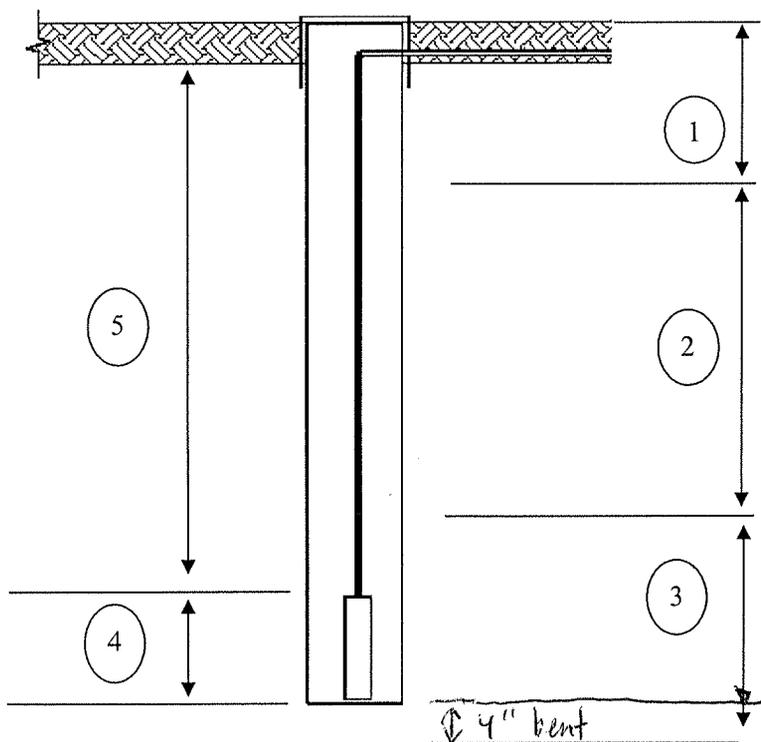
Date: 12/7/05

Start Time:

PM: CSM

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:  $\approx 1.5'$  bent.

(3) Sand Pack Interval and Type:  $\approx 3'$  #60

(4) Length of Sparge Point: 16.5"

(5) Length of PVC Riser: 7 feet untrimmed  
 $\approx 4'3"$  H<sub>2</sub>O<sub>2</sub> + point

Cored Interval Depth(s):

Riser Material and Diameter:

Drilling Method:

HA

**NOTES:**

length of H<sub>2</sub>O<sub>2</sub> tube: 7 feet untrimmed  
(+ point length)

- 6' : hole depth; add  $\approx 4"$  bent, then 6" sand  
→ into clay  $\approx 4"$



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *JPB* Driller: *JPB*

Project No.: *S376.02*

Sparge Point ID No.: *SP6*

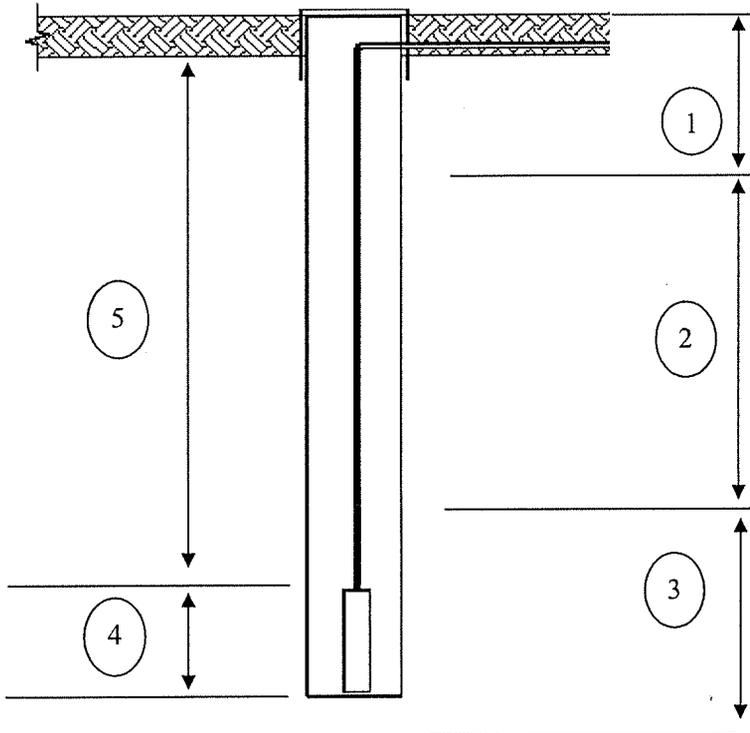
Date: *12/7/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

(3) Sand Pack Interval and Type: *SP 46"*

(4) Length of Sparge Point: *16.5"*

(5) Length of PVC Riser: *69" (H<sub>2</sub>O tube = 79")*

Cored Interval Depth(s):

Riser Material and Diameter: *1/2" sch 80 PVC*

Drilling Method: *Hand auger*

**NOTES:**

*Total depth ≈ 7'*  
*depth of clay ≈ 5.25'; insert 1.5' sand, <sup>bottom of</sup> point*  
*is at ≈ ~~6.75~~ 5.5'*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *JPB* Driller: *JPB*

Project No.: *5376.02*

Sparge Point ID No.: *SP7*

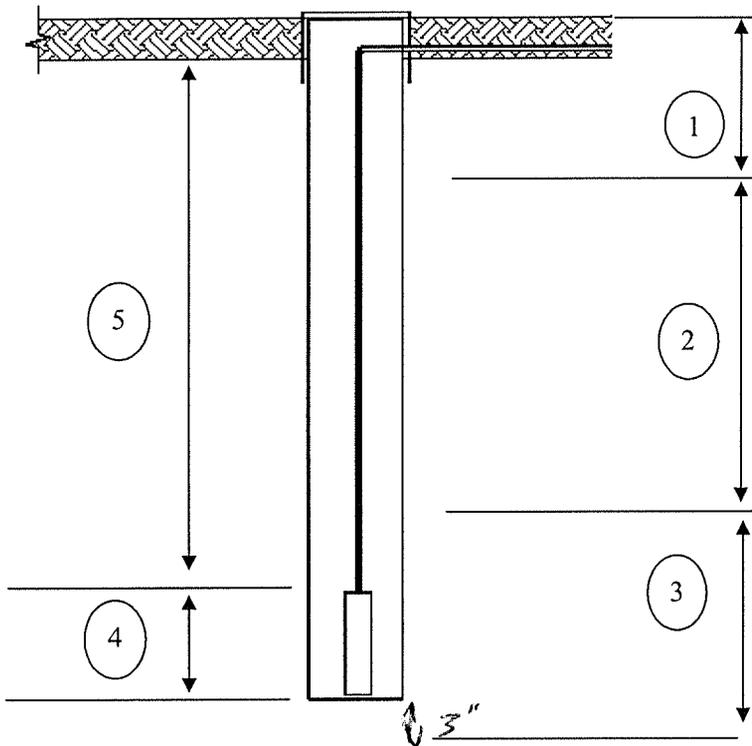
Date: *12/7/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type: *5.5' bentonite*

(3) Sand Pack Interval and Type:

(4) Length of Sparge Point: *30" #60*

(5) Length of PVC Riser: *15"*

*8' 9" unfinned*

Cored Interval Depth(s):

Riser Material and Diameter: *1/2" sch 80 PVC*

Drilling Method: *HA*

NOTES:

*total depth = 9.5' bgs. top of clay ≈ 9.25*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *Hsu wells*

Tech: *JMW* Driller: *JMW*

Project No.: *5376.02*

Sparge Point ID No.: *SP8*

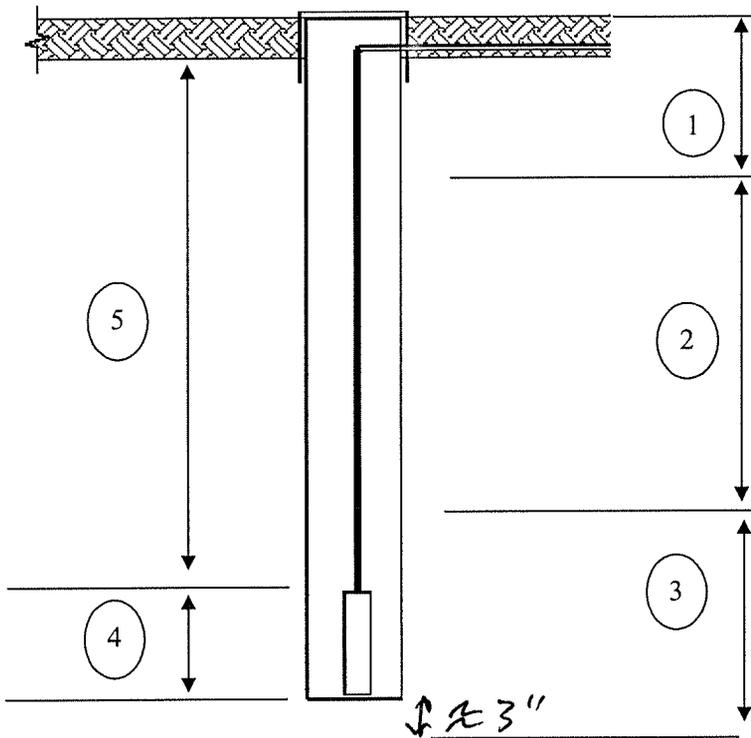
Date: *12/8/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

*~ 36" bentonite*

(3) Sand Pack Interval and Type:

*~ 30" #60*

(4) Length of Sparge Point:

*15"*

(5) Length of PVC Riser:

*~ 66"*

Cored Interval Depth(s):

Riser Material and Diameter:

*1/2" sch 80 PVC*

Drilling Method:

*HA*

NOTES:

*Total depth ≈ 7'*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *TBB*

Driller: *TBB*

Project No.: *5376.02*

Sparge Point ID No.: *SP9*

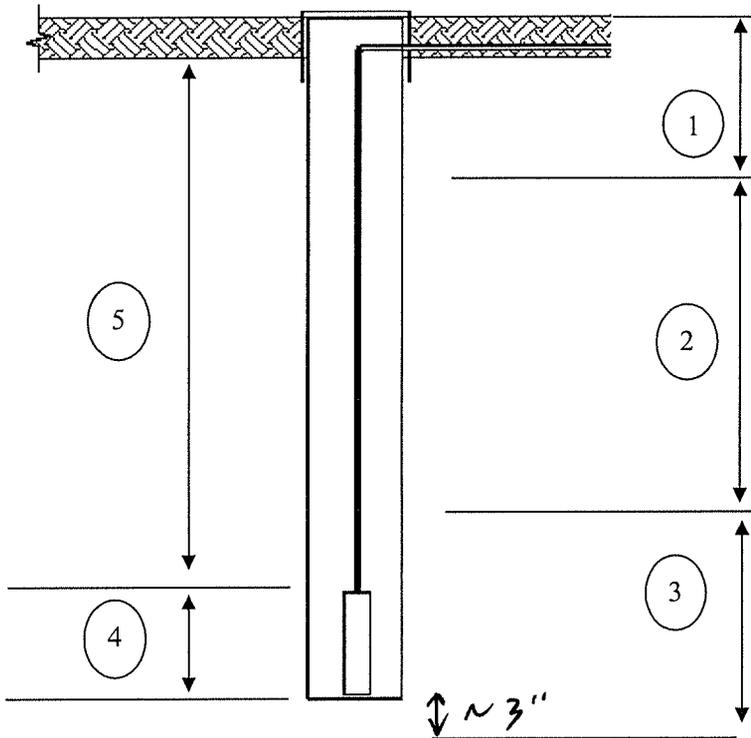
Date: ~~*12/9/05*~~ *(VS)* *12/13/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

(3) Sand Pack Interval and Type: *23" bentonite*

(4) Length of Sparge Point: *16.5"*

(5) Length of PVC Riser:

Cored Interval Depth(s): *~60" untrimmed*  
*(~55" trimmed)*

*H<sub>2</sub>O<sub>2</sub> line ~61"*

Riser Material and Diameter:

Drilling Method:

*Hand auger*

NOTES:

*total depth ~ 6' (sand [3"] to 6')*

*1/17/06: unfinished boring log. VTS + TBB discuss + agree that sparge point is installed within silty sand w/ clay. Bay margin, peatty material.*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

21 West Fourth Street, Eureka, CA 95501  
TEL 707.443.5054  
FAX 707.443.0552

Project Name: *HSU Wells*

Tech: *JMW* Driller: *JMW*

Project No.: *5376.02*

Sparge Point ID No.: *SP10*

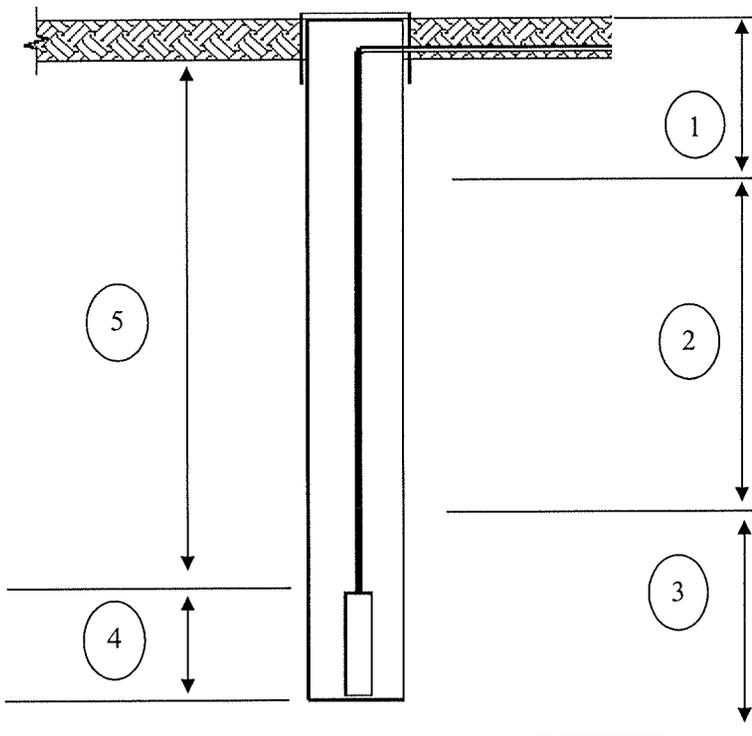
Date: *12/8/05*

Start Time:

PM: *CSM*

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

*~ 27" bentonite*

(3) Sand Pack Interval and Type:

*~ 27" #60*

(4) Length of Sparge Point:

*15"*

(5) Length of PVC Riser:

*~ 57"*

Cored Interval Depth(s):

Riser Material and Diameter:

*1/2 sch 80 PVC*

Drilling Method:

*HA*

NOTES:

*total depth ~ 6'*



**LACO ASSOCIATES**  
CONSULTING ENGINEERS

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TEL 707.443.5054  
FAX 707.443.0552

Project Name: HSK Wells

Tech: JMW Driller: JMW

Project No.: 5376.02

Sparge Point ID No.: SP11

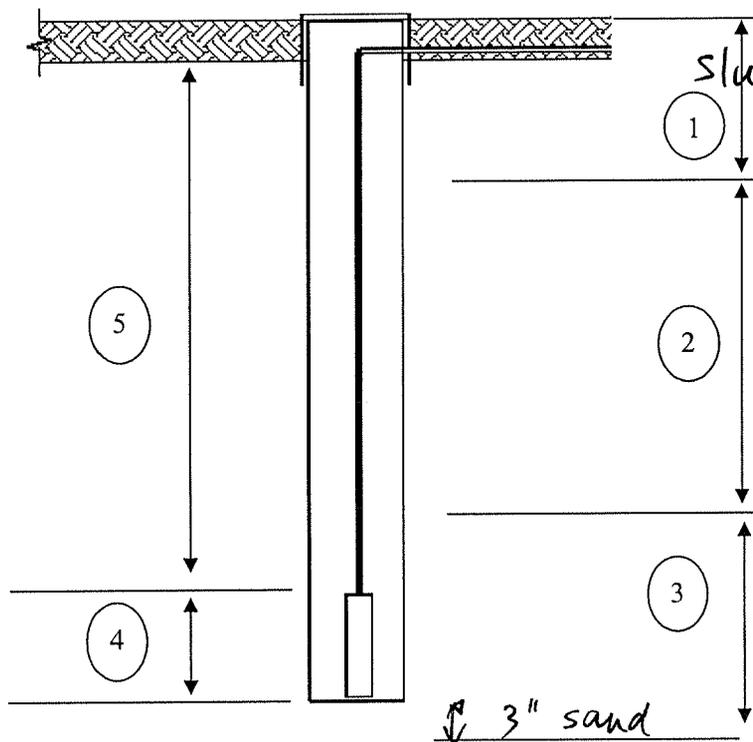
Date: 12/8/05

Start Time:

PM: CSM

End Time:

**Sparge Point Verification Form**



(1) Depth and Type of Access Box Seal:

(2) Sanitary Seal Interval and Type:

(3) Sand Pack Interval and Type:

(4) Length of Sparge Point:

(5) Length of PVC Riser:

Cored Interval Depth(s):

Riser Material and Diameter:

Drilling Method:

Slurry Bentonite  
48"  
30"  
27" #60  
15"  
78" trimmed 8' (untrimmed)

Hand auger

3" sand

NOTES:

Hole  $\approx 8'$   $\Rightarrow 7.75'$   
used 4" PVC to hold hole open (collapsing)

# **Attachment 2**



VAN 36 Pgs

SP1 PEROZONE 1.0 ACFM OPEN = 0.95 SCFM @ 28 psi  
INCREASE 1.40 SCFM @ 34 psi

SP2 PEROZONE 1.0 ACFM OPEN = 1.00 SCFM @ 17 psi  
INCREASE 2.00 SCFM @ 29 psi

SP3 OZONE 1.0 ACFM OPEN = 1.50 SCFM @ 40 psi  
1.50 SCFM @ 42 psi

SP4 OZONE 1.0 ACFM OPEN = 1.50 SCFM @ 40 psi  
1.50 SCFM @ 42 psi

SP5 PEROZONE 1.0 ACFM OPEN = 1.80 SCFM @ 30 psi  
INCREASE = 0.85 SCFM @ 34 psi

SP6 PEROZONE 1.0 ACFM OPEN = 1.00 SCFM @ 14 psi  
INCREASE = 1.80 SCFM @ 33 psi

SP7 OZONE 1.0 ACFM OPEN = 1.50 SCFM @ 38 psi  
1.50 SCFM @ 42 psi

SP8 OZONE 1.0 ACFM OPEN = 0.50 SCFM @ 25 psi  
0.70 SCFM @ 38 psi

SP9 PEROZONE 1.0 ACFM OPEN = 0.75 SCFM @ 34 psi  
0.95 SCFM @ 38 psi

SP10 OZONE 1.0 ACFM OPEN = 0.50 SCFM @ 39 psi  
0.50 SCFM @ 39

SP11 OZONE 1.0 ACFM OPEN = 0.50 SCFM @ 36 psi  
0.60 SCFM @ 39 psi