SUBJECT: HTW – BCT Meeting
May 17, 2005
10:00 a.m.
BRAC Conference Room

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	Erik Appel	Ahtna	916/372-2000	eappel@ahtnagov.com
[signature]	Bob Parkins	HydroGeoLogic	916/614-8770	rparkins@hgl.com
	Don Jones	HydroGeoLogic	916/614-8770	djones@hgl.com
	Kris Escarda	DTSC	916/255-3651	kescarda@dtsc.ca.gov
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SUBJECT: HTW – BCT Meeting
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Check (✓)	Name	Organization	Phone	E-mail address
RR	**Roman Racca**	DTSC	916/255-6407	Rracca@dtsc.ca.gov
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[signature]	**Carlene Merey**	MACTEC E&C	415/884-3276	cmerey@mactec.com
ME	**Marc Edwards**	COE	831/884-9925 ext 244	Marc.A.Edwards@usace.army.mil

Former Fort Ord
Agency Meeting Agendas
May 2005

May 16 at 1:00 p.m.
MR BCT Meeting
BRAC Conference Room

May 17 at 10:00 a.m.
HTW BCT Meeting
BRAC Conference Room

HTW BCT Meeting
BRAC Conf. Room

Item	Action	Comment
FFA Schedules	Status Update	
Range 36A Closure Activities	Status Update	
East Garrison Ranges Interim Action	Status Update	
Site 3 Eco Risk	Status Update	
Site 39 Eco Risk Work	Status Update	
Basewide Range Assessment	Status Update	Remediation Technology Review Presentation
OU1 Groundwater Remediation	Status Update	
Groundwater Treatment System Optimization	Status Update	
OU2 Landfill Gas	Status Update	
OU Carbon Tet Plume RI/FS	Status Update	
Calendar Update	Update	

SUMMARY OF REMEDIAL DESIGN CONSIDERATIONS

REMEDIAL DESIGN CONSIDERATIONS	FACTORS TO CONSIDER
REMEDIAL UNIT DEFINITION	
Range Locations, Number, Layout, Accessibility	Number of ranges and locations defined in BRA; scope of remediation depends on final cleanup levels/results of ERA for different scenarios Remedial implementation scheme will be affected by layout and accessibility of ranges; ecological impact considerations and priorities; munitions response work (e.g., burning); funding availability (e.g., staggered per range by priority vs. full-scale removal)
Estimated Volume, Lead Cleanup Level	Maximum volume of 122,000 cy (250 mg/kg eco risk-based lead level from Impact Area ERA) Minimum volume of 74,000 cy (1,860 mg/kg human health-based lead level from RI Sites ROD) ~40% volume differential depending on cleanup level
COST CONSIDERATIONS	
Standard Costs for Excavation, Hauling, Sampling & Analysis, Dust Control, UXO Support, Reporting	Preliminary estimate of $50/cy base cost included for each technology
Mobile vs. Central Processing	Accessibility, hauling to central processing area vs. onsite treatment or range-by-range cleanup, utilities, eco & UXO concerns, munitions response work, air quality impacts, public proximity would need to be considered
Minimum/Maximum Volumes & Cleanup Level Affects on Unit Cost, Mass Balance, Technology Applicability	Depends on final lead cleanup level; some reduction in unit cost for higher volumes
REGULATORY ISSUES	
Affect of Remediation on Biological Resources	HMP Requirements, NEBA, Biological Opinions (USFWS/CDFG/BLM) will affect approach and decision-making ERA will identify % and number of ranges w/variable ecological concerns Will need to develop cost-benefit analysis for decision-making
Excavation & Processing	Air permitting & monitoring requirements, public proximity to be considered
Excavation & Onsite Disposal & Capping at OU2 Landfill	Explanation of Significant Differences to OU2 Landfill ROD would be required

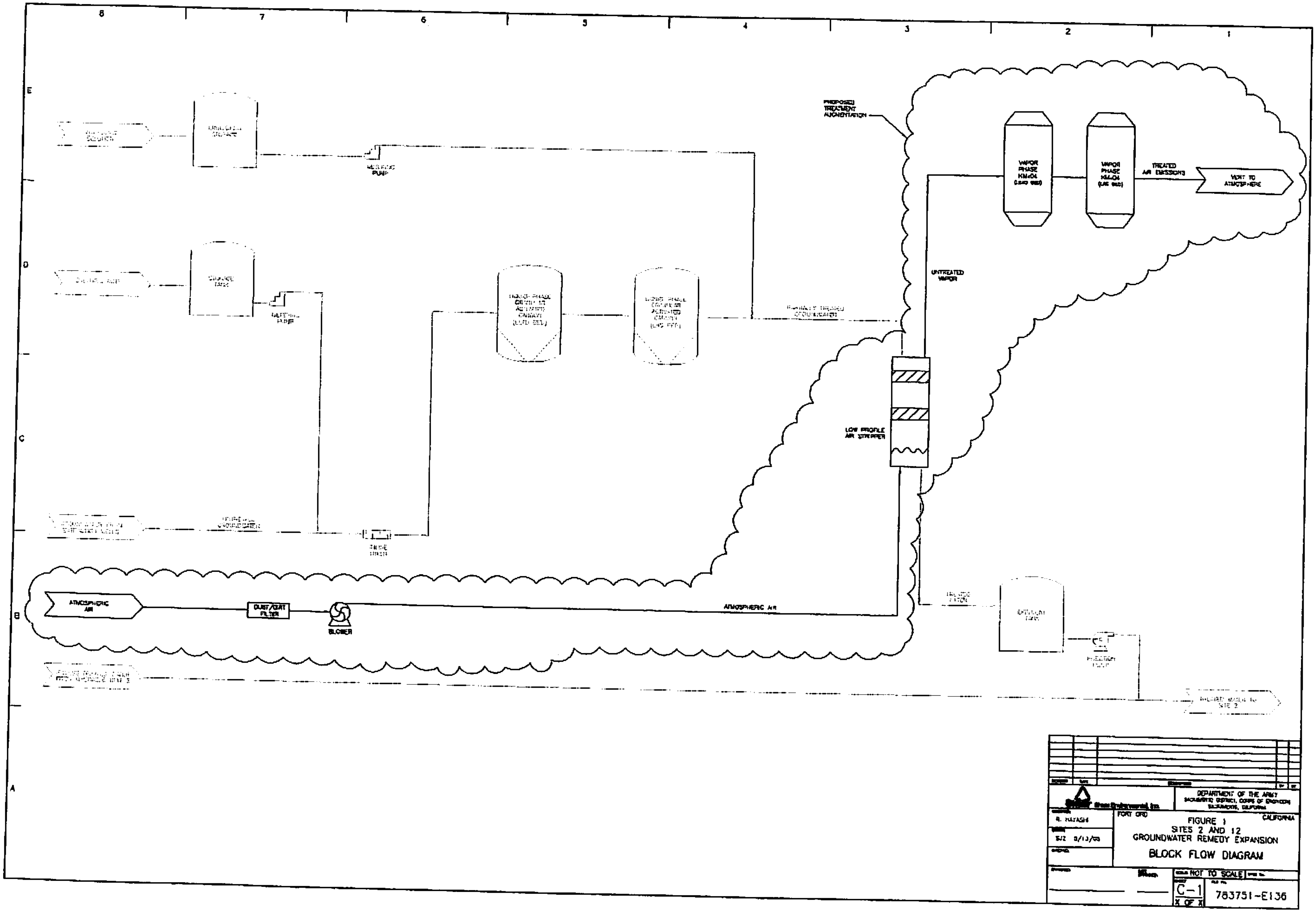
SUMMARY OF REMEDIAL TECHNOLOGY EVALUATION

Technology	Pros	Cons	Estimated Unit Cost (Per Cubic Yard)	Documentation
Dry Separation	Demonstrated effective in pilot study on representative soils Separates majority of lead-containing materials from waste stream Closed-loop system minimizes dust & air quality issues Flexible application: treatment unit(s) could be mobilized to each range location or set up at central staging and processing location Costs are approximately 15—70% lower than offsite disposal; 25% lower than soil washing; similar for onsite disposal at OU2 landfill	Complex treatment system requires multiple screening/processing stages Approximately 20% of volume could not be remediated due to organic content and would need to be stabilized & disposed offsite Air monitoring and permitting required	$106	*Range Remediation Pilot Study, Small Arms Range 18 and 19, Monterey, CA (ITSI, 2004)*
Soil Washing	Demonstrated effective in pilot study on representative soils Permanently removes lead from soils and can achieve low cleanup levels in all fractions using extractants Wet process eliminates dust & air quality issues Flexible application: treatment unit(s) could be mobilized to each range location or set up at central staging and processing location Costs are approximately 20—60% lower than offsite hazardous waste disposal	Complex treatment system requires multiple screening/processing stages Produces multiple waste streams that would require offsite hazardous waste treatment and disposal (bullets and fragments, process fluids, precipitant) Significant process water and utilities demands Air monitoring and permitting required Costs are approximately 25% higher than treatment via dry separation	$145	*Final Report for Soil Washing Field Demonstration, Former Fort Ord, Monterey, California (ECC, 2003)*
Onsite Disposal & Capping at OU2 Landfill	Already used for similar soils from ranges, both w/& w/out screening bullets Would not trigger hazardous waste or air permitting regulations Would not require treatment or offsite transport Available landfill capacity if 12—30 foot elevation increase acceptable at Area E Costs are approximately 15—70% lower than offsite disposal; 25% lower than soil washing; similar for dry separation	Does not reduce toxicity or volume of lead in soil Would require changes to ROD and delay transfer Would maximize capacity of OU2 landfill	$105	*Concept for Placing Additional Range Remediation Waste on OU2 Landfill Area E (Shaw, 2004)*
Offsite Disposal	Permanently removes lead contaminated soils from former Fort Ord Built-in flexibility for several different disposal options depending on lead levels and cleanup criteria Doesn't require onsite treatment; offsite stabilization would be conducted at landfill as necessary	Does not reduce toxicity or volume of lead in soil Highest cost; Class II only applies to lead < 350 mg/kg and STLC < 5 mg/L; Class I w/out stabilization only applies to STLC lead < 5 mg/L Long-term liability associated with materials at landfill is retained	$125—Class II $182—Class I w/o stabilization $356—Class 1 w/stabilization	*Forward & Kettleman Hills Landfill Facility Disposal Cost Estimates, 2005*

Sites 2 and 12 Engineering Design and Analysis Report

1. Issued 5/5, 30-day review requested
2. Objective is to reduce remediation time by increasing throughput of chemicals of concern
   a. key COCs = cis-1,2-DCE and vinyl chloride
   b. with current well configuration and influent concentrations project we can increase treatment rate (mass of COCs) by about 3 times if we augment treatment of these 2 compounds
3. Install low profile air stripper to transfer vinyl chloride and cis-1,2-DCE to vapor stream. Treat vapor stream through potassium permanganate impregnated substrate
4. SCREEN3 model used to determine risk associated with air emissions:
   a. Emissions in model are unabated (i.e. no potassium permanganate in place)
   b. Worst case for vinyl chloride < 1 in 10^{-5} MBUAPCD Rule 1000 limit and slightly above EPA 1 in 10^{-6} PRG
   c. Worst case for cis-1,2-DCE < EPA 1 in 10^{-6} PRG (no MBUAPCD Rule 1000 limit)

5. Pilot testing is not required.
6. Procurement for air stripper in progress.



PROPOSED TREATMENT AUGMENTATION
VAPOR PHASE KMnO4
VAPOR PHASE KMnO4
TREATED AIR EMISSIONS
VENT TO ATMOSPHERE
UNTREATED VAPOR
LOW PROFILE AIR STRIPPER
ATMOSPHERIC AIR
DUST/DIRT FILTER
BLOWER
ATMOSPHERIC AIR
DEPARTMENT OF THE ARMY
FORT ORD
CALIFORNIA
FIGURE 1
SITES 2 AND 12
GROUNDWATER REMEDY EXPANSION
BLOCK FLOW DIAGRAM
NOT TO SCALE
C-1
X OF X
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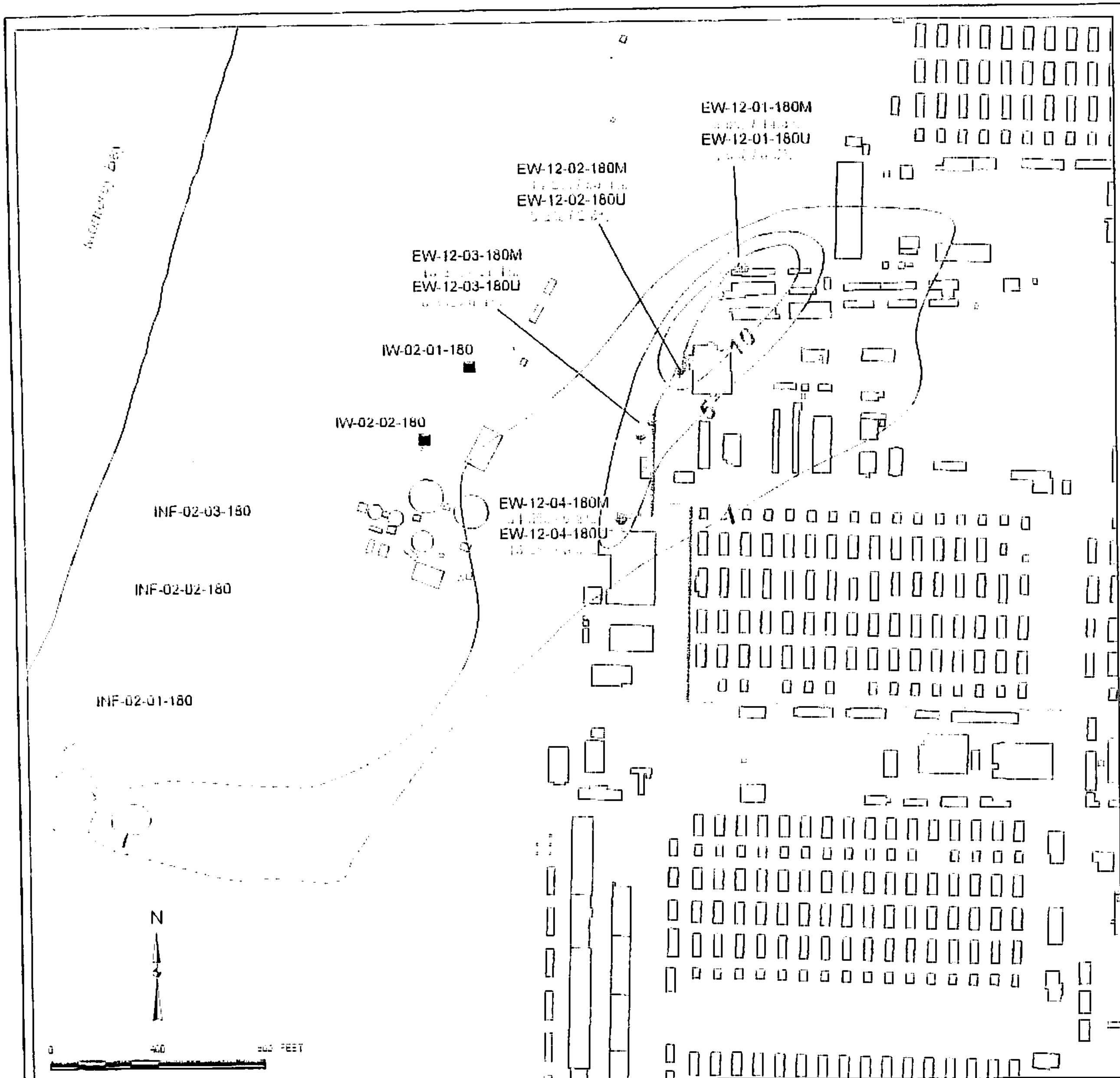


LEGEND

- Extraction Well
- Injection Well
- Infiltration Gallery
- Total Flow Percent
- Mass Removal Percent
- Groundwater Extraction Pipeline
- Groundwater Injection Pipeline
- TCE Concentration Contours (µg/L) Upper 180-foot Aquifer; dashed where inferred (from MACTEC, September 2004)

Extraction Well Flow Rates

Station Name	Average Quarterly Flow Rate Q4 2004 (GPM)	Percent of Total Flow
EW-12-01-180M	10.5	3.5%
EW-12-01-180U	14.9	4.0%
EW-12-02-180M	42.8	14.2%
EW-12-02-180U	24.9	8.2%
EW-12-03-180M	30.7	10.2%
EW-12-03-180U	25.1	8.3%
EW-12-04-180M	104.4	34.5%
EW-12-04-180U	49.0	16.2%
TOTALS:	302.4	100%

Injection and Infiltration Well Flow Rates

Station Name	Average Quarterly Flow Rate Q4 2004 (GPM)	Percent of Total Flow
IW-01	31.9	7.2%
IW-02	81.2	18.3%
INF-01	134.6	30.3%
INF-02	182.8	41.1%
INF-03	13.8	3.1%
TOTALS:	444.3	100%

Contribution per COC in each Extraction Well

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,2-DCA	Other VOCs	TOTALS
EW-12-01-180M	4.2%	59.4%	35.5%	0.5%	0.2%	0.2%	100%
EW-12-01-180U	64.3%	35.7%	0.0%	0.0%	0.0%	0.0%	100%
EW-12-02-180M	5.1%	61.2%	31.6%	0.4%	0.4%	0.4%	100%
EW-12-02-180U	36.7%	44.4%	18.9%	0.0%	0.0%	0.0%	100%
EW-12-03-180M	7.0%	60.1%	31.7%	0.3%	0.3%	0.5%	100%
EW-12-03-180U	26.1%	0.0%	65.4%	0.0%	8.5%	0.0%	100%
EW-12-04-180M	10.1%	56.5%	31.5%	0.0%	1.8%	0.0%	100%
EW-12-04-180U	16.2%	0.0%	75.8%	0.0%	7.9%	0.0%	100%

Mass Removed by Extraction Well

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	1,2-DCA	Total VOCs
EW-12-01-180M	8.2%	14.9%	16.4%	24.8%	4.5%	14.6%
EW-12-01-180U	4.1%	0.3%	0.0%	0.0%	0.0%	0.5%
EW-12-02-180M	40.5%	52.2%	48.5%	56.5%	35.4%	50.4%
EW-12-02-180U	12.5%	2.0%	1.5%	0.0%	0.0%	2.6%
EW-12-03-180M	19.6%	21.7%	21.1%	18.6%	13.0%	21.4%
EW-12-03-180U	1.5%	0.0%	0.9%	0.0%	6.9%	0.4%
EW-12-04-180M	12.2%	8.5%	9.1%	0.0%	31.0%	9.2%
EW-12-04-180U	1.3%	0.0%	1.5%	0.0%	9.2%	0.6%
TOTALS:	100%	100%	100%	100%	100%	100.0%

REVISION | DATE | DESCRIPTION | CHKD | APPR

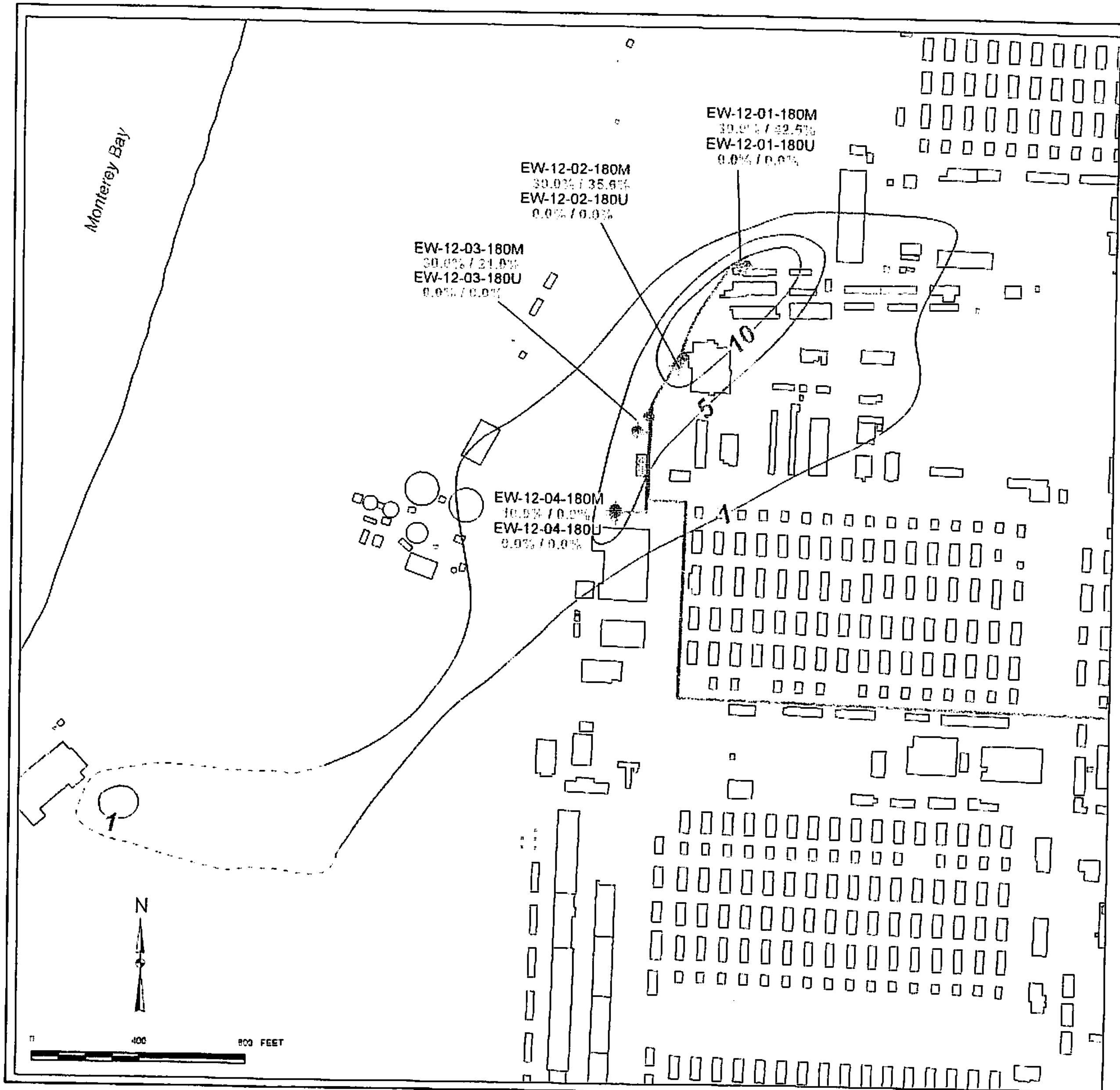
Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL
SUBMITTED:

EVALUATION OF Q4 2004 FLOW AND COCs MASS REMOVAL SITES 2/12 GROUNDWATER TREATMENT

Former Fort Ord, California

SCALE: | SPEC. NO.:
SHEET | FILE NO.: PlumeSite2-12.mxd



LEGEND

- Extraction Well
- 30.0% / 42.5% — Total Flow Percent (Proposed) / Mass Removal Percent (Projected)
- Groundwater Extraction Pipeline
- Groundwater Injection Pipeline
- TCE Concentration Contours (µg/L) Upper 180-foot Aquifer; dashed where inferred (from MACTEC, September 2004)

Proposed Flow Rates

Station Name	Proposed Flow Rate (GPM)	Percent of Total Flow
EW-12-01-180M	75	30.0%
EW-12-01-180U	0	0.0%
EW-12-02-180M	75	30.0%
EW-12-02-180U	0	0.0%
EW-12-03-180M	75	30.0%
EW-12-03-180U	0	0.0%
EW-12-04-180M	25	10.0%
EW-12-04-180U	0	0.0%
TOTALS:	250	100%

Projected Mass Removed by Extraction Well

Station Name	Total VOCs
EW-12-01-180M	42.5%
EW-12-01-180U	0.0%
EW-12-02-180M	35.6%
EW-12-02-180U	0.0%
EW-12-03-180M	21.0%
EW-12-03-180U	0.0%
EW-12-04-180M	0.9%
EW-12-04-180U	0.0%
TOTALS:	100.0%

REVISION	DATE	DESCRIPTION	CHKD	APPR

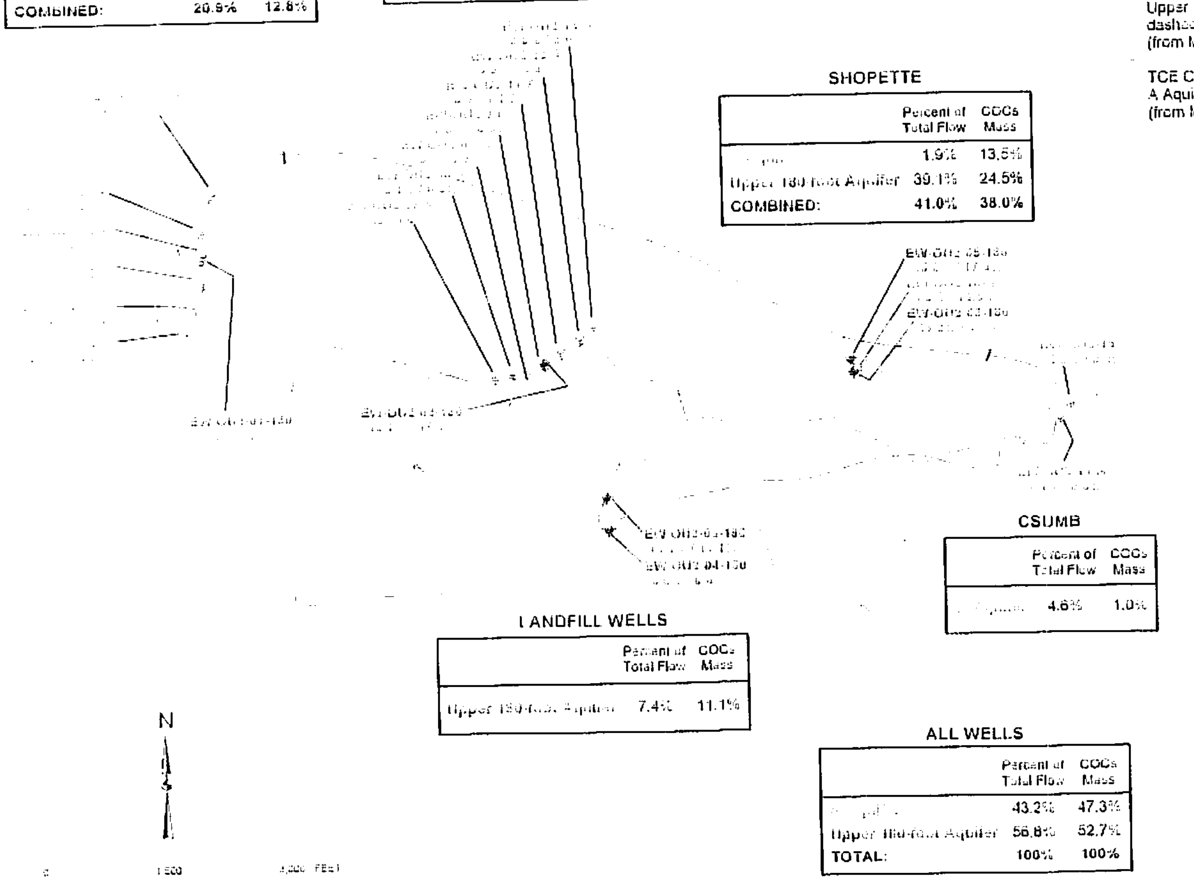
Shaw Shaw Environmental, Inc.

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: P. KELSALL
SUBMITTED

SCENARIO FOR IMPROVING COCs MASS REMOVAL
SITES 2/12 GROUNDWATER TREATMENT
Former Fort Ord, California

DATE | SCALE: | SPEC. No. | SHEET | FILE No. Site2-12_Proposed.mxd



WESTERN WELLS

	Percent of Total Flow	COCs Mass
[illegible]	20.9%	12.8%
Upper 180-foot Aquifer	0.0%	0.0%
COMBINED:	20.9%	12.8%

EASTERN WELLS

	Percent of Total Flow	COCs Mass
[illegible]	15.8%	20.0%
Upper 180-foot Aquifer	10.3%	17.1%
COMBINED:	26.1%	37.1%

SHOPETTE

	Percent of Total Flow	COCs Mass
[illegible]	1.9%	13.5%
Upper 180-foot Aquifer	39.1%	24.5%
COMBINED:	41.0%	38.0%

CSUMB

	Percent of Total Flow	COCs Mass
[illegible]	4.6%	1.0%

LANDFILL WELLS

	Percent of Total Flow	COCs Mass
Upper 180-foot Aquifer	7.4%	11.1%

ALL WELLS

	Percent of Total Flow	COCs Mass
[illegible]	43.2%	47.3%
Upper 180-foot Aquifer	56.8%	52.7%
TOTAL:	100%	100%

LEGEND

- Extraction Well, A Aquifer
- Extraction Well, Upper 180-foot Aquifer
- Total Flow Percent
- Mass Removal Percent
- Groundwater Extraction Pipeline
- Groundwater Injection Pipeline
- TCE Concentration Contours (µg/L) Upper 180-foot Aquifer; dashed where inferred (from MACTEC, September 2004)
- TCE Concentration Contours (µg/L) A Aquifer; dashed where inferred (from MACTEC, September 2004)

Contribution per COC in each Extraction Well, A Aquifer

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	Other VOCs	TOTALS
EW-OU2-01-A	0.0%	100.0%	0.0%	0.0%	0.0%	100%
EW-OU2-02-A	2.6%	97.4%	0.0%	0.0%	0.0%	100%
EW-OU2-03-A	NA	NA	NA	NA	NA	NA
EW-OU2-04-A	4.0%	90.7%	5.3%	0.0%	0.0%	100%
EW-OU2-05-A	3.6%	66.4%	24.5%	0.0%	2.5%	100%
EW-OU2-06-A	3.6%	65.8%	25.5%	0.0%	4.0%	100%
EW-OU2-07-A	8.1%	8.1%	0.0%	0.0%	83.7%	100%
EW-OU2-08-A	22.0%	25.5%	25.5%	2.8%	24.1%	100%
EW-OU2-09-A	12.5%	34.4%	28.7%	0.6%	23.7%	100%
EW-OU2-10-A	13.6%	36.1%	25.0%	2.3%	23.0%	100%
EW-OU2-11-A	14.7%	40.2%	28.2%	1.5%	15.4%	100%
EW-OU2-12-A	7.3%	69.2%	12.8%	0.6%	10.2%	100%
EW-OU2-13-A	7.0%	74.3%	11.5%	0.0%	7.2%	100%
EW-OU2-14-A	3.1%	75.7%	0.0%	0.0%	21.3%	100%
EW-OU2-15-A	0.0%	92.2%	0.0%	0.0%	7.8%	100%
EW-OU2-16-A	16.4%	22.7%	7.5%	1.3%	52.1%	100%

Contribution per COC in each Extraction Well, Upper 180-foot Aquifer

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	Other VOCs	TOTALS
EW-OU2-01-180	3.2%	96.8%	0.0%	0.0%	0.0%	100%
EW-OU2-02-180	4.6%	64.8%	25.2%	0.0%	5.5%	100%
EW-OU2-03-180	3.0%	84.5%	10.1%	0.0%	2.4%	100%
EW-OU2-04-180	5.4%	70.5%	8.6%	0.0%	15.5%	100%
EW-OU2-05-180	4.6%	78.5%	11.4%	0.0%	5.4%	100%
EW-OU2-06-180	21.6%	52.2%	17.5%	0.0%	8.7%	100%

Mass Removed by Extraction Well, A Aquifer

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	Total VOCs
EW-OU2-01-A	0.0%	0.1%	0.0%	0.0%	0.0%
EW-OU2-02-A	0.2%	1.2%	0.0%	0.0%	0.3%
EW-OU2-03-A	0.0%	0.0%	0.0%	0.0%	0.0%
EW-OU2-04-A	2.1%	9.8%	1.7%	0.0%	2.5%
EW-OU2-05-A	3.9%	15.6%	16.5%	0.0%	5.3%
EW-OU2-06-A	3.5%	13.6%	15.5%	0.0%	4.7%
EW-OU2-07-A	0.3%	0.0%	0.0%	0.0%	0.0%
EW-OU2-08-A	1.1%	0.3%	0.9%	1.7%	0.2%
EW-OU2-09-A	8.7%	5.5%	[illegible]	6.[illegible]%	3.8%
EW-OU2-10-A	18.[illegible]%	10.5%	21.8%	39.9%	[illegible]
EW-OU2-11-A	3.6%	2.1%	4.4%	4.5%	1.2%
EW-OU2-12-A	4.4%	8.7%	4.6%	4.1%	2.9%
EW-OU2-13-A	7.2%	16.0%	7.5%	0.0%	5.0%
EW-OU2-14-A	0.5%	2.7%	0.0%	0.0%	0.6%
EW-OU2-15-A	0.0%	0.6%	0.0%	0.0%	0.2%
EW-OU2-16-A	45.0%	13.1%	12.1%	43.4%	13.5%
TOTALS:	100%	100%	100%	100%	100%

Mass removed by Extraction Well, Upper 180-foot Aquifer

Station Name	PCE	TCE	cis-1,2-DCE	Vinyl Chloride	Total VOCs
EW-OU2-01-180	0.0%	0.0%	0.0%	0.0%	0.0%
EW-OU2-02-180	23.3%	29.1%	48.5%	0.0%	17.1%
EW-OU2-03-180	9.6%	24.7%	13.1%	0.0%	11.1%
EW-OU2-04-180	0.0%	0.0%	0.0%	0.0%	0.0%
EW-OU2-05-180	24.6%	37.0%	23.7%	0.0%	17.9%
EW-OU2-06-180	42.5%	9.1%	13.4%	0.0%	5.6%
TOTALS:	100%	100%	100%	100%	100%

Extraction Well Flow Rates, A Aquifer

Station Name	Average Quarterly Flow Rate Q4 2004 (GPM)	Percent of Total Flow
EW-OU2-01-A	0.8	0.3%
EW-OU2-02-A	6.4	2.5%
EW-OU2-03-A	0.0	0.0%
EW-OU2-04-A	50.2	19.4%
EW-OU2-05-A	40.5	15.7%
EW-OU2-06-A	27.2	10.5%
EW-OU2-07-A	1.8	0.7%
EW-OU2-08-A	5.4	2.1%
EW-OU2-09-A	20.5	7.9%
EW-OU2-10-A	19.4	7.5%
EW-OU2-11-A	15.4	5.9%
EW-OU2-12-A	10.1	3.9%
EW-OU2-13-A	22.1	8.5%
EW-OU2-14-A	18.4	7.1%
EW-OU2-15-A	9.0	3.5%
EW-OU2-16-A	11.6	4.5%
TOTALS:	258.7	100%

Extraction Well Flow Rates Upper 180-foot Aquifer

Station Name	Average Quarterly Flow Rate Q4 2004 (GPM)	Percent of Total Flow
EW-OU2-01-180	[illegible]	0.0%
EW-OU2-02-180	61.6	18.1%
EW-OU2-03-180	44.6	13.1%
EW-OU2-04-180	0.0	0.0%
EW-OU2-05-180	121.0	[illegible]
EW-OU2-06-180	113.0	33.2%
TOTALS:	340.1	100%

REVISION	DATE	DESCRIPTION	CHKD	APPR

Shaw Shaw Environmental, Inc.

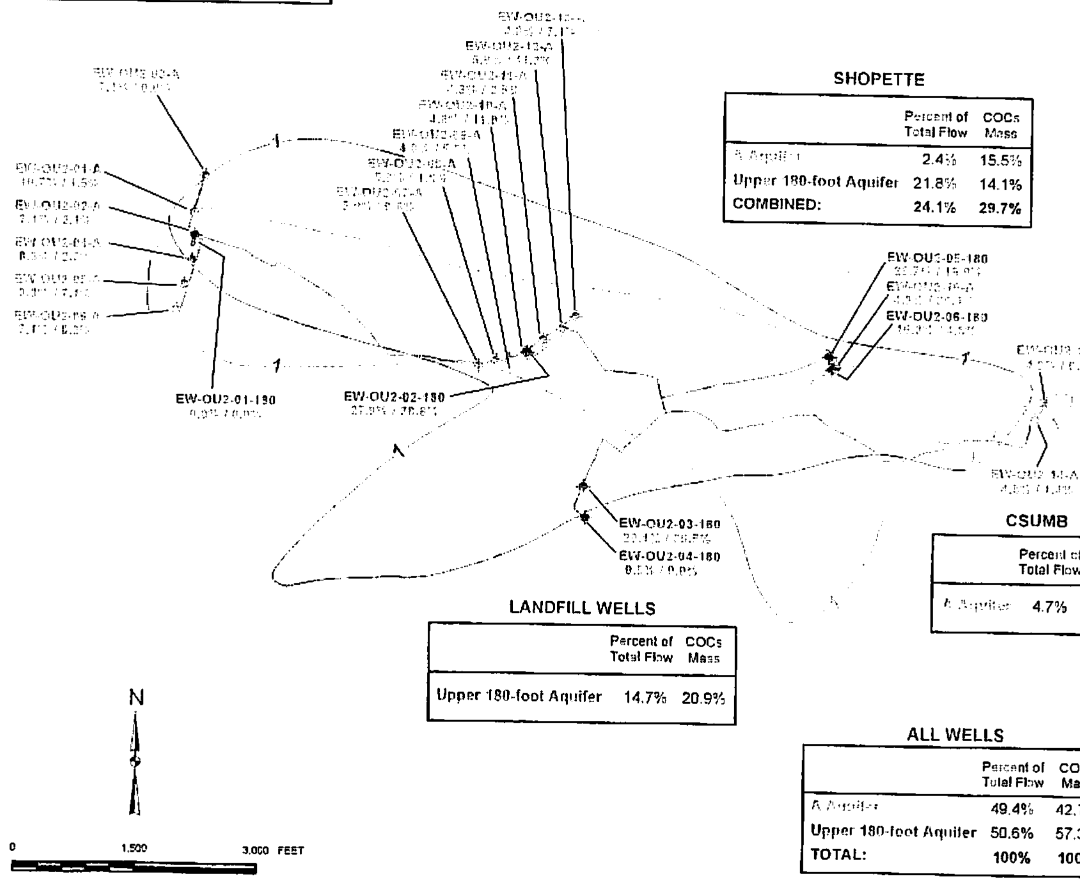
Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

DESIGNED: E. SCHMIDT
DRAWN: K. BLACK
CHECKED: F. ALLBAUGH
SUBMITTED: DATE:

EVALUATION OF Q4 2004 FLOW AND COCs MASS REMOVAL OU2 GROUNDWATER TREATMENT

Former Fort Ord, California

SCALE: | SHEET | FILE No. FlowsOU2.mxd



WESTERN WELLS

	Percent of Total Flow	COCs Mass
A Aquifer	24.1%	9.2%
Upper 180-foot Aquifer	0.0%	0.0%
COMBINED:	24.1%	9.2%

EASTERN WELLS

	Percent of Total Flow	COCs Mass
A Aquifer	18.2%	17.1%
Upper 180-foot Aquifer	14.1%	22.2%
COMBINED:	32.4%	39.3%

SHOPETTE

	Percent of Total Flow	COCs Mass
A Aquifer	2.4%	15.5%
Upper 180-foot Aquifer	21.8%	14.1%
COMBINED:	24.1%	29.7%

LANDFILL WELLS

	Percent of Total Flow	COCs Mass
Upper 180-foot Aquifer	14.7%	20.9%

CSUMB

	Percent of Total Flow	COCs Mass
A Aquifer	4.7%	0.9%

ALL WELLS

	Percent of Total Flow	COCs Mass
A Aquifer	49.4%	42.7%
Upper 180-foot Aquifer	50.6%	57.3%
TOTAL:	100%	100%

LEGEND

- Extraction Well, A Aquifer
- Extraction Well, Upper 180-foot Aquifer
- Total Flow Percent
- Mass Removal Percent
- Groundwater Extraction Pipeline
- Groundwater Injection Pipeline
- TCE Concentration Contours (µg/L) Upper 180-foot Aquifer; dashed where inferred (from MACTEC, September 2004)
- TCE Concentration Contours (µg/L) A Aquifer; dashed where inferred (from MACTEC, September 2004)

Proposed Flow Rates
A Aquifer

Station Name	Proposed Flow Rate (GPM)	Percent of Total Flow
EW-OU2-01-A	45.0	10.7%
EW-OU2-02-A	30.0	7.1%
EW-OU2-03-A	30.0	7.1%
EW-OU2-04-A	35.0	8.3%
EW-OU2-05-A	35.0	8.3%
EW-OU2-06-A	30.0	7.1%
EW-OU2-07-A	25.0	5.9%
EW-OU2-08-A	25.0	5.9%
EW-OU2-09-A	20.0	4.8%
EW-OU2-10-A	20.0	4.8%
EW-OU2-11-A	20.0	4.8%
EW-OU2-12-A	25.0	5.9%
EW-OU2-13-A	20.0	4.8%
EW-OU2-14-A	20.0	4.8%
EW-OU2-15-A	20.0	4.8%
EW-OU2-16-A	20.0	4.8%
TOTALS:	420.0	100%

Proposed Flow Rates
Upper 180-foot Aquifer

Station Name	Proposed Flow Rate (GPM)	Percent of Total Flow
EW-OU2-01-180	0.0	0.0%
EW-OU2-02-180	120.0	27.9%
EW-OU2-03-180	125.0	29.1%
EW-OU2-04-180	0.0	0.0%
EW-OU2-05-180	115.0	26.7%
EW-OU2-06-180	70.0	15.3%
TOTALS:	430.0	100%

Projected Mass Removed by Extraction Well
Upper 180-foot Aquifer

Station Name	Total VOCs
EW-OU2-01-180	0.0%
EW-OU2-02-180	36.8%
EW-OU2-03-180	36.5%
EW-OU2-04-180	0.0%
EW-OU2-05-180	19.9%
EW-OU2-05-180	4.8%
TOTALS:	100%

Projected Mass Removed by Extraction Well
A Aquifer

Station Name	Total VOCs
EW-OU2-01-A	1.5%
EW-OU2-02-A	2.1%
EW-OU2-03-A	0.0%
EW-OU2-04-A	2.7%
EW-OU2-05-A	7.1%
EW-OU2-06-A	9.2%
EW-OU2-07-A	0.6%
EW-OU2-08-A	1.6%
EW-OU2-09-A	5.8%
EW-OU2-10-A	11.0%
EW-OU2-11-A	2.5%
EW-OU2-12-A	11.3%
EW-OU2-13-A	7.1%
EW-OU2-14-A	1.4%
EW-OU2-15-A	0.7%
EW-OU2-16-A	35.4%
TOTALS:	100%

REVISION	DATE	DESCRIPTION	CHKD	APPD

Shaw Environmental, Inc.

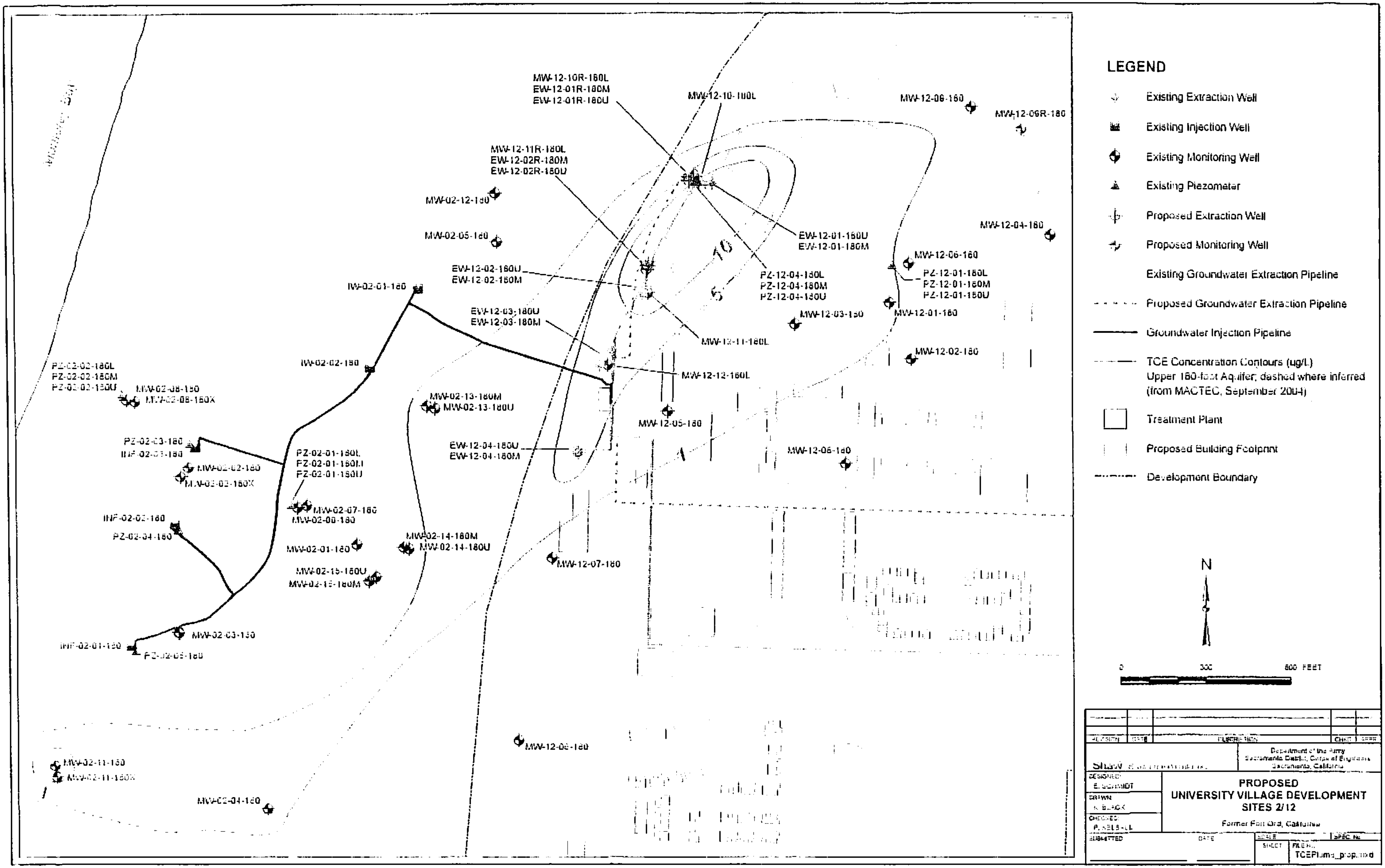
Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

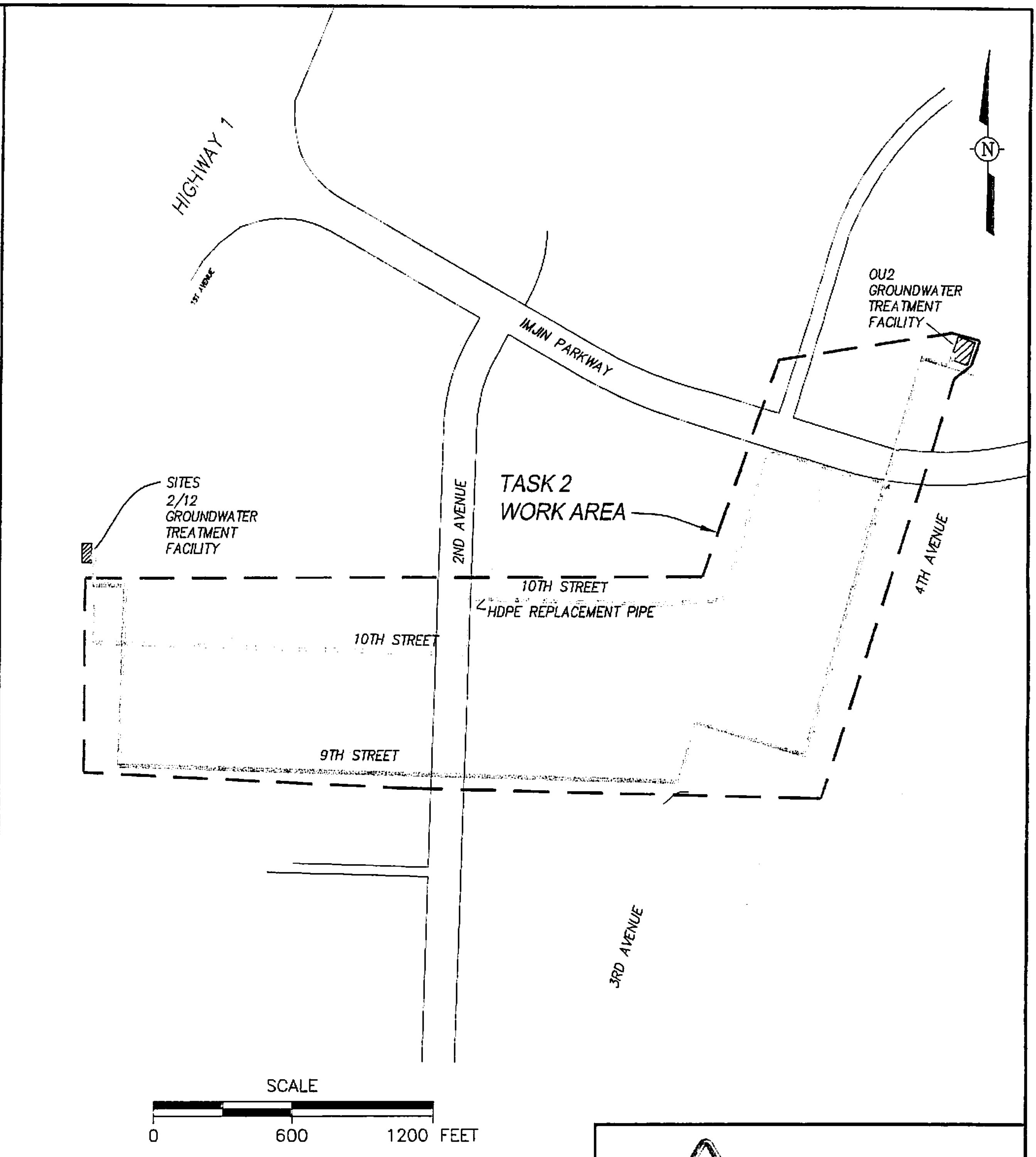
DESIGNED E. SCHMIDT
DRAWN K. BLACK
CHECKED P. KELSALL
SUBMITTED

SCENARIO FOR IMPROVING COCs MASS REMOVAL OU2 GROUNDWATER TREATMENT

Former Fort Ord, California

DATE | SCALE | SPEC. No. | SHEET | FILE No. OU2_Proposed.mxd


LEGEND
Existing Extraction Well
Existing Injection Well
Existing Monitoring Well
Existing Piezometer
Proposed Extraction Well
Proposed Monitoring Well
Existing Groundwater Extraction Pipeline
Proposed Groundwater Extraction Pipeline
Groundwater Injection Pipeline
TCE Concentration Contours (ug/L)
Upper 180-foot Aquifer; dashed where inferred
(from MACTEC, September 2004)
Treatment Plant
Proposed Building Footprint
Development Boundary
N
0
300
600 FEET
MW-12-10R-180L
EW-12-01R-180M
EW-12-01R-180U
MW-12-10-180L
MW-12-08-180
MW-12-09R-180
MW-12-11R-180L
EW-12-02R-180M
EW-12-02R-180U
MW-02-12-180
MW-02-05-180
EW-12-01-180U
EW-12-01-180M
MW-12-04-180
MW-12-06-180
EW-12-02-180U
EW-12-02-180M
IW-02-01-180
PZ-12-04-180L
PZ-12-04-180M
PZ-12-04-180U
PZ-12-01-180L
PZ-12-01-180M
PZ-12-01-180U
EW-12-03-180U
EW-12-03-180M
MW-12-03-180
MW-12-01-180
MW-12-11-180L
MW-12-02-180
IW-02-02-180
MW-12-12-180L
PZ-02-02-180L
PZ-02-02-180M
PZ-02-02-180U
MW-02-08-180
MW-02-13-180M
MW-02-13-180U
MW-12-05-180
PZ-02-03-180
PZ-02-01-180L
PZ-02-01-180M
PZ-02-01-180U
EW-12-04-180U
EW-12-04-180M
MW-12-06-180
MW-02-07-180
MW-02-08-180
INF-02-02-180
PZ-02-04-180
MW-02-14-180M
MW-02-14-180U
MW-02-01-180
MW-12-07-180
MW-02-15-180U
MW-02-15-180M
MW-02-03-180
INF-02-01-180
PZ-02-05-180
MW-12-08-180
MW-02-11-180
MW-02-04-180
10
5
Shaw
Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California
DESIGNED
E. SCHMIDT
DRAWN
N. BLACK
CHECKED
SUBMITTED
PROPOSED
UNIVERSITY VILLAGE DEVELOPMENT
SITES 2/12
Former Fort Ord, California
TCEPlume_prop.mxd



LEGEND

EXISTING RECHARGE PIPELINE

NEW RECHARGE PIPELINE

Shaw Shaw Environmental, Inc.

UNIVERSITY VILLAGES
MARINA COMMUNITY PARTNERS
PUMP & TREAT MODIFICATIONS

FIGURE 3-2

TASK 2
REALIGN 9th STREET PIPELINE

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	Concord	SJZ	3/15/05			112266-A4

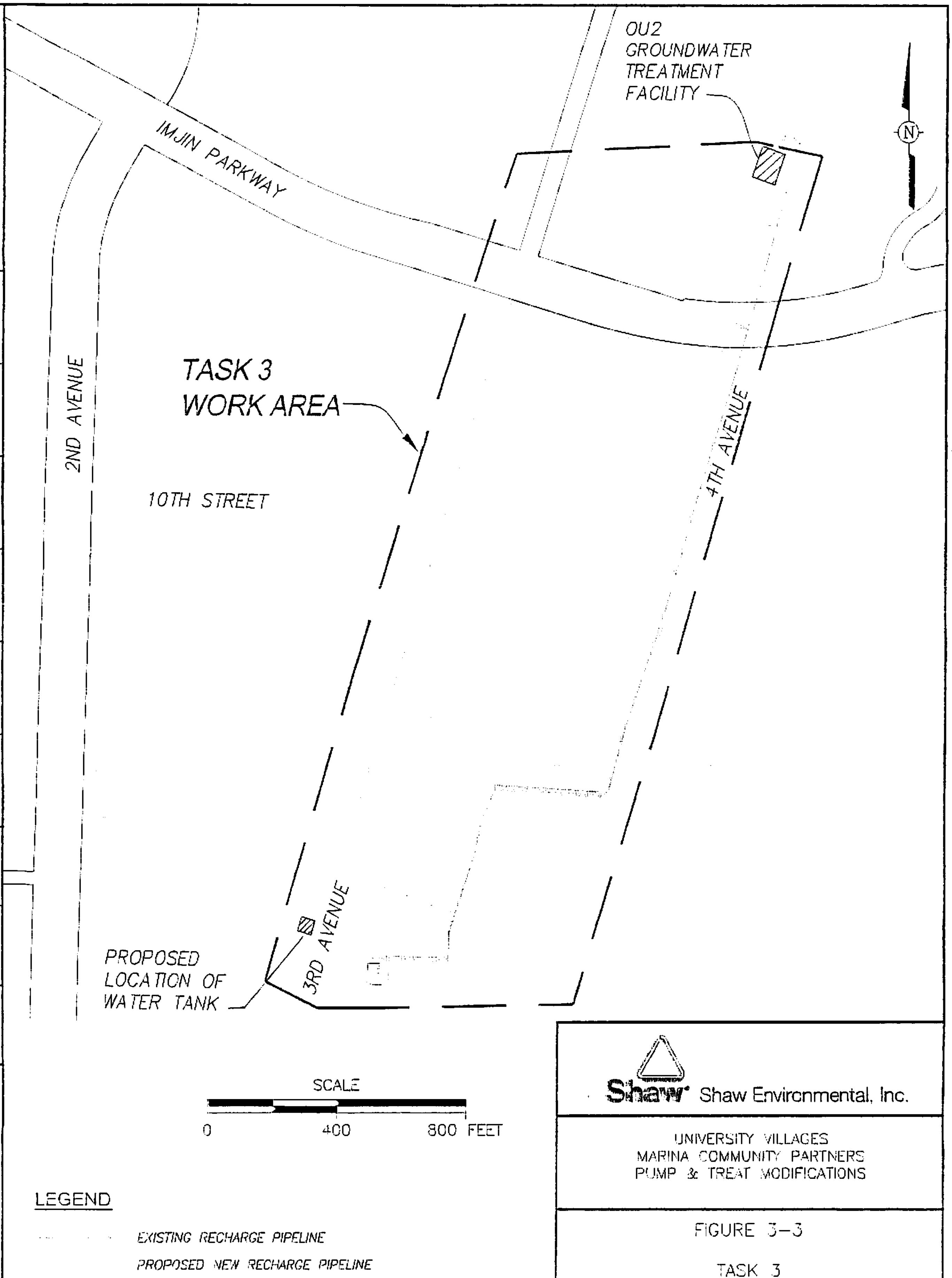


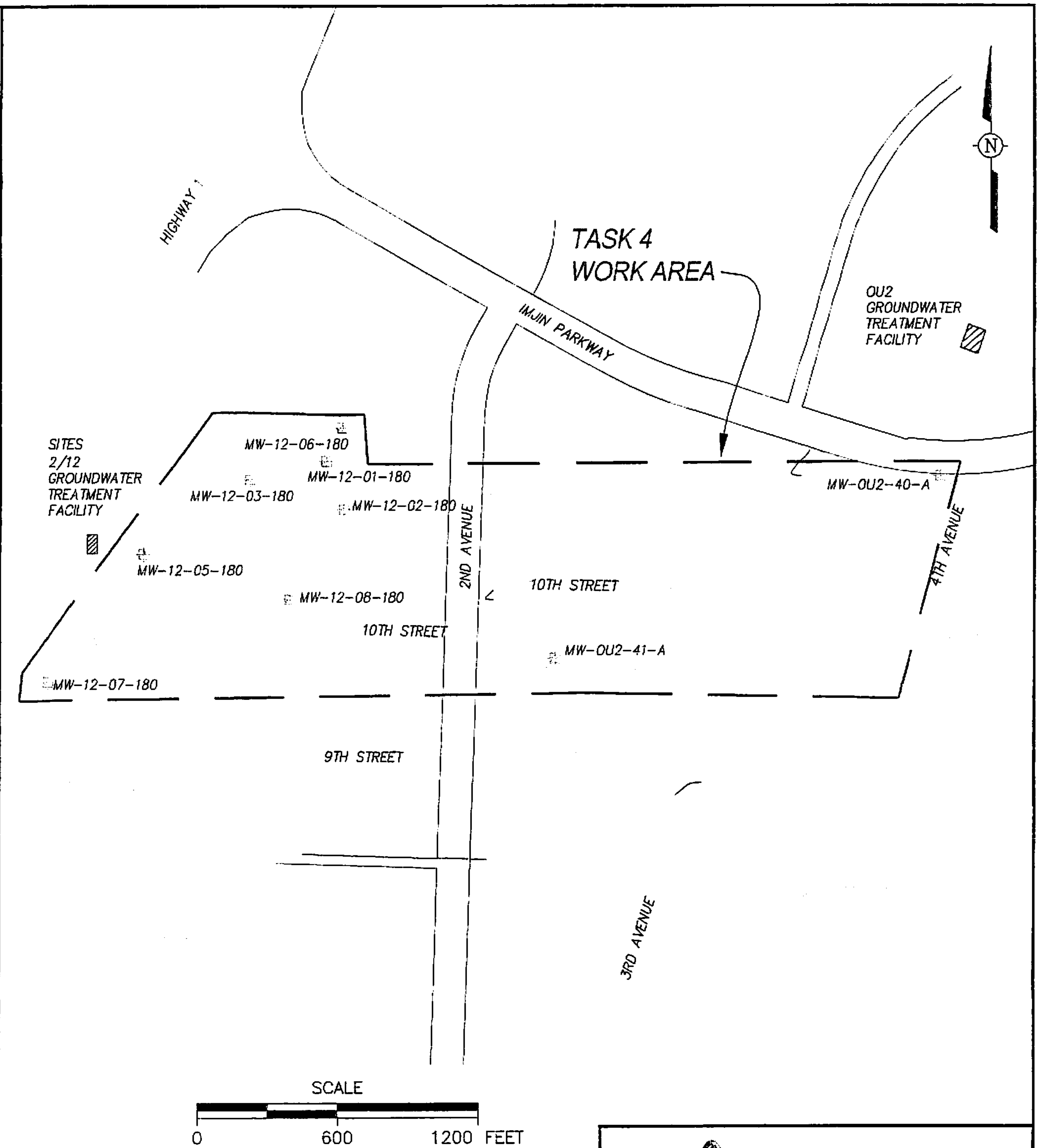
IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	Concord	S.Z	3/16/05			112266-A5

Shaw Environmental, Inc.

UNIVERSITY VILLAGES
MARINA COMMUNITY PARTNERS
PUMP & TREAT MODIFICATIONS

FIGURE 3-3

TASK 3
REALIGN 3rd AVENUE PIPELINE



LEGEND

EXISTING MONITORING WELL TO BE MODIFIED

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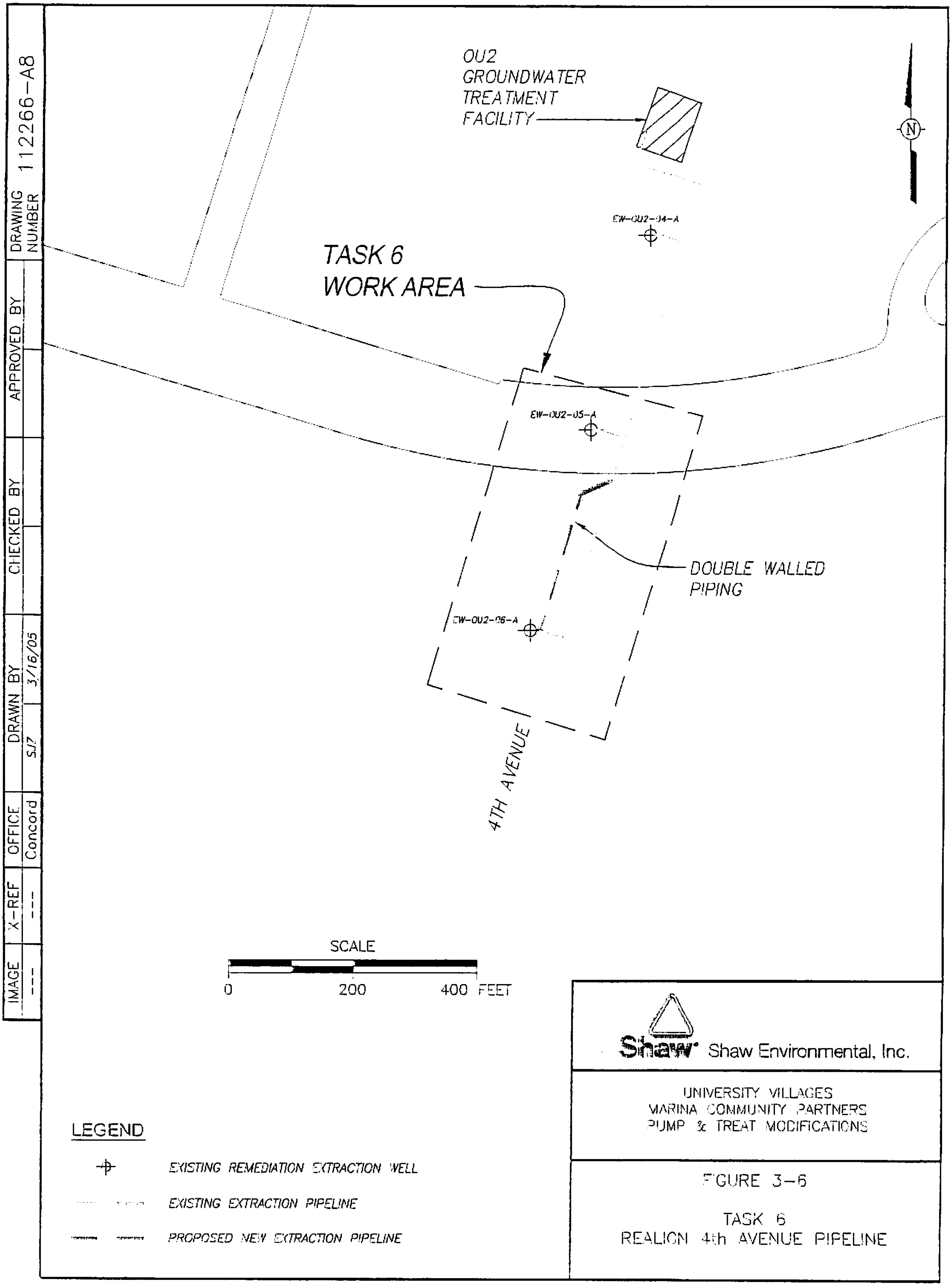
UNIVERSITY VILLAGES
MARINA COMMUNITY PARTNERS
PUMP & TREAT MODIFICATIONS

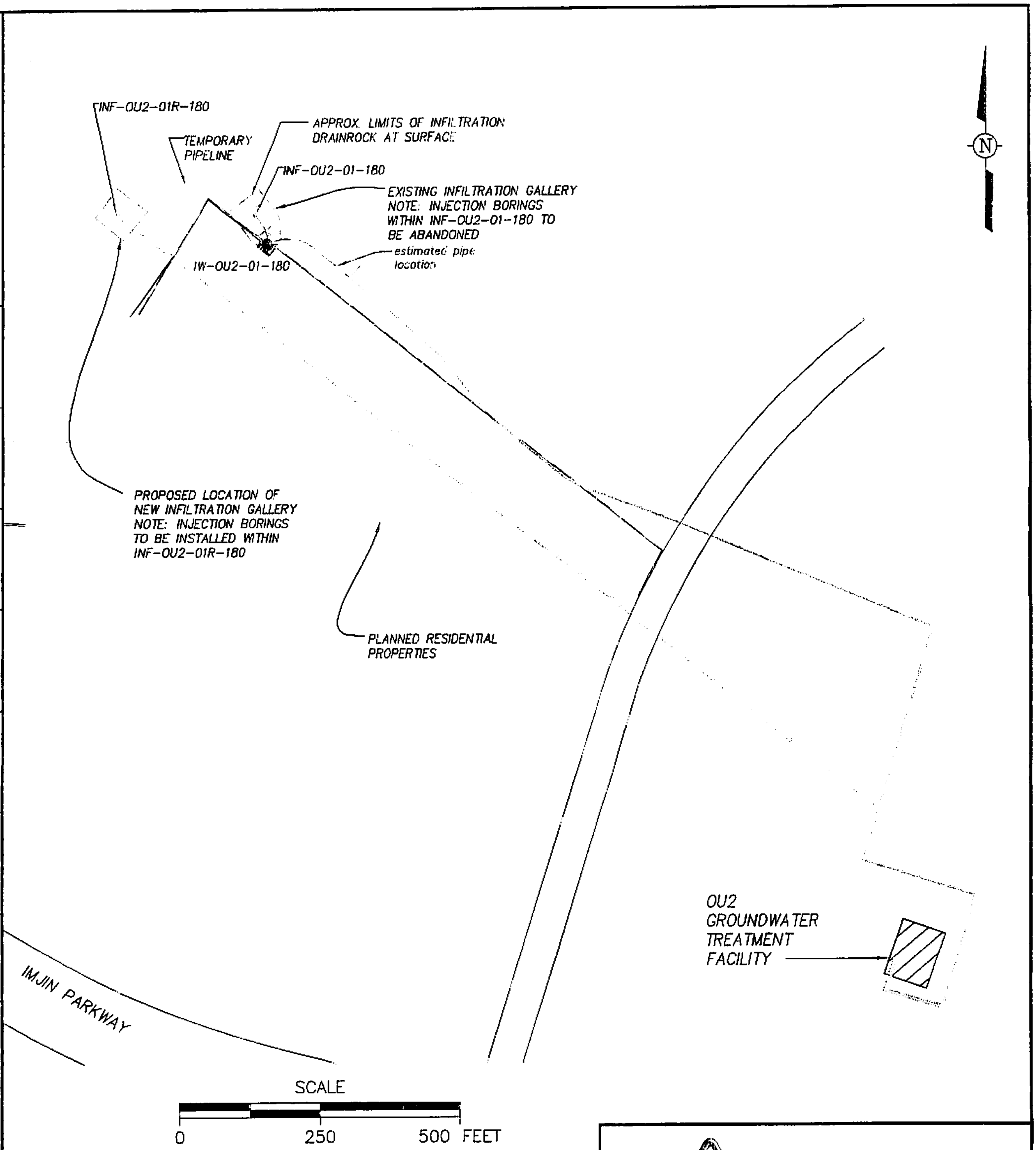
FIGURE 3-4

TASK 4
ADJUSTED WELL HEAD COMPLETIONS

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE	X-REF	IMAGE
112266-A6			SJZ 3/17/05	Concord	---	---



OU2
GROUNDWATER
TREATMENT
FACILITY
EW-OU2-04-A
TASK 6
WORK AREA
EW-OU2-05-A
DOUBLE WALLED
PIPING
EW-OU2-06-A
4TH AVENUE
N
SCALE
0
200
400 FEET
LEGEND
EXISTING REMEDIATION EXTRACTION WELL
EXISTING EXTRACTION PIPELINE
PROPOSED NEW EXTRACTION PIPELINE
Shaw Environmental, Inc.
UNIVERSITY VILLAGES
MARINA COMMUNITY PARTNERS
PUMP & TREAT MODIFICATIONS
FIGURE 3-6
TASK 6
REALIGN 4th AVENUE PIPELINE
IMAGE ---
X-REF ---
OFFICE Concord
DRAWN BY SJ7 3/16/05
CHECKED BY
APPROVED BY
DRAWING NUMBER 112266-A8



DRAWING NUMBER 112266-A9
APPROVED BY
CHECKED BY
DRAWN BY SJZ 3/17/05
OFFICE Concord
X-REF
IMAGE

LEGEND

EXISTING RECHARGE PIPELINE
PROPOSED NEW RECHARGE PIPELINE
RETAINING WALL

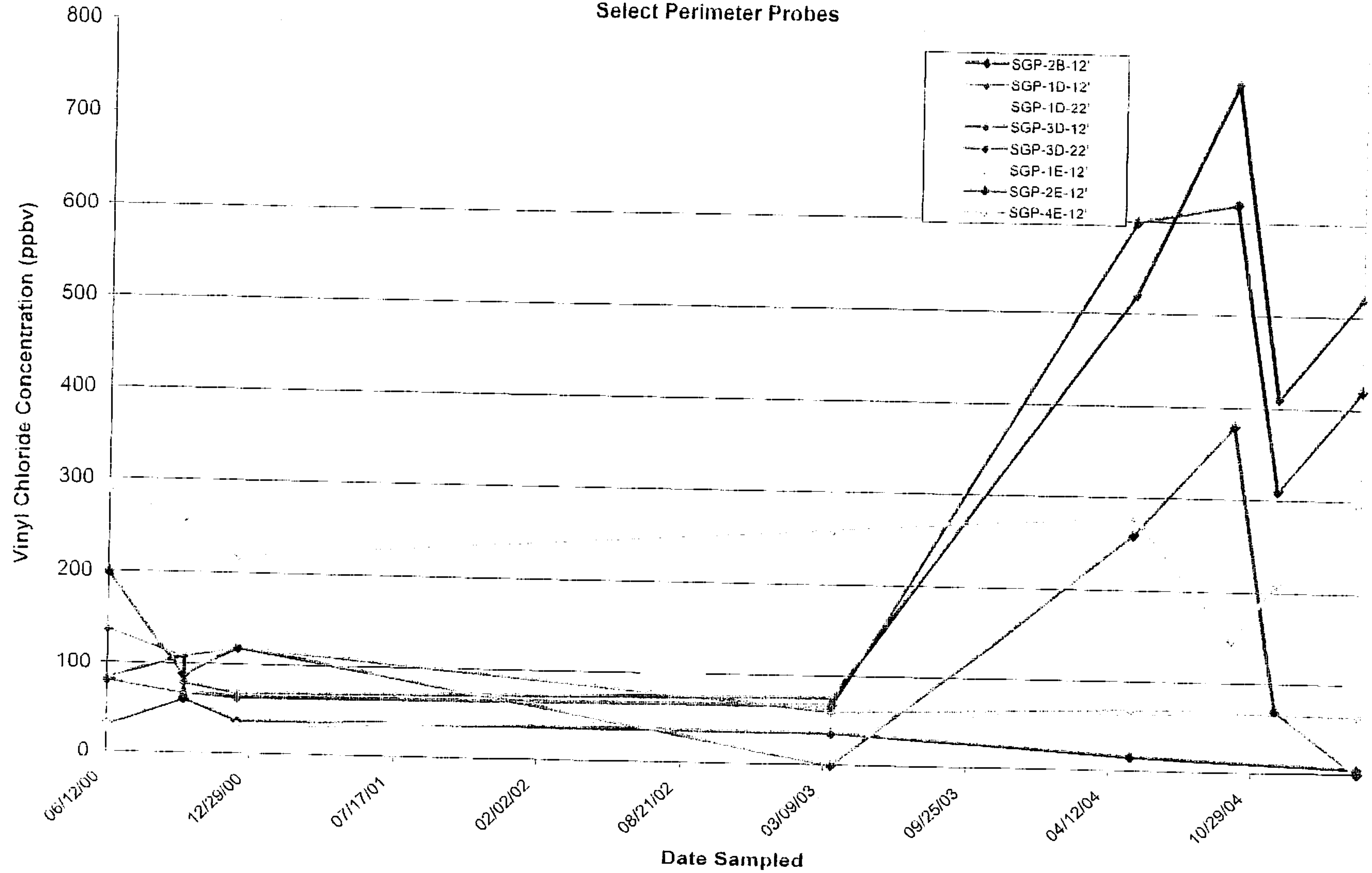
Shaw Environmental, Inc.

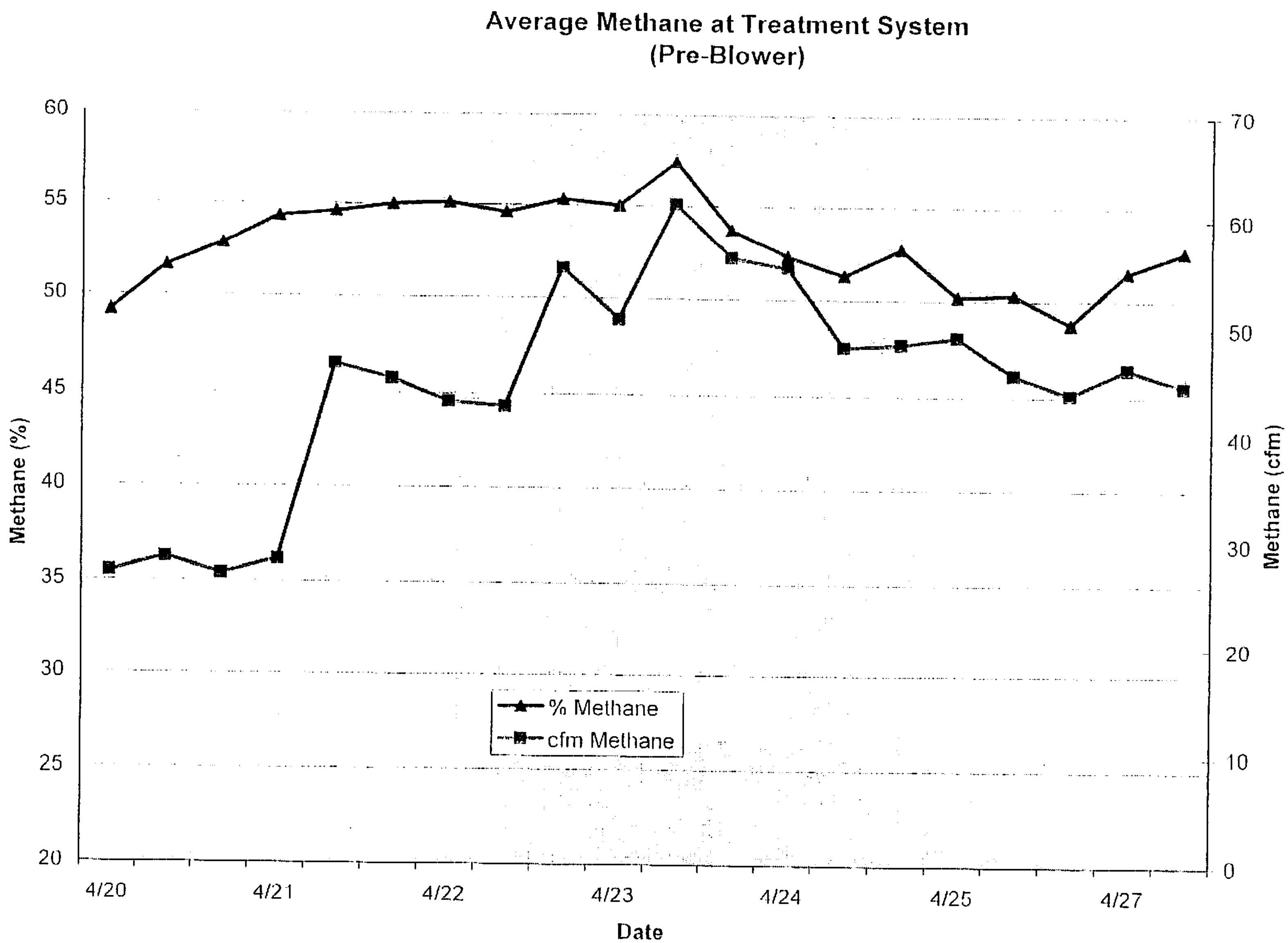
UNIVERSITY VILLAGES
MARINA COMMUNITY PARTNERS
PUMP & TREAT MODIFICATIONS

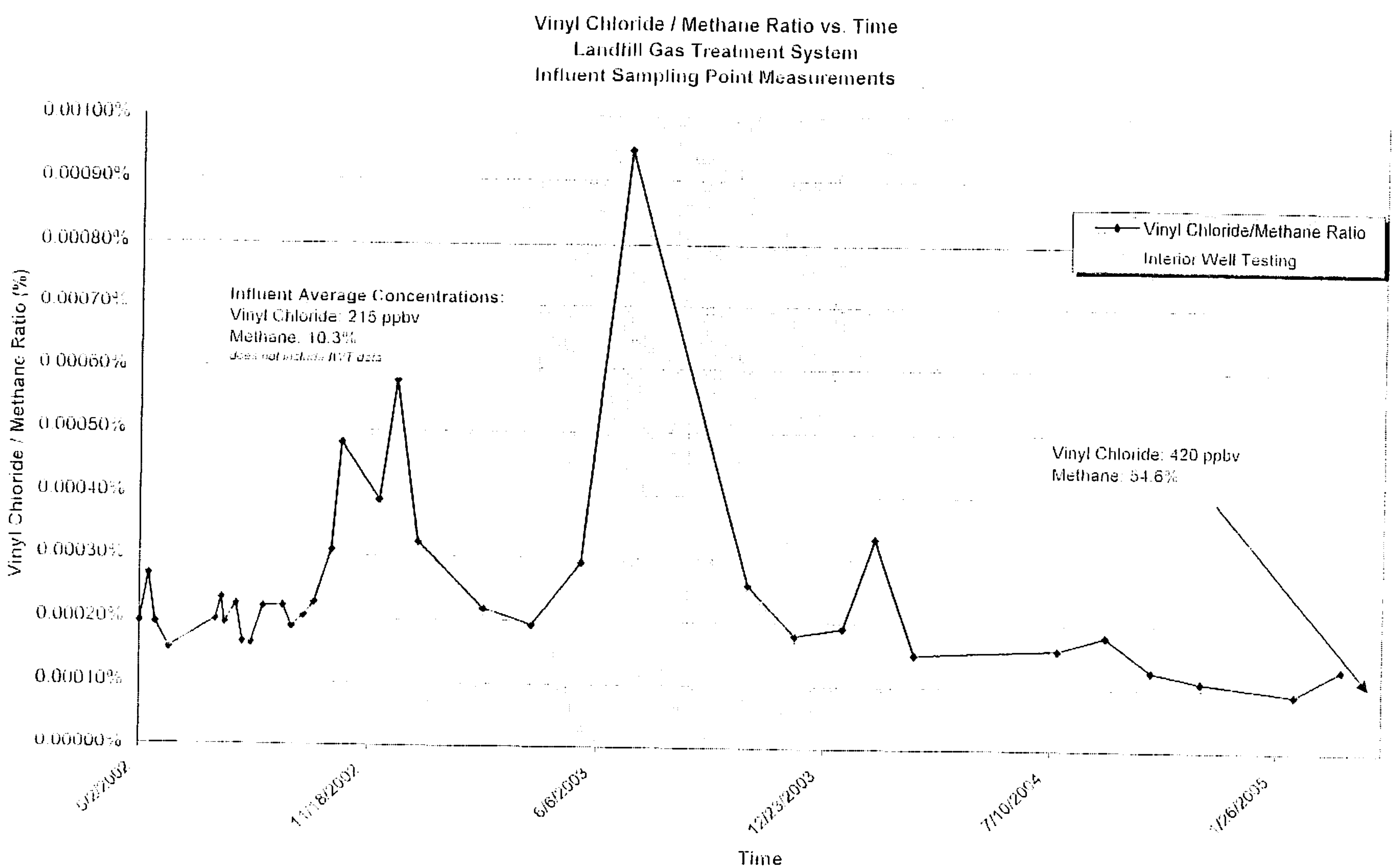
FIGURE 3-7

TASK 7
RELOCATE NORTH WEST
INFILTRATION GALLERY

Figure 6-1
Vinyl Chloride Concentration vs. Date
Select Perimeter Probes




Average Methane at Treatment System
(Pre-Blower)
Methane (%)
Methane (cfm)
Date
4/20
4/21
4/22
4/23
4/24
4/25
4/27
% Methane
cfm Methane



The spike that occurred on 7/4/03 is due to the low concentration of methane measured on that date (1.9%). Vinyl Chloride concentrations were consistent before and after this time (~150 ppbv). The low methane concentration was due to the higher levels of condensate water that were in the system at that time. It has been demonstrated that larger volumes of water in the treatment system will tend to reduce the measured methane concentrations at the influent point.

Remedial Alternative	Pros	Cons	Total Cost ($millions)
Monitored Natural Attenuation	•Already occurring •Source is attenuated/remediated •Eliminating vertical conduits and monitoring points of compliance will allow tracking of plumes and trigger contingency if needed •Lowest cost	•Requires long period to achieve ACLs •Does not address portions of plumes migrating offsite and towards drinking supply wells	**$2.75** (30+ years)
Pump & Treat	•Applicable and effective in remediating majority of plume within 30 years •Proven technology at former Ft Ord	•Requires long period to achieve ACLs •Would not capture downgradient (offsite) portion of plume •Significant costs associated with O&M	**$13.45— $19.47** (30 years)
Enhanced Biodegradation	•Applicable and effective in remediating entire plume within 15 years •Demonstrated effective technology in pilot study at site	•Follow-up sampling and analysis needed to verify effectiveness, type of reagent, longevity •Effects of reductive environment in subsurface would need to be addressed	**$9.54** (20 years)
Permeable Reactive Barrier	•Potentially applicable and effective as a containment option to control offsite/downgradient migration within 50 year period	•Pilot study needed to assess longevity (typically 20 years), effectiveness, installation techniques and barrier alignment •Would not prevent plume migration or be effective outside the limits of the barrier •Significant costs associated with installation	**$13.15** (50 years)

Property Transfer Update – May 17, 2005 HTW BCT Meeting

Finding of Suitability to Transfer (FOST)

Title/Description	Parcels	Notes
FOST 8 Track 0 and Track 0 Plug-in Group B Parcels 28 Parcels ~ 231 acres (V0/December 2004) (V1/March 2005) **GOAL: TRANSFER ALL PARCELS BY AUGUST 2005.**	E11a.1, E18.2.1, E18.2.2, E18.3, E20c.1.2, E20c.2.2, E29b.3, E29e, E2d.3.1, E5a.2, L20.13.1, L20.13.2, L20.13.4, L20.7.1, L20.7.2, L20.7.3, L20.7.4, L20.7.5, L3.1, L35.5, L5.10.2, S3.2.1, S3.2.2, S4.2.1, S4.2.2, S4.2.3, S4.2.4, S4.3	**30-day public comment period ended 4/24/05 – no comment from public, but late comments from EPA on 4/26/05.** • Includes parcels with no evidence of military munitions use. Track 0 ROD complete. • Approval Memorandum for Track 0 Plug-in Group B parcels 30-day public review period ended 4/23/05 – no comment from public, but late comments from EPA on 4/26/05. • FOST will be issued for Army signature after agency concurrence on Approval Memorandum. Request for concurrence sent on 5/2/05. • Four associated CRUPs for Special Groundwater Protection Zone. Draft CRUP submitted to agencies for review 3/3/05, comments requested by 4/6/05, comments received from DTSC on 4/29/05, CRUP resubmitted to DTSC and HFO/ELD, final pending. **Issues:** parcel L20.13.3 and MRS-43

Title/Description	Parcels	Notes
FOST 9 Track 0 Plug-in Group C and Track 1 Parcels 29 Parcels ~1,894 acres (V0/December 2004) (V1/April 2005) (V2/May 2005) **GOAL: TRANSFER ALL PARCELS BY SEPTEMBER 2005.**	E11a, E11b.6.2, E15.2, E20c.2.1, E2a, E4.1.2.1, E4.1.2.2, E4.1.2.3, E4.3.1.2, E4.3.2.1, E4.6.1, E4.6.2, E8a.1.1.2, L20.13.5, L20.14.1.1, L20.14.2, L20.15, L20.6, L23.5.1, L31, L5.6.1, L5.6.2, L9.1.1.2, L9.1.2.2, S3.1.1, S3.1.2, S3.1.3, S3.1.4, S4.1.1	**FOST revised based on EPA comments, submitted to HFO/ELD 5/6/05 and DTSC 5/12/05 for review. Comments received from HFO/ELD 5/16/05 (DTSC comments pending).** • Includes parcels where military munitions were suspected to have been used, but none were found. Final Track 1 ROD in April 2005. • Approval Memorandum for Track 0 Plug-in C parcels public comment period started 5/4/05. • Five associated CRUPs for Special Groundwater Protection Zone. **Issues:** • Format of FOST modified according to Army Model FOST.

Title/Description	Parcels	Notes
FOST 10 **Track 0 Plug-in, Track 1 Plug-in and OU2 Landfills Parcels** **18 Parcels ~ 397 acres** (V0/October 2005)	**Track 0 Plug-in (~172 acres):** E11b.6.3, E11b.7.2, L20.19.1.2, L23.3.2.2, L23.3.3.1, L23.3.3.2 **Track 1 Plug-in (~79 acres):** L20.2.3.1, E2c.4.1.2, E2c.4.2.2, E2c.4.3, E2c.4.4, E2d.3.2, L2.2.2, L20.17.2, L5.9.2, E29a **OU2 Landfills (~147 acres):** E8a.1.1.1, E8a.2	• Track 0 Plug-in parcels are those that dropped from FOST 8 and FOST 9 due to the California tiger salamander. Will require approval memo. • Track 1 Plug-in parcels are mostly associated with MRS-2 (8 of 10 parcels ~45 acres). Issue is Chemical Agent Identification Sets (CAIS). Will require approval memo. • OU2 Landfills parcels require an Explanation of Significant Differences to the OU2 ROD to transfer, as agreed with the agencies at December 2004 SMART. • Two CRUPs for Special Groundwater Protection Zone, one CRUP for residential restriction, one CRUP for landfills. **Issues:** • If Track 1 Plug-in parcels are not included, signature of FOST estimated to be in March 2006. If included, signature of FOST in July 2006.

Finding of Suitability to Lease (FOSL)

Title/Description	Parcel	Notes
FOSL 12 – Military Operations on Urbanized Terrain (MOUT) Site **1 Parcel ~ 54 acres** (V0/July 2004) (V1/January 2005) (V2/March 2005) (V3/May 2005)	F1.7.2	**Comments received from EPA and DTSC. FOSL in revision.**
FOSL 13 – Monterey Horse Park **3 Parcels ~ 340 acres**	E19a.1, E19a.2, E19a.3	**Not started.** **Issues:** No official request for property yet.
FOSL 14 – Del Rey Oaks/Native Plant Society Habitat Reserve **1 Parcel ~ 5 acres**	E29a	**Not started.** **Issues:** No official request for property yet.

Finding of Suitability for Early Transfer (FOSET)

Title/Description	Parcels	Notes
FOSET 5 **61 Parcels ~ 3,635 acres** (V0/June 2005)		**Draft FOSET in progress, draft to be submitted to HFO by mid-June.**

Feasibility Study Summary

Operable Unit

Carbon Tetrachloride Plume

BCT Meeting
May 17, 2005
Former Fort Ord, California

Purpose & Objectives

Evaluate a range of remedial approaches for the three OUCTP aquifers to determine the most timely, cost effective, and ARAR-compliant alternatives for achieving aquifer cleanup levels

Feasibility Study Summary

- ❑ Recap Results of RI and HHRA
- ❑ Remedial Action Objectives
- ❑ Remedial Technology Screening
- ❑ Assembly of Alternatives
- ❑ Evaluation and Comparison of Remedial Alternatives
- ❑ Selection of Preferred Remedial Alternative

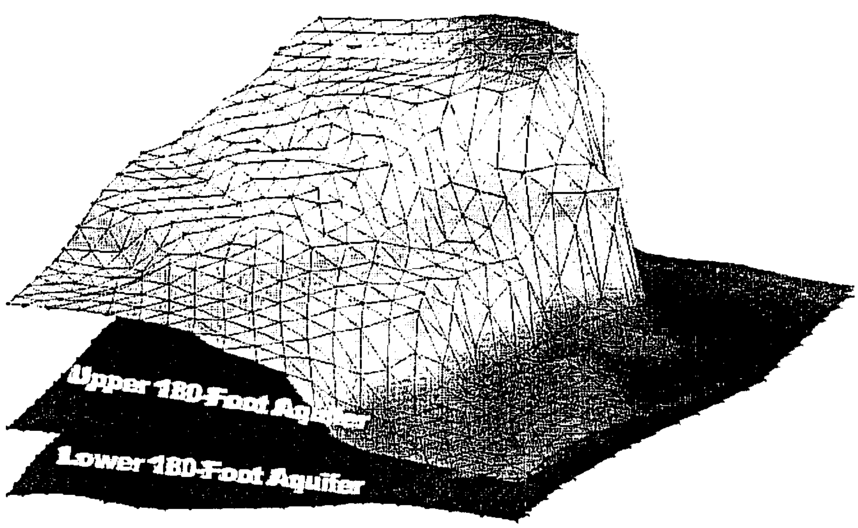
Results of RI

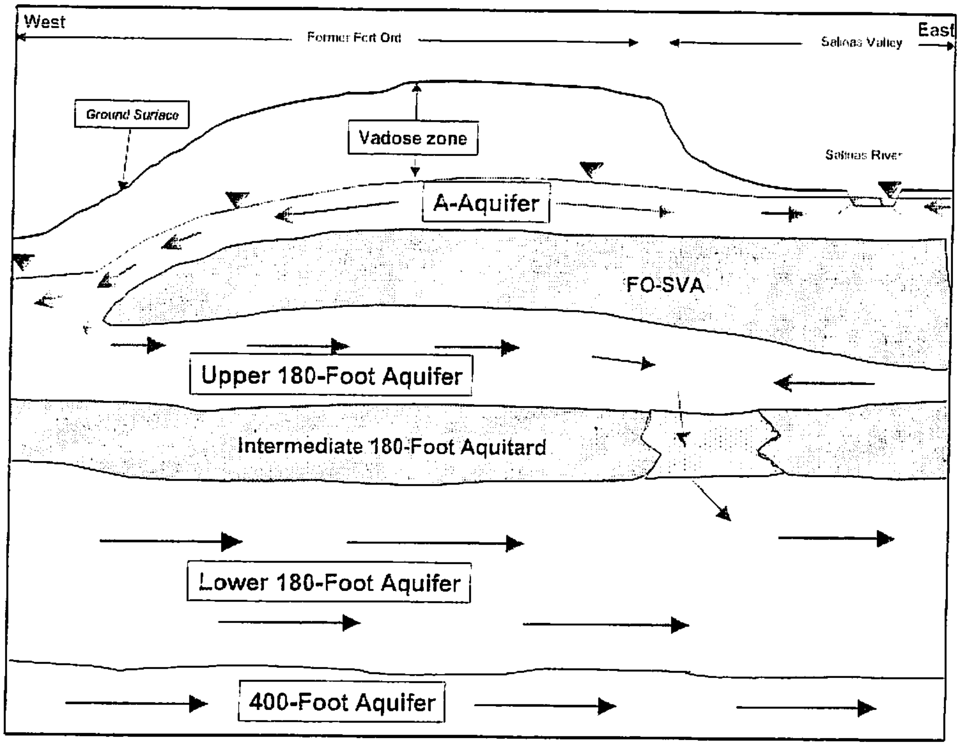
- ❑ Aquifer Characteristics
- ❑ Nature & Extent of Contamination
- ❑ Natural Attenuation & Enhanced Biodegradation Studies
- ❑ Groundwater Modeling
  - o *(Discussed under remedial alternatives)*

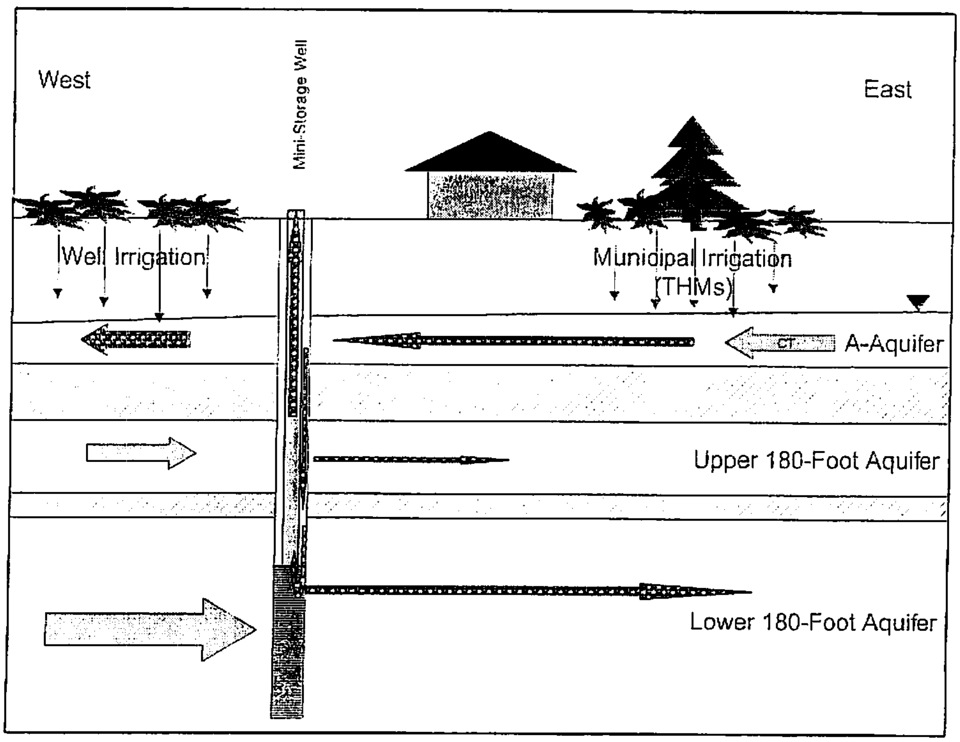
Aquifer Characteristics

- A-Aquifer contains source of CT from cleaning solvent disposal in 1950s in the form of a large dissolved plume
- Two vertical conduits allowed CT to migrate through aquitard down into Upper and Lower 180-Foot Aquifers, creating two smaller plumes in each aquifer
- Source of CT attenuated over last 50 years and SVE removed residual source in soil vapor
- Contamination throughout OUCTP is in the aqueous phase, and the plume is no longer attached to its source area

Groundwater Flow Directions




West
Former Fort Ord
Salinas Valley
East
Ground Surface
Vadose zone
Salinas River
A-Aquifer
FO-SVA
Upper 180-Foot Aquifer
Intermediate 180-Foot Aquitard
Lower 180-Foot Aquifer
400-Foot Aquifer


West
Mini-Storage Well
East
Well Irrigation
Municipal Irrigation
(THMs)
A-Aquifer
Upper 180-Foot Aquifer
Lower 180-Foot Aquifer

Nature & Extent of CT

MCL = 0.5 ug/L

A-Aquifer

- Current concentrations range from 0.25 to 15ug/L
- Concentrations generally decreasing over time
- Toe of plume defined but not captured (migrating offsite)

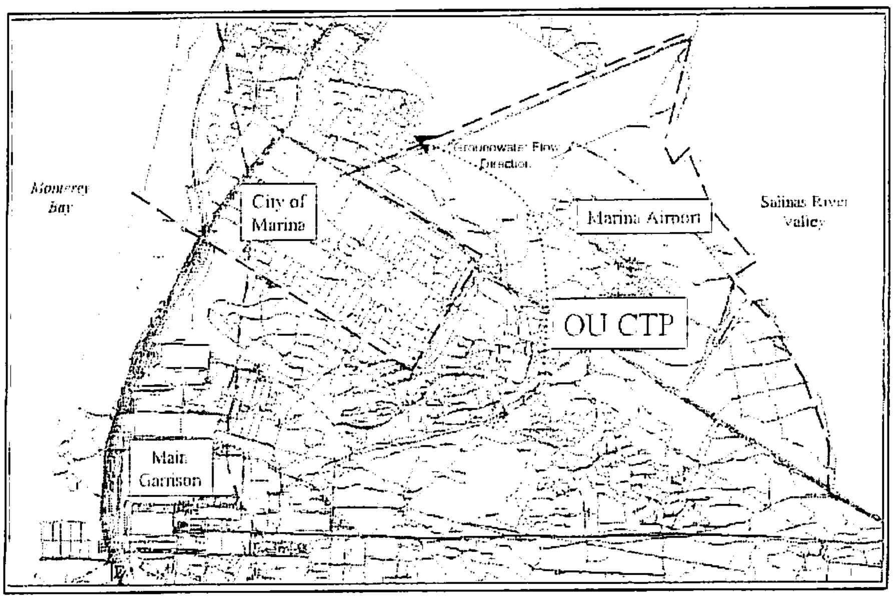
Upper 180-Foot Aquifer

- Current concentrations range from 0 to 3.5ug/L
- Concentrations in two plumes generally decreasing
- Toe of plume commingles with OU2 TCE plume

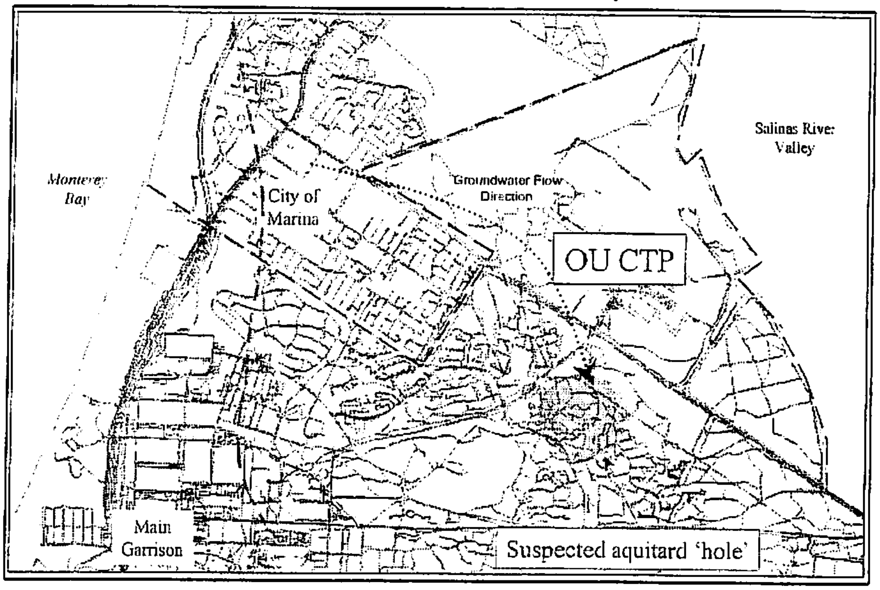
Lower 180-Foot Aquifer

- Current concentrations range from 0 to 3.6ug/L
- Concentrations in two plumes stable
- Toe of plume upgradient of water supply wells

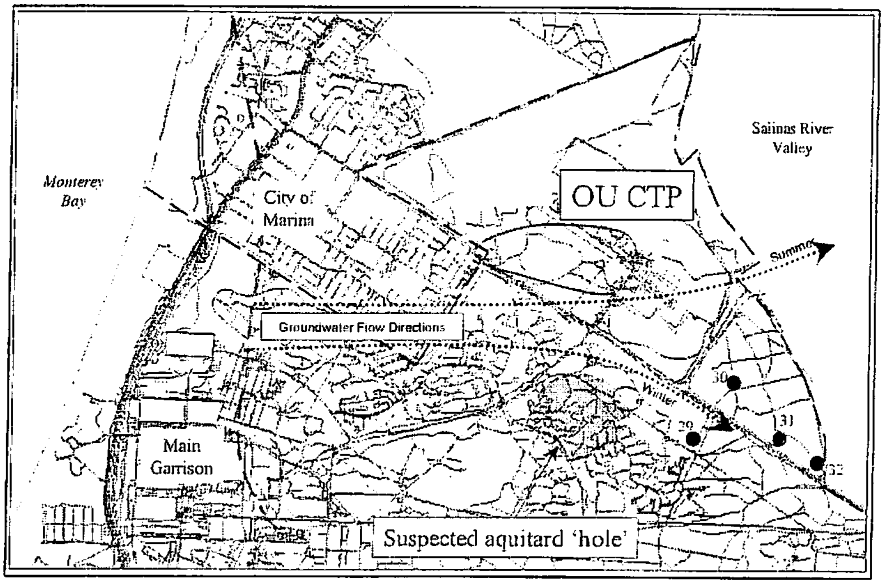
A-Aquifer



Upper 180-Foot Aquifer



Lower 180-Foot Aquifer



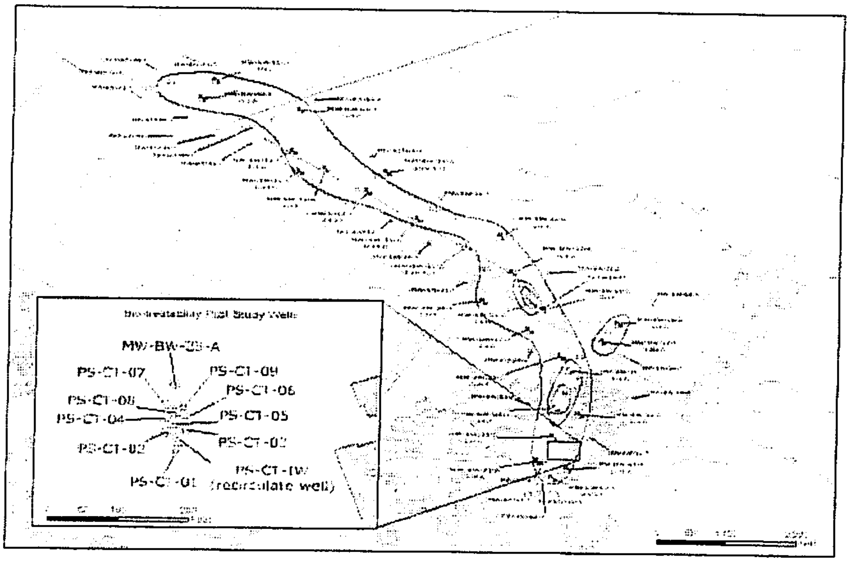
Natural Attenuation Study

- Natural attenuation appears to be occurring in the A-Aquifer via microbial and physical processes
- The aquifer environment within OUCTP is generally aerobic (oxygenated), and does not provide ideal conditions for significant biodegradation of CT
- CT biodegrades under anaerobic (low oxygen) conditions that predominate near the suspected source area with localized areas throughout the plume
- Physical processes appear to control the downgradient extent of the CT in the A-Aquifer; however, they are inadequate to attenuate continued westward migration of the plume

Enhanced Biodegradation Studies

- Microbial bench-scale study selected lactate as most effective enhancement for A-Aquifer
- Lactate was injected and recirculated in field bio-treatability study
- Data indicated CT biodegraded and dissolved oxygen (DO) concentrations remained low / favorable for enhanced anaerobic biodegradation after 8 months
- Follow-up sampling and analysis required to determine longevity of lactate and enhanced biodgradation processes

Bio-Treatability Study Location



Feasibility Study

- ❑ Remedial Action Objectives
- ❑ Remedial Technology Screening
- ❑ Assembly of Alternatives
- ❑ Evaluation and Comparison of Remedial Alternatives
- ❑ Selection of Preferred Remedial Alternative

Remedial Action Objectives

Reduce risks to human health and the environment and comply with ARARs through:

- Exposure Control—Prevent potential exposure of residents to groundwater contaminants above aquifer cleanup levels (ACLs)
  - Achieved via DW well ordinance
- Source Control—Prevent or minimize further degradation of groundwater at the site
  - Will be achieved via eliminating vertical conduits
- Plume Containment—Mitigate the potential for contaminants to continue to migrate offsite
  - Implement remedial technologies
- Plume Remediation—Reduce contaminant concentrations in groundwater to below ACLs
  - Implement remedial technologies

Aquifer Cleanup Levels

- Potential cancer risks under most conservative scenario evaluated in HHRA (daily use of untreated groundwater for 30 years)
  - A-Aquifer (1.3 out of 100,000 people)
  - Upper 180 Foot-Aquifer (3.5 out of one million people)
  - Lower 180-Foot Aquifer (2.2 out of one million people)
- Noncancer risks below Hazard Index for all scenarios and aquifers
- Risks within EPA and Cal/EPA-DTSC cancer risk management range and below point of departure for risk management
- MCLs are enforceable standards for chemicals that may affect public health or the aesthetic qualities of drinking water
- Therefore, because risks were within management range, the more conservative or lower of the federal or State MCLs for each COC within OUCTP were selected as ACLs

Remedial Technology Screening

General Response Actions

- No Action with Monitored Natural Attenuation — No action with continued groundwater monitoring for COCs and natural attenuation parameters
- Containment — Containing contaminated groundwater using barriers *(permeable reactive barriers discussed under in situ treatment)*
- Collection — Extraction of contaminated groundwater for aboveground (ex situ) treatment
- Treatment — In situ (belowground) and ex situ (aboveground) treatment of contaminated groundwater
- Disposal — Reinjection or recirculation of treated water back into the aquifer, or discharge to the surface or drainage systems

Evaluation Criteria

- Effectiveness, Implementability, Relative Cost

No Action with Monitored Natural Attenuation

Considered for all three aquifers

- No longer an active source of CT within the aquifer and natural attenuation appears to be occurring via microbial and physical processes
- Stable and generally declining dilute CT concentrations (in parts per billion range)
- Widespread extent of plumes within three high-flow deep aquifers could be difficult and costly to capture or contain and actively remediate
- Specifically, active remediation of the Lower 180-Foot Aquifer plume is not considered further at this time because (1) it would impact the hydrologic stability of this significant potable drinking water source; (2) the plumes are limited in extent and concentration; (3) they have not impacted drinking water supply wells; and (4) their presence is due to vertical conduits that will be eliminated

Collection & Disposal Technologies

Considered for A- & Upper 180-Foot Aquifers

- Extraction wells, drains, trenches
- Injection and recirculation wells
- Infiltration galleries
- Surface or storm drain discharge

Retained

- Extraction, injection and recirculation wells

Treatment Technologies

In Situ

- Permeable Reactive Barriers
- Enhanced Biodegradation

Other technologies would not be effective in high flow, deep aquifers for low concentrations of CT throughout widespread plumes

Ex Situ (Pump & Treat)

- Activated carbon
- Air stripping

Other technologies would not be effective in high flow systems for low concentrations of CT

In Situ Remedial Technologies

Considered for A-Aquifer

Permeable Reactive Barrier (zero-valent iron w/ nickel-plated or other surface coatings and particle sizes)

Enhanced Biodegradation

Considered

- Gaseous nutrient injection
- Hydrogen Release Compound (HRC®)
- Emulsion-based amendments (edible oils, surfactants)
- Molasses
- Lactate

Retained

- Lactate, others if follow-up pilot study monitoring indicates need during remedial design

Pump & Treat Technologies

A-Aquifer

- Extraction wells (vertical & horizontal)
- Aboveground treatment via activated carbon or air stripping
- Reinjection of treated water into aquifer

Upper 180-Foot Aquifer

- Extraction well to capture CT and commingled TCE plume
- Treatment in existing OU2 GWTS as part of optimization

Lower 180-Foot Aquifer

- Wellhead treatment via activated carbon or air stripping as contingency if COCs detected in supply wells
- Discharge of treated water into water supply system

Summary of Remedial Technology Screening

- No Action with Monitored Natural Attenuation (A, Upper and Lower 180)
- In Situ Enhanced Biodegradation (via Lactate Injection) (A)
- In Situ Permeable Reactive Barrier (A)
- Groundwater Extraction and Treatment (via Activated Carbon Adsorption or Air Stripping) (A, Upper and Lower 180)

Assembly of Remedial Alternatives

Remedial Alternative 1

- No Action With Monitored Natural Attenuation (All Aquifers)

Remedial Alternative 2

- In Situ Enhanced Biodegradation (A-Aquifer)

Remedial Alternative 3

- In Situ Permeable Reactive Barrier (A-Aquifer)

Remedial Alternative 4

- Groundwater Extraction and Treatment (A-Aquifer)

Remedial Alternatives 2—4

- Groundwater Extraction and Treatment Within OU2 GWTS (Upper 180-Foot Aquifer)
- Monitored Natural Attenuation with Wellhead Treatment Contingency (Lower 180-Foot Aquifer)

Groundwater Modeling

- Advective Flow (Steady-State) Calibration
- Mass Transport
  - Plume formation since 1950
- Remedial Alternatives
  - A-Aquifer
    - o Pump & Treat (5 Extraction Wells)
    - o Enhanced Biodegradation
    - o Permeable Reactive Barrier
  - Upper 180-Foot Aquifer
    - o Pump & Treat (1 Extraction Well)

Components of All Remedial Alternatives

- Vertical conduits will be eliminated
  - MW-B-13-A will be destroyed (grouted and sealed)
  - Mini-Storage well will be destroyed (grouted and sealed), or if it is determined that it could be converted into an extraction well (EW) that would provide additional containment of the plume, it would be converted for wellhead treatment via carbon or air stripping
- Up to 30 additional "point of compliance" monitoring wells would be installed to trigger reassessment of the remedy or implementation of a contingency plan for wellhead treatment if COCs are detected in water supply wells in the Lower 180-Foot Aquifer
- Monitoring for COCs and natural attenuation parameters using a phased approach over a 30-year period.

Upper 180-Foot Aquifer

- Newly installed EW-OU2-07-180 would be pumped at 150 gpm
- Piping conveyance would be installed
- Groundwater would be treated as part of optimized OU2 GWTS
- Vertical conduits will be eliminated

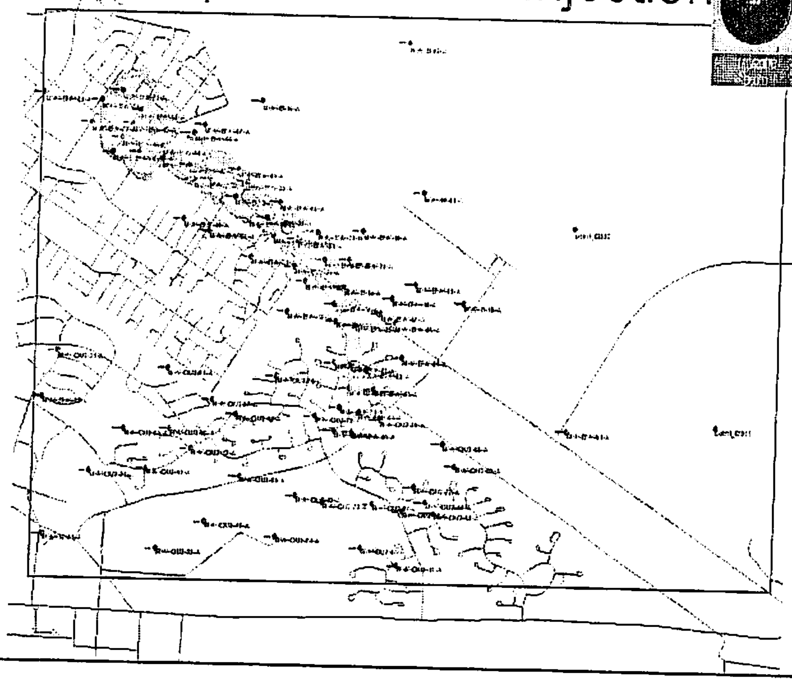
Lower 180-Foot Aquifer

- Monitored Natural Attenuation with wellhead treatment contingency

A-Aquifer
Enhanced Biodegradation

- 10 treatment cells that span the width of the plume with lactate injection points located every 40 feet
- 250 gallons of a 60% sodium lactate solution would be injected at each injection point every 2.5 years for 15 years
- Majority of injection points would be permanent injection/recirculation wells
- Offsite injection points would be direct-push
- Treatment system monitoring and MNA for 20 years

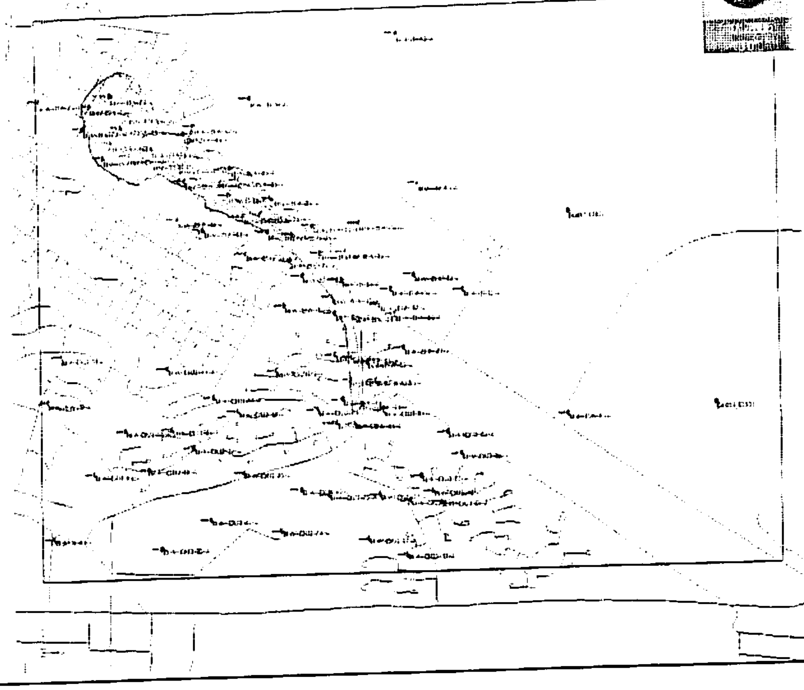
A-Aquifer Lactate Injection



A-Aquifer Permeable Reactive Barrier

- Conduct pilot study to verify effectiveness and estimate lifespan
- Install at downgradient plume boundary for offsite migration control spanning the width of the plume
- Comprised of three cells of ZVI, fully penetrating the A-Aquifer, keyed into aquitard with a flow-through thickness of 1 foot
- Observation well monitoring and MNA for 30 years

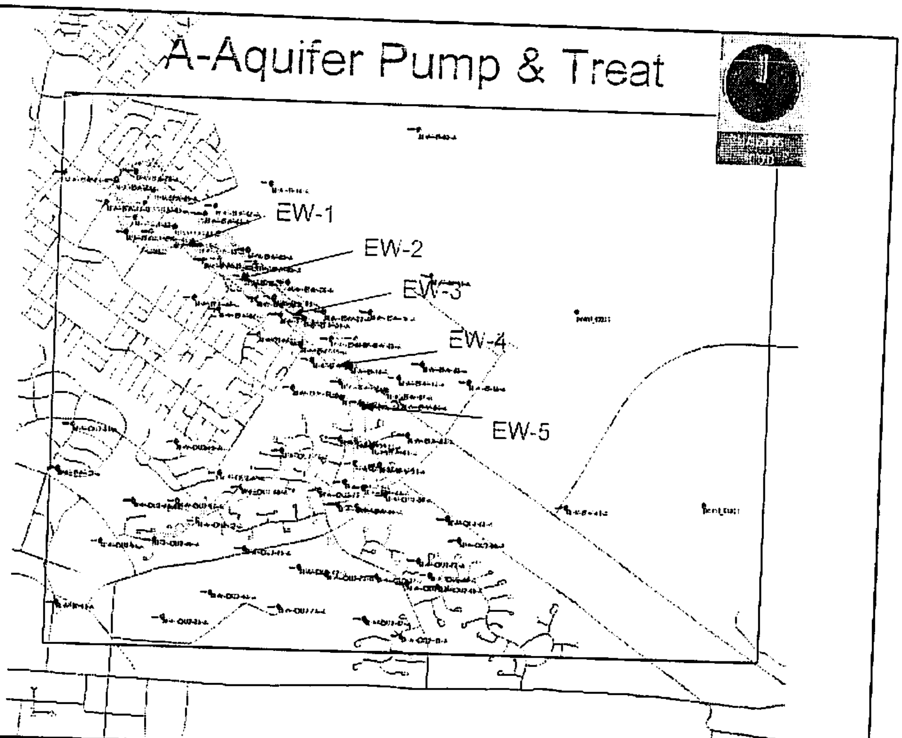
A-Aquifer Permeable Reactive Barrier

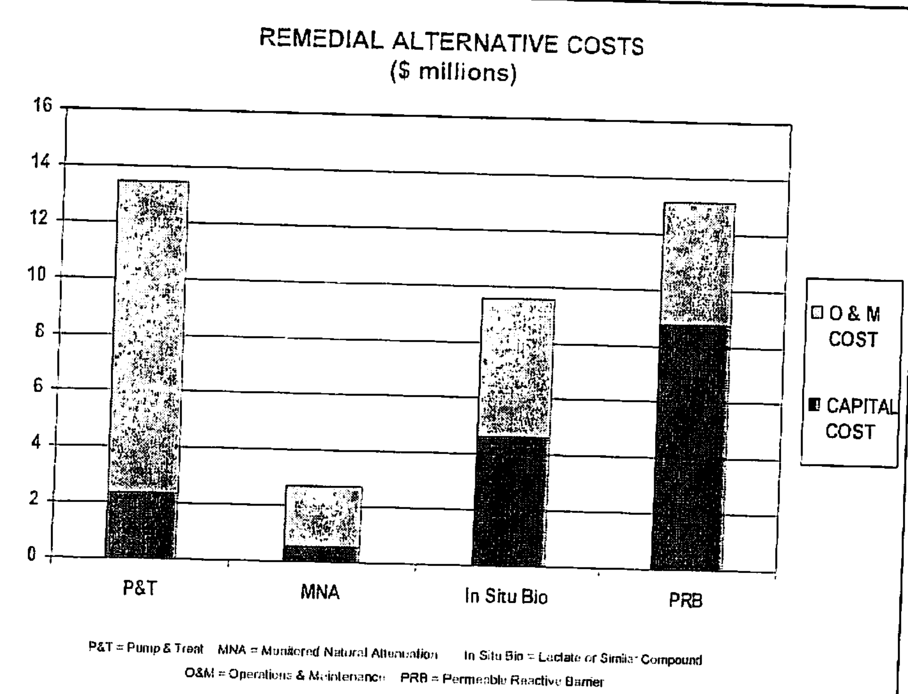


A-Aquifer
Pump & Treat

- Install five extraction wells pumping at a total flow rate of approximately 150 gpm and reinjection wells
- Install piping conveyance (two wells piped under Reservation Road)
- Construct treatment system (carbon or air stripper)
- Treatment system O&M and groundwater monitoring for 30 years

A-Aquifer Pump & Treat





Summary of Remedial Alternatives

Remedial Alternative	Pros	Cons	Total Cost ($millions)
Monitored Natural Attenuation	•Already occurring •Source is attenuated/remediated •Eliminating vertical conduits and monitoring points of compliance will allow tracking of plumes and trigger contingency if needed •Lowest cost	•Requires long period to achieve ACLs •Does not address portions of plumes migrating offsite and towards drinking supply wells	$2.75 (30+ years)
Pump & Treat	•Applicable and effective in remediating majority of plume within 30 years •Proven technology at former Ft. Ord	•Requires long period to achieve ACLs •Would not capture downgradient (offsite) portion of plume •Significant costs associated with O&M	$13.4[illegible]—$15.47 (30 years)
Enhanced Biodegradation	•Applicable and effective in remediating entire plume within 15 years •Demonstrated effective technology in pilot study at site	•Follow-up sampling and analysis needed to verify effectiveness, type of reagent, longevity •Effects of reductive environment in subsurface would need to be addressed	$9.54 (20 years)
Permeable Reactive Barrier	•Potentially applicable and effective as a containment option to control offsite/downgradient migration within 50 year period	•Pilot study needed to assess longevity (typically 20 years), effectiveness, installation techniques and barrier alignment •Would not prevent plume migration or be effective outside the limits of the barrier •Significant costs associated with installation	$13.15 (50 years)

Selection of Preferred Alternative

- A-Aquifer—Enhanced biodegradation because it would remediate plume within 15 years and address offsite migration
- Upper 180-Foot Aquifer—Pump & treat via OU2 GWTS
- Lower 180-Foot Aquifer—Monitored Natural Attenuation with Wellhead Treatment Contingency

Remedial Design Considerations

- Collect and analyze additional bio-treatability study data
- Consider phased approach to lactate injection (toe of plume and axis first?)
- Tie-in EW in Upper 180-Foot Aquifer to OU2 GWTS
- Select locations for point of compliance monitoring wells depending on remedial action