7.0 Area I Industrial/ Manufacturing Area

7. AREA I – INDUSTRIAL/MANUFACTURING AREA

A description of Area I follows, including the physical characteristics, operational history, current use of the land, and land ownership. FSIPs and SSHPs for Area I are presented at the end of this section. The FSIPs and SSHPs will be added to the Workplan as they are developed.

7.1 Location

Area I occupies an irregularly shaped tract of land consisting of approximately 200 acres. It is bounded on the north and east by Area M, on the south by Carquinez Strait, and on the west by the Arsenal boundary line (see Figure 7-1).

7.2 Area I Conceptual Geologic Model

Figure 7-2 presents a conceptual hydrogeologic model that includes Area I. The southernmost portion of Area I rises from sea level at the Carquinez Strait to an elevation of approximately 10 feet above mean sea level (msl) near Jackson Street. The elevation rapidly rises to a maximum 140 feet (approximately) above msl at the northeast corner of Area I. Adjacent to the Arsenal in the bay itself are tidal flats and marshlands where a maze of natural drainage channels have created islands. Several marshlands, identified as swamps on historical site maps, have since been filled in and developed.

Figure 7-3 is a schematic geologic cross section that includes Area I. The location of this geologic cross section is shown on Figure 6-2. The northern and eastern portions of Area I are composed of southwesterly, steeply dipping beds of massive sandstone, siltstone, and shale from the Martinez and upper Chico Formations. These beds account for the rapid rise in elevation described previously. The Martinez Formation includes marine-derived sandstone interbedded with thin fossiliferous shale. Occasional thick beds of a well-cemented pebbly conglomerate occur throughout the formation. The Chico Formation includes marine-derived massive and thinly-bedded shale alternating with massive sandstone. Discontinuous beds of conglomerates also occur within the formation. Soil covering these bedrock units is expected to vary in thickness from several inches to several feet. The southern portion of Area I is composed of alluvium, which varies from a few feet thick to more than 80 feet thick.

Shallow water within the alluvium exists at an elevation approximately equal to the elevation of water in the Carquinez Strait. At the time of this report, specific water quality data are not available. However, the water is most likely brackish, representing inflow and underflow of bay waters through the alluvium. Water in the alluvium may also be partially fed by rainwater seeping down from the foothills.

At least two groundwater monitoring wells have been installed by Benicia Industries Inc. to monitor the groundwater depth and quality at 700 Bayshore Road. The wells were installed after a fuel UST was removed from the site. The depth to groundwater at this site ranges from 4 to 7 feet bgs.

7.3 Geologic Factors Influencing Subsurface Investigation

Subsurface investigation on the northern and eastern portions of Area I may be impeded by the presence of the sandstone, siltstone, and shale of the Martinez and Upper Chico Formations. Near surface soil and soil gas sampling may be possible in some areas where a

70

57

57B

58

154

AUXILLARY TANKS
MOUNTED ON BLDG 154

GASOLINE
10,000 GAL.

EXISTING
CONCRETE
SLAB

GASOLINE
7,000 GAL.

INLET

WHITE GASOLINE
1,400 GAL.

RETURN FROM BLDG 53

INLET

FILLPORT

INLET

FILLPORT

RETURN FROM
BLDG 53

CONCRETE

ASPHALT

56A

MAY HAVE BEEN REMOVED
WHEN 4,000 GAL UST
WAS INSTALLED

GASOLINE
10,000 GAL

DIESEL OIL
1,000 GAL

AUXILLARY GASOLINE TANK
MOUNTED ON BLDG 53

AUXILLARY DIESEL TANK
MOUNTED ON BLDG 53

GASOLINE 4,000 GAL
USES FORMER
10,000 GAL PIPING

FILLPORT

53

RAMP

FIRE HYDRANT

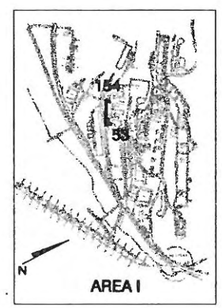
STORM DRAIN

LINCOLN STREET

LINCOLN STREET

LEGEND

181	Buildings
- - - - -	UST/Tank Line
++++++++++	Railroad Tracks
→	Fluid Flow Direction
▫	Concrete Block Encasing Fillport or Tank Inlet for Fluid Level Measurement



N

10 0 10 20 30 40
Scale In Feet
(Approximate)

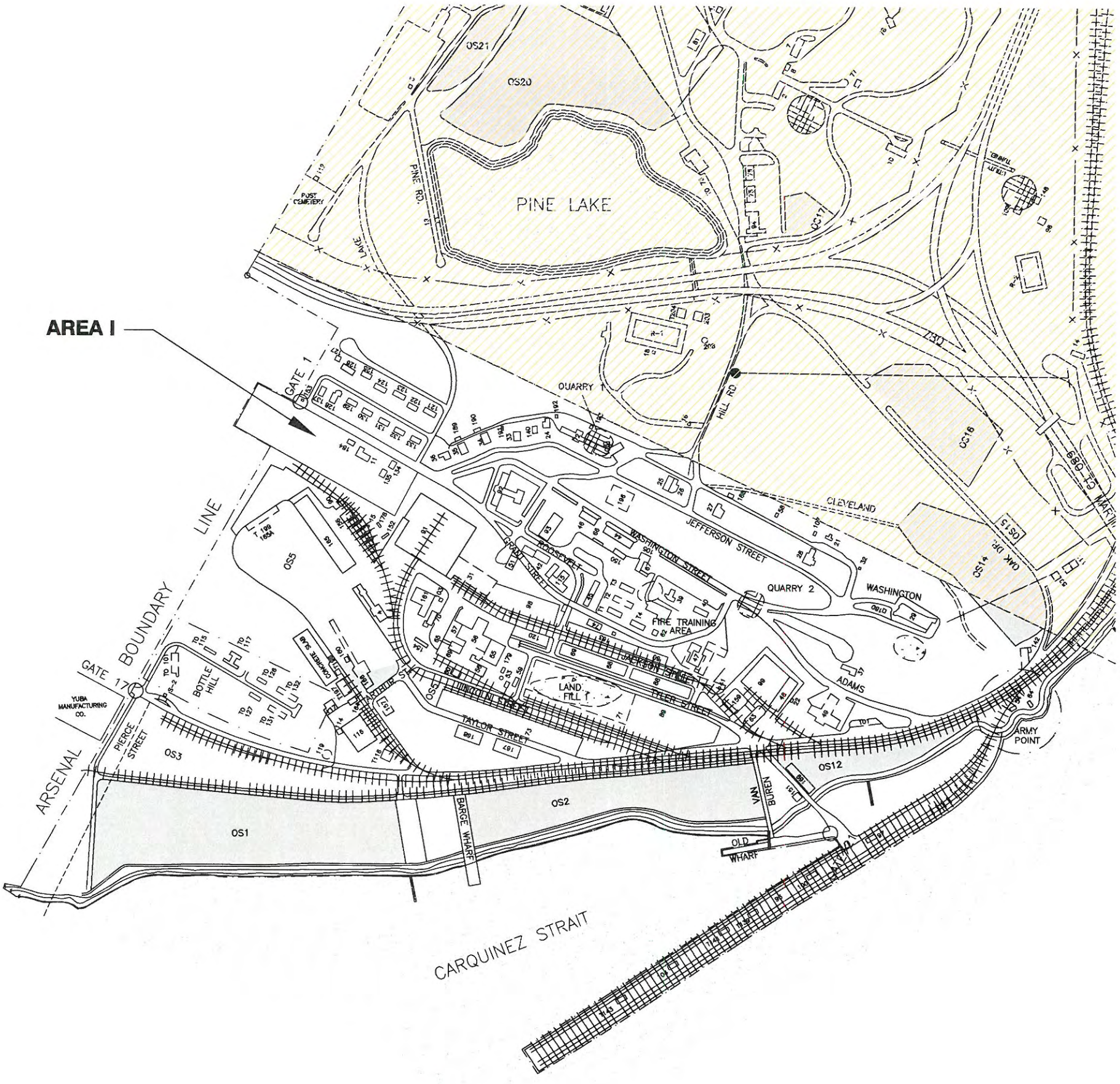
Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Site Location Map
Fuel Storage Facilities at Building 154 and 53

Area I - Field Site Investigation Plan
Benicia Arsenal

FIGURE 1

1-29-99 jkr p:\Special\DACW05-97-D-0035A_E\workplan\FSIP\b154site.dwg



LEGEND:

- Area M – Motor Pool and Historic Ordnance Storage Area
- Open Storage Areas
- Arsenal Boundary Line
- Area Boundary Line
- Road
- Railroad Tracks
- 40 Building
- Landfill
- Water
- Quarries

AREA OF DETAIL

N

200 0 200 400 600

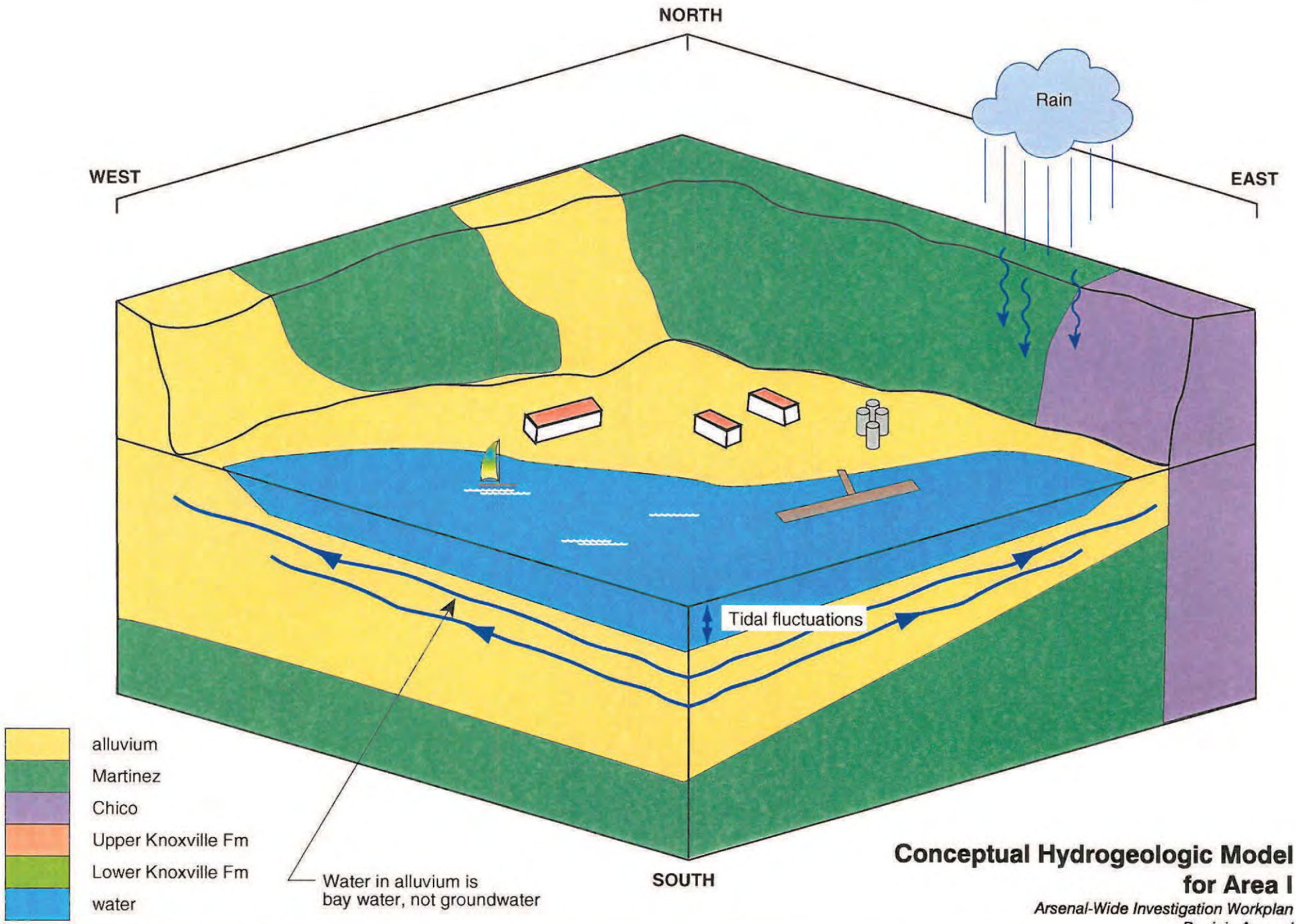
Scale In Feet
(Approximate)

SOURCE: BASIC INFORMATION MAPS, MARCH 1958
LAND UTILIZATION MAP, MAY 1956
PRELIMINARY BENICIA ARSENAL REHABILITATION
OF MAINTENANCE BLDGS. PLOT PLAN, AUGUST 1950

Area I
Industrial / Manufacturing Area

Arsenal-Wide Investigation Workplan
Benicia Arsenal

FIGURE 7-1



Conceptual Hydrogeologic Model for Area I

Arsenal-Wide Investigation Workplan
Benicia Arsenal
FIGURE 7-2

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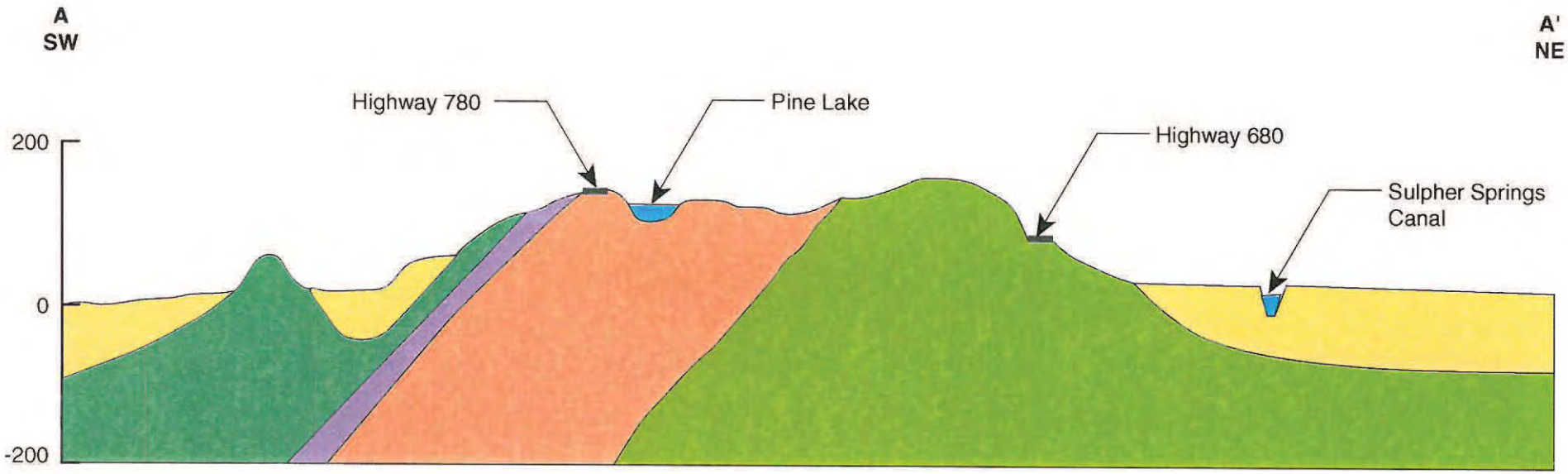

Legend

- alluvium
- Martinez
- Chico
- Upper Knoxville Fm
- Lower Knoxville Fm
- water

200
0
1350
Scale in Feet

Schematic Geologic Cross Section A-A'
Areas I, M, and W
Arsenal-Wide Investigation Workplan
Benicia Arsenal
FIGURE 7-3

P:\Special\DACW05-97-D-0035A_E\workplan\Rev2workplan\figures-drawings\Fig7-3A-A.ai

soil horizon has been established either naturally or by emplaced fill. Borings may require the use of air rotary or mud rotary methods and excavations using a backhoe may be difficult.

In the southern portion of Area I, subsurface investigation may be accomplished using hand or power auger tools and/or direct push techniques, to at least the depth of the alluvium. Excavations using a standard backhoe will be possible in this portion of Area I. If sampling is required below the alluvium, air or mud rotary drilling methods may be required.

7.4 Operational History and Current Land Use and Ownership

Area I contains several of the original Arsenal structures that were erected in the 1800's. This area served as the main industrial and manufacturing area throughout the Arsenal's 115-year history. Several machine shops, manufacturing shops, and cleaning and painting shops were housed here, along with a blacksmith shop, a welding shop, numerous vehicle and artillery repair shops, and small arms shops. Area I also housed the Arsenal's administrative offices, most of the permanent housing facilities, photographic laboratories, a firehouse, and a hospital. Fuel storage and dispensing facilities, a locomotive house, a boiler house, storehouse and warehouse facilities, open storage facilities, landfills, and quarries were also located within Area I. Area I was the center of activity at the Arsenal. Wharf facilities and storehouses in the southern portion of Area I, adjacent to Carquinez Strait, were used for shipping and receiving large volumes of equipment and supplies throughout the history of the Arsenal.

Industrial activities that were conducted in Area I involved parts cleaning and degreasing, steam cleaning, sandblasting, paint stripping, plating and electroplating, painting, parts lubrication, and photographic processing. Materials handled in Area I included petroleum-based solvents, chlorinated solvents, alkali cleaning solutions, acids, caustics, iron and chromium plating solutions, paints, oils, greases, lubricants, fuels, and photographic processing solutions. Industrial waste materials generated in Area I were reportedly discharged to landfills, storm drains, and the sanitary sewer. Wastes contained in 55-gallon containers were reportedly taken to a salvage yard located in Area M. No information is available on disposition of these wastes after transport to the salvage yard.

Post-closure use of properties within Area I has been varied and has included ownership and or/occupancy by automotive, chemical, construction, distribution, fabrication, manufacturing, plastics, retail, transportation, and warehousing businesses. Industrial activities associated with these businesses include machine shop work, servicing and repair of equipment, metal fabrication and casting, plastics manufacturing, assembly and distribution of marine equipment, silk screen printing, fabrication of shipping containers, leather processing, welding, painting, chemical manufacturing, and woodworking. Offices, retail shops, restaurants, and private residences also occupy portions of Area I.

7.5 FSIPs/SSHPs

As described in Section 2, investigation activities within Area I will be conducted on a site-by-site basis. The scope and objectives of each investigation are documented in site specific FSIPs. Site specific health and safety protocol are presented in SSHPs. The FSIPs/SSHPs for Area I are attached to this section. As the Arsenal investigation progresses, new FSIPs will be added to this chapter as they are developed and approved. Table 7-1 summarizes the site use categories for Area I. The flysheet preceeding the FSIPs/SSHPs lists each FSIP/SSHP in the order of completion.

Table 7-1
Site Use Categories, Area I

DOD Facility ID	DOD use	Storage and warehouse areas	Ordnance and Ammunition Handling and Storage Facilities	Maintenance, Repair, Paint Facilities and Carpenter Shops	Fuel Facilities	Landfills and Dumpsites	Burnsites	Septic, Sewer, and Storm drains	Misc.	Potable Water Facilities and Utilities	Offices, Barracks, Hospitals, Firehouses
4	Sandblast/spray painting			X							
15	Pump house-fuel oil				X						
22	Transformer house									X	
23	Transformer vault									X	
25	Lieutenant's quarters				X						X
26	Lieutenant's quarters				X						X
27	Captain's quarters				X						X
28	Commanding officers' quarters				X						X
29	Storehouse	X	X								
31	Store house/engine rebuild	X		X	X						
41	Pump house-sewage							X			
42	Garage/Repair shop			X							
44	Utilities building									X	
45	Enlisted men's barracks				X						X
46	Office building				X						X
47	Office building				X						X
48	Shop/storage C&P			X							
49	Shop/Fire control			X					X		
51	Stable/Maintenance/Photo lab			X					X		
52	Photography Lab/Storehouse/ office	X							X		X
53	Dynamometer shop/Engine Testing/fuel storage	X			X						
54	Pump house-water				X			X			
55	Blacksmith/welding shop			X							
55A	Welding shop			X							
56	Leather & Canvas Shop			X							
56A	Small Arms shop		X	X							
57	Small Arms Shop		X								
58	Small Arms Repair and retinning/ Transformer house		X							X	
59	Tool House/ degreaser pit	X		X							
60	Storehouse (group K;	X									

Table 7-1
Site Use Categories, Area I

DOD Facility ID	DOD use	Storage and warehouse areas	Ordnance and Ammunition Handling and Storage Facilities	Maintenance, Repair, Paint Facilities and Carpenter Shops	Fuel Facilities	Landfills and Dumpsites	Burnsites	Septic, Sewer, and Storm drains	Misc.	Potable Water Facilities and Utilities	Offices, Barracks, Hospitals, Firehouses
	chemical stores)										
62	Surveillance laboratory		X								
63	Storehouse	X									
64	Pump house-firewater							X			
65	Boiler house									X	
66	Paint/Welding shop	X		X							
68	Storehouse	X									
69	Storehouse	X									
70	Powerhouse									X	
71	Storehouse; artillery and ordnance material		X								
72	Hospital				X						X
73	Service station				X						
73A	Service station and scales				X						
73B	Storehouse, spec. inert Materials/ Vehicle storage	X	X								
74	Photography Lab								X		
88	Storehouses	X									
89	Storehouses	X									
89A	Storehouses	X									
90	Locomotive building			X							
91	Machine shop/ combat vehicle and artillery repair			X							
91A	temporary machine shop/engine rebuild			X							
91 (addition)	Equilibrator shop/ combat vehicle repair			X							
92	Headquarters/office building										X
93	Truck storage/MMW repair			X							
95	Wharf	X	X								
97	Transformer house on wharf		X							X	
98	Carpenter / machine shop			X							
99	storehouse / shop building	X		X							
99A	storehouse/shop building	X		X							
101	Battery charging	X		X							
103	Service station/ office building				X						X

Table 7-1
Site Use Categories, Area I

DOD Facility ID	DOD use	Storage and warehouse areas	Ordnance and Ammunition Handling and Storage Facilities	Maintenance, Repair, Paint Facilities and Carpenter Shops	Fuel Facilities	Landfills and Dumpsites	Burnsites	Septic, Sewer, and Storm drains	Misc.	Potable Water Facilities and Utilities	Offices, Barracks, Hospitals, Firehouses
105	Fire station and fire training site						X				X
114	Carpenter shed/ Oil storage			X	X						
116	Carpenter shop			X							
117	Sticker building/ Carpenter shop			X							
118(a)	Diesel tank				X						
118(b)	Sawdust disposal system						X				
118c	Incinerator								X		
119	Incinerator/ Sawdust Burner								X		
120	Quartermaster storage/shop			X							
142	Steam cleaning			X							
152	21,000-gallon fuel tank				X						
154	engine testing/spray painting			X							
154	Fuel storage				X						
156	Locomotive house			X							
157	Lumber Shed/ Storage building	X									
160	Boiler house									X	
161	Motor/steam cleaning and spray painting/ Fuel storage			X	X						
163	Storehouses	X									
164	Carpenter Change Building/Office Building			X							X
165	Reclamation / vehicle repair shop			X							
165A	Steam Cleaning			X							
166	Paint shop			X							
167	Vehicle storage/ shop	X		X							
168	Packaging/ vehicle storage	X		X							
169	Rigger's building storage		X								
178	23,500-gallon diesel tank				X						
179	Compressor building									X	

Table 7-1
Site Use Categories, Area I

DOD Facility ID	DOD use	Storage and warehouse areas	Ordnance and Ammunition Handling and Storage Facilities	Maintenance, Repair, Paint Facilities and Carpenter Shops	Fuel Facilities	Landfills and Dumpsites	Burnsites	Septic, Sewer, and Storm drains	Misc.	Potable Water Facilities and Utilities	Offices, Barracks, Hospitals, Firehouses
180	Transformer building									X	
Landfill 1	Landfill					X					
Landfill 2	Landfill					X					
OS1	Lumber Storage	X									
OS12	Open Storage	X									
OS2	Lumber Storage	X									
OS3	Open Storage	X									
OS5	Open Storage	X									
Quarry 1	Sandstone quarry					X					
Service Station west of Building 45	Service station				X						
Smoke Stack	incinerator								X		
T116	Carpenter Shed Addition			X							
T138	Wharf shed/storage	X	X								
T139	Wharf shed/storage	X	X								
T141	Wharf shed/storage	X	X								
T143	Wharf shed/storage	X	X								
T197	Maintenance/ Box Shop			X							
T199	Maintenance/body repair/radiator shop			X							
TO127	Storehouse	X									
TO131	Storehouse	X	X	X							
TO132	Storehouse	X									

Area I - FSIPs/SSHPs

Contents

Field Site Investigation Plan

for

Area I Fuel Storage Facilities At Building 53

This Field Site Investigation Plan (FSIP) presents the background, rationale, and scope of field activities to be conducted at the fuel facilities associated with Building 53. The FSIP follows the rapid characterization approaches for the fuel facilities use category as outlined in Section 5 of this Arsenal-Wide Investigation Workplan for the Benicia Arsenal (Arsenal), where applicable. The purpose of activities described in this FSIP is to investigate features, based on information available as of January 1998, suspected or confirmed to have the potential to cause contamination to soil or groundwater from past Department of Defense (DoD) use of the fuel facilities at Building 53.

Section 1. Site Background and Location

Building 53 is currently a machine shop and is owned by Gordon Potter. At the time of a March 1998 site inspection, machine shop activities involving the use of oils and greases were underway inside Building 53. The building is located east of Building 56A (Figure 1).

Section 2. Site History and Historical Use

The history of Building 53 reportedly includes the installation of one 4,000-gallon gasoline underground storage tank (UST), one 10,000-gallon high-octane gasoline UST, one 1,000-gallon diesel UST, and associated piping. Diesel and gasoline was pumped to the Building 53 tank system from the 1,400-gallon diesel and 10,000-gallon gasoline tank system at Building 154 through approximately 340 lineal feet of piping that was (is) located along the southern edge of Building 56. Table 1 summarizes background information for this fuel facility and it's associated features.

Building 53 was constructed in 1942 for the storage of oils, paints, varnishes, and alcohol. In 1943, Building 53 was converted to a dynamometer shop and engine testing facility.

Historical drawings show the location of two proposed USTs, one installed UST, and associated pipelines at Building 53 (Jacobs, 1998). An April 1943 drawing shows the proposed locations of the 10,000-gallon high-octane gasoline UST and 1,000-gallon diesel USTs. These USTs were to be installed approximately 125 feet west of Building 53. A January 1951 drawing shows an existing UST installed 2 feet below grade and 11 feet west of the southwest corner of Building 53 but does not show the other two USTs. It is unclear whether the 10,000-gallon high-octane gasoline UST and 1,000-gallon diesel UST indicated on the April 1943 drawing were ever installed. If they were installed in the location indicated on the drawing, the footprint of the expansion of Building 56A (which occurred in 1944) would have covered these two USTs. Physical evidence of the three USTs or associated piping was not visible during a site visits.

Section 3. Previous Investigations

No previous investigations have been conducted for the fuel storage facilities at Building 53.

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57B

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154

AUXILLARY TANKS
MOUNTED ON BLDG 154

GASOLINE
10,000 GAL.

EXISTING
CONCRETE
SLAB

GASOLINE
7,000 GAL.

INLET

WHITE GASOLINE
1,400 GAL.

RETURN FROM BLDG 53

INLET

FILLPORT

INLET

FILLPORT

RETURN FROM
BLDG 53

CONCRETE

ASPHALT

56A

MAY HAVE BEEN REMOVED
WHEN 4,000 GAL UST
WAS INSTALLED

GASOLINE
10,000 GAL

DIESEL OIL
1,000 GAL

AUXILLARY GASOLINE TANK
MOUNTED ON BLDG 53

AUXILLARY DIESEL TANK
MOUNTED ON BLDG 53

GASOLINE 4,000 GAL
USES FORMER
10,000 GAL PIPING

FILLPORT

53

RAMP

FIRE HYDRANT

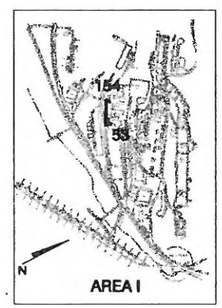
STORM DRAIN

LINCOLN STREET

LINCOLN STREET

LEGEND

181	Buildings
- - - - -	UST/Tank Line
++++++++++	Railroad Tracks
→	Fluid Flow Direction
▫	Concrete Block Encasing Fillport or Tank Inlet for Fluid Level Measurement



N

10 0 10 20 30 40
Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Site Location Map
Fuel Storage Facilities at Building 154 and 53

Area I - Field Site Investigation Plan
Benicia Arsenal

FIGURE 1

1-29-99 jkr p:\Special\DACW05-97-D-0035A_E\workplan\FSIP\b154site.dwg

Table 1

Background Information for Fuel Storage Facilities at Building 53

Facility ID	Feature	Function	Materials Handled	Evidence	Present Status
Building 53 (outside)	4,000-gallon gasoline UST and associated piping	Storage of fuels from the Building 154T tank system for Building 53	• Leaded Gasoline • Lead	Records Research Report	Unconfirmed
	10,000-gallon high octane gasoline UST and associated piping	Storage of fuels for Building 53	• Leaded Gasoline • Lead	Records Research Report	Unconfirmed. Possibly located beneath the southern portion of Building 56A. Records are not clear if UST was installed.
	1,000-gallon diesel UST and associated piping	Storage of fuels for Building 53	Diesel	Records Research Report	Unconfirmed. Possibly located beneath the southern portion of Building 56A. Records are not clear if UST was installed.

Section 4. Data Quality Objectives

The data quality objectives (DQOs) for this field investigation are presented in Table 2. The United States Army Corps of Engineers (USACE) Data Quality Objective Guidance worksheet was used to generate Table 2.

Section 5. Sampling Plan

There is no available data indicating the removal of the USTs. No investigation has been conducted to date with regard to possible petroleum hydrocarbon or lead contamination associated with USTs and associated piping. Therefore, the USTs and associated piping may remain in place at Building 53. The following is proposed for this FSIP.

Review additional records as they become available during the investigation including facility drawings and documents on file at local agencies to determine any additional history about the installation or removal of the USTs at Building 53.

A geophysical survey will be conducted to confirm the existence and determine the location of the USTs and associated piping.

If the geophysical survey identifies anomalies indicating the possible location of the USTs and associated piping or the survey is inconclusive, a subsurface investigation will be conducted.

The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and/or groundwater (if encountered) from petroleum hydrocarbons and lead.

File Review. Facility drawings and documents from the USACE were reviewed for any additional historical data not included in the Records Research Report (RRR) (Jacobs, 1998). The Solano County Department of Environment and Management and local fire department records were also reviewed for any references to USTs or previous investigations at Building 53. Reviewed records regarding the existence of three USTs are inconclusive. Additional records discovered during the investigation will be reviewed as they become available. If additional records indicate that the USTs were removed, then no further investigation will be conducted.

Table 2

Data Quality Objectives

State the Problem:

Confirm the existence of fuel storage facilities at Building 53 (two USTs [underground storage tank] beneath the southeastern corner of Building 56A and one UST near the west wall of Building 53). Determine the presence of petroleum hydrocarbons and lead in soil and/or groundwater associated with fuel storage activities at this Department of Defense (DoD) facility.

Identify the Decision:

Investigation-wide decisions:

- Assess the impact of soil type and stratigraphy on the mobility and distribution of chemicals of potential concern (COPC).
- Assess if COPC are present in soil and/or groundwater and if concentrations exceed assessment criteria and may require additional data collection, risk analysis or remediation.

Feature-specific Decisions:

- Determine if the USTs and associated piping exist beneath the southeastern corner of Building 56A and near the west wall of Building 53. Determine if they require removal or closure.
- If USTs and related pipelines exist, assess if COPC are present in soil or groundwater beneath the tanks and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis or remediation.

Identify Inputs:

- Results of facility drawings from the United States Army Corps of Engineers (USACE), and Solano County and local fire department files in the area of the UST(s) and associated pipelines.
- Results of geophysical survey in the area of the UST(s) inside the southeastern corner of Building 56A and outside the west wall of Building 53.
- Numeric assessment criteria for Arsenal COPC that will be compared to soil and groundwater sample analytical data.
- Analytical results from soil samples collected in areas of geophysical survey anomalies for UST(s).
- Analytical results from soil and/or groundwater samples for petroleum hydrocarbons and lead collected from soil borings, located beneath the southeastern corner of Building 56A.

Physical Study Boundaries:

- The area inside the southeastern portion of Building 56A will be investigated.
- The area west of Building 53, extending to the eastern side of Building 56A will be investigated.
- This investigation will not include the buildings infrastructure, sewer or storm drain system.

Practical Study Boundaries:

- Shallow groundwater will be sampled beneath USTs only if encountered near the bottom of the USTs and pipelines.

Temporal Study Boundaries:

- Standard field and analytical methods are proposed to generate data useable for the duration of investigation and remediation.

Table 2

Data Quality Objectives

- Limited temporal influence on groundwater sampling data may result from tide-related changes in groundwater.
- Field activities and sample results are not anticipated to be significantly affected by changing weather conditions

General Site Decision Rules:

- If results for COPC are above detection limits, then values will be compared against assessment criteria. If values are below the assessment criteria, the investigation will be considered complete. If values exceed assessment criteria, results will be evaluated and recommendations made for possible additional data collection, risk analysis, or remediation.
- If county records indicate tank(s) beneath the southeastern portion of Building 56A or along the west wall of Building 53 have been removed, then no further investigation will be performed.
- If county records are inconclusive, a geophysical survey will be conducted.
- If the geophysical survey results from the areas suspected to contain the UST(s) and piping indicate that the UST(s) and associated pipelines are not present, no further investigation will be performed.
- If the geophysical survey results from the areas of the UST(s) are inconclusive or show anomalies, then soil samples will be collected from angle borings and test pits. Angle borings will be drilled beneath Building 56A to sample soil beneath the suspected UST(s). Test pits will be dug in the suspected lank location or anomaly location along the west wall of Building 53. A grab groundwater sample will be collected if shallow groundwater is encountered in any of the borings or test pits.
- If angle borings and/or test pits confirm the presence of USTs and/or pipelines, then a tank and pipeline removal program will be initiated by the USACE.
- If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel then step-out/step-down samples will be collected in a triangular pattern, until the extent of the contamination is defined.

Specify Tolerable Limits on Decision Errors:

- The analyses must provide definitive data. Accuracy, precision, and completeness objectives set forth in the Arsenal-Wide Quality Assurance Project Plan will apply.
- Assessment criteria will be used as absolute values to compare point-by point to analytical results. Results that exceed assessment criteria will be evaluated further.

Optimize Design for Study:

Based on site history and file review activities, collect soil and groundwater samples at pre-selected locations and depths. Sequence investigation activities so that scope of work can be modified as new information is collected.

Geophysical Survey. A geophysical survey will be conducted between Building 56A and Building 53 and within the southeastern corner of Building 56A. One set of railroad tracks exists at the site. The railroad tracks and existing utilities, including a fire water line that is located along the south side of Building 56A, may impede the identification of any subsurface piping related to the USTs. Utility providers will be called to the site to identify their respective lines.

Subsurface Investigation. If the geophysical survey does not indicate the presence of USTs or associated piping, no further investigation will be conducted. If the geophysical survey is inconclusive or indicates the presence of USTs or pipelines, angle borings and test pits will be dug to confirm the presence of the UST or piping.

Subsurface activities will include soil borings and test pits, and collecting soil and groundwater (if encountered) samples.

Table 3 summarizes commonly used substances of concern identified during record search to have been used at the fuels storage facilities at Building 53. This table also correlates each substance to an analytical method that will be used to assess if the substance if present. Table 4 presents the specific sampling and analysis activities that will be conducted to evaluate the substances presented in Table 3.

Table 4 lists the general requirements for sampling at Building 53 based on the size of the UST and in accordance with Tri-Regional Board Guidelines (August 1990). The purpose of these activities will be to assess the nature and extent of potential impacts from previous uses.

Table 3

Summary of Commonly Used Substances at Building 53 and Analytical Rationale

Building 53 Substance of Concern	Commonly Associated Chemical Type	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Fuels	Gasoline	M8015V (volatile TPH)	M8015V (volatile TPH)	
	Diesel	M8015E (extractable TPH)	M8015E (extractable TPH)	TO-14
	BTEX	SW8260B (VOCs)	SW8260B (VOCs)	
	PAH	SW8310 (PAH)	SW8310 (PAH)	
	Lead	SW7421	SW7421	

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = poly aromatic hydrocarbons
VOCs = volatile organic compounds

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Building 53

Attribute Investigated	Reference Point	Sampling Point/Sample Name	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
4,000-gallon gasoline UST	Building 53 (west) and Lincoln Street	IB053SB001	Approximately 15 feet northwest of southwest corner of Building 53	Test Pit/6 feet and 11 feet	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
4,000-gallon gasoline UST	Building 53 (west) and Lincoln Street	IB053GR001	Standing water in bottom of test pit	Test Pit/11 feet	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
Pipelines to 4,000-gallon gasoline UST from Building 53	Building 53 and Lincoln Street	No Samples	Approximately every 40 feet along pipeline	Test Pits to verify pipeline existence	Soil	Diesel and leaded gasoline	NONE
Pipelines to 1,000-gallon diesel UST and 10,000-gallon gasoline UST from the 4,000-gallon UST	Building 53/56 and Lincoln Street	No Samples	Approximately every 40 feet along pipeline	Test Pits to verify pipeline existence	Soil	Diesel and leaded gasoline	NONE
Pipelines from 4,000-gallon gasoline UST to the Building 154 UST system	Building 53/56 and Lincoln Street	No Samples	Approximately every 40 feet along pipeline	Test Pits to verify pipeline existence (a maximum of three test pits, if the pipelines are present in the first test pit, then the other test pits will not be dug)	Soil	Diesel and leaded gasoline	NONE

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Building 53

Attribute Investigated	Reference Point	Sampling Point/Sample Name	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
1,000-gallon diesel UST and 10,000-gallon gasoline UST	Building 53/56A and Lincoln Street	IB053SB002	South side of Building 56, 30 feet west of southeast corner, begin boring 7 feet south of building 56	Angle boring using 25 degrees from horizontal 9 feet bgs = 22 feet boring length 14 feet bgs = 33 feet boring length 19 feet bgs = 44 feet boring length	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
1,000-gallon diesel UST and 10,000-gallon gasoline UST	Building 53/56A and Lincoln Street	IB053GR002	South side of Building 56, 30 feet west of southeast corner, begin boring 7 feet south of building 56	Angle boring using 25 degrees from horizontal 14 feet bgs = 33 feet boring length	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
1,000-gallon diesel UST and 10,000-gallon gasoline UST	Building 53/56A and Lincoln Street	IB053SB003	East side of Building 56, 7 feet north of ramp, begin boring 5 feet east of Building 56	Angle boring using 25 degrees from horizontal 20 feet bgs = 46 feet boring length 24 feet bgs = 57 feet boring length	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
1,000-gallon diesel UST and 10,000-gallon gasoline UST	Building 53/56A and Lincoln Street	IB053GR003	East side of Building 56, 7 feet north of ramp, begin boring 5 feet east of Building 56	Angle boring using 30 degrees from horizontal 18.5 feet bgs = 37.0 feet boring length	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Building 53

Attribute Investigated	Reference Point	Sampling Point/Sample Name	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]

[1]Sampling points, locations, depths, and analytical methods to be determined in the field. The sampling points, locations, depths, and analytical methods listed for this table are only a guide in accordance with Tri-Regional Board guidelines for UST tank removals.

[2] Diesel and leaded gasoline are considered chemicals of potential concern at these sampling locations because of the proximity of the diesel UST to the other USTs and the potential for some lateral migration of contaminants.

[3] Groundwater samples for dissolved lead will be filtered using a 0.45 µm filter.

Notes:

Field QC samples, including trip blanks, equipment blanks, and field duplicates, will be taken at the minimum frequency specified in the QAPP.

If laboratory results in soil are greater than 250 mg/kg for TPH - gas, and 500 mg/kg for diesel, than step-out and/or step-down samples will be collected and analyzed. See step-out and step-down decision logic in Section 5 of the Arsenal Wide Investigation Workplan

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes

PAH = poly aromatic hydrocarbons

VOCs = volatile organic compounds

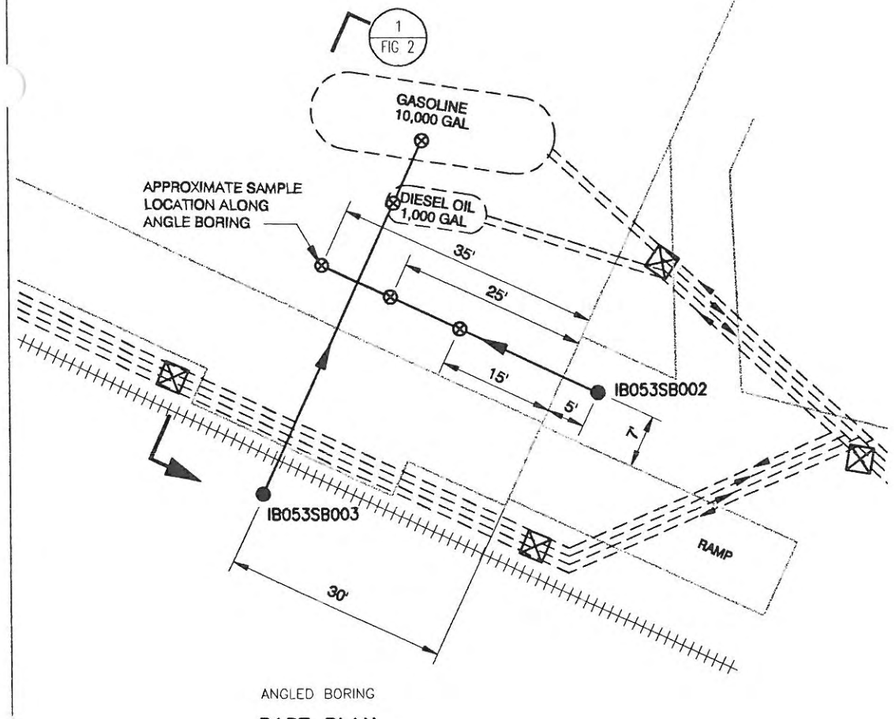
It is anticipated that three test pits should be sufficient to determine the presence of this piping corridor. If the first test pit along the Building 154/Building 53 piping corridor indicates that the piping is present, then the other test pits will not be dug. In addition, the FSIP for fuel facilities at Building 154 includes test pits to confirm the presence of the Building 154/53 piping corridor. If this investigation is completed by the start of the Building 154 investigation, and the piping is not present, then the test pits for this investigation will not be dug along the Building 154/53 piping corridor. If the piping is present at the Building 154 side, then the test pits will be dug to confirm that they are present at the Building 53 side. Figure 2 shows the proposed locations of the test pits. Recommended analyses for each location is presented in Table 4 and summarized on Table 5.

If a UST is encountered in a test pit and samples cannot be collected, then one additional test pit will be dug for the collection of soil and/or groundwater samples. This test pit will be located a distance approximately twice the tank diameter in the direction of the fillpoint end of the UST. If the diameter is not known, the diameter will be estimated based on similar tanks of known diameter at the Arsenal. If the fillpoint is unknown, then the test pit will be dug in the downgradient direction from the UST.

One test pit will be located approximately 15 feet northwest of the southwest corner of Building 53 to locate the 4,000-gallon gasoline UST and piping. Additional test pits will be dug to confirm the presence of piping from Building 53 to the 4,000-gallon UST, from the 4,000-gallon UST to the suspected 10,000-gallon and 1,000-gallon USTs, and from the 4,000-gallon UST to Building 154. There was (is) approximately 340 lineal feet of piping along the southern edge of Building 56A linking the tank system at Building 154 to the system at Building 53. A maximum of three test pits will be dug starting from the Building 53 tank system toward the Building 154 tank system, approximately every 40 feet.

If it is determined that the 1,000-gallon diesel and 10,000-gallon gasoline USTs exist beneath Building 56A (using geophysical methods), it will not be possible to dig test pits inside Building 56A. For these USTs, one angle boring will be drilled along the south and east side of Building 56A for the collection of soil and groundwater samples directly under the USTs. Groundwater is expected at approximately 10 feet bgs. The southern angle boring will reach the first UST at approximately 20 feet vertical depth, and 25 feet vertical depth when the boring reaches the second UST (Figure 2). The eastern angle boring will be drilled between the ramp and a planter along the east side of Building 56A. Based on the approximate locations of the USTs as drawn on Figure 2, this angle boring will pass the USTs in the downgradient direction. Samples are proposed for this boring at 10, 15, and 20 feet bgs. The angled borings may encounter groundwater before reaching the first UST. If groundwater is not encountered, three soil samples will be collected from each boring. The proposed locations, sample depths and boring lengths are shown on Figure 2 and Table 4. Sampling planned to address the workshop building complex (50 Series Complex) may provide additional data to assist in the assessment of soil and groundwater conditions in the vicinity of these suspected USTs. Details regarding this investigation will be presented in a separate FSIP for the 50 Series Complex.

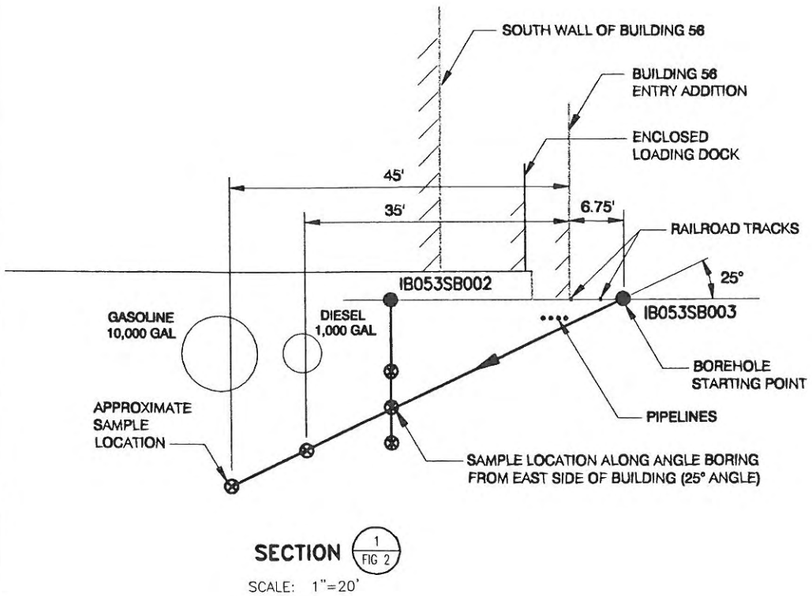
Samples collected for Building 53 will be analyzed by an on-site mobile laboratory or on-site field GC unit, if economically feasible. If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel, then step-out or step-down samples will be collected. These step-out samples may be collected using a backhoe, drilling rig, or direct push rig.



ANGLED BORING

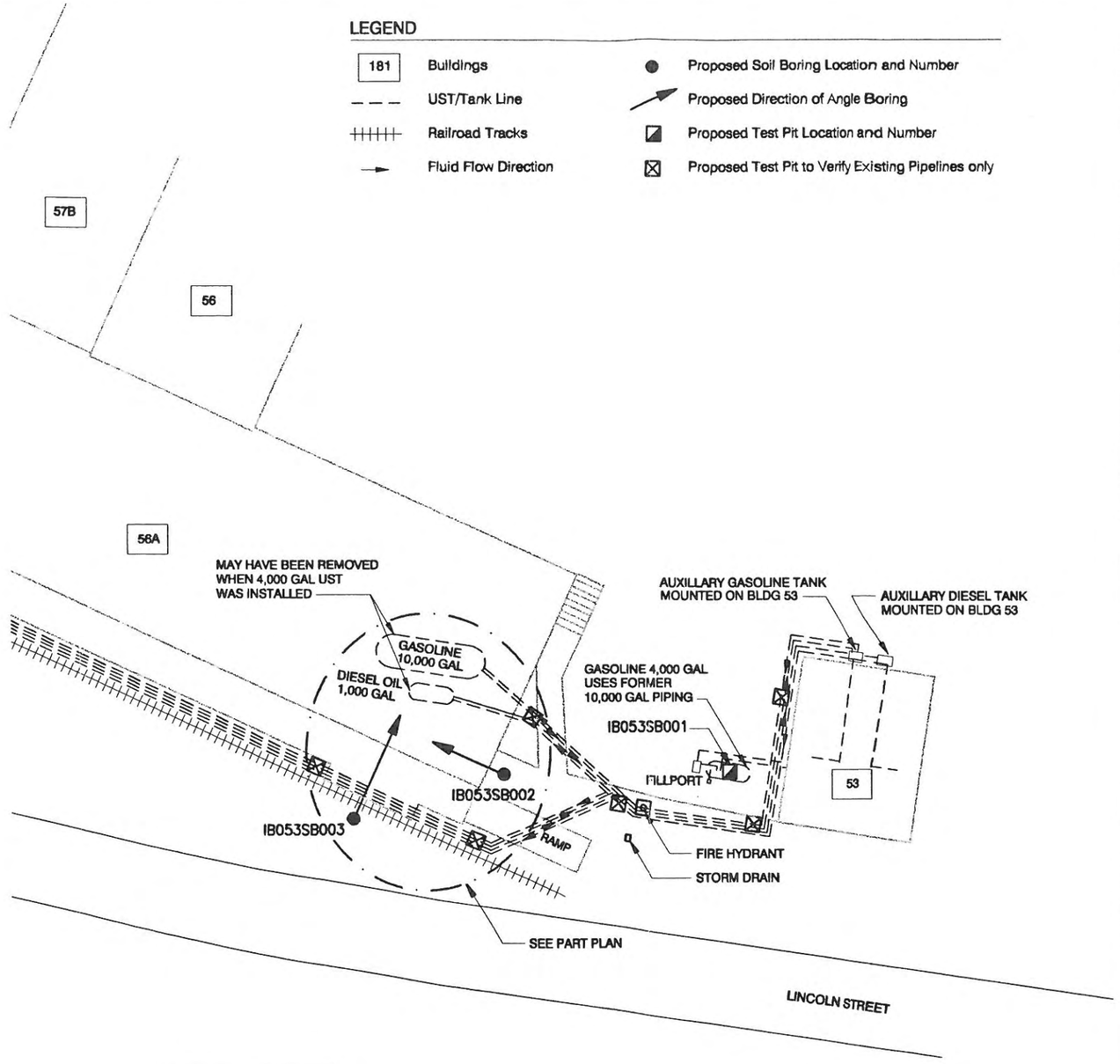
PART PLAN

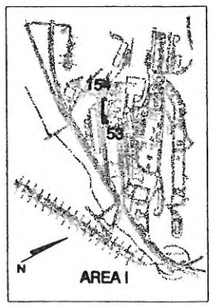
SCALE: 1"=20'

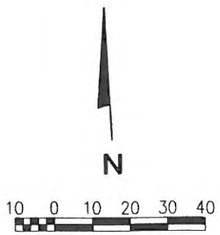


SECTION 1 / FIG 2

SCALE: 1"=20'







Note: All site features referenced in Records Research Report (Jacobs Engineering) documents or noted during site inspection are included on this figure.

Boring/Test Pit Location Map
Fuel Storage Facilities
at Building 53

Area I - Field Site Investigation Plan

Benicia Arsenal

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FIGURE 2

Table 5

Summary of Subsurface Investigation Activities for Fuel Facilities at Building 53

Attribute Investigated	Number of Test Pits	Number of Soil Borings	Number of Soil Samples	Number of Soil Gas Samples	Number of Grab Groundwater Samples
1,000-gallon diesel and 10,000-gallon gasoline UST	0	2	5	0	2(1)
4,000-gallon gasoline UST	1	0	2	0	1(1)
Pipelines to 4,000-gallon gasoline UST from Building 53	1(2)	0	0	0	0
Pipelines to 1,000-gallon diesel UST and 10,000-gallon gasoline UST from the 4,00-gallon UST	1(2)	0	0	0	0
Pipelines from 4,000-gallon gasoline UST to the Building 154 tank system	1(2)	0	0	0	0
Subtotal	4	2	7	0	3
Duplicate Samples			(A)	0	(A)
Split Samples			(A)	0	(A)
Equipment blanks			0	0	1
Total	4	2	7	0	4

(1) Samples for groundwater will be collected, if encountered, in each boring.

(2) Additional test pits may be necessary to verify existence of pipelines.

(A) The number of duplicate and split samples will be based on the total number of samples collected for all FSIPs done in conjunction with this FSIPs.

Generally, step-out samples will be collected in a triangular pattern (if possible) away from the original sample for lateral definition. Step-out sample locations may be moved or omitted if access is insufficient for the backhoe, drilling or direct push rig, or subsurface obstructions are encountered (i.e., overhead and underground utilities, or other facility substructures). Vertical definition will be determined by collecting additional sample(s) downward from the original sample, until groundwater is encountered.

Section 6. Schedule of Work

Once field activities begin, the Building 53 fuel facilities investigation will be conducted in a sequence which will enable project personnel to refine the scope of work as new data are collected. In general, non-invasive activities will be conducted first, followed by invasive activities. As described above, the initial step will be to complete file review. Upon completion of the file review, the geophysical survey will be conducted inside and outside the buildings to better define targets and clear drilling locations. The initial invasive activity will be to collect soil and groundwater samples (if encountered) in test pits or angle borings.

Section 7. Sample Analyses

A description of the chemical analyses to be conducted on each soil and groundwater sample is presented in Table 4. A detailed description of each analytical method is presented in the Quality Assurance Project Plan (QAPP) (Brown and Caldwell, 1999). QA/QC sampling protocol is also described in the QAPP and will include collecting sample duplicates (10 percent frequency), sample splits (10 percent frequency), and sample splits (10 percent frequency) for each media (see Table 6). One equipment blank will be collected for this FSIP. Trip blanks will be analyzed for each VOC sample shipment. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected in coordination with the analytical laboratory for the appropriate methods so that each analytical batch contains an MS/MSD sample as required by the QAPP. The Contract Analytical Laboratory procedures and services will be in accordance with the QAPP.

After collection (Standard Operating Procedure [SOP] 7.0), samples will be packed, preserved, and shipped via courier or overnight delivery as described in SOPs 9.0 and 10.0. The analytical laboratory will be notified prior to sample shipment of the number and type of samples and analyses. Sample collection and transportation will be documented in field log books and on the sample chain of custody (SOP 4.0). Upon receipt of the sample shipment, the laboratory will document the status of the shipment by sending a copy of the completed chain-of-custody and login sheet to the Project Manager by fax.

Sample analytical results will be reported in electronic and hardcopy deliverables of sample receipt. Specifications for the laboratory reporting package are included in the QAPP.

Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. Upon completion of data validation, analytical results will be reported according to Section 5.0 of the Arsenal-Wide Investigation Workplan.

Section 8. References

Brown and Caldwell. 1999. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Jacobs Engineering. 1998. Records Research Report for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. Draft. March.

Site Safety And Health Plan
For
Area I Fuel Storage Facilities at
Building 53

Benicia Arsenal

Prepared by: _____ Date: 3/8/99
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: A. Baptiste Date: 2-17-99
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 3/8/99
Ms. Wendy Linck
Site Safety Officer

Effective Dates: 3/8/99 to 3/8/2000

Site Safety and Health Plan
for
Area I Fuel Storage Facilities at Building 53

Preface

The Forsgren Associates/Brown and Caldwell (FA/BC) Health and Safety (H&S) Program Manual and the Benicia Arsenal General Site Safety and Health Plan (General SSHP) for the Benicia Arsenal (Arsenal) Formerly Used Defense Site (FUDS), will be referenced throughout this site-specific SSHP. The FA/BC H&S Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, section 203.5, page 2-13.

PROJECT SUMMARY

The purpose of this investigation is to confirm the existence of fuel storage facilities (three USTs and associated pipelines) at Building 53 in Area I and assess whether soil and/or groundwater have been impacted by petroleum hydrocarbons associated with these facilities. The tasks for this investigation includes a geophysical survey, subsurface investigation (utility clearance, test pits, and drilling), and groundwater and soil sampling.

KEY PERSONNEL

The key personnel for this site-specific SSHP are:

- Program Manager: Mr. Dave Jones.
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist.
- Project Manager: Ms. Patti DeLaO.
- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez.

Descriptions of responsibilities for each key personnel and subcontractor are included in the Benicia Arsenal General SSHP.

Project Contacts

A reference list of project contacts is located in the Benicia Arsenal General SSHP.

HAZARD ANALYSIS

The site-specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for this site is presented in Table 1.

Chemical Hazards

Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table 2.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. General training requirements for all FA/BC staff working on site is described in the Benicia Arsenal General SSHP.

PERSONAL PROTECTIVE EQUIPMENT

The minimum required level of personal protection on the site at all times is level D. Level D includes safety boots/shoes, safety glasses, and a hard hat. In addition to this protection, colored Tyvek© coveralls (preferably blue or brown) or equivalent will

Table 1

Potential Hazards and Recommended Controls for Building 53 Investigation Activities

Potential Hazards	Recommended Controls
Chemical Exposure	The minimum level of proper Personal Protective Equipment (PPE) during activities is Level D. This level is adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Air monitoring will be performed with an Organic Vapor Monitor or equivalent to monitor the air quality in and around the work zone.
Back Injury	There are no heavy pieces of equipment anticipated for this project that would require lifting and possible back injuries. In any event, use proper lifting techniques and use adequate back support during all field tasks.
Noise	Heavy equipment is anticipated for this project (i.e. drilling rig and backhoe), such that hearing protection may be necessary. Use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum Handling	Drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums.
Migration of Contamination	A work zone will be delineated before start of work. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figure 1 is provided in this SSHP to show the area of the work zone.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, Trips, and Falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e. steep slopes, potholes, and uneven surfaces).
Utilities	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities.
Heavy Equipment	Drilling and excavating equipment maybe necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site.
Biological Hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. The area around Building 53 is open and these types of biological hazards are not anticipated.
Radiological Hazards	There are no radiological hazards anticipated for this project.

PPE: Personal Protective Equipment

Table 2

Chemical Exposure Limits and Characteristics Controls for Building 53 Investigation Activities

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	IDLH[d] level	Flammable range percent	Odor threshold, ppm	Notes[e]	Potential symptoms of exposure[f]
Benzene	9.24	150	0.5 ppm	Ca (500 ppm)	1.3-7.9	4.68	C,F,65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Toluene	8.82	110	50 ppm	500 ppm	1.2-7.1	0.17-40	T,F,65	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Ethylbenzene	8.76	100	100 ppm	800 ppm	1.0-6.7	0.25-200	T,F	Irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Xylene	8.56	111	100 ppm	800 ppm	1.0-7.0	0.05-200	T,F	Dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Lead	NA	NA	0.05 mg/m^3	100 mg/m^3	NC	NA	C,T,65	Immediate irritation to eyes, insomnia, facial pallor, anorexia, weight-loss, abdominal pain, constipation, colic, anemia

[a] Ionization potential in electron-volts (eV).
[b] Century Organic Vapor Analyzer relative response to the compound in percent.
[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1997.
[d] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.
[e] Hazard category; C-Carcinogen; F-Flammable; T-Toxic; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.
[f] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.
Notes: NA = Not applicable or not available, NC = Noncombustable

be worn inside the work zone, when there is a potential of contact with hazardous materials (i.e. soil handling during drilling). These items are also listed on Table 3, Field Equipment. Descriptions of other levels of PPE are described in the FA/BC H&S Manual (301 and 302; p. 1-24) and the Benicia Arsenal General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for this site. Equipment anticipated for environmental monitoring is listed on Table 3. Environmental monitoring will be in accordance with the Organic Vapor Response criteria outlined in Table 4. Generally, all projects will include monitoring of air quality in and around the work area and heat or cold stress.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for this site. The Benicia Arsenal General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

A map of the site is included as Figure 1, showing the approximate work zone. Zone locations are subject to change based on work activities, site access, and wind direction. Equipment necessary for site control measures is listed on Table 3. Further details regarding site control measures can be found in the FA/BC H&S Manual (406; p.25-28).

DECONTAMINATION

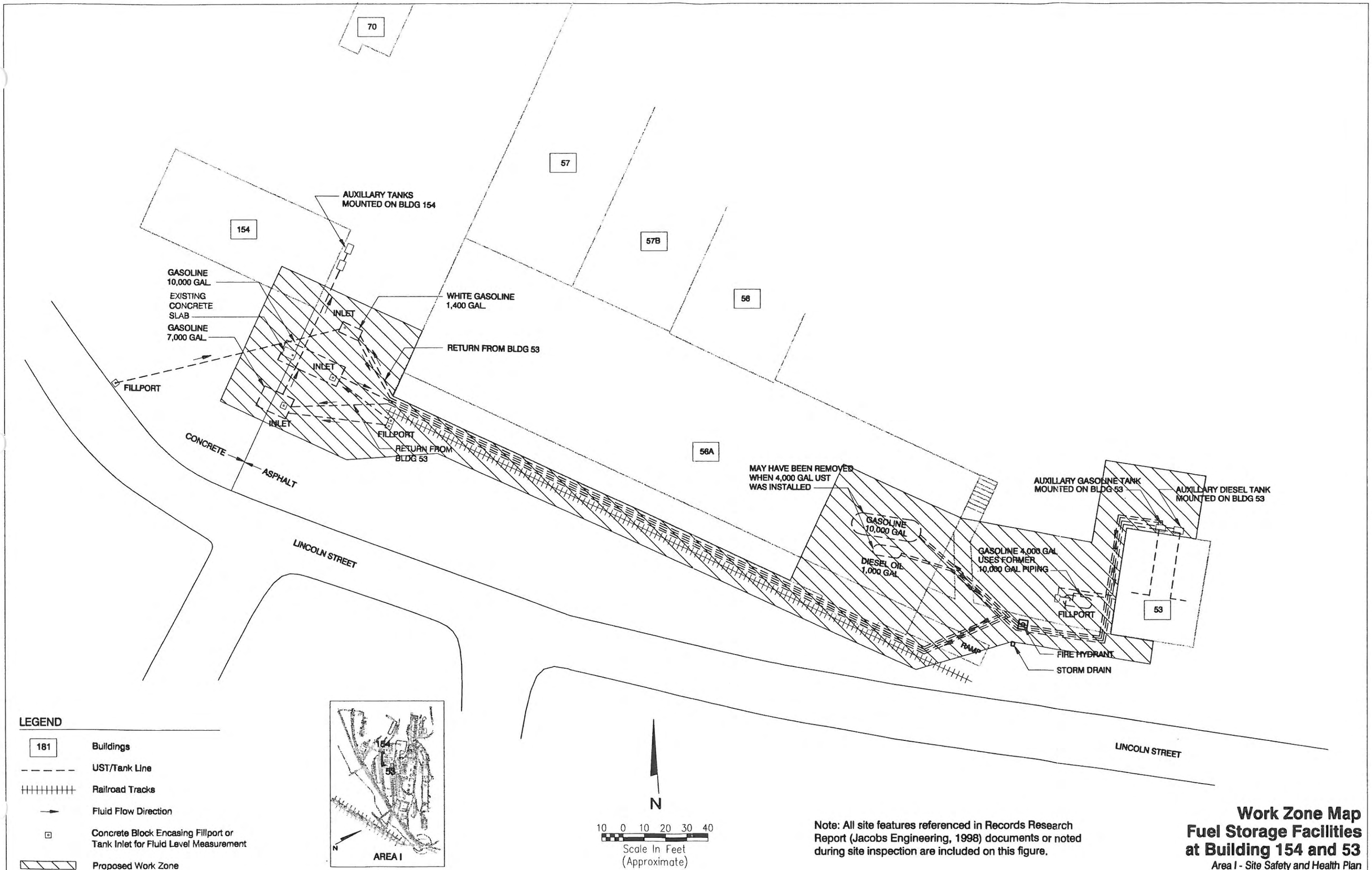
Decontamination will take place within the work zone identified on site and shown on Figure 1. A sample decontamination set-up can be found in the FA/BC H&S Manual (405; p.23). There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table 3.

EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital located at 975 Sereno Dr., Vallejo, CA., telephone number: (707)-651-1000.** Directions from this site to the nearest hospital is presented below and shown on the route to hospital map included in this document as Figure 2.

Directions to **Kaiser Permanente Hospital** from Building 53:

- From **Lincoln Street** heading northwest to Jackson Street
- Right on **Jackson Street** head east to Polk Street
- Left on **Polk Street** heading northwest until it becomes Grant Street
- Continue northwest on **Grant Street** which becomes Military East
- Continue northwest on **Military East** to East 5th Street
- Right onto **East 5th Street** heading northeast
- Left onto on-ramp to **I-780** heading west
- Travel on **I-780 West** for approximately 5.4 miles
- Continue west onto **Maryland Street** for 1.6 miles
- Right on **Sonoma Boulevard** heading north for 2.1 miles
- Right on **Sereno Drive** heading east for 0.4 miles to 975 Sereno Drive
- Total travel time to **Kaiser Permanente Hospital** from Building 53 is approximately 10 miles taking 20 minutes.



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Work Zone Map
Fuel Storage Facilities at Building 154 and 53

Area I - Site Safety and Health Plan

Benicia Arsenal

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FIGURE 1

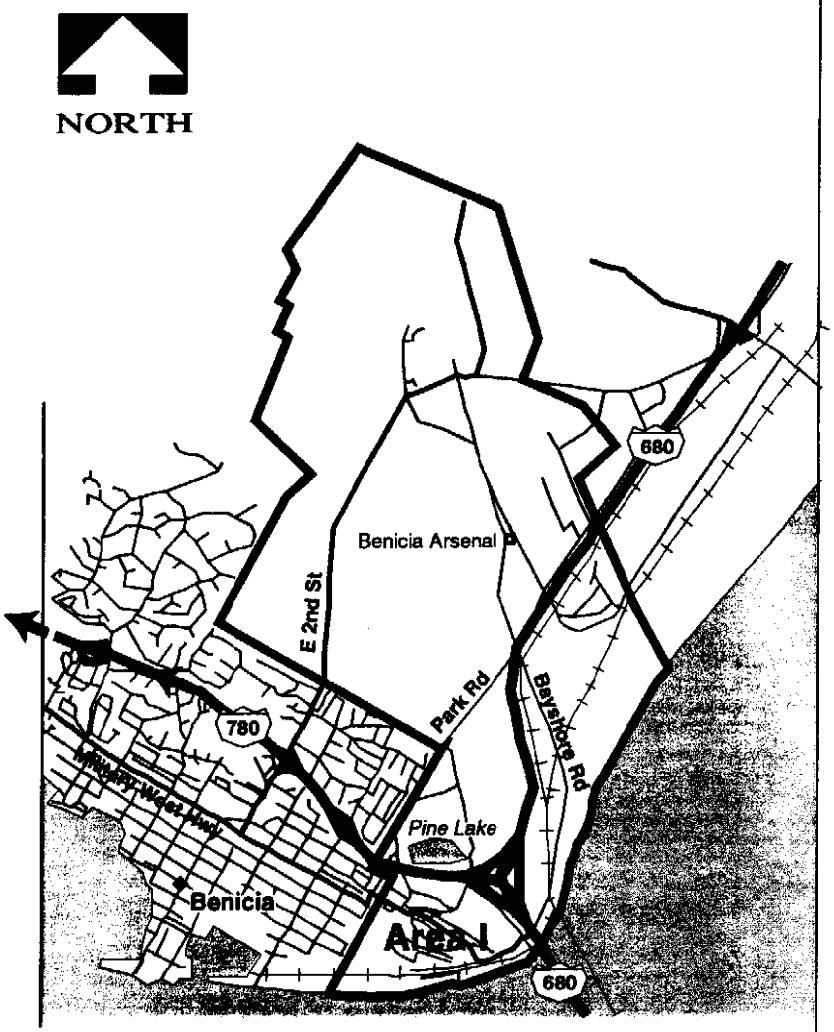
Table 3
Anticipated Field Equipment for Building 53 Investigation Activities

Equipment	Purpose and Description
Personal Protective Equipment (PPE)	
Nitrile disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. An organic vapor cartridge should be adequate protection for the contaminants expected at this site. A cartridge of this type should be changed out daily or when break through occurs, whichever comes first.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic Vapor Monitor (OVM) or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is responding to contaminants.
Benzene Detector Tubes (0.5-10ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones and Safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone.
Decontamination Equipment	
Wash buckets and soap	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e. work boots).
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/Electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field notebook.
Sampling Containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.
Sample labels, chain-of custody forms, Zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper chain-of custody forms, labels, and custody seals will be completed for proper quality control. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.

Table 4
Organic Vapor Response Criteria for Petroleum Hydrocarbons that May Include Gasoline

Organic Vapor Concentrations in Breathing Zone[a]	Sampling Frequency	Action Taken
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity.
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity. • If DTs reveal detectable concentrations greater than 1 ppm, then upgrade to Level C PPE.
10 to 100 ppm for more than 2 minutes	Every 15 minutes.	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes.	• Stop work. • Work crews position themselves upwind of site. • Re-evaluate in 15 minutes. • Contact Health and Safety Director and Project Manager. • Evacuate

[a] OVM calibrated to methane (concentrations will be less if calibrated to isobutylene)



FROM **LINCOLN STREET** HEADING NORTHWEST TO JACKSON STREET
RIGHT ON **JACKSON STREET** HEADING EAST TO POLK STREET
LEFT ONTO **POLK STREET** HEADING NORTHWEST UNTIL IT BECOMES GRANT STREET
CONTINUE NORTHWEST ON **GRANT STREET** WHICH BECOMES MILITARY EAST
CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5th STREET
RIGHT ONTO **EAST 5th STREET** HEADING NORTHEAST
LEFT ONTO ON-RAMP TO **I-780** HEADING WEST
TRAVEL ON **I-780** WEST FOR APPROXIMATELY 5.4 MILES
CONTINUE WEST ONTO **MARYLAND STREET** FOR 1.6 MILES
RIGHT ON **SONOMA BOULEVARD** HEADING NORTH FOR 2.1 MILES
RIGHT ON **SERENO DRIVE** HEADING EAST FOR 0.4 MILES TO 975 SERENO DRIVE

TOTAL TRAVEL TIME TO **KAISER PERMANENTE HOSPITAL** FROM B53
IS APPROXIMATELY 10 MILES TAKING 20 MINUTES.

Route to Hospital
Fuel Storage Facilities
at Building 53

Area I - Site Safety and Health Plan
Benicia Arsenal

P:\Specia\DACW05-97-D-0035A_E\workplan\SSHP\Hospital53.ai

FIGURE 2

The nearest telephone is located in the work zone. If a cell phone is to be used for emergency purposes, it must be checked upon arrival to the site to verify that reception to the area is available. **When a cell phone is used for emergency purposes, dial (707) 745-3411 or (707) 745-3412.** The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC H&S Manual (Forward; p. F-5). **In the event of a medical emergency, 911 will be dialed first.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this Workplan. The procedures and frequency in which each Attachment must be completed is described in Table 5.

Table 5
Attachments A – E Building 53 Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the Project Manager and the Health and Safety Director will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e., field notes, boring logs) submitted by the contractor at the end of the day.	Daily

Field Site Investigation Plan

for

Area I Fuel Storage Facilities at Former Building 73

This Field Site Investigation Plan (FSIP) presents the background, rationale, and scope of field activities to be conducted at the fuel facilities associated with former Building 73. The FSIP follows the rapid characterization approaches for the fuel facilities use category as outlined in Section 5 of this Arsenal-Wide Investigation Workplan for the Benicia Arsenal (Arsenal), where applicable. The purpose of activities described in this FSIP is to investigate features, based on information available as of January 1998, suspected or confirmed to have the potential to cause contamination to soil or groundwater from past Department of Defense (DoD) use of the fuel facilities at former Building 73.

Section 1. Site Background and Location

Former Building 73 is approximated to be under the southwest corner of Building 98. Gordon Potter owns Building 98 (built in 1942) and Unico Services operates a machine shop within the building. The history of former Building 73 reportedly includes the installation of one 1,000-gallon underground storage tank (UST) and associated piping, a battery of three pumps and tanks for oils, a 5-gallon gasoline pump, and a 15-ton truck scale. It is not clear from the available information if the "oils" are waste oils or fuel oils.

Section 2. Site History and Historical Use

According to historical records, former Building 73 was built in 1920 and was used as a service station. Sometime after 1932 the building was removed. The former location of this building is identified on the Benicia Ordnance Depot General Map, dated 18 May 1932. Former Building 73 covered an area 16 feet by 15 feet, and had a concrete foundation and walls. A 1932 map of the Arsenal shows the location of former Building 73 as being approximately 100 feet north of Building 56. The former location of former Building 73 is approximated in relation to existing buildings on Figure 1. Table 1 summarizes background information for this fuel facility and it's associated features.

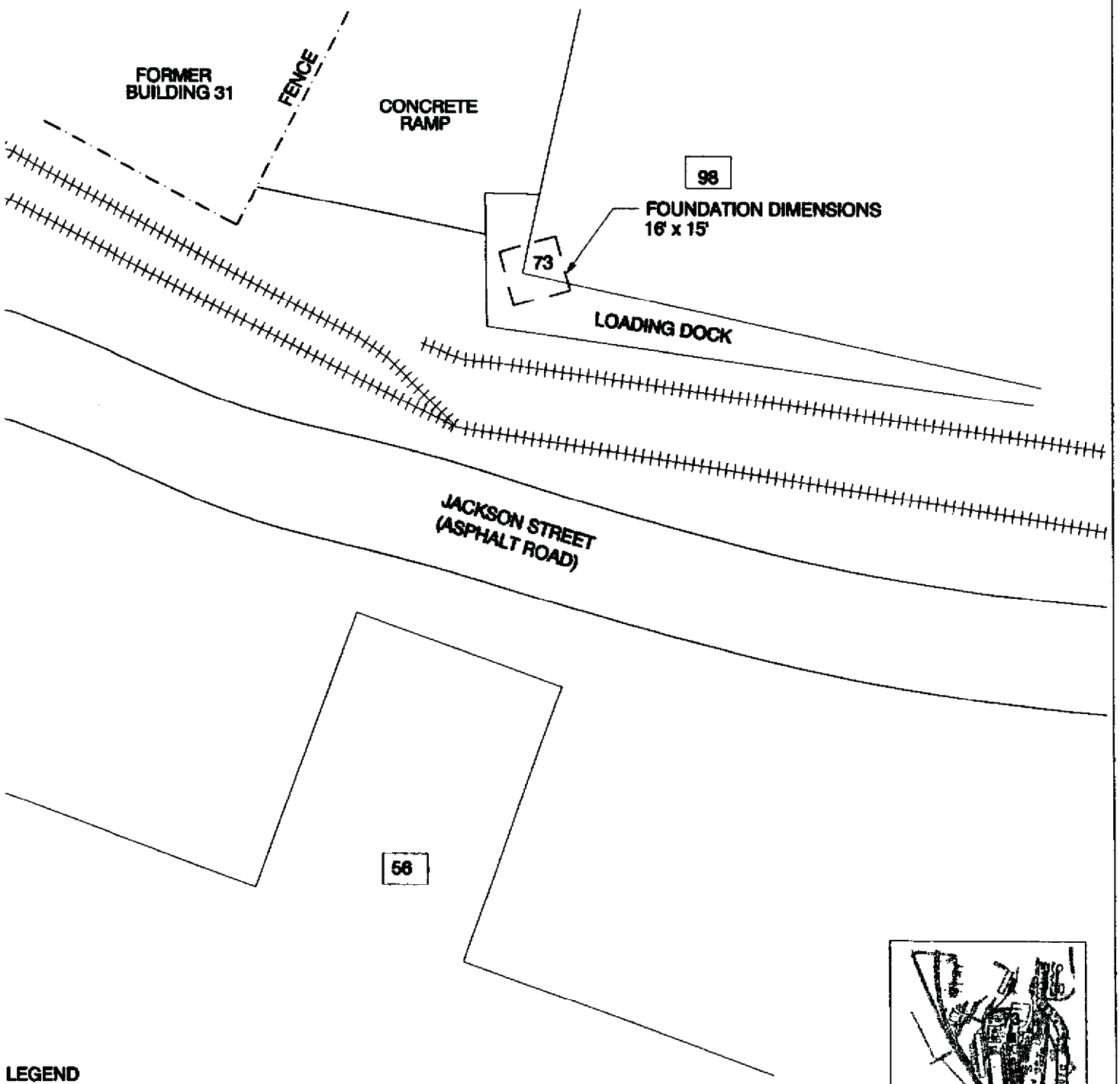
No other records or drawings for former Building 73 were recovered while preparing the Records Research Report (Jacobs Engineering [Jacobs], 1998). No information was available regarding the status of the fuel storage and dispensing facilities. However, several former Arsenal employees indicated that it was unlikely that DOD removed any of the former fuel storage facilities at former Building 73. A field site inspection in March 1998 did not show evidence of former Building 73, or associated installed equipment.

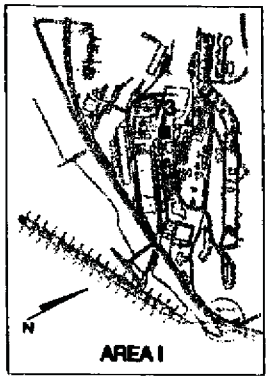
Section 3. Previous Investigations

No previous investigations have been conducted for the fuel storage facilities at former Building 73.

Section 4. Data Quality Objectives

The data quality objectives (DQOs) for this field investigation are presented in Table 2. The United States Army Corps of Engineers (USACE) Data Quality Objective Guidance worksheet was used to generate Table 2.





LEGEND

- 98 — Buildings
- 73 — Former Location of Building 73
- Fence Line
- Railroad Tracks

N

10 0 10 20 30 40
Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Location Map
Fuel Storage Facilities at Former Building 73

Area I - Field Site Investigation Plan

Benicia Arsenal

1-29-99 jkr p:\Special\DACW05-97-D0035A_E\workplan\FSIP\B73site.dwg

FIGURE 1

Table 1

Background Information for Fuel Storage Facilities at Former Building 73

Facility ID	Feature	Function	Materials Handled	Evidence	Present Status
Former Building 73	1,000-gallon fuel UST and associated piping	Storage of fuels at the former service station (former Building 73)	• Unknown fuels • Lead	Records Research Report	Unconfirmed. Possibly located beneath the southwest corner of Building 98.
	Battery of 3 pumps and tanks for oils	Storage of oils and fuel pumps at the former service station (former Building 73)	• Unknown fuels • Lead • Unknown Oils	Records Research Report	Unconfirmed. Possibly located beneath the southwest corner of Building 98.
	5-gallon gasoline pump	Fuel pump at the former service station (former Building 73)	• Unknown fuels • Lead	Records Research Report	Unconfirmed. Possibly located beneath the southwest corner of Building 98.
	15-ton truck scale	Truck scale at the former Building 73.	• None	Records Research Report	Unconfirmed. Possibly located beneath the southwest corner of Building 98.

Table 2

Data Quality Objectives

State the Problem:

Confirm the existence of fuel storage facilities at former Building 73 (one fuel UST [underground storage tank] and oils tanks (possible USTs) beneath the southwestern corner of Building 98. Determine the presence of petroleum hydrocarbons, oils, polyaromatic hydrocarbons (PAHs) and lead in soil and/or groundwater associated with fuel and oil storage activities at this Department of Defense (DoD) facility.

Identify the Decision:

Investigation-wide decisions:

- Assess the impact of soil type and stratigraphy on the mobility and distribution of chemicals of potential concern (COPC).
- Assess if COPC are present in soil and/or groundwater and if concentrations exceed assessment criteria and which may require additional data collection, risk analysis or remediation.

Feature-specific Decisions:

- Determine if the USTs, tanks, and associated piping exist beneath the southwestern corner of Building 98. Determine if they require removal or closure.
- If USTs and related pipelines exist, assess if COPC are present in soil or groundwater beneath the tanks and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis or remediation.

Identify Inputs:

- Results of facility drawings from the U.S. Army Corps of Engineers, and Solano County and local fire department files in the area of the UST(s) and associated pipelines.
- Results of geophysical survey inside the southwestern corner of Building 98 and outside the loading dock around the southwestern corner of Building 98.
- Numeric assessment criteria for Arsenal COPC that will be compared to soil and groundwater sample analytical data.
- Analytical results from soil and/or groundwater samples for petroleum hydrocarbons, oils, PAHs, and lead collected from test pits located along the west and south walls of the loading dock.

Physical Study Boundaries:

- Along the western and southern walls of the loading dock, since the thickness of the concrete loading dock and floor of the southwestern portion of Building 98 is greater than 1 foot thick.
- This investigation will not include the buildings infrastructure, sewer or storm drain system.

Practical Study Boundaries:

- Shallow groundwater will be sampled in the location of the USTs only if encountered near the bottom of the USTs and pipelines.

Table 2

Data Quality Objectives

Temporal Study Boundaries:

- Standard field and analytical methods are proposed to generate data useable for the duration of investigation and remediation.
- Limited temporal influence on groundwater sampling data may result from tide-related changes in groundwater.
- Field activities and sample results are not anticipated to be significantly affected by changing weather conditions

General Site Decision Rules:

- If results for COPC are above detection limits, then values will be compared against assessment criteria. If values are below the assessment criteria, the investigation will be considered complete. If values exceed assessment criteria, results will be evaluated and recommendations made for possible additional data collection, risk analysis, or remediation.
- If county records indicate the UST(s) have been removed, then no further investigation will be performed.
- If county records are inconclusive, a geophysical survey will be conducted.
- If the geophysical survey results from the areas suspected to contain the UST(s) and piping indicate that the UST(s) and associated pipelines are not present, no further investigation will be performed.
- If the geophysical survey results from the areas of the UST(s) are inconclusive or show anomalies, then soil samples will be collected from test pits. Test pits will be dug in the suspected lank location or anomaly location along the west and southern walls of the loading dock. A grab groundwater sample will be collected if shallow groundwater is encountered in any of the test pits.
- If test pits confirm the presence of USTs and/or pipelines, then a tank and pipeline removal program will be initiated by the USACE.
- If laboratory results in soil are greater than 250 mg/kg for TPH - gas, and 500 mg/kg for diesel then step-out/step-down samples will be collected in a triangular pattern, until the extent of the contamination is defined.

Specify Tolerable Limits on Decision Errors:

- The analyses must provide definitive data. Accuracy, precision, and completeness objectives set forth in the Arsenal-Wide QAPP will apply.
- Assessment criteria will be used as absolute values to compare point-by point to analytical results. Results that exceed assessment criteria will be evaluated further.

Optimize Design for Study:

Based on site history and file review activities, collect soil and groundwater samples at pre-selected locations and depths. Sequence investigation activities so that scope of work can be modified as new information is collected.

Section 5. Sampling Plan

There is no available data indicating the disposition of the UST or whether or not any previous investigations have been conducted at former Building 73. The presence of the UST and associated piping has not been positively determined. The File Review was conducted and results were inconclusive. Therefore, the UST and associated piping may remain in place at the former location of former Building 73. The following is proposed for this FSIP.

Review additional records as they become available during the investigation including facility drawings and documents on file at local agencies to determine any additional history about the installation or removal of the UST at former Building 73.

A geophysical survey will be conducted to confirm the existence and determine the location of the UST and associated piping.

If the geophysical survey identifies anomalies indicating the possible location of the UST and associated piping or the survey is inconclusive, a subsurface investigation will be conducted. The purpose of the investigation will be to determine the presence of the UST and associated piping and the possible presence and magnitude of impact to the subsurface soil and groundwater (if encountered) from petroleum hydrocarbons.

The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and/or groundwater (if encountered) from petroleum hydrocarbons and lead.

File Review. Facility drawings and documents from the U.S. Army Corps of Engineers were reviewed for any additional historical data not included in the Records Research Report. The Solano County Department of Environment and Management and local fire department records were also reviewed for any references to USTs or previous investigations at former Building 73. Reviewed records regarding the existence of the USTs are inconclusive. Additional records discovered during the investigation will be reviewed as they become available. If additional records indicate that the UST was removed, then no further investigation will be conducted.

Geophysical Survey. A geophysical survey will be conducted outside the southwest corner of Building 98, near the approximated location of the former Building 73, and inside Building 98 (if possible). The outside of Building 98 in the area of the former Building 73 is a loading dock (Figure 1). The concrete loading dock may be reinforced with rebar, as well as the interior floor of Building 98. In addition, utility lines may exist in this area. These metallic features (rebar and utility lines) will result in high magnetic readings, which may mask any pipes and/or the UST which may be located deeper than the rebar or utility lines. This masking effect may impede the identification of any subsurface piping related to the UST and the UST itself. As a result, a geophysical survey may not be possible. Utility providers will be called to the site to identify their respective lines.

Subsurface Investigation. If the geophysical survey does not indicate the presence of USTs or piping then no further investigation will be conducted. If the geophysical survey is inconclusive or indicates the presence of the UST or pipelines, test pits will be dug to confirm the presence of the UST or pipelines.

Subsurface activities will include test pits, and collecting soil and groundwater (if encountered) samples. Table 3 summarizes commonly used substances of concern identified during record search to have been used at the fuels storage facilities at former Building 73. This table also correlates each substance to an analytical method that will be used to assess if the substance if present. Table 4 presents the specific

Table 3

Summary of Commonly Used Substances at Former Building 73 and Analytical Rationale

Former Building 73 Substance of Concern	Commonly Associated Chemical Type	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Fuels	Unspecified fuels	M8015V (volatile TPH) M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH)	M8015V (volatile TPH) M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH)	TO-14
	Lead	SW7421	SW7421	
Oils (waste)	Unspecified oils	M8015E (extractable TPH) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (oil and grease) SW8310 (PAHs) SW6020 (Cd, Cr, Pb, Ni, and Zn only)	M8015E (extractable TPH) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (oil and grease) SW8310 (PAHs) SW6020 (Cd, Cr, Pb, Ni, and Zn only)	TO-14

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
Cd = Cadmium
Cr = Chromium
Ni = Nickel
PAH = Poly aromatic hydrocarbons
Pb = Lead
SVOCs = Semi-volatile organic compounds
VOCs = Volatile organic compounds
Zn = Zinc

Table 4
Sampling and Analysis Matrix and Field Sampling Specifications for Former Building 73

Attribute Investigated	Reference Point	Sampling Point/ Location Name[1]	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
1,000-gallon UST	Along west wall of loading dock	IB073SB001	Approximately 5 feet west of west wall of loading dock	Test Pit/6 feet and 11 feet	Soil	Unspecified fuels and oils, lead	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW6020 (Cd, Cr, Pb, Ni, and Zn only) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (Oil & Grease) SW8310 (PAHs)
1,000-gallon UST	Along west wall of loading dock	IB073GR001	Standing water in bottom of test pit	Test Pit/11 feet	Water[3]	Unspecified fuels and oils, lead	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW6020 (Cd, Cr, Pb, Ni, and Zn only) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (Oil & Grease) SW8310 (PAHs)
1,000-gallon UST	Along south wall of loading dock	IB073SB002	Approximately 5 feet south of south wall of loading dock	Test Pit/6 feet and 11 feet	Soil	Unspecified fuels and oils, lead	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW6020 (Cd, Cr, Pb, Ni, and Zn only) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (Oil & Grease) SW8310 (PAHs)

Table 4
Sampling and Analysis Matrix and Field Sampling Specifications for Former Building 73

Attribute Investigated	Reference Point	Sampling Point/ Location Name[1]	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
1,000-gallon UST	Along south wall of loading dock	IB073GR002	Standing water in bottom of test pit	Test Pit/11 feet	Water[3]	Unspecified fuels and oils, lead	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW6020 (Cd, Cr, Pb, Ni, and Zn only) SW8260B (VOCs) SW8270C (SVOCs) 413.2 (Oil & Grease) SW8310 (PAHs)

[1]Sampling points, locations, depths, and analytical methods to be determined in the field. The sampling points, locations, depths, and analytical methods listed for this table are only a guide in accordance with Tri-Regional Board guidelines for UST tank removals.

[2] It is unknown what types of fuels and/or oils were stored in the Former Building 73 UST. Therefore, common factors and waste oils are considered chemicals of potential concern at these sampling locations.

[3] Groundwater samples for dissolved lead will be filtered using a 0.45 µm filter.

Notes:

Field QC samples, including trip blanks, equipment blanks, and field duplicates, will be taken at the minimum frequency specified in the QAPP.

If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel than step-out and/or step-down samples will be collected and analyzed. See step-out and step-down decision logic in Section 5 of the Arsenal Wide Investigation Workplan.

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
Cd = Cadmium
Cr = Chromium
Ni = Nickel
PAH = Poly aromatic hydrocarbons
Pb = Lead
SVOCs = Semi-volatile organic compounds
VOCs = Volatile organic compounds
Zn = Zinc

sampling and analysis activities that will be conducted to evaluate the substances presented in Table 3. Table 4 lists the general requirements for sampling at former Building 73 based on the size of the UST and in accordance with Tri-Regional Board Guidelines (August 1990). The purpose of these activities will be to assess the nature and extent of potential impacts from previous uses.

Two test pits will be dug adjacent to the west and south sides of the loading dock, nearest to the suspected location of former Building 73, without digging into the loading dock. If test pits do not indicate the presence of the UST or pipelines then no further investigation will be conducted.

Samples collected for former Building 73 will be analyzed by an on-site mobile laboratory or on-site field GC unit, if economically feasible. If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel then step-out or step-down samples will be collected. These step-out samples may be collected using a backhoe, drilling rig, or direct push rig. Generally, step-out samples will be collected in a triangular pattern (if possible) away from the original sample for lateral definition. Step-out sample locations may be moved or omitted if access is insufficient for the backhoe, drilling or direct push rig, or subsurface obstructions are encountered (i.e., overhead and underground utilities, or other facility substructures). Vertical definition will be determined by collecting additional sample(s) downward from the original sample, until groundwater is encountered.

Section 6. Schedule of Work

Once field activities begin, the Building 73 fuel facilities investigation will be conducted in a sequence which will enable project personnel to refine the scope of work as new data are collected. In general, non-invasive activities will be conducted first, followed by invasive activities. As described above, the initial step will be to complete file review. Upon completion of the file review, the geophysical survey will be conducted inside and outside the buildings to better define targets and clear drilling locations. The initial invasive activity will be to collect soil and groundwater samples (if encountered) in test pits or angle borings.

Section 7. Sample Analyses

A description of the chemical analyses to be conducted on each soil and groundwater sample is presented in Table 4. A detailed description of each analytical method is presented in the Quality Assurance Project Plan (QAPP) (Brown and Caldwell, 1999). Quality Assurance/Quality Control (QA/QC) sampling protocol is also described in the QAPP and will include collecting sample duplicates (10 percent frequency), sample splits (10 percent frequency), and sample splits (10 percent frequency) for each media (see Table 5). One equipment blank will be collected for this FSIP. Trip blanks will be analyzed for each volatile organic compound sample shipment. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected in coordination with the analytical laboratory for the appropriate methods so that each analytical batch contains an MS/MSD sample as required by the QAPP. The Contract Analytical Laboratory procedures and services will be in accordance with the QAPP.

After collection (SOP 7.0), samples will be packed, preserved, and shipped via courier or overnight delivery as described in SOPs 9.0 and 10.0. The analytical laboratory will be notified prior to sample shipment of the number and type of samples and analyses. Sample collection and transportation will be documented in field log books and on the sample chain of custody (SOP 4.0). Upon receipt of the sample shipment, the laboratory will document the status of the

Table 5

Summary of Subsurface Investigation Activities for Fuel Facilities at Former Building 73

Attribute Investigated	Number of Test Pits	Number of Soil Borings	Number of Soil Samples	Number of Soil Gas Samples	Number of Grab Groundwater Samples
1,000-gallon UST	2	0	4	0	2[1]
Subtotal	2	0	4	0	3
Duplicate Samples			(A)	0	(A)
Split Samples			(A)	0	(A)
Equipment blanks			1	0	0
Total	2	0	4	0	4

(1) Samples for groundwater will be collected, if encountered, in each boring.

(2) Additional test pits may be necessary to verify existence of pipelines.

(A) The number of duplicate and split samples will be based on the total number of samples collected for all FSIPs done in conjunction with this FSIPs.

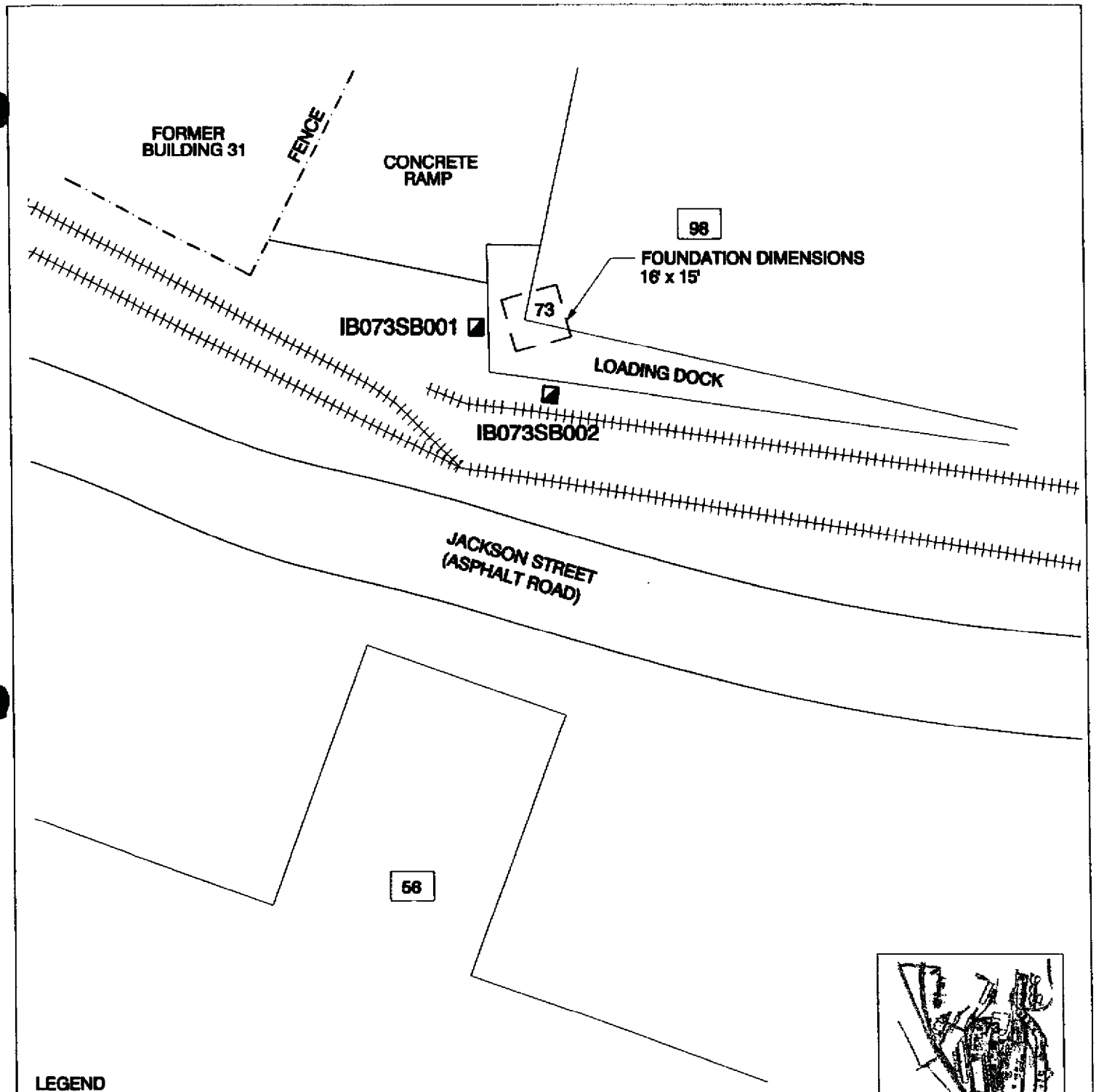
shipment by sending a copy of the completed COC and login sheet to the PM by fax.

Sample analytical results will be reported in electronic and hardcopy deliverables of sample receipt. Specifications for the laboratory reporting package are included in the QAPP. Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. Upon completion of data validation, analytical results will be reported according to Section 5.0 of the Arsenal-Wide Investigation Workplan.

Section 8. References

Brown and Caldwell. 1999. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Jacobs Engineering. 1998. Records Research Report for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. Draft. March.



LEGEND

- 98 — Buildings
- 73 — Former Location of Building 73
- Fence Line
- Railroad Tracks
- Proposed Test Pit Location and Number

N

10 0 10 20 30 40
Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Test Pit Location Map Fuel Storage Facilities at Former Building 73

Area I - Field Site Investigation Plan
Benicia Arsenal

1-29-99 jkr p:\Special\DACW05-97-D0035A_E\workplan\FSIP\B73pits.dwg

FIGURE 2

Site Safety and Health Plan
for
Area I Fuel Storage Facilities at Former Building 73

Benicia Arsenal

Prepared by: _____ Date: 3-8-99
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: _____ Date: 2-17-99
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 3-8-99
Ms. Wendy Linck
Site Safety Officer

Effective Dates: 3-8-99 to 3-8-00

Site Safety and Health Plan
for
Area I Fuel Storage Facilities at Former Building 73

Preface

The Forsgren Associates/Brown and Caldwell (FA/BC) Health and Safety (H&S) Program Manual and the Benicia Arsenal General Site Safety and Health Plan (General SSHP) for the Benicia Arsenal (Arsenal) Formerly Used Defense Site (FUDS)will be referenced throughout this site-specific SSHP. The FA/BC H&S Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, section 203.5, page 2-13.

PROJECT SUMMARY

The purpose of this investigation is to confirm the existence of fuel storage facilities (one UST and associated pipelines) at Building 73 in Area I and assess whether soil and/or groundwater have been impacted by petroleum hydrocarbons associated with these facilities. The tasks for this investigation include a geophysical survey, subsurface investigation (utility clearance, test pits, and drilling), and groundwater and soil sampling.

KEY PERSONNEL

The key personnel for this site specific SSHP are:

- Program Manager: Mr. Dave Jones.
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist.
- Project Manager: Ms. Patti DeLaO.
- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez.

Descriptions of responsibilities for each key personnel and subcontractor are included in the Benicia Arsenal General SSHP.

Project Contacts

A reference list of project contacts is located in the Benicia Arsenal General SSHP.

HAZARD ANALYSIS

The site-specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for this site is presented in Table 1.

Chemical Hazards

Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table 2.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. General training requirements for all FA/BC staff working on site is described in the Benicia Arsenal General SSHP.

Table 1
Potential Hazards and Recommended Controls for Former Building 73
Investigation Activities

Potential Hazards	Recommended Controls
Chemical Exposure	The minimum level of proper Personal Protective Equipment (PPE) during activities is Level D. This level is adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Air monitoring will be performed with an Organic Vapor Monitor or equivalent to monitor the air quality in and around the work zone.
Back Injury	There are no heavy pieces of equipment anticipated for this project that would require lifting and possible back injuries. In any event, use proper lifting techniques and use adequate back support during all field tasks.
Noise	Heavy equipment is anticipated for this project (i.e. drilling rig and backhoe), such that hearing protection may be necessary. Use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum Handling	Drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums.
Migration of Contamination	A work zone will be delineated before start of work. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figure 1 is provided in this SSHP to show the area of the work zone.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, Trips, and Falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e. steep slopes, potholes, and uneven surfaces).
Utilities	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities.
Heavy Equipment	Drilling and excavating equipment maybe necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site.
Biological Hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. The area around Building 73 is open and these types of biological hazards are not anticipated.
Radiological Hazards	There are no radiological hazards anticipated for this project.

PPE: Personal Protective Equipment

Table 2
Chemical Exposure Limits and Characteristics Controls for Building 73 Investigation Activities

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	IDLH[d] level	Flammable range percent	Odor threshold, ppm	Notes[e]	Potential symptoms of exposure[f]
Benzene	9.24	150	0.5 ppm	Ca (500 ppm)	1.3-7.9	4.68	C,F,65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Toluene	8.82	110	50 ppm	500 ppm	1.2-7.1	0.17-40	T,F,65	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Ethylbenzene	8.76	100	100 ppm	800 ppm	1.0-6.7	0.25-200	T,F	Irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Xylene	8.56	111	100 ppm	800 ppm	1.0-7.0	0.05-200	65	Dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Lead	NA	NA	0.05 mg/m^3	100 mg/m^3	NC	NA	C,T,65	Immediate irritation to eyes, insomnia, facial pallor, anorexia, weight-loss, abdominal pain, constipation, colic, anemia

[a] Ionization potential in electron-volts (eV).

[b] Century Organic Vapor Analyzer relative response to the compound in percent.

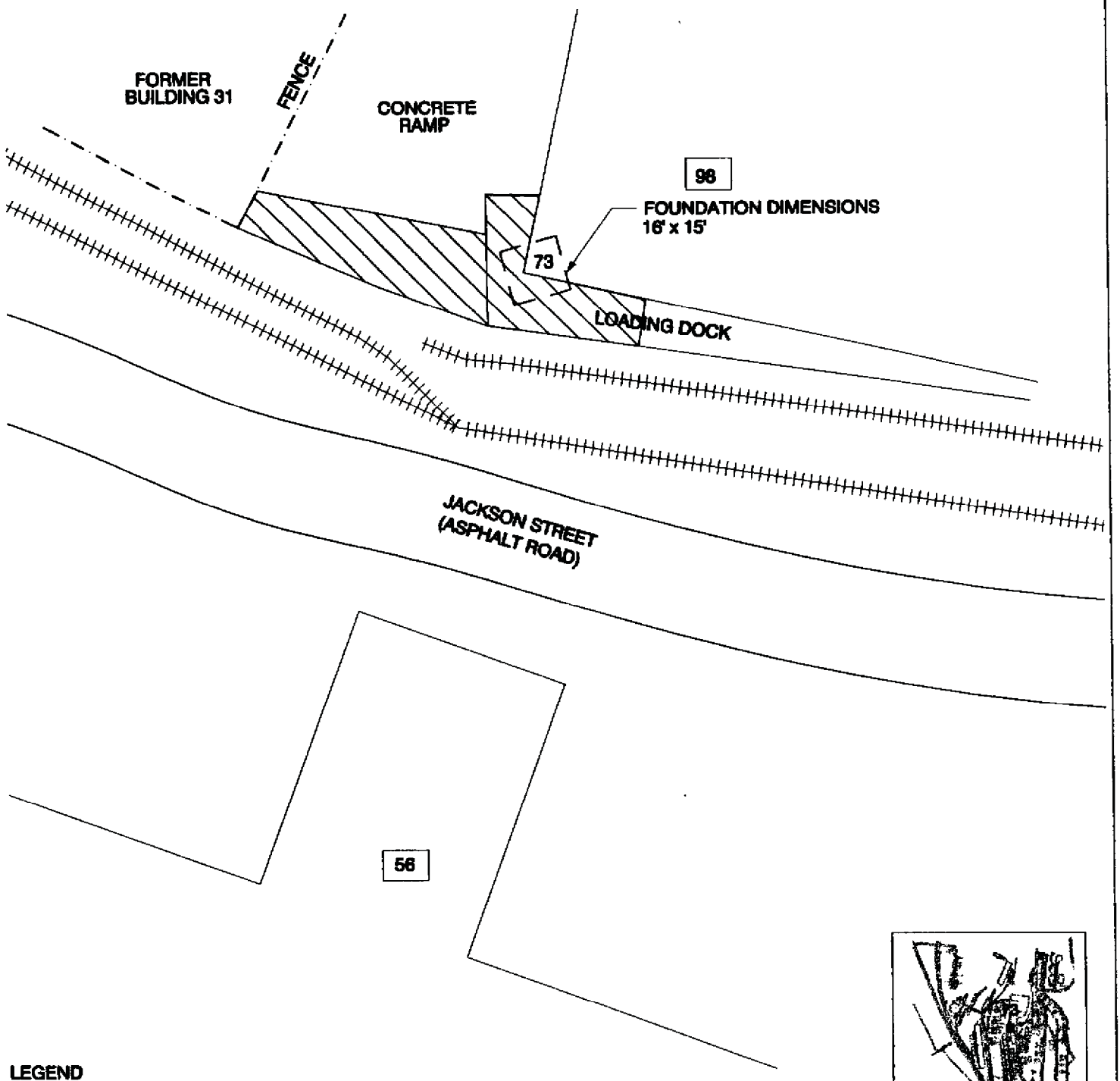
[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1997.

[d] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.

[e] Hazard category; C-Carcinogen; F-Flammable; T-Toxic; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.

[f] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.

Notes: NA = Not applicable or not available, NC = Noncombustable



LEGEND

- 98 — Buildings
- 73 — Former Location of Building 73
- Fence Line
- Railroad Tracks
- Proposed Work Zone

N

10 0 10 20 30 40
Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Work Zone Map
Fuel Storage Facilities at Former Building 73

Area I - Site Safety and Health Plan
Benicia Arsenal

1-29-99 jkr p:\Special\DACW05-97-D0035A_E\workplan\SSHP\B73work.dwg

FIGURE 1

PERSONAL PROTECTIVE EQUIPMENT

The minimum required level of personal protection on the site at all times is level D. Level D includes safety boots/shoes, safety glasses, and a hard hat. In addition to this protection, colored Tyvek© coveralls (preferably blue or brown) or equivalent will be worn at all times inside the work zone. These items are also listed on Table 3, Field Equipment. Descriptions of other levels of PPE are described in the FA/BC H&S Manual (301 and 302; p. 1-24) and the Benicia Arsenal General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for this site. Equipment anticipated for environmental monitoring is listed on Table 3. Environmental monitoring will be in accordance with the Organic Vapor Response criteria outlined in Table 4. Generally, all projects will include monitoring of air quality in and around the work area and heat or cold stress.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for this site. The Benicia Arsenal General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

A map of the site is included as Figure 1, showing the approximate work zone. Zone locations are subject to change based on work activities, site access, and wind direction. Equipment necessary for site control measures is listed on Table 3. Further details regarding site control measures can be found in the FA/BC H&S Manual (406; p.25-28).

DECONTAMINATION

Decontamination will take place within the work zone identified on site and shown on Figure 1. A sample decontamination set-up can be found in the FA/BC H&S Manual (405; p.23). There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table 3.

EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital** located at **975 Sereno Dr., Vallejo, CA.**, telephone number: **(707)-651-1000.** Directions from this site to the nearest hospital is presented below and shown on the route to hospital map included in this document as Figure 2.

Directions to Kaiser Permanente Hospital **from Building 73:**

From **Jackson Street** head east to Polk Street

Left on **Polk Street** heading northwest until it becomes Grant Street

Continue northwest on **Grant Street** which becomes Military East

Continue northwest on **Military East** to East 5th Street

Right onto **East 5th Street** heading northeast

Left onto on-ramp to **I-780** heading west

Travel on **I-780 West** for approximately 5.4 miles

Continue west onto **Maryland Street** for 1.6 miles

Right on **Sonoma Boulevard** heading north for 2.1 miles

Right on **Sereno Drive** heading east for 0.4 miles to **975 Sereno Drive**

Table 3
Anticipated Field Equipment for Building 73 Investigation Activities

Equipment	Purpose and Description
Personal Protective Equipment (PPE)	
Nitrile Disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© Coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. An organic vapor cartridge should be adequate protection for the contaminants expected at this site. A cartridge of this type should be changed out daily or when break through occurs, whichever comes first.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic Vapor Monitor (OVM) or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is responding to contaminants.
Benzene Detector Tubes (0.5-10ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones and Safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone.
Decontamination Equipment	
Wash buckets and soap	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e. work boots).
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/Electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field notebook.
Sampling Containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.

Table 3
Anticipated Field Equipment for Building 73 Investigation Activities

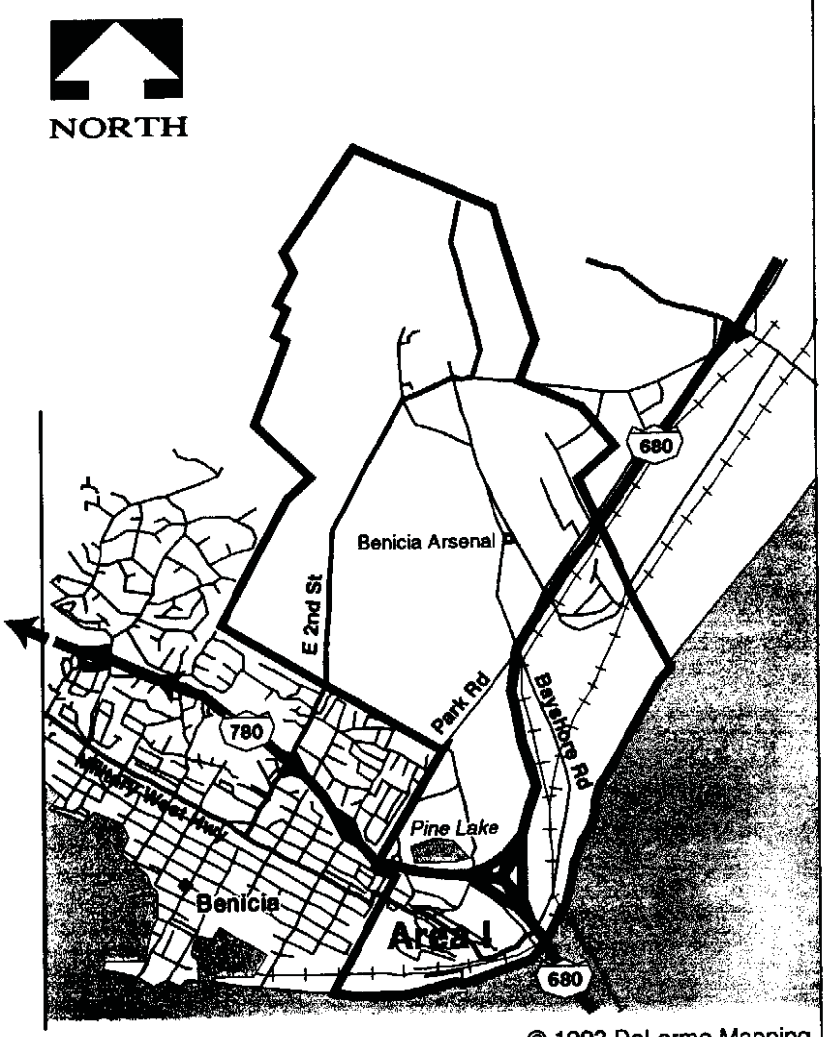
Equipment	Purpose and Description
Sample labels, chain-of custody forms, Zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper chain-of custody forms, labels, and custody seals will be completed for proper quality control. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.

Table 4

Organic Vapor Response Criteria for Petroleum Hydrocarbons that May Include Gasoline

Organic Vapor Concentrations in Breathing Zone[a]	Sampling Frequency	Action Taken
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity.
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity. • If DTs reveal detectable concentrations greater than 1 ppm, then upgrade to Level C PPE.
10 to 100 ppm for more than 2 minutes	Every 15 minutes.	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes.	• Stop work. • Work crews position themselves upwind of site. • Re-evaluate in 15 minutes. • Contact Health and Safety Director and Project Manager. • Evacuate

[a] OVM calibrated to methane (concentrations will be less if calibrated to isobutylene)



FROM **JACKSON STREET** HEAD EAST TO POLK STREET
LEFT ONTO **POLK STREET** HEADING NORTHWEST UNTIL IT BECOMES GRANT STREET
CONTINUE NORTHWEST ON **GRANT STREET** WHICH BECOMES MILITARY EAST
CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5th STREET
RIGHT ONTO **EAST 5th STREET** HEADING NORTHEAST
LEFT ONTO ON-RAMP TO **I-780** HEADING WEST
TRAVEL ON **I-780** WEST FOR APPROXIMATELY 5.4 MILES
CONTINUE WEST ONTO **MARYLAND STREET** FOR 1.6 MILES
RIGHT ON **SONOMA BOULEVARD** HEADING NORTH FOR 2.1 MILES
RIGHT ON **SERENO DRIVE** HEADING EAST FOR 0.4 MILES TO 975 SERENO DRIVE

TOTAL TRAVEL TIME TO **KAISER PERMANENTE HOSPITAL** FROM B73
IS APPROXIMATELY 10 MILES TAKING 20 MINUTES.

Route to Hospital
Fuel Storage Facilities
at Former Building 73

Area I - Site Safety and Health Plan
Benicia Arsenal
FIGURE 2

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Total travel time to **Kaiser Permanente Hospital** from Building 73 is approximately 10 miles taking 20 minutes.

The nearest telephone is located in the work zone. If a cell phone is to be used for emergency purposes, it must be checked upon arrival to the site to verify that reception to the area is available. **When a cell phone is used for emergency purposes, dial (707) 745-3411 or (707) 745-3412.** The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC H&S Manual (Forward; p. F-5). **In the event of a medical emergency, 911 will be dialed first.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this Workplan. The procedures and frequency in which each Attachment must be completed is described in Table 5.

Table 5
Attachments A – E Building 73 Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the Project Manager and the Health and Safety Director will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily

Field Site Investigation Plan

for

Area I Fuel Storage Facilities at Building 103

This Field Site Investigation Plan (FSIP) presents the background, rationale, and scope of field activities to be conducted at the fuel facilities associated with Building 103. The FSIP follows the rapid characterization approaches for the fuel facilities use category as outlined in Section 5 of this Arsenal-Wide Investigation Workplan for the Benicia Arsenal (Arsenal), where applicable. The purpose of activities described in this FSIP is to investigate features, based on information available as of January 1998, suspected or confirmed to have the potential to cause contamination to soil or groundwater from past Department of Defense (DoD) use of the fuel facilities at Building 103.

Section 1. Site Background and Location

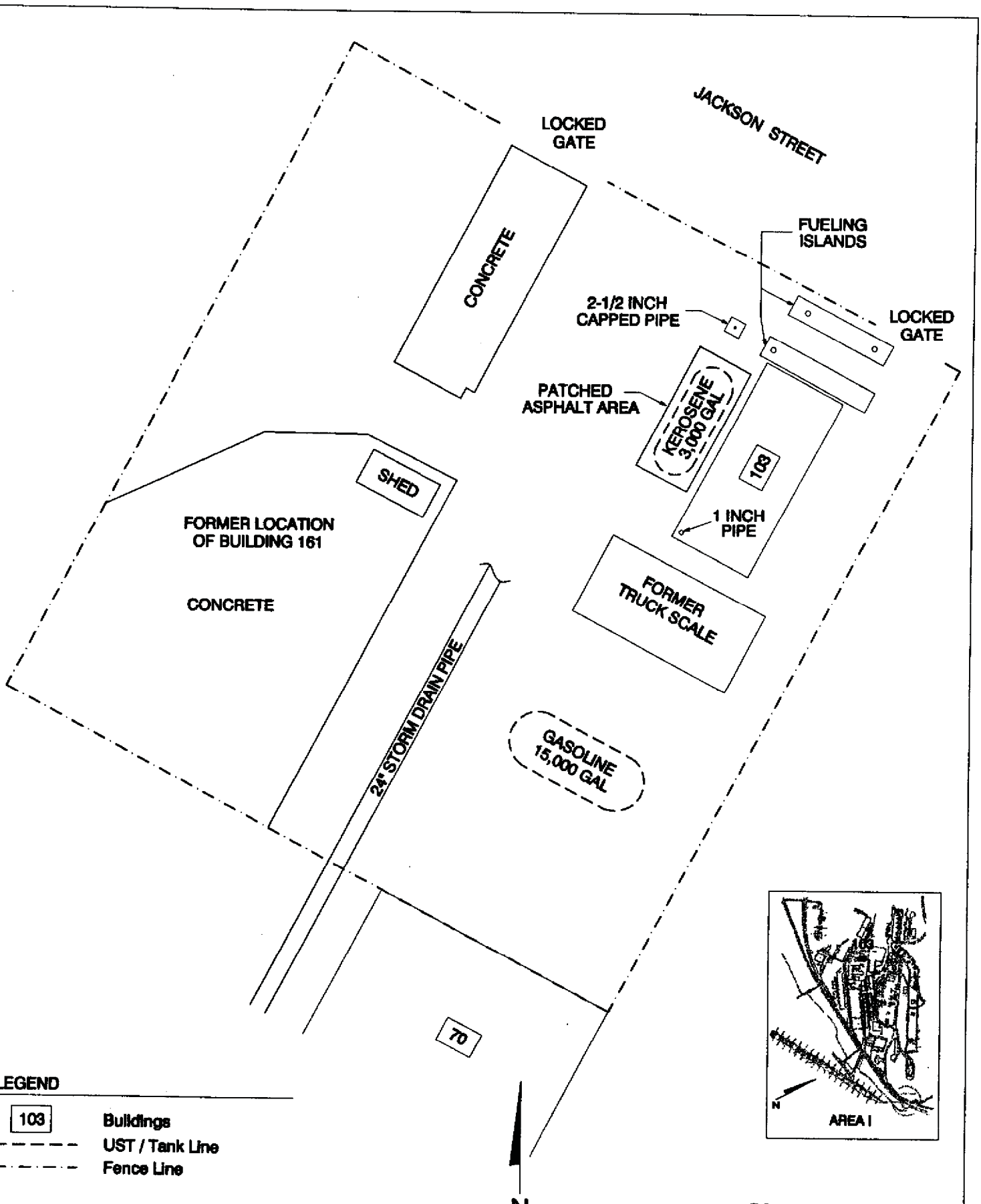
Building 103 is currently vacant, and is owned by Gordon Potter. Building 103 is located along Jackson Street, approximately 70 feet north of Building 70 (Figure 1). The history of Building 103 includes the installation of two underground storage tanks (USTs): a 15,000-gallon gasoline and a 3,000-gallon kerosene UST and associated piping.

Section 2. Site History and Historical Use

According to the Benicia Arsenal Records Research Report ([RRR] Jacobs, 1998), Building 103 was built in 1943 and was used as a service station for the original motor pool located along the waterfront. In 1952, the motor pool was relocated to Area M and Building 103 was then used as an office. Building 103 covers a 13-foot by 31-foot square area and has a concrete foundation and wooden walls. According to a 31 May 1944 drawing, a truck scale and a gasoline underground storage tank (UST) were installed southeast of Building 103 (Jacobs, 1998) (Figure 1). In addition to the USTs and truck scale, equipment reportedly installed at Building 103 included two fueling islands. Table 1 summarizes background information for this fuel facility and it's associated features.

According to the RRR (Jacobs, 1998), one of the two USTs was located in an area where bay (saltwater) intrusion had been occurring and the tank was "corroded and pitted to such an extent that a replacement will be necessary." However, it is unknown which of the two USTs the report was referring to. According to a Project Estimate dated 18 August 1951, a request was made to remove the existing building, and relocate the service station and pumps, including the fueling islands and USTs. It is not known if the USTs were removed when the motor pool and service station were relocated in 1952. Records do not indicate the current status of these USTs.

A field inspection in March 1998 showed that Building 103 and the two fueling islands were still intact. A 2 ½ -inch diameter capped galvanized steel pipe, possibly a UST fill port pipe, was observed near the northwest corner of the building. An asphalt patched area was noted adjacent to the northwestern side of the building and a 1-inch diameter galvanized steel pipe, possibly a UST vent pipe, was observed extending above the southwest corner of the building wall. These features may suggest that the kerosene UST may have been located in the area adjacent to the northwest side of Building 103 and not the 15,000-gallon gasoline tank because the 31 May



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Site Location Map
Fuel Storage Facilities at Building 103

Area I - Field Site Investigation Plan
Benicia Arsenal

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FIGURE 1

Table 1

Background Information for Fuel Storage Facilities at Building 103

Facility ID	Feature	Function	Materials Handled	Evidence	Present Status
Building 103	15,000-gallon gasoline UST and associated piping	Storage of gasoline at the former service station (Building 103)	• Gasoline • Lead	Records Research Report	Unconfirmed.
	3,000-gallon kerosene UST and associated piping	Storage of kerosene at the former service station (Building 103)	• Kerosene	Records Research Report	Unconfirmed.
	Two pump islands	Pump fuels at the former service station (Building 103)	• Gasoline • Lead • Kerosene	Records Research Report and site visit	Unconfirmed.
	Truck scale	Truck scale at Building 103.	• None	Records Research Report	Unconfirmed.

1944 drawing shows the 15,000-gallon gasoline tank to be further southeast of Building 103 (Figure 1).

Section 3. Previous Investigations

No previous investigations have been conducted for the fuel storage facilities at Building 103.

Section 4. Data Quality Objectives

The data quality objectives (DQOs) for this field investigation are presented in Table 2. The United States Army Corps of Engineers (USACE) Data Quality Objective Guidance worksheet was used to generate Table 2.

Section 5. Sampling Plan

There is no available data indicating the disposition of the USTs or whether or not any previous investigations have been conducted at Building 103. The presence of the USTs and associated piping has not been positively determined. The file review was conducted and results were inconclusive. Therefore, the USTs and associated piping may remain in place at Building 103. The following is proposed for this FSIP.

Review additional records as they become available during the investigation including facility drawings and documents on file at local agencies to determine any additional history about the installation or removal of the USTs at Building 103.

A geophysical survey will be conducted to confirm the existence and determine the location of the USTs and associated piping.

If the geophysical survey identifies anomalies indicating the possible location of the USTs and associated piping or the survey is inconclusive, a subsurface investigation will be conducted. The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and groundwater (if encountered) from petroleum hydrocarbons.

The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and/or groundwater (if encountered) from petroleum hydrocarbons and lead.

File Review. Facility drawings and documents from the USACE were reviewed for any additional historical data not included in the RRR. The Solano County Department of Environment and Management and local fire department records were also reviewed for any references to USTs or previous investigations at Building 103. Reviewed records regarding the existence of the USTs are inconclusive. Additional records discovered during the investigation will be reviewed as they become available. If additional records indicate that the USTs were removed, then no further investigation will be conducted.

Geophysical Survey. A geophysical survey will be conducted around Building 103 over the suspected locations of the 3,000-gallon kerosene UST and the 15,000-gallon gasoline UST. Existing underground utilities may impede the identification of any subsurface piping related to the USTs. Utility providers will be called to the site to identify their respective lines.

Subsurface Investigation. If the geophysical survey does not indicate the presence of USTs or associated piping, no further investigation will be conducted. If the geophysical survey is inconclusive or indicates the presence of USTs or pipelines, test pits (using a backhoe, hand auger or shovel) will be installed to confirm the presence of USTs or piping.

Table 2

Data Quality Objectives

State the Problem:

Confirm the existence of fuel storage facilities at Building 103 (one gasoline USTs [underground storage tank] south of Building 103, one kerosene UST near the western wall of Building 103, and two pump islands). Determine the presence of petroleum hydrocarbons and lead in soil and/or groundwater associated with fuel storage activities at this Department of Defense (DoD) facility.

Identify the Decision:

Investigation-wide decisions:

- Assess the impact of soil type and stratigraphy on the mobility and distribution of chemicals of potential concern (COPC).
- Assess if COPC are present in soil and/or groundwater and if concentrations exceed assessment criteria and may require additional data collection, risk analysis or remediation.

Feature-specific Decisions:

- Determine if the USTs and associated piping exist. Determine if they require removal or closure.
- If USTs and related pipelines exist, assess if COPC are present in soil and/or groundwater beneath the USTs and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis or remediation.

Identify Inputs:

- Results of facility drawings from the U.S. Army Corps of Engineers, and Solano County and local fire department files in the area of the UST(s) and associated pipelines.
- Results of geophysical survey in the area of the UST(s) south of Building 103 and along the western wall of Building 103.
- Numeric assessment criteria for Arsenal COPC that will be compared to soil and groundwater sample analytical data.
- Analytical results from soil samples collected in areas of geophysical survey anomalies for UST(s).
- Analytical results from soil and/or groundwater samples for petroleum hydrocarbons and lead collected from test pits.

Physical Study Boundaries:

- The area south of Building 103 will be investigated in the area of the suspected gasoline UST.
- The area west of Building 103 in the area of the suspected kerosene UST will be investigated.
- This investigation will not include the buildings infrastructure, sewer or storm drain system.

Practical Study Boundaries:

- Shallow groundwater will be sampled beneath USTs only if encountered near the bottom of the USTs and pipelines.

Table 2

Data Quality Objectives

Temporal Study Boundaries:

- Standard field and analytical methods are proposed to generate data useable for the duration of investigation and remediation.
- Limited temporal influence on groundwater sampling data may result from tide-related changes in groundwater.
- Field activities and sample results are not anticipated to be significantly affected by changing weather conditions

General Site Decision Rules:

- If results for COPC are above detection limits, then values will be compared against assessment criteria. If values are below the assessment criteria, the investigation will be considered complete. If values exceed assessment criteria, results will be evaluated and recommendations made for possible additional data collection, risk analysis, or remediation.
- If county records indicate the USTs have been removed, then no further investigation will be performed.
- If county records are inconclusive, a geophysical survey will be conducted.
- If the geophysical survey results from the areas suspected to contain the USTs and piping indicate that the UST(s) and associated pipelines are not present, no further investigation will be performed.
- If the geophysical survey results from the areas of the USTs are inconclusive or show anomalies, then soil samples will be collected from test pits. One test pits will be dug for each suspected lank location or anomaly location associated with the USTs. A grab groundwater sample will be collected if shallow groundwater is encountered in any of the test pits.
- If test pits confirm the presence of USTs and/or pipelines, then a tank and pipeline removal program will be initiated by the USACE.
- If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel then step-out/step-down samples will be collected in a triangular pattern, until the extent of the contamination is defined.

Specify Tolerable Limits on Decision Errors:

- The analyses must provide definitive data. Accuracy, precision, and completeness objectives set forth in the Arsenal-Wide QAPP will apply.
- Assessment criteria will be used as absolute values to compare point-by point to analytical results. Results that exceed assessment criteria will be evaluated further.

Optimize Design for Study:

Based on site history and file review activities, collect soil and groundwater samples at pre-selected locations and depths. Sequence investigation activities so that scope of work can be modified as new information is collected.

Subsurface activities will include test pits, and collecting soil and groundwater (if encountered) samples. Table 3 summarizes commonly used substances of concern identified during record search to have been used at the fuels storage facilities at Building 53. This table also correlates each substance to an analytical method that will be used to assess if the substance if present. Table 4 presents the specific sampling and analysis activities that will be conducted to evaluate the substances presented in Table 3. The purpose of these activities will be to assess the nature and extent of potential impacts from previous uses.

A test pit will be located in the area approximately 35 feet southwest of the Building 103 for the 15,000-gallon gasoline UST and another test pit will be located approximately 5 feet west of Building 103 for the 3,000-gallon kerosene UST.

If a UST is encountered in a test pit and samples cannot be collected, one additional test pit will be dug for the collection of soil and/or groundwater samples. This test pit will be located a distance approximately twice the tank diameter in the direction of the fill port end of the UST. If the diameter is unknown, the diameter will be based on similar tanks of known diameter at the Arsenal. If the fill port location is unknown, the test pit will dug in the down gradient direction from the UST.

Additional test pits will be dug to confirm the presence of any associated pipelines. Additional test pit locations will be determined using the geophysical survey results and information from the test pits used to confirm the presence of the USTs. If test pits do not indicate the presence of USTs or pipelines then no further investigation will be conducted.

Samples collected for Building 103 will be analyzed by an on-site mobile laboratory or on-site field GC unit, if economically feasible. If laboratory results in soil are greater than 250 mg/kg for TPH-gas, and 500 mg/kg for diesel then step-out or step-down samples will be collected. These step-out samples may be collected using a backhoe, drilling rig, or direct push rig. Generally, step-out samples will be collected in a triangular pattern (if possible) away from the original sample for lateral definition. Step-out sample locations may be moved or omitted if access is insufficient for the backhoe, drilling or direct push rig, or subsurface obstructions are encountered (i.e., overhead and underground utilities, or other facility substructures). Vertical definition will be determined by collecting additional sample(s) downward from the original sample, until groundwater is encountered.

Section 6. Schedule of Work

Once field activities begin, the Building 103 fuel facilities investigation will be conducted in a sequence which will enable project personnel to refine the scope of work as new data are collected. In general, non-invasive activities will be conducted first, followed by invasive activities. As described above, the initial step will be to complete file review. Upon completion of the file review, the geophysical survey will be conducted inside and outside the buildings to better define targets and clear drilling locations. The initial invasive activity will be to collect soil and groundwater samples (if encountered) in test pits or angle borings.

Section 7. Sample Analyses

A description of the chemical analyses to be conducted on each soil and groundwater sample is presented in Table 4. A detailed description of each analytical method is presented in the Quality Assurance Project Plan (QAPP) (Brown and Caldwell, 1999). Quality assurance/quality control (QA/QC) sampling protocol is also described in the

Table 3

Summary of Commonly Used Substances at Building 103 and Analytical Rationale

Building 103 Substance of Concern	Commonly Associated Chemical Type	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Fuels	Gasoline Kerosene Lead	M8015V (volatile TPH) M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH) SW7421	M8015V (volatile TPH) M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH) SW7421	TO-14

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = poly aromatic hydrocarbons
VOCs = volatile organic compounds
TPH = total petroleum hydrocarbons

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Building 103

Attribute Investigated	Reference Point	Sampling Point/ Location Name[1]	Location	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
3,000-gallon kerosene UST	Along west wall of Building 103	IB103SB001	Approximately 5 feet west of Building 103 at center of west wall	Test Pit/6 feet and 11 feet	Soil	Kerosene and Leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
3,000-gallon kerosene UST	Along west wall of Building 103	IB103GR001	Standing water in bottom of test pit	Test Pit/11 feet	Water[3]	Kerosene and Leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Building 103

Attribute Investigated	Reference Point	Sampling Point/ Location Name[1]	Location	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
15,000-gallon gasoline UST	Between Building 103 and Building 70	IB103SB002	Approximately 35 feet southwest of Building 103	Test Pit/6 feet and 11 feet	Soil	Kerosene and Leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
15,000-gallon gasoline UST	Between Building 103 and Building 70	IB103GR002	Standing water in bottom of test pit	Test Pit/11 feet	Water[3]	Kerosene and Leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
Pipelines for 3,000-gallon kerosene UST	All areas around Building 103	No Samples	Where geophysical survey results indicate pipeline location	Test Pits to verify pipeline existence	Soil	Kerosene and Leaded gasoline	NONE
Pipelines for 15,000-gallon gasoline UST	Between Building 103 and Building 70	No Samples	Where geophysical survey results indicate pipeline location	Test Pits to verify pipeline existence	Soil	Kerosene and Leaded gasoline	NONE

[1]Sampling points, locations, depths, and analytical methods to be determined in the field. The sampling points, locations, depths, and analytical methods listed for this table are only a guide in accordance with Tri-Regional Board guidelines for UST tank removals.

[2] Kerosene and leaded gasoline are considered chemicals of potential concern at these sampling locations because of the proximity of the kerosene UST to the other USTs and the potential for some lateral migration of contaminants.

[3] Groundwater samples for dissolved lead will be filtered using a 0.45 μm filter.

Notes:

Field QC samples, including trip blanks, equipment blanks, and field duplicates, will be taken at the minimum frequency specified in the QAPP.

If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel than step-out and/or step-down samples will be collected and analyzed. See step-out and step-down decision logic in Section 5 of the Arsenal Wide Investigation Workplan.

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes

PAH = poly aromatic hydrocarbons

VOCs = volatile organic compounds

TPH = total petroleum hydrocarbons

QAPP and will include collecting sample duplicates (10 percent frequency), sample splits (10 percent frequency), and sample splits (10 percent frequency) for each media (see Table 5). One equipment blank will be collected for this FSIP. Trip blanks will be analyzed for each volatile organic compound sample shipment. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected in coordination with the analytical laboratory for the appropriate methods so that each analytical batch contains an MS/MSD sample as required by the QAPP. The Contract Analytical Laboratory procedures and services will be in accordance with the QAPP.

After collection (SOP 7.0), samples will be packed, preserved, and shipped via courier or overnight delivery as described in SOPs 9.0 and 10.0. The analytical laboratory will be notified prior to sample shipment of the number and type of samples and analyses. Sample collection and transportation will be documented in field log books and on the sample chain of custody (SOP 4.0). Upon receipt of the sample shipment, the laboratory will document the status of the shipment by sending a copy of the completed COC and login sheet to the PM by fax.

Sample analytical results will be reported in electronic and hardcopy deliverables of sample receipt. Specifications for the laboratory reporting package are included in the QAPP. Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. Upon completion of data validation, analytical results will be reported according to Section 5.0 of the Arsenal-Wide Investigation Workplan.

Section 8. References

Brown and Caldwell. 1999. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Jacobs Engineering. 1998. Records Research Report for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. Draft. March.

Table 5

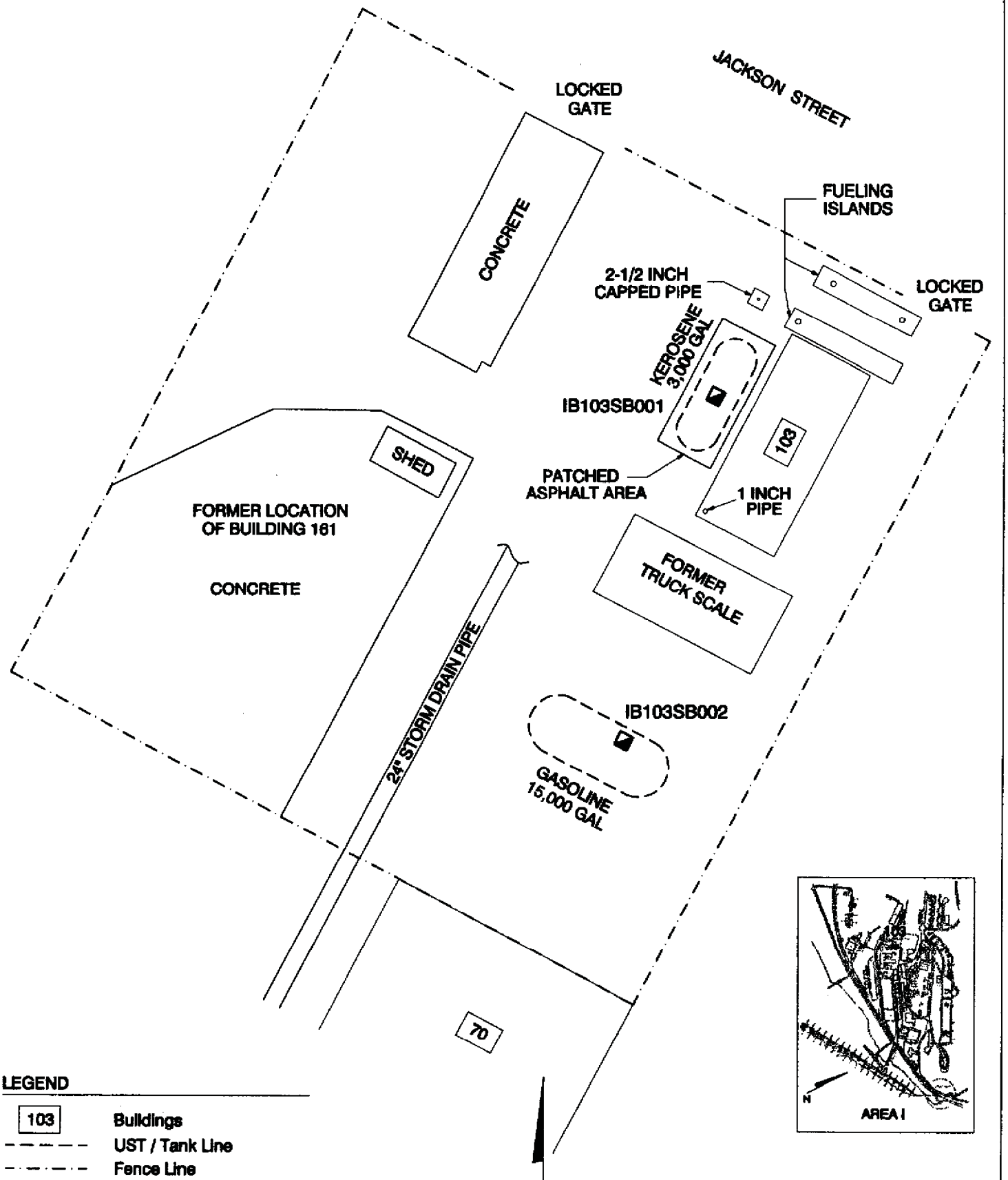
Summary of Subsurface Investigation Activities for Fuel Facilities at Building 103

Attribute Investigated	Number of Test Pits	Number of Soil Borings	Number of Soil Samples	Number of Soil Gas Samples	Number of Grab Groundwater Samples
3,000-gallon kerosene UST	1	0	2	0	1(1)
15,000-gallon gasoline UST	1	0	2	0	1(1)
Pipelines for 3,000-gallon kerosene UST	1(2)	0	0	0	0
Pipelines for 15,000-gallon gasoline UST	1(2)	0	0	0	0
Subtotal	4	0	4	0	2
Duplicate Samples			(A)	0	(A)
Split Samples			(A)	0	(A)
Equipment blanks			0	0	1
Total	4	0	4	0	3

(1) Samples for groundwater will be collected, if encountered, in each boring.

(2) Additional test pits may be necessary to verify existence of pipelines.

(A) The number of duplicate and split samples will be based on the total number of samples collected for all FSIPs done in conjunction with this FSIPs.



LEGEND

- 103 — Buildings
- UST / Tank Line
- Fence Line
- Proposed Test Pit Location and Number

Note: All site features referenced in Records Research Report (jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Test Pit Location Map
Fuel Storage Facilities at Building 103

Area I - Field Site Investigation Plan

Benicia Arsenal

2-2-99 jkr p:\Special\DACW05-97D-0035A_E\workplan\FSIP\b103pits.dwg

FIGURE 2

Site Safety And Health Plan
For
Area I Fuel Storage Facilities at
Building 103

Benicia Arsenal

Prepared by: _____ Date: 3/8/99
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: A. Baptiste Date: 2-17-99
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 3/8/99
Ms. Wendy Linck
Site Safety Officer

Effective Dates: 3/8/99 to 3/8/00

Site Safety and Health Plan
for
Area I Fuel Storage Facilities at Building 103

Preface

The Forsgren Associates/Brown and Caldwell (FA/BC) Health and Safety (H&S) Program Manual and the Benicia Arsenal General Site Safety and Health Plan (General SSHP) for the Benicia Arsenal (Arsenal) Formerly Used Defense Site (FUDS), will be referenced throughout this site-specific SSHP. The FA/BC H&S Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, section 203.5, page 2-13.

PROJECT SUMMARY

The purpose of this investigation is to confirm the existence of fuel storage facilities (three USTs and associated pipelines) at Building 103 in Area I and assess whether soil and/or groundwater have been impacted by petroleum hydrocarbons associated with these facilities. The tasks for this investigation include a geophysical survey, subsurface investigation (utility clearance, test pits, and drilling), and groundwater and soil sampling.

KEY PERSONNEL

The key personnel for this site-specific SSHP are:

- Program Manager: Mr. Dave Jones.
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist.
- Project Manager: Ms. Patti DeLaO.
- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez.

Descriptions of responsibilities for each key personnel and subcontractor are included in the Benicia Arsenal General SSHP.

Project Contacts

A reference list of project contacts is located in the Benicia Arsenal General SSHP.

HAZARD ANALYSIS

The site specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for this site is presented in Table 1.

Chemical Hazards

Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table 2.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. General training requirements for all FA/BC staff working on site is described in the Benicia Arsenal General SSHP.

PERSONAL PROTECTIVE EQUIPMENT

The minimum required level of personal protection on the site at all times is level D. Level D includes safety boots/shoes, safety glasses, and a hard hat. In addition to this

Table 1

Potential Hazards and Recommended Controls for Building 103 Investigation Activities

Potential Hazards	Recommended Controls
Chemical Exposure	The minimum level of proper Personal Protective Equipment (PPE) during activities is Level D. This level is adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Air monitoring will be performed with an Organic Vapor Monitor or equivalent to monitor the air quality in and around the work zone.
Back Injury	There are no heavy pieces of equipment anticipated for this project that would require lifting and possible back injuries. In any event, use proper lifting techniques and use adequate back support during all field tasks.
Noise	Heavy equipment is anticipated for this project (i.e. drilling rig and backhoe), such that hearing protection may be necessary. Use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum Handling	Drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums.
Migration of Contamination	A work zone will be delineated before start of work. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figure 1 is provided in this SSHP to show the area of the work zone.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, Trips, and Falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e. steep slopes, potholes, and uneven surfaces).
Utilities	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities.
Heavy Equipment	Drilling and excavating equipment maybe necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site.
Biological Hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. The area around Building 103 is open and these types of biological hazards are not anticipated.
Radiological Hazards	There are no radiological hazards anticipated for this project.

PPE: Personal Protective Equipment

Table 2
Chemical Exposure Limits and Characteristics Controls for Building 103 Investigation Activities

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	IDLH[d] level	Flammable range percent	Odor threshold, ppm	Notes[e]	Potential symptoms of exposure[f]
Benzene	9.24	150	0.5 ppm	Ca (500 ppm)	1.3-7.9	4.68	C,F,65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Toluene	8.82	110	50 ppm	500 ppm	1.2-7.1	0.17-40	T,F,65	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Ethylbenzene	8.76	100	100 ppm	800 ppm	1.0-6.7	0.25-200	T,F	Irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Xylene	8.56	111	100 ppm	800 ppm	1.0-7.0	0.05-200	T,F	Dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Lead	NA	NA	0.05 mg/m^3	100 mg/m^3	NC	NA	C,T,65	Immediate irritation to eyes, insomnia, facial pallor, anorexia, weight-loss, abdominal pain, constipation, colic, anemia

[a] Ionization potential in electron-volts (eV).

[b] Century Organic Vapor Analyzer relative response to the compound in percent.

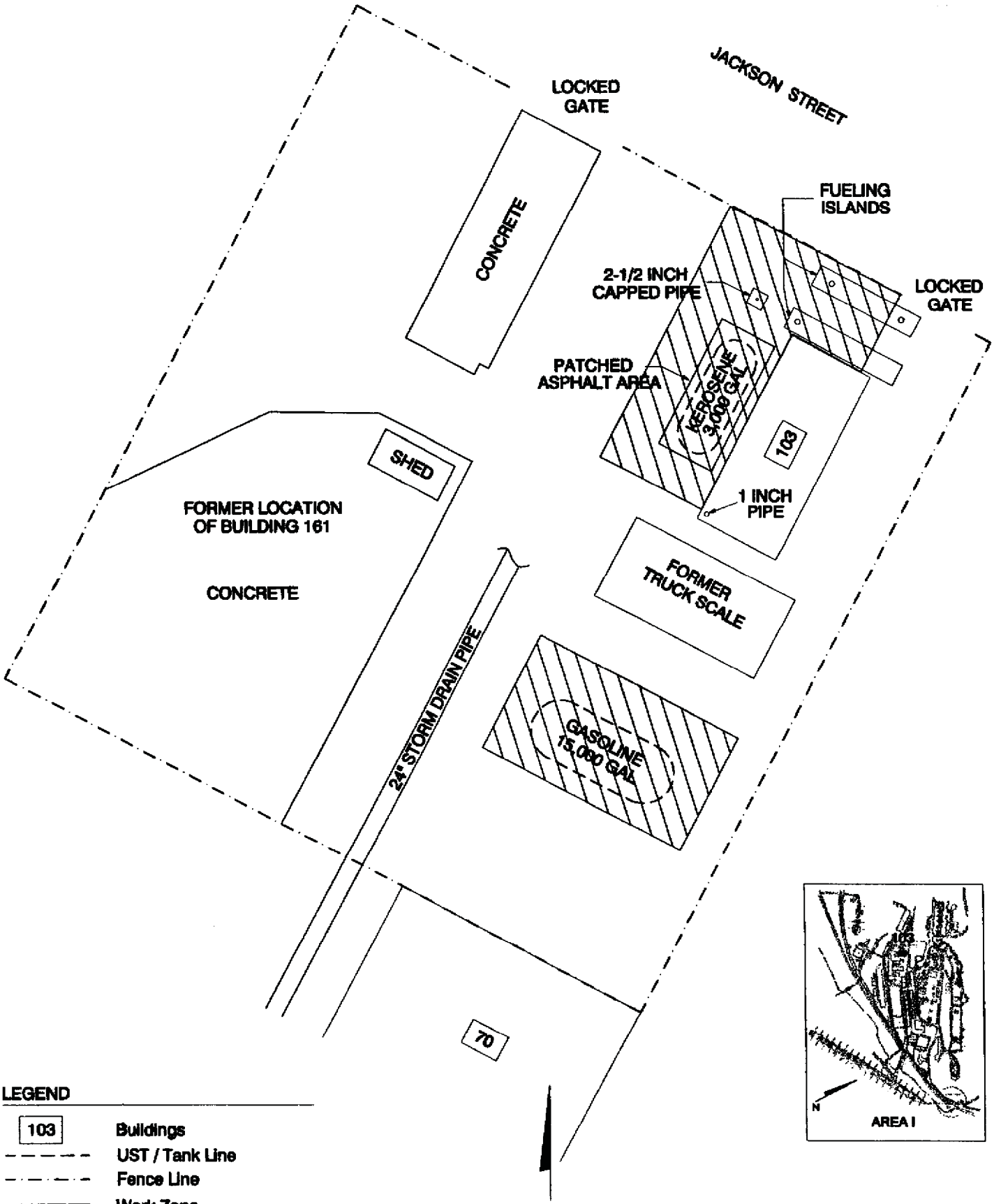
[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1997.

[d] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.

[e] Hazard category; C-Carcinogen; F-Flammable; T-Toxic; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.

[f] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.

Notes: NA = Not applicable or not available, NC = Noncombustable



LEGEND

- 103 — Buildings
- UST / Tank Line
- Fence Line
- Work Zone

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

N

5 0 5 10 15 20

Scale In Feet
1:240
(approximate)

Work Zone Map
Fuel Storage Facilities at Building 103

Area I - Site Safety and Health Plan
Benicia Arsenal

2-2-99 jkr p:\Special\DACW05-97D-0035A_E\workplan\SSHP\b103work.dwg

FIGURE 1

protection, colored Tyvek© coveralls (preferably blue or brown) or equivalent will be worn at all times inside the work zone. These items are also listed on Table 3, Field Equipment. Descriptions of other levels of PPE are described in the FA/BC H&S Manual (301 and 302; p. 1-24) and the Benicia Arsenal General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for this site. Equipment anticipated for environmental monitoring is listed on Table 3. Environmental monitoring will be in accordance with the Organic Vapor Response criteria outlined in Table 4. Generally, all projects will include monitoring of air quality in and around the work area and heat or cold stress.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for this site. The Benicia Arsenal General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

A map of the site is included as Figure 1, showing the approximate work zone. Zone locations are subject to change based on work activities, site access, and wind direction. Equipment necessary for site control measures is listed on Table 3. Further details regarding site control measures can be found in the FA/BC H&S Manual (406; p.25-28).

DECONTAMINATION

Decontamination will take place within the work zone identified on site and shown on Figure 1. A sample decontamination set-up can be found in the FA/BC H&S Manual (405; p.23). There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table 3.

EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital located at 975 Sereno Dr., Vallejo, CA., telephone number: (707)-651-1000.** Directions from this site to the nearest hospital is presented below and shown on the route to hospital map included in this document as Figure 2.

Directions to **Kaiser Permanente Hospital** from Building 103:

- From Jackson Street head east to **Polk Street**
- Left on **Polk Street** heading northwest until it becomes Grant Street
- Continue northwest on **Grant Street** which becomes Military East
- Continue northwest on **Military East** to East 5th Street
- Right onto **East 5th Street** heading northeast
- Left onto on-ramp to **I-780** heading west
- Travel on **I-780 West** for approximately 5.4 miles
- Continue west onto **Maryland Street** for 1.6 miles
- Right on **Sonoma Boulevard** heading north for 2.1 miles
- Right on **Sereno Drive** heading east for 0.4 miles to 975 Sereno Drive

Total travel time to **Kaiser Permanente Hospital** from Building 103 is approximately 10 miles taking 20 minutes.

The nearest telephone is located in the work zone. If a cell phone is to be used for emergency purposes, it must be checked

Table 3
Anticipated Field Equipment for Building 103 Investigation Activities

Equipment	Purpose and Description
Personal Protective Equipment (PPE)	
Nitrile Disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© Coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. An organic vapor cartridge should be adequate protection for the contaminants expected at this site. A cartridge of this type should be changed out daily or when break through occurs, whichever comes first.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic Vapor Monitor (OVM) or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is responding to contaminants.
Benzene Detector Tubes (0.5-10ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones and Safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone.
Decontamination Equipment	
Wash buckets and soap	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e. work boots).
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/Electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field notebook.
Sampling Containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.

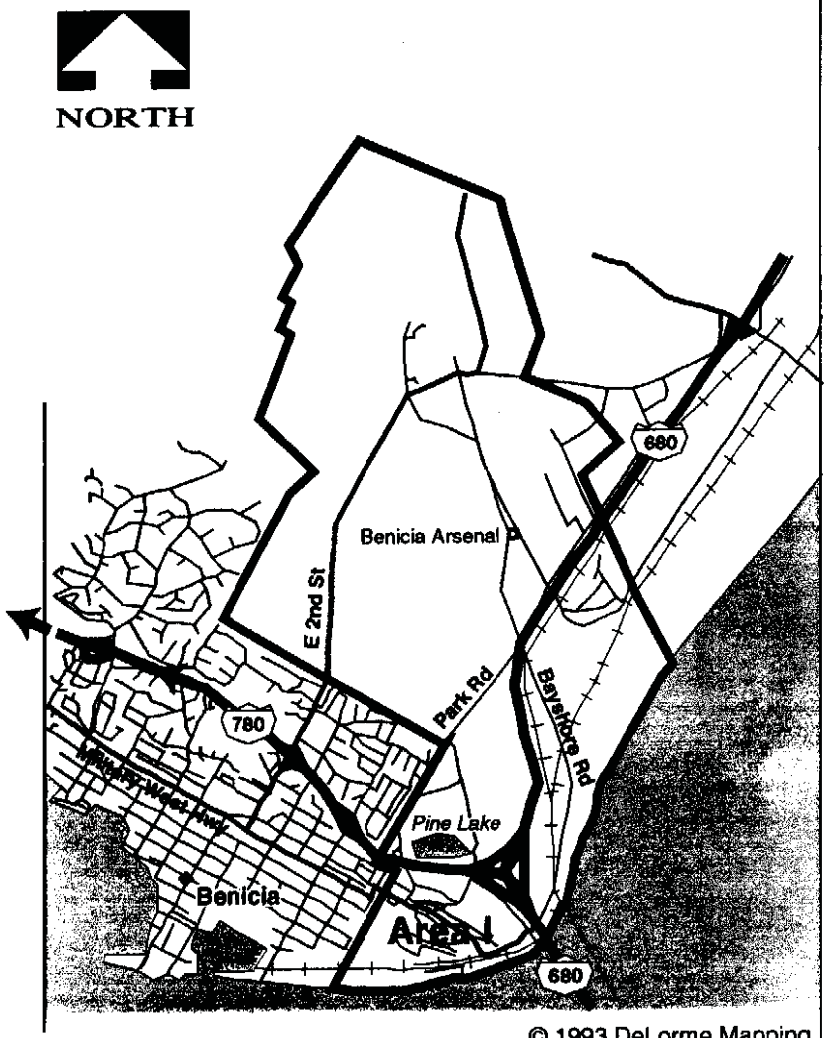
Table 3
Anticipated Field Equipment for Building 103 Investigation Activities

Equipment	Purpose and Description
Sample labels, chain-of custody forms, Zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper chain-of custody forms, labels, and custody seals will be completed for proper quality control. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.

Table 4
Organic Vapor Response Criteria for Petroleum Hydrocarbons that May Include Gasoline

Organic Vapor Concentrations in Breathing Zone[a]	Sampling Frequency	Action Taken
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity.
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity. • If DTs reveal detectable concentrations greater than 1 ppm, then upgrade to Level C PPE.
10 to 100 ppm for more than 2 minutes	Every 15 minutes.	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes.	• Stop work. • Work crews position themselves upwind of site. • Re-evaluate in 15 minutes. • Contact Health and Safety Director and Project Manager. • Evacuate

[a] OVM calibrated to methane (concentrations will be less if calibrated to isobutylene)



FROM **JACKSON STREET** HEAD EAST TO POLK STREET
LEFT ONTO **POLK STREET** HEADING NORTHWEST UNTIL IT BECOMES GRANT STREET
CONTINUE NORTHWEST ON **GRANT STREET** WHICH BECOMES MILITARY EAST
CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5th STREET
RIGHT ONTO **EAST 5th STREET** HEADING NORTHEAST
LEFT ONTO ON-RAMP TO **I-780** HEADING WEST
TRAVEL ON **I-780** WEST FOR APPROXIMATELY 5.4 MILES
CONTINUE WEST ONTO **MARYLAND STREET** FOR 1.6 MILES
RIGHT ON **SONOMA BOULEVARD** HEADING NORTH FOR 2.1 MILES
RIGHT ON **SERENO DRIVE** HEADING EAST FOR 0.4 MILES TO 975 SERENO DRIVE

TOTAL TRAVEL TIME TO **KAISER PERMANENTE HOSPITAL** FROM B103
IS APPROXIMATELY 10 MILES TAKING 20 MINUTES.

Route to Hospital
Fuel Storage Facilities
at Building 103

Area I - Site Safety and Health Plan
Benicia Arsenal

P:\Specia\DACW05-97-D-0035A_E\workplan\SSHP\Hospital103.ai

FIGURE 2

upon arrival to the site to verify that reception to the area is available. **When a cell phone is used for emergency purposes, dial (707) 745-3411 or (707) 745-3412.** The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC H&S Manual (Forward; p. F-5). **In the event of a medical emergency, 911 will be dialed first.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this Workplan. The procedures and frequency in which each Attachment must be completed is described in Table 5.

Table 5
Attachments A – E Building 103 Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the Project Manager and the Health and Safety Director will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e., field notes, boring logs) submitted by the contractor at the end of the day.	Daily

Field Site Investigation Plan

for

Area I Fuel Storage Facilities at Building 154

This Field Site Investigation Plan (FSIP) presents the background, rationale, and scope of field activities to be conducted at the fuel facilities associated with Building 154. The FSIP follows the rapid characterization approaches for the fuel facilities use category as outlined in Section 5 of this Arsenal-Wide Investigation Workplan for the Benicia Arsenal (Arsenal), where applicable. The purpose of activities described in this FSIP is to investigate features, based on information available as of January 1998, suspected or confirmed to have the potential to cause contamination to soil or groundwater from past Department of Defense (DoD) use of the fuel facilities at Building 154.

Section 1. Site Background and Location

Building 154 is currently vacant, and is owned by Gordon Potter. Building 154 is located near Building 53 along Lincoln Street (Figure 1).

Section 2. Site History and Historical Use

The history of fuel tanks at Building 154 reportedly includes the installation of three underground storage tanks (USTs): a 10,000-gallon high-octane gasoline (red), a 7,000-gallon 80 octane gasoline, and a 1,400-gallon white gasoline and associated piping. Table 1 summarizes background information for this fuel facility and it's associated features.

Gasoline was pumped from both the 10,000-gallon and 7,000-gallon USTs to Building 154. Diesel from the 1,400-gallon UST and gasoline from the 10,000-gallon UST were pumped to a tank system west of Building 53. According to historic records, Building 154 was built in 1944, and was first used as a motor test shed. Sometime later it was converted to a paint spray booth. A series of three historic drawings from the Benicia Arsenal Records Research Report ([RRR] Jacobs, 1998) indicate that the three USTs were installed near the southeast corner outside of Building 154. Potential concerns inside Building 154 are not included in this FSIP, and will be addressed in a separate FSIP.

The piping associated with Fuel Storage facilities at B154 includes approximately 400 lineal feet. This includes piping from the USTs to Building 154, and from the USTs along the southern wall of Buildings 56A to a separate fuel storage facility at Building 53 (Figure 1).

Records indicate that the 1,400-gallon UST (5 feet in diameter by 10-feet in length) was located 15 feet east and 5 feet south of the southern corner of Building 154. The top of the UST was approximately 2 feet below ground surface (bgs). A 3-inch diameter fill port for the 1,400-gallon UST was within a 1' X 1' X 1' concrete block approximately 68 feet southwest of the western end of the tank. The location of the pump for this 1,400-gallon UST is unknown. A drawing, dated 19 April 1944, states that this tank was previously used as the "old boilerhouse" fuel tank (Jacobs, 1998). This UST reportedly supplied diesel to the fuel storage system located west of Building 53. Building 53 USTs are included in the FSIP for Building 53. Prior to installation of the 1,400-gallon UST at Building 154, all rust was to be removed from the tank exterior, then coated with "red lead" and then a final coat of "hot tar". The interior was to be steam-cleaned to remove any oil residues.

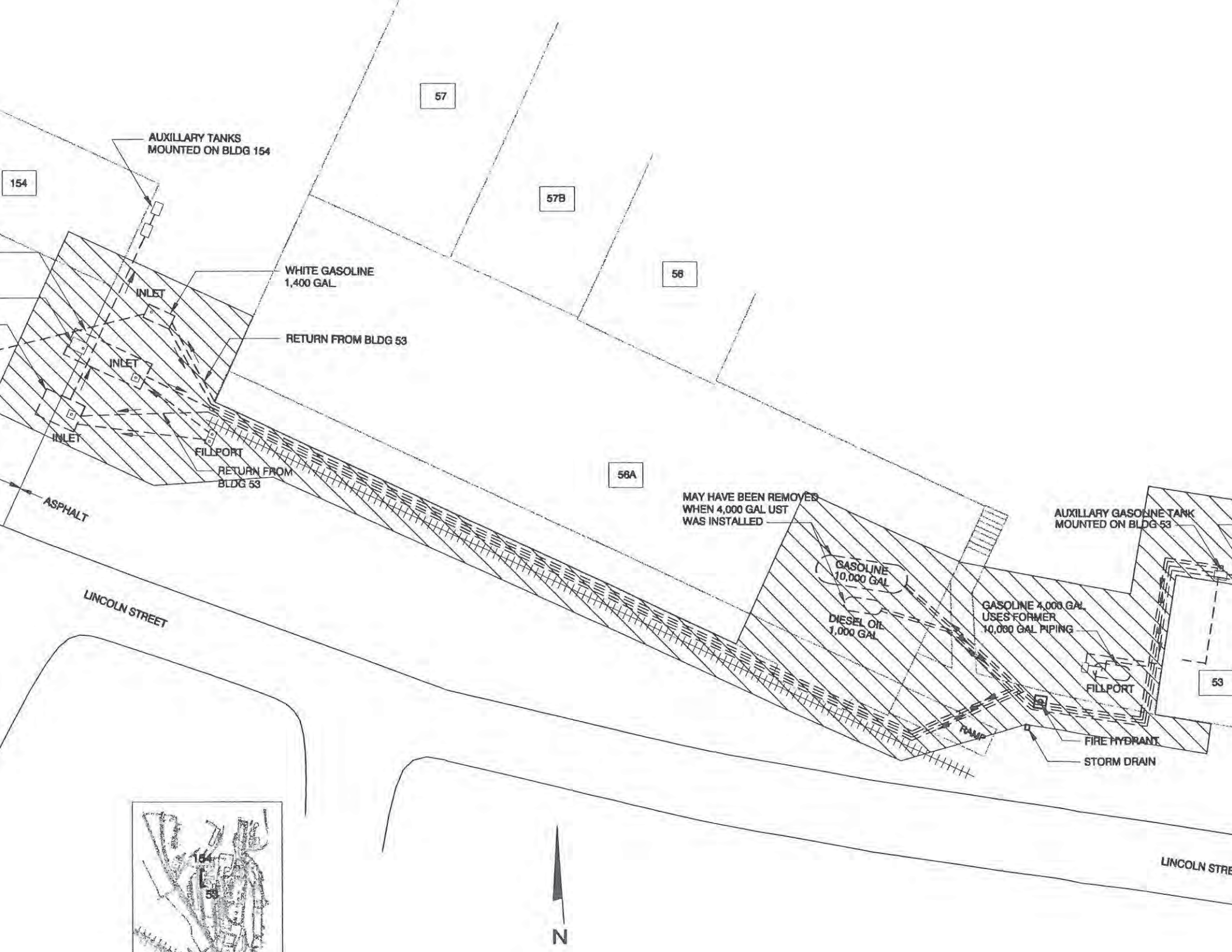

57
AUXILLARY TANKS
MOUNTED ON BLDG 154
154
57B
58
WHITE GASOLINE
1,400 GAL
INLET
RETURN FROM BLDG 53
INLET
INLET
FILLPORT
RETURN FROM
BLDG 53
56A
ASPHALT
MAY HAVE BEEN REMOVED
WHEN 4,000 GAL UST
WAS INSTALLED
AUXILLARY GASOLINE TANK
MOUNTED ON BLDG 53
GASOLINE
10,000 GAL
DIESEL OIL
1,000 GAL
GASOLINE 4,000 GAL
USES FORMER
10,000 GAL PIPING
FILLPORT
53
RAMP
FIRE HYDRANT
STORM DRAIN
LINCOLN STREET
LINCOLN STRE
154
53
N

Table 1

Background Information for Fuel Storage Facilities at Building 154

Facility ID	Feature	Function	Materials Handled	Evidence	Present Status
Building 154	10,000-gallon high octane (red) gasoline UST and associated piping	Storage of gasoline for Building 154 and Building 53	• Gasoline • Lead	Records Research Report	Unconfirmed.
	7,000-gallon 80-octane gasoline UST and associated piping	Storage of gasoline for Building 154 and Building 53	• Gasoline • Lead	Records Research Report	Unconfirmed.
	1,400-gallon white gasoline (diesel) UST and associated piping	Storage of diesel for Building 154 and Building 53	• Diesel	Records Research Report	Unconfirmed.
	"Pump slab"	Pump fuels to Building 154 and Building 53	• Gasoline • Diesel • Lead	Records Research Report and site visit	Unconfirmed. Possible location of an existing concrete slab.

Drawings, dated 14 November 1944 identify the location of a 10,000-gallon gasoline tank (7-foot diameter by 29 feet in length) and pipelines (Jacobs, 1998). According to the drawings, the 10,000-gallon gasoline UST was located approximately 40 feet south of the southeast corner of Building 154. The top of the UST was located approximately 1.5 feet bgs. A 3-inch fill line connected the eastern end of the UST to a fill port encased in a 1.5' X 1.5' X 1' concrete block approximately 48 feet east of the UST. The fill port was located next to the southern edge of the railroad tracks for railroad car filling. An above ground "pump slab" (4' X 6' X 1.5') was located above the western end of the tank. Two motors were mounted on this "pump slab", which were each connected to one suction line from the 10,000-gallon and the 7,000-gallon gasoline UST. The 7,000-gallon UST was located approximately 8 feet south of the 10,000-gallon UST and is described in more detail below. The suction lines were the only pipes that penetrated the "pump slab." One motor powered a 660-gallon per minute (gpm) pump, which supplied gasoline to Building 154 from the 10,000-gallon and the 7,000-gallon UST. The other motor powered a 270 gpm pump, which supplied gasoline from the 10,000-gallon UST to the fuel system located west of Building 53. According to drawings, pipelines for the 10,000-gallon gasoline UST and the 1,400-gallon UST, and one set of railroad tracks ran east along the south side of Building 56A to Building 53 (Figure 1). The pipelines were located beneath or along the northern side of the railroad tracks, next to Building 56A (Figure 1). These pipelines included two return lines from Building 53, one line to the 1,400-gallon UST and one line to the 7,000-gallon UST. Approximately 340 lineal feet of piping connected the Building 154 tank system to the Building 53 tank system. Approximately 60 lineal feet of piping connects to the USTs to Building 154.

The 14 November 1944 drawing also identifies a 7,000-gallon gasoline tank (9 feet in diameter and approximately 17 feet in length) approximately 8 feet south of the 10,000-gallon UST. Piping from the 7,000-gallon gasoline UST connected to the inflow of the 10,000-gallon UST. The fill port for the 7,000-gallon diesel UST was located a few feet south of the 10,000-gallon UST fill port at the railroad tracks (Figure 1). The gasoline from the 7,000-gallon UST was solely for Building 154. The 7,000-gallon and the 1,400-gallon USTs were each strapped to an 18- to 21-inch thick reinforced concrete slab. The tanks may have been strapped to prevent the tendency for the tanks to "float", if shallow groundwater entered the tank pit. However, drawings indicate that the 10,000-gallon UST was not supported by a concrete slab or strapped.

During a field inspection in March 1998, a rectangular concrete slab was observed approximately 40 feet south of the southeast corner of Building 154. This concrete slab may be the remnants of the "pump slab" that was located over the 10,000-gallon gasoline UST. During an additional field inspection in May 1998, field personnel noted that the top of the "pump slab" is level with the existing grade and does not have the remnants of any suction lines coming through the slab. The area south of Building 154 is concrete. The concrete appears to be cut, and is parallel to the eastern side of Building 154 (Figure 1). East of the concrete is asphalt, under which may be all three USTs. No fill ports were observed in the area of the railroad tracks. The presence of the asphalt may indicate that the fill ports and possibly the USTs were removed.

Section 3. Previous Investigations

No previous investigations have been conducted for the fuel storage facilities at Building 154.

Section 4. Data Quality Objectives

The data quality objectives (DQOs) for this field investigation are presented in Table 2. The United States Army Corps of Engineers (USACE) Data Quality Objective Guidance worksheet was used to generate Table 2.

Section 5. Sampling Plan

There is no available data indicating the disposition of the USTs or whether or not any previous investigations have been conducted at for fuel facilities at Building 154. The presence of the USTs and associated piping has not been positively determined. The file review was conducted and results were inconclusive. Therefore, the USTs and associated piping may remain in place at Building 154. The following is proposed for this FSIP.

- Review additional records as they become available during the investigation including facility drawings and documents on file at local agencies to determine any additional history about the installation or removal of the USTs at Building 154.
- A geophysical survey will be conducted to confirm the existence and determine the location of the USTs and associated piping.
- If the geophysical survey identifies anomalies indicating the possible location of the USTs and associated piping or the survey is inconclusive, a subsurface investigation will be conducted. The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and groundwater (if encountered) from petroleum hydrocarbons.
- The purpose of the investigation will be to determine the presence of the USTs and associated piping and the possible presence and magnitude of impact to the subsurface soil and/or groundwater (if encountered) from petroleum hydrocarbons and lead.

File Review. Facility drawings and documents from the USACE were reviewed for any additional historical data not included in the RRR. The Solano County Department of Environment and Management and local fire department records were also reviewed for any references to USTs or previous investigations for fuel facilities at Building 154. Reviewed records regarding the existence of three USTs are inconclusive. Additional records discovered during the investigation will be reviewed as they become available. If additional records indicate that the USTs were removed, then no further investigation will be conducted.

Geophysical Survey. A geophysical survey will be conducted between Buildings 154 and 56A, from the southern corner of Building 154 to Lincoln Street, and outside the southwestern side of Building 56A to the railroad tracks. One set of railroad tracks remain at the site. The railroad tracks and existing utilities, including a fire water line that is located along the south side of Building 56, may impede the identification of any subsurface piping related to the USTs. Utility providers will be called to the site to identify their respective lines.

Subsurface Investigation. If the geophysical survey does not indicate the presence of USTs or associated piping, no further investigation will be conducted. If the geophysical survey is inconclusive or indicates the presence of USTs or pipelines, test pits (using a backhoe, hand auger or shovel) will be installed to confirm the presence of the UST or piping.

Subsurface activities will include test pits, and collecting soil and groundwater (if encountered) samples. Table 3 summarizes commonly used substances of

Table 2

Data Quality Objectives

State the Problem:

Confirm the existence of fuel storage facilities at Building 154 (two gasoline USTs [underground storage tank] south of Building 154, one diesel UST between Building 56A and Building 154, and a "pump slab"). Determine the presence of petroleum hydrocarbons and lead in soil and/or groundwater associated with fuel storage activities at this Department of Defense (DoD) facility.

Identify the Decision:

Investigation-wide decisions:

- Assess the impact of soil type and stratigraphy on the mobility and distribution of chemicals of potential concern (COPC).
- Assess if COPC are present in soil and/or groundwater and if concentrations exceed assessment criteria and may require additional data collection, risk analysis or remediation.

Feature-specific Decisions:

- Determine if the USTs and associated piping exist. Determine if they require removal or closure.
- If USTs and related pipelines exist, assess if COPC are present in soil and/or groundwater beneath the USTs and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis or remediation.

Identify Inputs:

- Results of facility drawings from the U.S. Army Corps of Engineers, and Solano County and local fire department files in the area of the USTs and associated pipelines.
- Results of geophysical survey in the area of the USTs south of Building 154 and between Building 56A and Building 154.
- Numeric assessment criteria for Arsenal COPC that will be compared to soil and groundwater sample analytical data.
- Analytical results from soil samples collected in areas of geophysical survey anomalies for USTs.
- Analytical results from soil and/or groundwater samples for petroleum hydrocarbons and lead collected from test pits.

Physical Study Boundaries:

- The area south of Building 154 will be investigated in the area of the suspected gasoline USTs.
- The area between Building 56A and Building 154 will be investigated.
- This investigation will not include the buildings infrastructure, sewer or storm drain system.

Table 2

Data Quality Objectives

Practical Study Boundaries:

- Shallow groundwater will be sampled beneath USTs only if encountered near the bottom of the USTs and pipelines.

Temporal Study Boundaries:

- Standard field and analytical methods are proposed to generate data useable for the duration of investigation and remediation.
- Limited temporal influence on groundwater sampling data may result from tide-related changes in groundwater.
- Field activities and sample results are not anticipated to be significantly affected by changing weather conditions

General Site Decision Rules:

- If results for COPC are above detection limits, then values will be compared against assessment criteria. If values are below the assessment criteria, the investigation will be considered complete. If values exceed assessment criteria, results will be evaluated and recommendations made for possible additional data collection, risk analysis, or remediation.
- If county records indicate the USTs have been removed, then no further investigation will be performed.
- If county records are inconclusive, a geophysical survey will be conducted.
- If the geophysical survey results from the areas suspected to contain the USTs and piping indicate that the USTs and associated pipelines are not present, no further investigation will be performed.
- If the geophysical survey results from the areas of the USTs are inconclusive or show anomalies, then soil samples will be collected from test pits. One test pit will be dug for each suspected lank location or anomaly location associated with the USTs. A grab groundwater sample will be collected if shallow groundwater is encountered in any of the test pits.
- If test pits confirm the presence of USTs and/or pipelines, then a tank and pipeline removal program will be initiated by the USACE.
- If laboratory results in soil are greater than 250 mg/kg for TPH - gas, and 500 mg/kg for diesel then step-out/step-down samples will be collected in a triangular pattern, until the extent of the contamination is defined.

Specify Tolerable Limits on Decision Errors:

- The analyses must provide definitive data. Accuracy, precision, and completeness objectives set forth in the Arsenal-Wide QAPP will apply.
- Assessment criteria will be used as absolute values to compare point-by point to analytical results. Results that exceed assessment criteria will be evaluated further.

Optimize Design for Study:

Based on site history and file review activities, collect soil and groundwater samples at pre-selected locations and depths. Sequence investigation activities so that scope of work can be modified as new information is collected.

Table 3

Summary of Commonly Used Substances for Fuel Facilities at Building 154 and Analytical Rationale

Building 154 Substance of Concern	Commonly Associated Chemical Type	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Fuels	Gasoline	M8015V (volatile TPH)	M8015V (volatile TPH)	TO-14
	Diesel	M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH)	M8015E (extractable TPH) SW8260B (VOCs) SW8310 (PAH)	
	Lead	SW7421	SW7421	

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = poly aromatic hydrocarbons
VOCs = volatile organic compounds

concern identified during record search to have been used at the fuels storage facilities at Building 53. This table also correlates each substance to an analytical method that will be used to assess if the substance if present. Table 4 presents the specific sampling and analysis activities that will be conducted to evaluate the substances presented in Table 3. The purpose of these activities will be to assess the nature and extent of potential impacts from previous uses. One test pit will be located in the area approximately 30 feet south of the southeast corner of Building 154 to locate the 10,000-gallon gasoline UST. One test pit will be located approximately 20 feet south of the concrete slab to locate the 7,000-gallon gasoline UST, and one test pit will be located approximately 20 feet east and 15 feet south of the southeast corner of Building 154 for the 1,400-gallon UST. Based on the drawings from the Records Research Report, these test pits also coincide with approximate location of the piping associated with each UST. Additional test pits will be dug to confirm the presence of piping from the Building 154 tank system to the Building 53 tank system and from the 1,400-gallon UST to the fillpoint at Lincoln Street.

There was (is) approximately 340 lineal feet of piping along the southern edge of Building 56 linking the tank system at Building 154 to the UST system at Building 53. A maximum of three test pits will be dug starting from the junction of the piping at the railroad tracks toward the Building 53 tank system, approximately every 40 feet. It is anticipated that three test pits should be sufficient to determine the presence of this piping corridor. If the first test pit along the Building 154/Building 53 piping corridor indicates that the piping is present, then the other test pits will not be dug. In addition, the Building 53 FSIP includes test pits to confirm the presence of the Building 154/53 piping corridor. If this investigation is completed by the start of the Building 154 investigation, and the piping is not present, then the test pits for this investigation will not be dug along the Building 154/53 piping corridor. If the piping is present at the Building 53 side, then the test pits will be dug to confirm that they are present at the Building 154 side.

Test pits will be dug starting from the west end of the 1,400-gallon UST to the fillpoint at Lincoln Street to confirm the presence of piping. Figure 2 shows the proposed locations of the test pits. Table 4 summarizes the sample locations for these test pits.

If a UST is encountered in a test pit and samples cannot be collected, then one additional test pit will be dug for the collection of soil and/or groundwater samples. This test pit will be located a distance approximately twice the tank diameter in the direction of the fillpoint end of the UST. If the diameter is not known, the diameter will be estimated based on similar tanks of known diameter at the Arsenal. If the fillpoint is unknown, then the test pit will be dug in the downgradient direction from the UST.

Sampling planned to address the workshop building complex (50 Series Complex) may provide additional data to assist in the assessment of soil and groundwater conditions in the vicinity of these suspected USTs. Details regarding this investigation will be presented in a separate FSIP for the 50 Series Complex.

Samples collected for Building 154 will be analyzed by an on-site mobile laboratory or on-site field GC unit, if economically feasible. If laboratory results in soil are greater than 250 mg/kg for total petroleum hydrocarbons as gasoline, and 500 mg/kg for diesel then step-out or step-down samples will be collected. These step-out samples may be collected using a backhoe, drilling rig, or direct push rig. Generally, step-out samples will be collected in a triangular pattern (if possible) away from the

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Fuel Facilities at Building 154

Attribute Investigated	Reference Point	Sampling Point/ Sample Name	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
1,400-gallon UST	Between Building 154 and Building 56	IB154SB001	Approximately 20 feet east and 15 feet south of southwest corner of Building 154	Test Pit/6 feet and 11 feet	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
1,400-gallon UST	Between Building 154 and Building 56	IB154GR001	Approximately 20 feet east and 15 feet south of southwest corner of Building 154	Test Pit/11 feet	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
7,000-gallon UST	Between Building 154 and Lincoln Street	IB154SB002	Approximately 20 feet south of concrete slab	Test pit/ 6 feet and 11 feet	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
7,000-gallon UST	Between Building 154 and Lincoln Street	IB154GR002	Approximately 20 feet south of concrete slab	Test pit/ 11 feet	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
10,000-gallon UST	Between Building 154 and Lincoln Street	IB154SB003	Approximately 30 feet south of southeast corner of Building 154	Test pit/ 6 feet and 11 feet	Soil	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)

Table 4

Sampling and Analysis Matrix and Field Sampling Specifications for Fuel Facilities at Building 154

Attribute Investigated	Reference Point	Sampling Point/ Sample Name	Location[1]	Type/Sample Depth Interval (feet bgs)[1]	Matrix	Chemicals of Potential Concern[2]	Analytical Methods[1]
10,000-gallon UST	Between Building 154 and Lincoln Street	IB154GR003	Approximately 30 feet west of southeast corner of Building 154	Test pit/ 11 feet	Water[3]	Diesel and leaded gasoline	SW8015V (volatile TPH) SW8015E/3630C (extractable TPH) SW8260B (VOCs) SW7421 (Lead) SW8310 (PAHs)
Pipelines from Building 154T UST system to Building 53 UST system	Building 53/56 and Lincoln Street	No Samples	Approximately every 40 feet along pipeline	Test Pits to verify pipeline existence (a maximum of three test pits, if the pipelines are present in the first test pit, then the other test pits will not be dug)	Soil	Diesel and leaded gasoline	NONE
Pipelines from 1,400-gallon UST to fillpoint on Lincoln Street	Between Building 154 and Lincoln Street	No Samples	Approximately every 40 feet along pipeline	Test Pits to verify pipeline existence (a maximum of three test pits, if the pipelines are present in the first test pit, then the other test pits will not be dug)	Soil	Diesel and leaded gasoline	NONE

[1]Sampling points, locations, depths, and analytical methods to be determined in the field. The sampling points, locations, depths, and analytical methods listed for this table are only a guide in accordance with Tri-Regional Board guidelines for UST tank removals.

[2] Diesel and leaded gasoline are considered chemicals of potential concern at these sampling locations because of the proximity of the diesel UST to the other USTs and the potential for some lateral migration of contaminants.

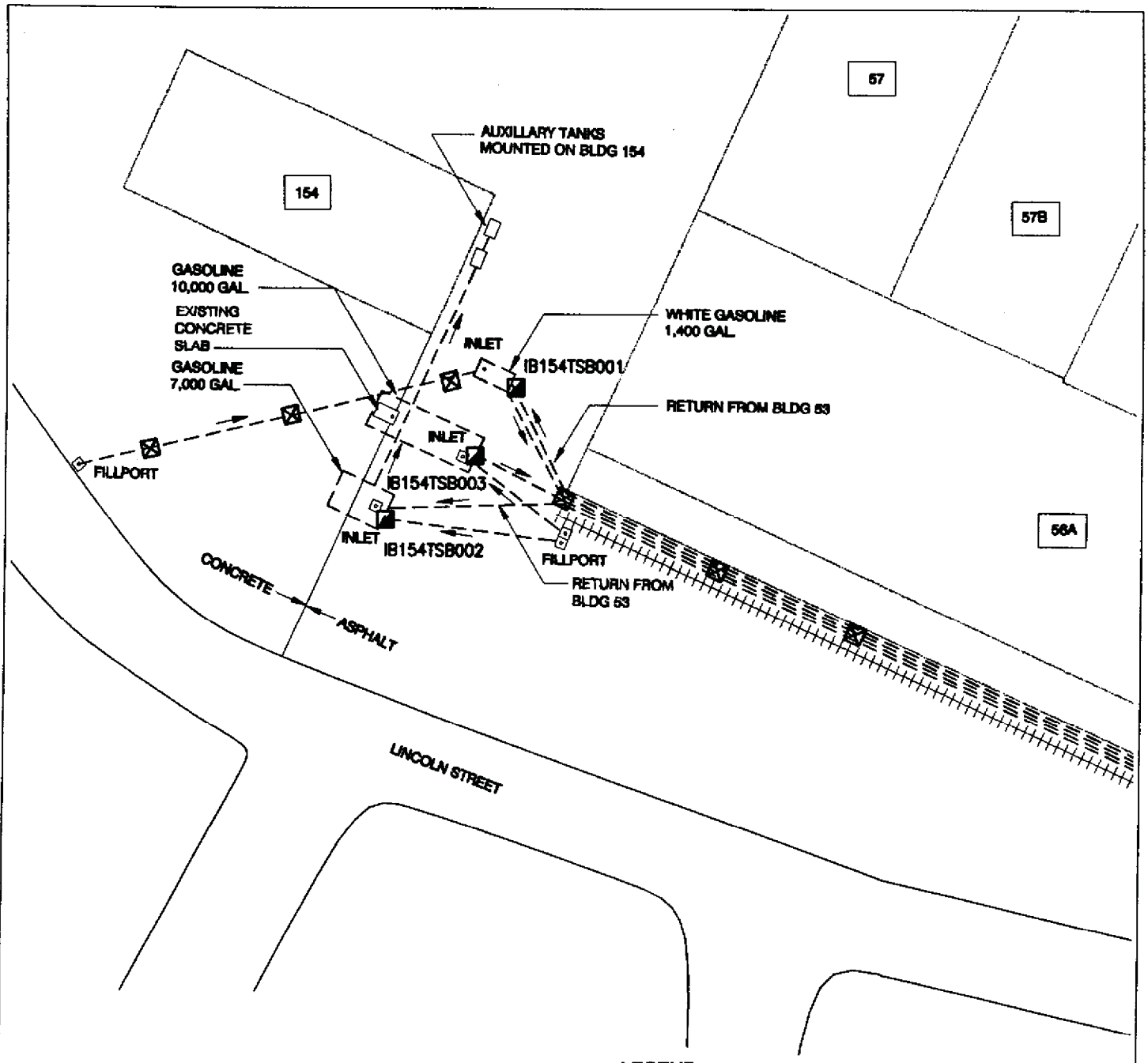
[3] Groundwater samples for dissolved lead will be filtered using a 0.45 μm filter.

Notes:

Field QC samples, including trip blanks, equipment blanks, and field duplicates, will be taken at the minimum frequency specified in the QAPP.

If laboratory results in soil are greater than 250 mg/kg for TPH - gas, and 500 mg/kg for diesel, than step-out and/or step-down samples will be collected and analyzed. See step-out and step-down decision logic in Section 5 of the Arsenal Wide Investigation Workplan.

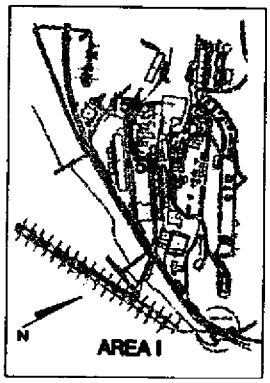
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = poly aromatic hydrocarbons
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds



Note: All site features referenced in Records Research Report (Jacobs Engineering) documents or noted during site inspection are included on this figure.

LEGEND

- 181 — Buildings
- UST/Tank Line
- Railroad Tracks
- Fluid Flow Direction
- Concrete Block Encasing Fillport or Tank Inlet for Fluid Level Measurement
- Proposed Test Pit Location and Number
- Proposed Test Pit to Verify Existing Pipelines Only



N

10 0 10 20 30 40

Scale In Feet
(Approximate)

Test Pit Location
Fuel Storage Facilities
at Building 154

Area I - Field Site Investigation Plan

Benicia Arsenal

1-29-99 jkr p:\Special\DACW05-97-D-0035A_E\workplan\FSIP\B154Tpits.dwg

FIGURE 2

original sample for lateral definition. Step-out sample locations may be moved or omitted if access is insufficient for the backhoe, drilling or direct push rig, or subsurface obstructions are encountered (i.e. overhead and underground utilities, or other facility substructures). Vertical definition will be determined by collecting additional sample(s) downward from the original sample, until groundwater is encountered.

Section 6. Schedule of Work

Once field activities begin, the Building 154 fuel facilities investigation will be conducted in a sequence which will enable project personnel to refine the scope of work as new data are collected. In general, non-invasive activities will be conducted first, followed by invasive activities. As described above, the initial step will be to complete file review. Upon completion of the file review, the geophysical survey will be conducted inside and outside the buildings to better define targets and clear drilling locations. The initial invasive activity will be to collect soil and groundwater samples (if encountered) in test pits or angle borings.

Section 7. Sample Analyses

A description of the chemical analyses to be conducted on each soil and groundwater sample is presented in Table 4. A detailed description of each analytical method is presented in the Quality Assurance Project Plan (QAPP) (Brown and Caldwell, 1999a). Quality assurance/quality control (QA/QC) sampling protocol is also described in the QAPP and will include collecting sample duplicates (10 percent frequency), sample splits (10 percent frequency), and sample splits (10 percent frequency) for each media (see Table 5). One equipment blank will be collected for this FSIP. Trip blanks will be analyzed for each VOC sample shipment. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected in coordination with the analytical laboratory for the appropriate methods so that each analytical batch contains an MS/MSD sample as required by the QAPP. The Contract Analytical Laboratory procedures and services will be in accordance with the QAPP.

After collection (SOP 7.0), samples will be packed, preserved, and shipped via courier or overnight delivery as described in SOPs 9.0 and 10.0. The analytical laboratory will be notified prior to sample shipment of the number and type of samples and analyses. Sample collection and transportation will be documented in field log books and on the sample chain of custody (SOP 4.0). Upon receipt of the sample shipment, the laboratory will document the status of the shipment by sending a copy of the completed COC and login sheet to the PM by fax.

Sample analytical results will be reported in electronic and hardcopy deliverables of sample receipt. Specifications for the laboratory reporting package are included in the QAPP. Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. Upon completion of data validation, analytical results will be reported according to Section 5.0 of the Arsenal-Wide Investigation Workplan.

Section 8. References

Brown and Caldwell. 1999. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Jacobs Engineering. 1998. Records Research Report for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. Draft. March.

Table 5

Summary of Subsurface Investigation Activities for Fuel Facilities at Building 154

Attribute Investigated	Number of Test Pits	Number of Soil Borings	Number of Soil Samples	Number of Soil Gas Samples	Number of Grab Groundwater Samples
1,400-gallon UST	1	0	2	0	1(1)
7,000-gallon UST	1	0	2	0	1(1)
10,000-gallon UST	1	0	2	0	1(1)
Pipelines from Building 154 UST system to Building 53 UST system	1(2)	0	0	0	0
Pipelines from 1,400-gallon UST to fillport on Lincoln Street	1(2)	0	0	0	0
Subtotal	5	0	6	0	3
Duplicate Samples			(A)	0	(A)
Split Samples			(A)	0	(A)
Equipment blanks			1	0	
Total	5	0	7	0	3

(1) Samples for groundwater will be collected, if encountered, in each boring.

(2) Additional test pits may be necessary to verify existence of pipelines.

(A) The number of duplicate and split samples will be based on the total number of samples collected for all FSIPs done in conjunction with this FSIPs.

Site Safety And Health Plan
For
Area I Fuel Storage Facilities at
Building 154

Benicia Arsenal

Prepared by: _____ Date: 3-8-99
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: A. Baptiste Date: 2-17-99
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 3-8-99
Ms. Wendy Linck
Site Safety Officer

Effective Dates: 3-8-99 to 3-8-00

Site Safety and Health Plan
for
Area I Fuel Storage Facilities at Building 154

Preface

The Forsgren Associates/Brown and Caldwell (FA/BC) Health and Safety (H&S) Program Manual and the Benicia Arsenal General Site Safety and Health Plan (General SSHP) for the Benicia Arsenal (Arsenal) Formerly Used Defense Site (FUDS), will be referenced throughout this site-specific SSHP. The FA/BC H&S Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, section 203.5, page 2-13.

PROJECT SUMMARY

The purpose of this investigation is to confirm the existence of fuel storage facilities (three USTs and associated pipelines) at Building 154 in Area I and assess whether soil and/or groundwater have been impacted by petroleum hydrocarbons associated with these facilities. The tasks for this investigation include a geophysical survey, subsurface investigation (utility clearance, test pits, and drilling), and groundwater and soil sampling.

KEY PERSONNEL

The key personnel for this site specific SSHP are:

- Program Manager: Mr. Dave Jones.
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist.
- Project Manager: Ms. Patti DeLaO.
- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez.

Descriptions of responsibilities for each key personnel and subcontractor are included in the Benicia Arsenal General SSHP.

Project Contacts

A reference list of project contacts is located in the Benicia Arsenal General SSHP.

HAZARD ANALYSIS

The site specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for this site is presented in Table 1.

Chemical Hazards

Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table 2.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. General training requirements for all FA/BC staff working on site is described in the Benicia Arsenal General SSHP.

PERSONAL PROTECTIVE EQUIPMENT

The minimum required level of personal protection on the site at all times is level D. Level D includes safety boots/shoes, safety glasses, and a hard hat. In addition to this protection, colored Tyvek© coveralls

Table 1

Potential Hazards and Recommended Controls for Building 154 Investigation Activities

Potential Hazards	Recommended Controls
Chemical Exposure	The minimum level of proper Personal Protective Equipment (PPE) during activities is Level D. This level is adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Air monitoring will be performed with an Organic Vapor Monitor or equivalent to monitor the air quality in and around the work zone.
Back Injury	There are no heavy pieces of equipment anticipated for this project that would require lifting and possible back injuries. In any event, use proper lifting techniques and use adequate back support during all field tasks.
Noise	Heavy equipment is anticipated for this project (i.e. drilling rig and backhoe), such that hearing protection may be necessary. Use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum Handling	Drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums.
Migration of Contamination	A work zone will be delineated before start of work. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figure 1 is provided in this SSHP to show the area of the work zone.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, Trips, and Falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e. steep slopes, potholes, and uneven surfaces).
Utilities	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities.
Heavy Equipment	Drilling and excavating equipment maybe necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site.
Biological Hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. The area around Building 154 is open and these types of biological hazards are not anticipated.
Radiological Hazards	There are no radiological hazards anticipated for this project.

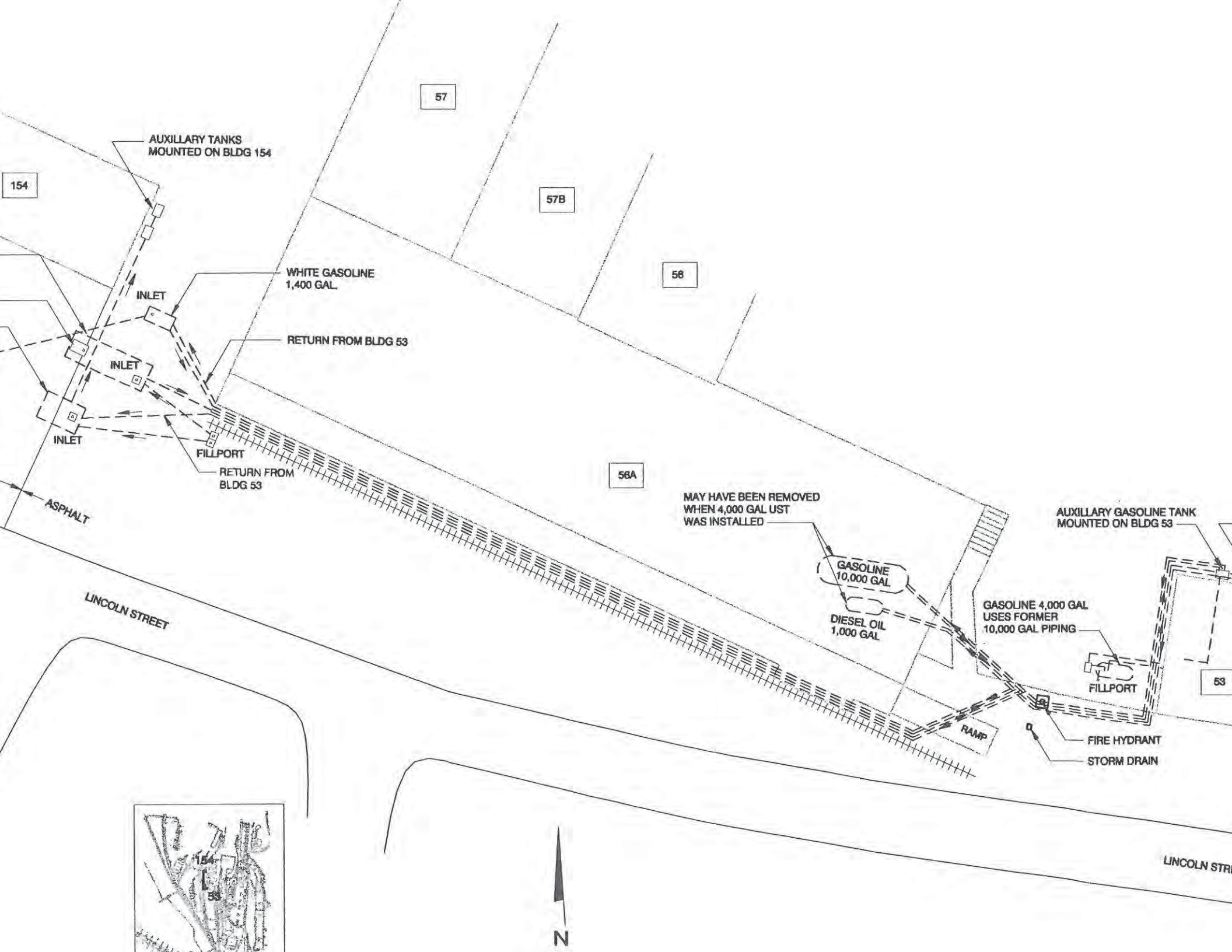
PPE: Personal Protective Equipment

Table 2

Chemical Exposure Limits and Characteristics Controls for Building 154 Investigation Activities

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	IDLH[d] level	Flammable range percent	Odor threshold, ppm	Notes[e]	Potential symptoms of exposure[f]
Benzene	9.24	150	0.5 ppm	Ca (500 ppm)	1.3-7.9	4.68	C,F,65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Toluene	8.82	110	50 ppm	500 ppm	1.2-7.1	0.17-40	T,F,65	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Ethylbenzene	8.76	100	100 ppm	800 ppm	1.0-6.7	0.25-200	T,F	Irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Xylene	8.56	111	100 ppm	800 ppm	1.0-7.0	0.05-200	65	Dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Lead	NA	NA	0.05 mg/m^3	100 mg/m^3	NC	NA	C,T,65	Immediate irritation to eyes, insomnia, facial pallor, anorexia, weight-loss, abdominal pain, constipation, colic, anemia

[a] Ionization potential in electron-volts (eV).
[b] Century Organic Vapor Analyzer relative response to the compound in percent.
[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1997.
[d] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.
[e] Hazard category; C-Carcinogen; F-Flammable; T-Toxic; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.
[f] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.
Notes: NA = Not applicable or not available, NC = Noncombustable


57
AUXILLARY TANKS
MOUNTED ON BLDG 154
154
57B
56
WHITE GASOLINE
1,400 GAL
INLET
RETURN FROM BLDG 53
INLET
INLET
FILLPORT
RETURN FROM
BLDG 53
56A
ASPHALT
MAY HAVE BEEN REMOVED
WHEN 4,000 GAL UST
WAS INSTALLED
GASOLINE
10,000 GAL
DIESEL OIL
1,000 GAL
AUXILLARY GASOLINE TANK
MOUNTED ON BLDG 53
GASOLINE 4,000 GAL
USES FORMER
10,000 GAL PIPING
FILLPORT
53
RAMP
FIRE HYDRANT
STORM DRAIN
LINCOLN STREET
LINCOLN STR
154
53
N

(preferably blue or brown) or equivalent will be worn at all times inside the work zone. These items are also listed on Table 3, Field Equipment. Descriptions of other levels of PPE are described in the FA/BC H&S Manual (301 and 302; p. 1-24) and the Benicia Arsenal General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for this site. Equipment anticipated for environmental monitoring is listed on Table 3. Environmental monitoring will be in accordance with the Organic Vapor Response criteria outlined in Table 4. Generally, all projects will include monitoring of air quality in and around the work area and heat or cold stress.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for this site. The Benicia Arsenal General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

A map of the site is included as Figure 1, showing the approximate work zone. Zone locations are subject to change based on work activities, site access, and wind direction. Equipment necessary for site control measures is listed on Table 3. Further details regarding site control measures can be found in the FA/BC H&S Manual (406; p.25-28).

DECONTAMINATION

Decontamination will take place within the work zone identified on site and shown on Figure 1. A sample decontamination set-up can be found in the FA/BC H&S Manual (405; p.23). There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table 3.

EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital located at 975 Sereno Dr., Vallejo, CA., telephone number: (707)-651-1000**. Directions from this site to the nearest hospital is presented below and shown on the route to hospital map included in this document as Figure 2.

Directions to **Kaiser Permanente Hospital** from Building 154:

- From **Lincoln Street** heading northwest to Jackson Street
- Right on **Jackson Street** head east to Polk Street
- Left on **Polk Street** heading northwest until it becomes Grant Street
- Continue northwest on **Grant Street** which becomes Military East
- Continue northwest on **Military East** to East 5th Street
- Right onto **East 5th Street** heading northeast
- Left onto on-ramp to **I-780** heading west
- Travel on **I-780 West** for approximately 5.4 miles
- Continue west onto **Maryland Street** for 1.6 miles
- Right on **Sonoma Boulevard** heading north for 2.1 miles
- Right on **Sereno Drive** heading east for 0.4 miles to 975 Sereno Drive

Table 3
Anticipated Field Equipment for Building 154 Investigation Activities

Equipment	Purpose and Description
Personal Protective Equipment (PPE)	
Nitrile Disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© Coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. An organic vapor cartridge should be adequate protection for the contaminants expected at this site. A cartridge of this type should be changed out daily or when break through occurs, whichever comes first.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic Vapor Monitor (OVM) or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is responding to contaminants.
Benzene Detector Tubes (0.5-10ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones and Safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone.
Decontamination Equipment	
Wash buckets and soap	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e. work boots).
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/Electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field notebook.

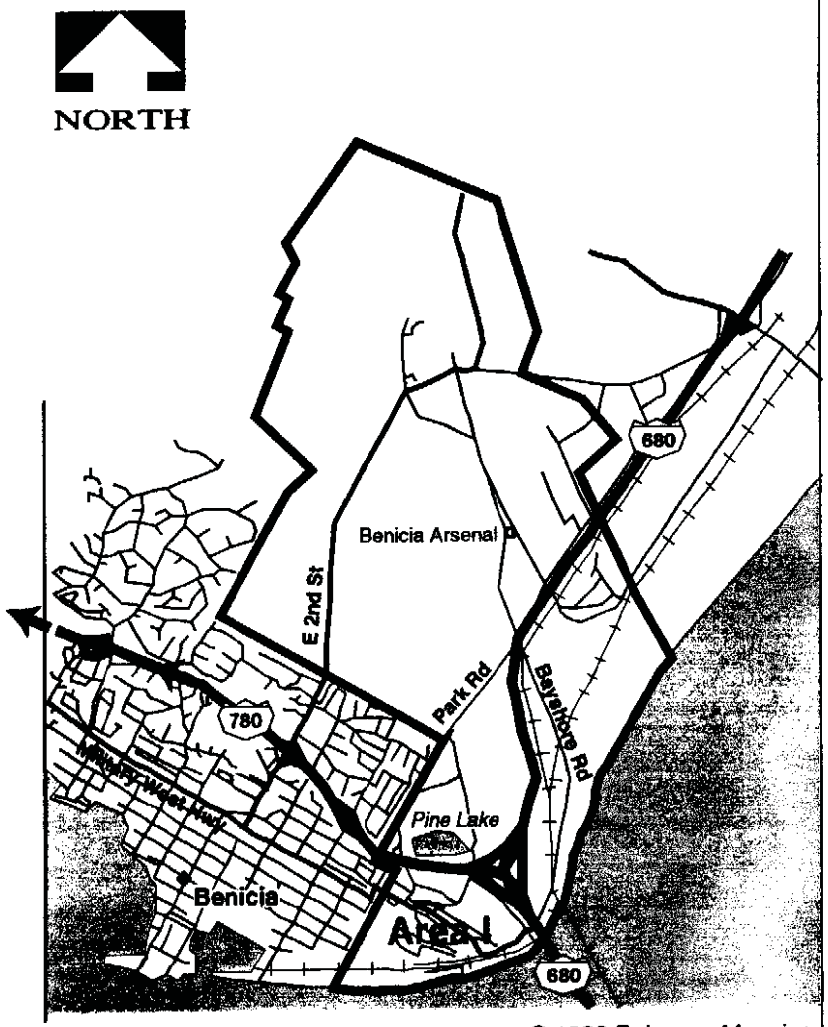
Table 3
Anticipated Field Equipment for Building 154 Investigation Activities

Equipment	Purpose and Description
Sampling Containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.
Sample labels, chain-of custody forms, Zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper chain-of custody forms, labels, and custody seals will be completed for proper quality control. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.

Table 4
Organic Vapor Response Criteria for Petroleum Hydrocarbons that May Include Gasoline

Organic Vapor Concentrations in Breathing Zone[a]	Sampling Frequency	Action Taken
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity.
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity. • If DTs reveal detectable concentrations greater than 1 ppm, then upgrade to Level C PPE.
10 to 100 ppm for more than 2 minutes	Every 15 minutes.	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes.	• Stop work. • Work crews position themselves upwind of site. • Re-evaluate in 15 minutes. • Contact Health and Safety Director and Project Manager. • Evacuate

[a] OVM calibrated to methane (concentrations will be less if calibrated to isobutylene)



FROM **LINCOLN STREET** HEADING NORTHWEST TO JACKSON STREET
RIGHT ON **JACKSON STREET** HEADING EAST TO POLK STREET
LEFT ONTO **POLK STREET** HEADING NORTHWEST UNTIL IT BECOMES GRANT STREET
CONTINUE NORTHWEST ON **GRANT STREET** WHICH BECOMES MILITARY EAST
CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5th STREET
RIGHT ONTO **EAST 5th STREET** HEADING NORTHEAST
LEFT ONTO ON-RAMP TO **I-780** HEADING WEST
TRAVEL ON **I-780** WEST FOR APPROXIMATELY 5.4 MILES
CONTINUE WEST ONTO **MARYLAND STREET** FOR 1.6 MILES
RIGHT ON **SONOMA BOULEVARD** HEADING NORTH FOR 2.1 MILES
RIGHT ON **SERENO DRIVE** HEADING EAST FOR 0.4 MILES TO 975 SERENO DRIVE

TOTAL TRAVEL TIME TO **KAISER PERMANENTE HOSPITAL** FROM B154T
IS APPROXIMATELY 10 MILES TAKING 20 MINUTES.

Route to Hospital
Fuel Storage Facilities
at Building 154

Area I - Site Safety and Health Plan
Benicia Arsenal

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FIGURE 2

Total travel time **to Kaiser Permanente Hospital** from Building 154 is approximately 10 miles taking 20 minutes.

The nearest telephone is located in the work zone. If a cell phone is to be used for emergency purposes, it must be checked upon arrival to the site to verify that reception to the area is available. **When a cell phone is used for emergency purposes, dial (707) 745-3411 or (707) 745-3412.** The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC H&S Manual (Forward; p. F-5). **In the event of a medical emergency, 911 will be dialed first.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this Workplan. The procedures and frequency in which each Attachment must be completed is described in Table 5.

Table 5
Attachments A - E Building 154 Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the Project Manager and the Health and Safety Director will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily

Plan for Determining Ambient Metals Concentrations in Area I Soils
Area I, Former Benicia Arsenal Environmental Restoration
Benicia, California

7A.1 Purpose

The purpose of this Plan is to present the approach and methods that will be used to determine ambient concentrations of selected chemicals in Area I soil. For this Plan, "ambient concentrations" include both naturally occurring concentrations of chemicals, and anthropogenic concentrations of chemicals from human-made, non-site sources (USEPA, 1995). Ambient concentrations in soil will be used as assessment criteria to evaluate analytical data collected during Area I environmental investigations. Data necessary to implement this Plan will be collected during individual site investigations.

This Plan is organized into nine sections. An overview of the general approach to developing ambient concentrations is presented in Section 7A.2. Chemicals selected for determination of ambient concentrations are given in Section 7A.3. Physical characteristics of Area I that could influence sample collection and ambient calculations are discussed in Section 7A.4, and the sampling plan for collecting ambient data is presented in Section 7A.5. Details of the statistical methodology are given in Section 7A.6, and interpretation and use of ambient concentrations are discussed in Section 7A.7. References and definitions are presented in Sections 7A.8 and 7A.9, respectively. Data quality objectives (DQOs) are given in Table 1.

7A.2 General Approach

The proposed statistical methodology for calculating ambient concentrations for Area I is based on the California Department of Toxic Substances Control (DTSC) guidance document entitled *"Selecting Inorganic Constituents as Chemicals of Potential Concern in Risk Assessments at Hazardous Waste Sites and Permitted Facilities."* (DTSC, 1997). The DTSC document presents an approach that extracts "ambient data sets" from larger "expanded data sets." Expanded data sets consist of site characterization data that are typically collected to assess the magnitude and extent of possible contamination. Because the number of site characterization samples is usually large, this method does not require the collection of ambient-specific or off-site samples. This is a particularly effective technique for soil samples that are analyzed for many metals because a sample contaminated with one metal may exhibit ambient concentrations for the remaining metals. Once the ambient data sets are formed, a concentration that is representative of the upper range of ambient conditions is calculated, and measurements from impacted samples are compared to that limit.

In general, the proposed method produces more accurate results than the traditional approach. Traditional methods generally calculate ambient concentrations from a small number of samples collected from known uncontaminated areas. One reason for this increased accuracy is that the ambient data sets prepared using the "DTSC approach" are usually larger than traditional ambient data sets. Also, variability resulting from influencing factors such as soil type is likely to be less for the DTSC approach because ambient samples are collected in closer proximity to contaminated samples.

The planned sequence of events for determining ambient metals concentrations in soils in Area I is shown in Figure 7A-1. The flow chart shows the relative timing of

sample collection, data evaluation, and reporting. Data evaluation will include a preliminary data characterization, an initial calculation of ambient concentrations, and a final calculation of ambient concentrations. A technical memorandum will be prepared after the initial calculation, and updated after the final determination of ambient concentrations. The updated ambient concentrations are expected to be more representative of Area I than the initial concentrations, due to increased spatial coverage of samples as the site investigation progresses.

Because of variations in influencing factors such as geology, soil type, or depth, it may be necessary to create two or more ambient data sets for a particular chemical. For example, the ambient concentration for lead in surface soils may be considerably different than the concentration in deeper soils. The effects of influencing factors on data characteristics will be examined during the preliminary data evaluation. Based on the results of the preliminary data evaluation, locations and number of samples may be modified for the remainder of Area I site investigations. It is expected that the preliminary data evaluation will be unnecessary for the remaining areas at the Arsenal because information obtained from Area I will be applicable to other areas.

7A.3 Area I Ambient Chemicals

Ambient concentrations will be determined for nineteen metals that are considered to be of potential concern as Department of Defense (DoD) contaminants at one or more former Arsenal facilities. Those metals were identified during preparation of the Quality Assurance Project Plan (QAPP) for the Benicia Arsenal (Brown and Caldwell, 1999). A variety of information sources, including the Records Research Report (RRR) (Jacobs Engineering, 1999), were used to identify chemicals of potential concern. The 19 metals that will be included in the ambient study include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tin, vanadium, and zinc.

7A.4 Influencing Factors

This section describes several factors that could influence ambient concentrations of chemicals in Area I. Information presented in this section was used to develop the sampling plan, which is presented in Section 7A.5. The influencing factors that are described include the geology and soil type of Area I and adjacent areas, the presence of regional sources of contamination, and the probable locations of Area I investigation activities.

There are several reasons for addressing influencing factors. Whenever ambient concentrations are determined in environmental media, it is important to remove extraneous sources of variability. For example, if alluvial soil in Area I has a considerably different chemical composition from residual bedrock soil, it may be desirable to calculate separate ambient concentrations for each soil type. Regional sources of contamination such as lead from freeways or particulates from refineries can also add unwanted variability to data. Choosing sampling locations entirely within or entirely outside of the impacted area can minimize this variability.

The probable locations of Area I investigation activities are pertinent because most of the data in the expanded data sets will be generated from samples collected at investigation locations. This type of sampling could cause the data to be spatially biased because most of the samples are clustered together in relatively small areas. Conducting supplemental sampling in areas that are under-represented by the investigative sampling program will decrease the bias.

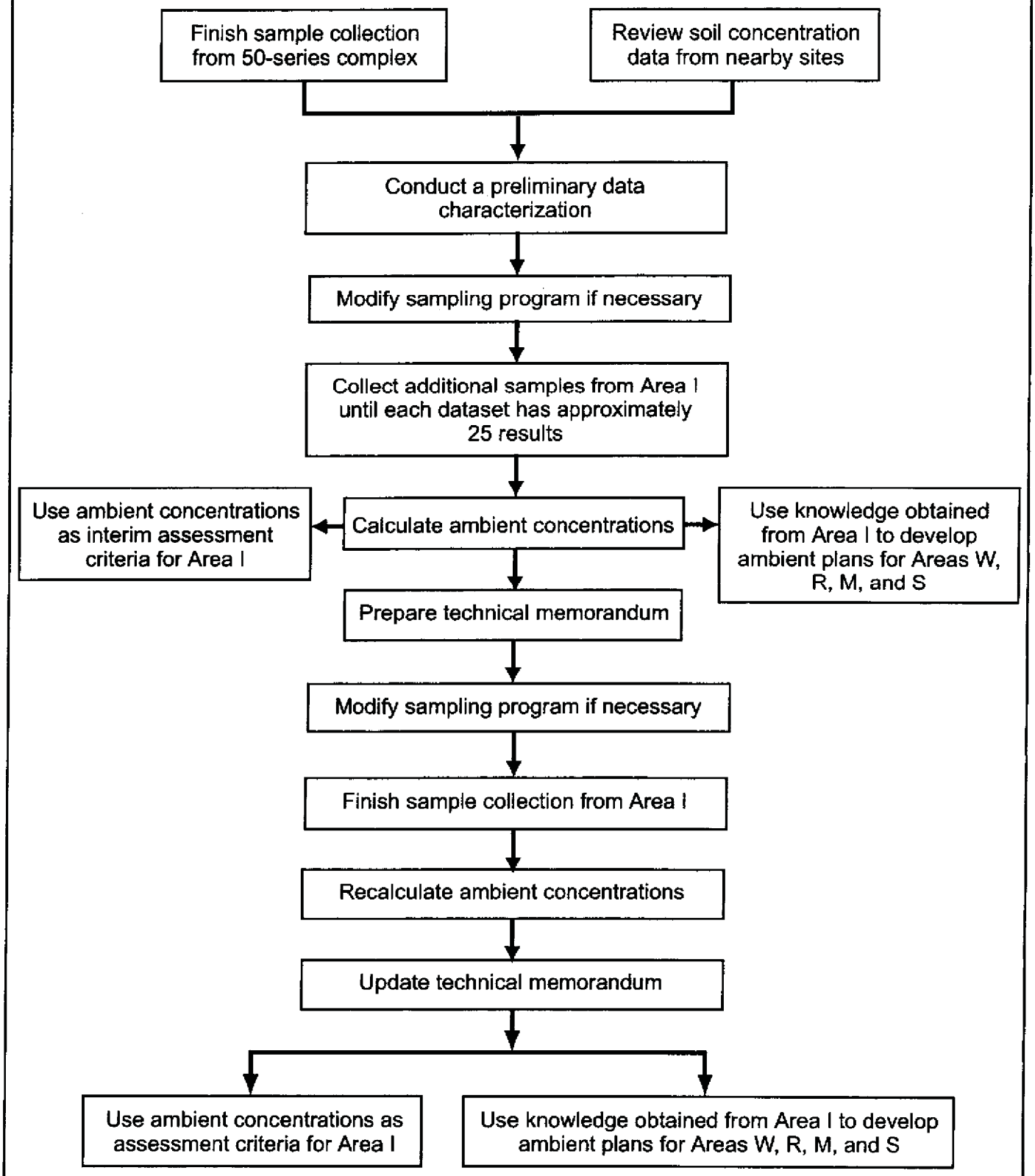


Figure 7A-1
Proposed Sequence of Events for Determining Ambient Metals Concentrations in Soil for Area I
Ambient Plan for Area I
Benicia Arsenal

70

57

154

57B

56

AUXILLARY TANKS
MOUNTED ON BLDG 154

GASOLINE
10,000 GAL.

EXISTING
CONCRETE
SLAB

GASOLINE
7,000 GAL.

WHITE GASOLINE
1,400 GAL.

INLET

RETURN FROM BLDG 53

INLET

FILLPORT

INLET

FILLPORT

RETURN FROM
BLDG 53

CONCRETE

ASPHALT

56A

MAY HAVE BEEN REMOVED
WHEN 4,000 GAL UST
WAS INSTALLED

AUXILLARY GASOLINE TANK
MOUNTED ON BLDG 53

AUXILLARY DIESEL TANK
MOUNTED ON BLDG 53

GASOLINE
10,000 GAL

DIESEL OIL
1,000 GAL

GASOLINE 4,000 GAL
USES FORMER
10,000 GAL PIPING

FILLPORT

53

RAMP

FIRE HYDRANT

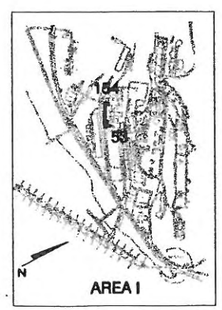
STORM DRAIN

LINCOLN STREET

LINCOLN STREET

LEGEND

181	Buildings
- - - - -	UST/Tank Line
++++++++++	Railroad Tracks
→	Fluid Flow Direction
⊡	Concrete Block Encasing Fillport or Tank Inlet for Fluid Level Measurement
▨	Proposed Work Zone



N

10 0 10 20 30 40
Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1998) documents or noted during site inspection are included on this figure.

Work Zone Map
Fuel Storage Facilities at Building 154 and 53

Area I - Site Safety and Health Plan
Benicia Arsenal

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FIGURE 1

Area I Alluvium Areas*

- Qa — Quaternary—Alluvium surficial deposits
- Qao — Quaternary—Older Alluvium

Area I Bedrock Areas*

- Tmz — Tertiary—Martinez Formation claystone, siltstone with minor sandstone
- Kus — Cretaceous—Chico Formation thick sandstone interbedded with shale and conglomerate
- Kgus — Cretaceous—Upper Knoxville Formation mudstone, siltstone, shale with interbedded sandstone

* See Section 7A.4.1 for discussion of Area I geology.

Source:
Preliminary Geologic Map of the Benicia Quadrangle, Thomas W. Dibblee Jr. 1980,
Preliminary Geologic Map of Solano County and parts of Napa, Contra Costa, Marin, and Yolo Counties, California; Sims, J.D.; Fox, K.F.; Barton, J.A.; and Hedley, E.J. 1973.

Figure 7A-2
Geologic Map
Ambient Plan for Area I
Benicia Arsenal

Forsgren Associates/Brown and Caldwell
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Final
September 2000

7A.4.1 Area I Geology. A geologic map of Area I is presented in Figure 7A.2. Three general geologic areas have been differentiated within Area I and include bedrock areas, alluvial areas, and fill areas as described below. Review of available literature did not identify specific chemical concentrations related to soil or bedrock, so until data are collected and analyzed, it is not possible to predict the impact of site geology or soil-type on ambient concentrations.

Bedrock. Steeply dipping beds of sandstone, siltstone, and shale bedrock from the Martinez and upper Chico Formations make up the geology in the hills and higher elevation portions of Area I. Those areas are located primarily in the northern and eastern portions of Area I, but also occur in the northwestern section of Area I referred to as Bottle Hill, and in a small central area near the Series 50 complex of buildings (Figure 7A.2). Sandstone intervals of the Martinez and Chico Formations were quarried within Area I for use in Arsenal buildings. The quarries may have been later used as landfills or fill sites. Arsenal land use in the hilly bedrock areas is mostly residential and administrative with lesser amounts of industrial activity.

Alluvium. The southern and central portion of Area I is underlain by alluvium, which varies from a few feet to more than 80 feet thick and overlies bedrock formations. Alluvial areas are typically flat and occur at elevations near mean sea level. Based on several shallow soil borings in the Series 50 complex area, alluvium is predominantly fine-grained consisting of clay to sandy clay. The alluvium was deposited in shallow drainages and marshlands adjacent to Carquinez Strait, and is derived from the local Tertiary and Cretaceous bedrock Formations. The flat alluvial areas of Area I have been developed for heavy industrial use.

Fill. Within the Area I alluvial areas, large portions of former marshland and tidal area have been filled, paved, and developed. The areas that are likely to have significant amounts of fill are presented in Figure 7A.3. The location of fill areas was estimated by comparing 1924 and 1928 aerial photos with recent site photos, and mapping significant fill deposits in areas that were previously marshland and water but are now developed. Sources of fill identified in the RRR include material dredged and pumped from the bay, from Bottle Hill, and from various construction areas on the Arsenal mostly in the 1940's. However, information on source of fill for specific areas is not available.

7A.4.2 Area I Soil. A soil map of Area I (USDA, 1977) is presented as Figure 7A.4. Two primary surface soil types are shown on the map; the Dibble-Los Osos clay loam (identified as DIC and DIE on Figure 7A.4) and the Reyes silty clay (identified as Re). The Dibble-Los Osos clay loam consists of well-drained soil, typically underlain by sandstone at a depth of 20 to 40 inches, and occurs on slopes of 2 to 50 percent. Reyes silty clay is poorly drained, strongly acidic, saline, forms on alluvium derived from mixed sources, and is typical of flat low-lying areas such as salt marshlands. Today, much of the Reyes silty clay in Area I has been covered with fill and developed.

The two soil types identified in Area I correspond closely to bedrock geology shown on Figure 7A.2. The Dibble-Los Osos clay loam has formed on bedrock areas. The Reyes silty clay has formed on alluvial material. Fill material is likely imported and does not necessarily correspond to soil type or geologic material.

Area I Alluvium Areas*

- Qa — Quaternary—Alluvium surficial deposits
- Qao — Quaternary—Older Alluvium

Area I Bedrock Areas*

- Tmz — Tertiary—Martinez Formation claystone, siltstone with minor sandstone
- Kus — Cretaceous—Chico Formation thick sandstone interbedded with shale and conglomerate
- Kgus — Cretaceous—Upper Knoxville Formation mudstone, siltstone, shale with interbedded sandstone

* See Section 7A.4.1 for discussion of Area I geology.

Source:
Preliminary Geologic Map of the Benicia Quadrangle, Thomas W. Dibblee Jr. 1980,
Preliminary Geologic Map of Solano County and parts of Napa, Contra Costa, Marin, and Yolo Counties, California; Sims, J.D.; Fox, K.F.; Barton, J.A.; and Hedley, E.J. 1973.

Figure 7A-2
Geologic Map
Ambient Plan for Area I
Benicia Arsenal

Forsgren Associates/Brown and Caldwell
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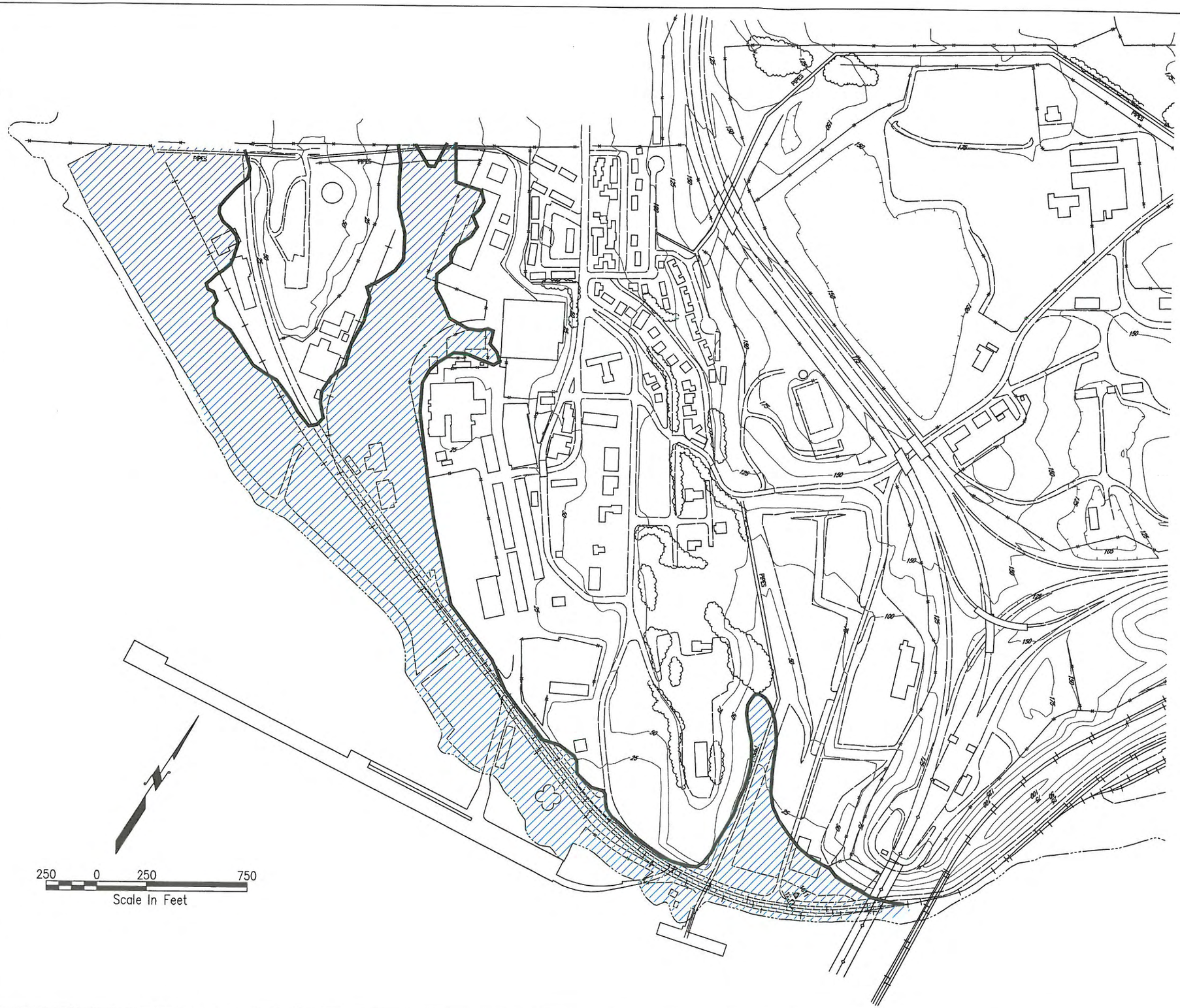
September 2000



Areas of significant fill based on comparison of 1924 and 1928 site photos with recent and curent area land use.

Figure 7A-3
Locations with Significant Fill Material
Ambient Plan for Area I
Benicia Arsenal

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September 2000

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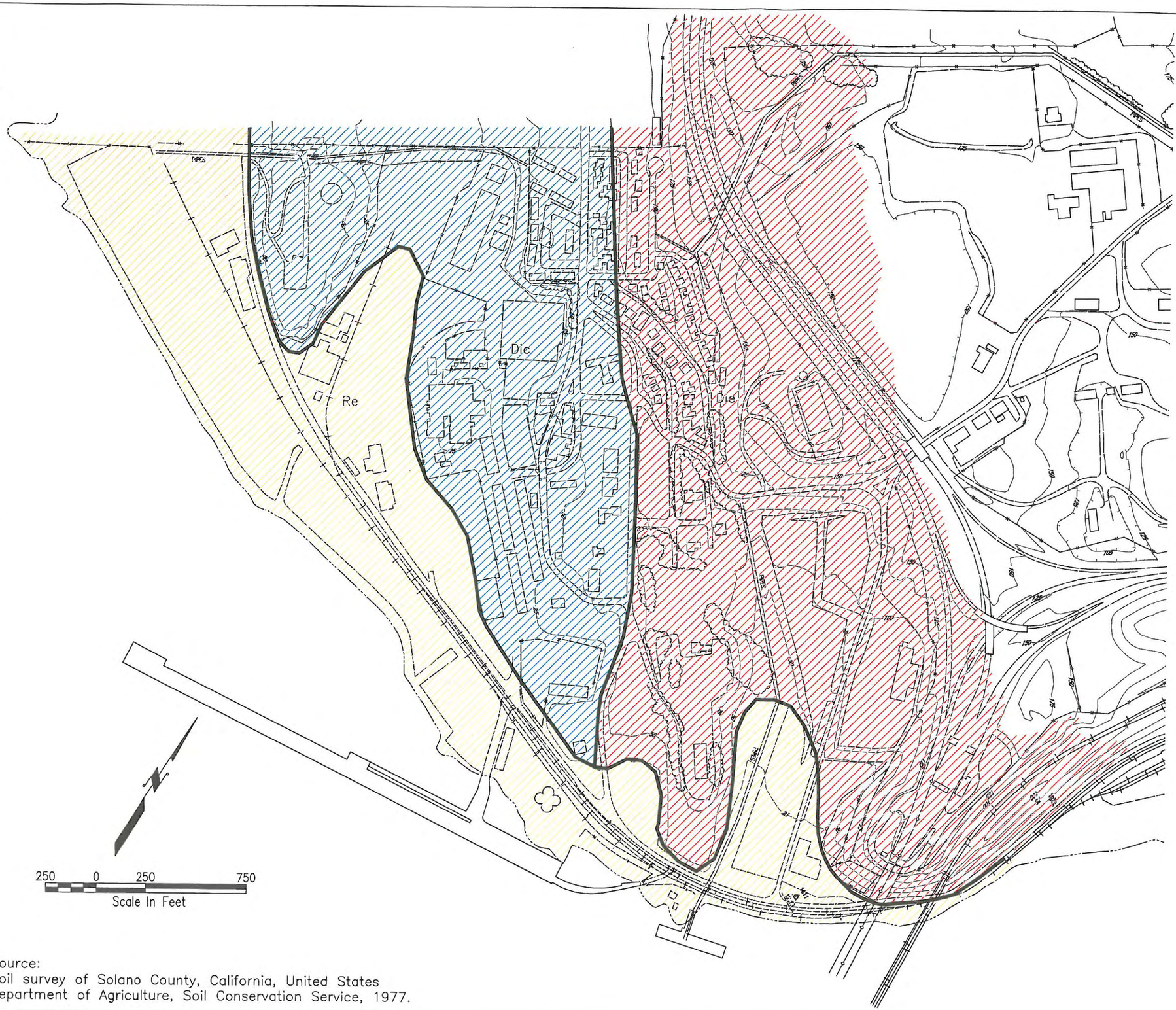

USDA Soil Mapping Units

Re	Reyes silty clay*
Dic	Dibble–Los Osos clay loam 2 to 9 percent slopes
Die	Dibble–Los Osos clay loam 9 to 30 percent slopes

*Most of the Reyes silty clay areas have been covered with imported fill. See Figure 7A.B.

Source:
Soil survey of Solano County, California, United States Department of Agriculture, Soil Conservation Service, 1977.

Figure 7A-4
Soil Map
Ambient Plan for Area I
Benicia Arsenal

Final
September 2000

Forsgren Associates/Brown and Caldwell
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7A.4.3 Regional Sources of Contamination. Throughout the history of the Benicia Arsenal and the City of Benicia, a variety of industrial practices have occurred that may have distributed potential chemicals of concern over the Arsenal region. Those industrial practices are summarized below using regional historical documentation and information presented in the RRR.

Benicia Tanneries. As many as five tanneries operated in the late 1800's into the early 1900's. The tanneries were primarily located on First Street and West Sixth Street in downtown Benicia (Bruegmann, 1997). Tannery waste typically includes liquids and sludges with high concentrations of metals, as well as solvents.

Selby Smelter. The Selby smelter operated in Benicia between the late 1890s and the early 1970's. Fallout from the smelter exhausts has resulted in elevated concentration of metals, particularly lead and cadmium, in the Arsenal soil. Ambient soil concentrations for lead in the vicinity of Area I have been reported between 35 and 105 ppm (EIP, 1989).

Exxon Refinery. A large portion of Area S, which is located east of Area I, was purchased by Humble Oil (now Exxon) in 1966. The area is currently occupied by an Exxon refinery, which is one of several oil refineries in the Benicia/Martinez area. Refineries discharge a variety of compounds to the air including VOCs, lead, arsenic, dioxins, and PAHs.

Interstate Highways. Exhaust from combustion of leaded gasoline has been shown to cause elevated concentrations of lead adjacent to high traffic areas. Two major interstate highways (680 and 780) converge within and near Area I.

Arsenal Practices. The RRR documents widespread use of organochlorine pesticides throughout the Arsenal and the use of waste oil as weed killer.

7A.4.4 Locations of Site Investigations. Locations of field investigations that may take place within Area I are presented in Figure 7A.5. The field investigation locations are based on DoD activities that are documented in the RRR at Area I facilities.

7A.5 Sampling Plan

The sampling plan for acquiring data to support the calculation of ambient concentrations is presented in this section. Techniques to account for the effects of influencing factors are incorporated into the sampling plan. Sampling plan details, such as the exact number and locations of samples, will be supplied after sufficient data have been collected from Area I to define data characteristics.

Sample collection activities for the ambient evaluation will take place during individual site investigations that are (or will be) described in Area I FSIPs. Likely subsurface investigation locations are shown on Figure 7A.5. Sampling locations, sample depths, and chemicals to be analyzed will first be selected to address the potential for site specific DoD contamination. The overall scope of the sampling activities will then be evaluated against data needs for the ambient evaluation, and additional sampling activities may be proposed for the ambient chemicals.

7A.5.1 Geology and Soil Type. Soil type and geologic material can be a source of variability because the natural chemical composition can change significantly depending on parent material, origin, age, and depositional history. Potential chemical variation in soil samples related to site geology or soil type will be accounted for by classifying each investigation soil sample

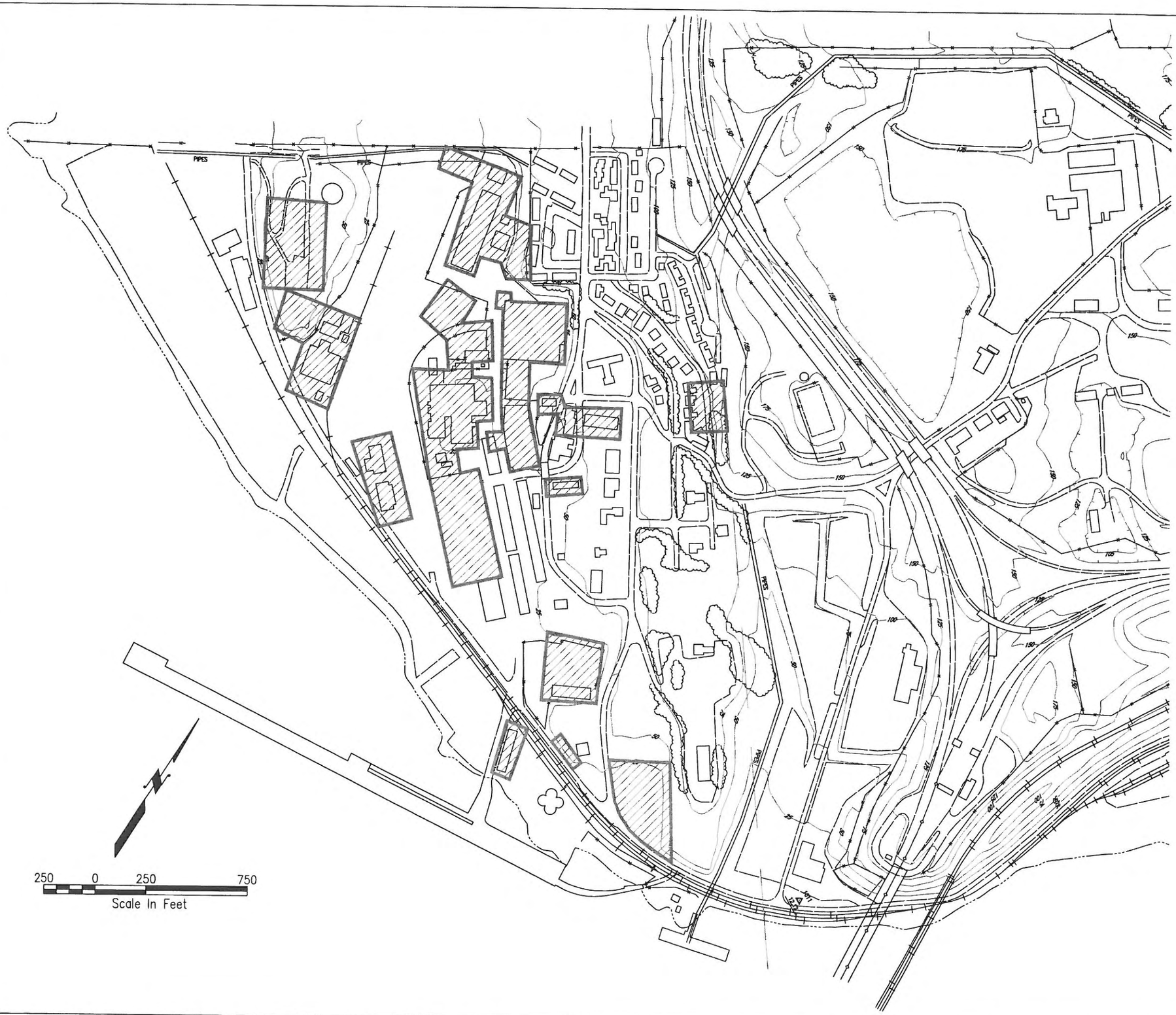

Figure 7A-5
Subsurface Investigation
Ambient Plan for Area I
Benicia Arsenal

according to its likely Area I parent material: i.e., Martinez formation, Chico formation, alluvium, or fill. The classification will be made by the field geologist based on a field description and the location of the sample relative to mapped geologic formations and soil types.

After an adequate number of samples from each geologic unit or parent material have been collected, statistical analysis techniques will be used to determine whether separate ambient concentrations based on geologic parent material are necessary. The number of samples required to make this determination will depend on variability within and between geologic units, but is expected to be approximately 25 samples for each parent material.

Chemical composition of soil samples is often correlated with grain size. As a result, grain size data will be collected as part of the field classification of each investigation soil sample and may be used to qualitatively evaluate the relationship between chemical composition and grain size.

7A.5.2 Regional Sources of Contamination. In general, it is anticipated that the regional sources of contamination identified in this Plan will primarily impact surface soil. Depending on the amount of contamination, it may be necessary to determine ambient concentrations separately for shallow (0-24 inches) and deep (>24 inches) soil. To enable future evaluation of chemical variability with depth, the exact depth interval of each soil sample container will be recorded and entered into the electronic database. After an adequate number of samples from shallow and deep soil have been collected, statistical analysis techniques will be used to determine whether separate ambient concentrations based on sample depth are necessary. The number of samples required to make this determination will depend on variability within and between shallow and deep soil, but is expected to be approximately 25 samples per depth unit.

7A.5.3 Locations of Site Investigations. Most data that will be included in the evaluation of ambient conditions will be generated from samples collected at site investigation locations (Figure 7A.5). As a result, samples will be clustered rather than spread out across Area I. This would not be a problem if the chemical composition of soil were homogenous throughout Area I, however, that is not expected to be the case. This bias will be particularly high when initial ambient concentrations are calculated because only one or two sites will have been investigated at that time. To reduce the spatial bias introduced by using investigation data, four sub-areas have been delineated within Area I (Figure 7A.6). Boundaries of the sub-areas were selected primarily based on site investigation locations and site geology. The sub-areas will be used to plan sample collection activities by requiring that a minimum number of samples be collected from each sub-area prior to the initial calculation of ambient concentrations. The minimum number of required samples from each area will be determined after enough samples have been collected to allow for evaluation of data characteristics (e.g., variability, distribution, and central tendency). The minimum number of required samples is expected to be approximately 10 samples per sub-area.

7A.6 Statistical Methodology

The steps involved in the proposed approach for determining ambient metals concentrations are shown in Figure 7A.7 and explained in this section. Reporting procedures, modification of the proposed approach, and use of additional data are also discussed.

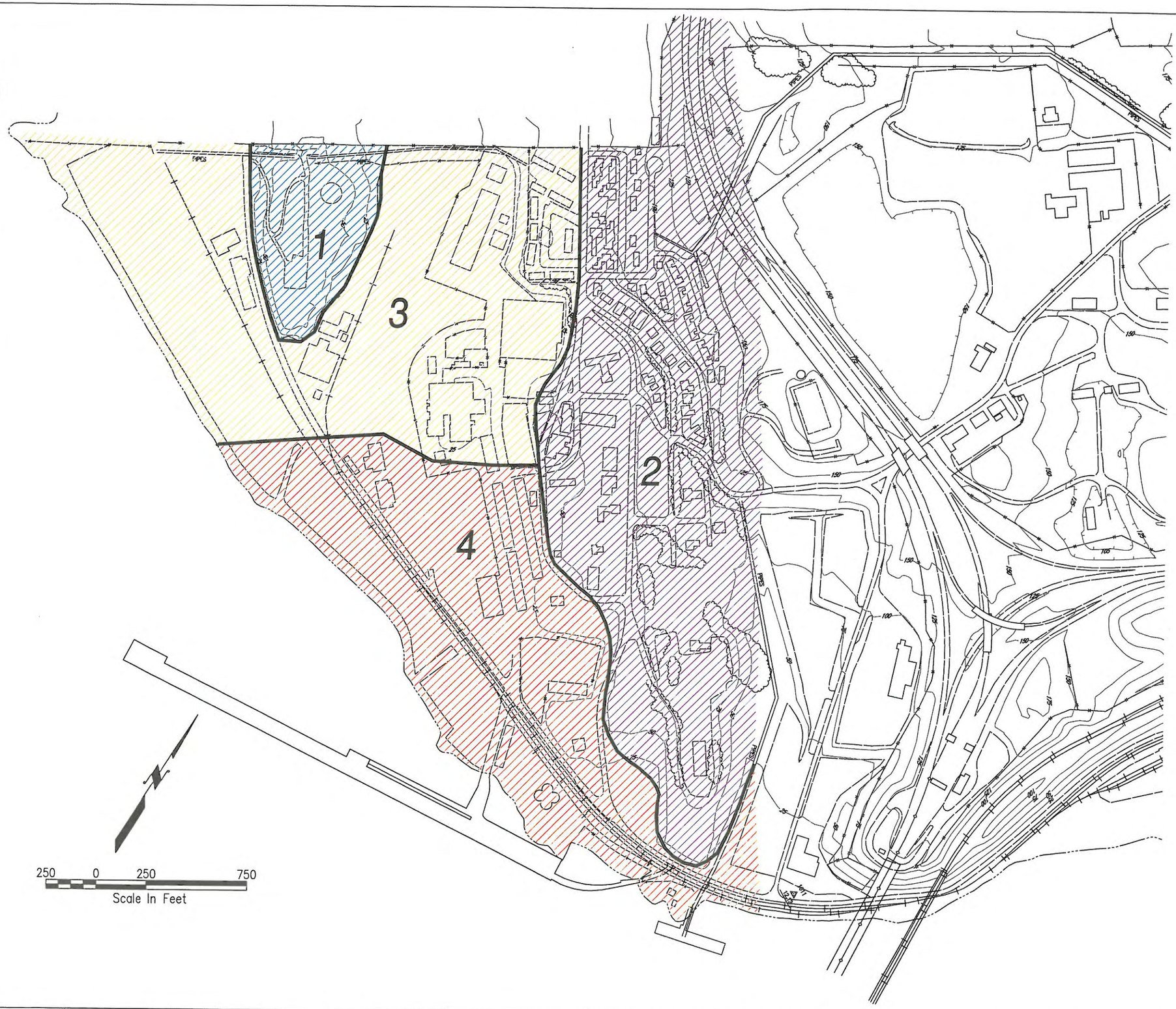

Figure 7A-6
Background Sampling Subareas
Ambient Plan for Area I
Benicia Arsenal

Forsgren Associates/Brown and Caldwell
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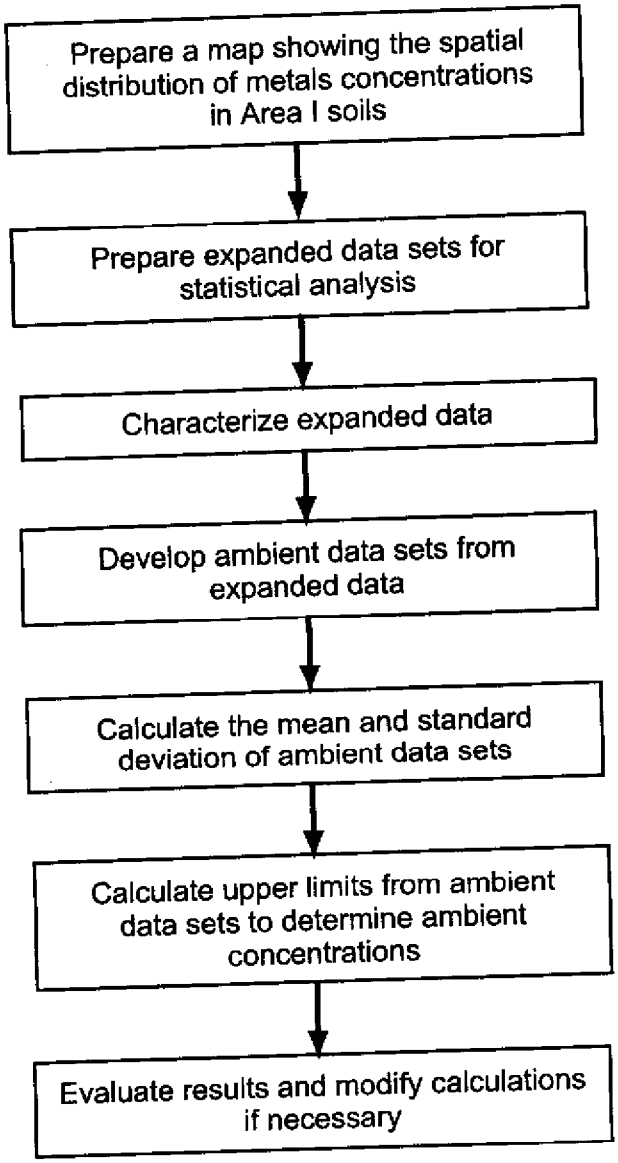

Figure 7A-7
Proposed Statistical Approach for Determining Ambient Metals Concentrations in Soil for Area I
Ambient Plan for Area I
Benicia Arsenal

7A.6.1 Preparation of Expanded Data. The expanded data sets will consist primarily of data collected during site investigations of Area I. Data collected from potentially contaminated areas and from relatively non-impacted areas will be combined. The expanded data sets will be prepared in accordance with the following rules:

- Only final, validated data will be included in the expanded data sets. Unvalidated data will only be used if it has undergone a quality control review approved by the United States Army Corps of Engineers (USACE) and the appropriate regulatory agencies.
- Unusable data (qualified by "R") will not be included.
- Results from field duplicates will be averaged for use in ambient calculations.
- Data that are qualified with a "J" (estimated) will be treated in the same manner as non-qualified data. There has been considerable research on the effects of using estimated data in statistical calculations, and the general consensus is that better results are obtained if the actual data are used versus the censored data (i.e., "3.2 J" provides more information than "<5")(Porter et. Al, 1988).
- Screening level data will not be used.
- Non-detected values that have an elevated reporting limit which exceeds detected values reported for other site samples will not be included in the expanded data sets. The use of abnormally high reporting limits can produce biased results.

7A.6.2 Characterization of Expanded Data. Expanded data will be characterized using graphical procedures and summary statistics. Ranked data plots will be prepared for each expanded data set. In addition, normal probability plots will be prepared for expanded data sets with a high frequency of detection (i.e., approximately 80 percent or greater). Normal probability plots are useful for examining a variety of data characteristics including multiple populations.

In accordance with the DTSC guidance, a variety of summary statistics will be calculated for each expanded data set. The summary statistics that will be calculated are briefly defined as follows:

number of detects. number of values at or above the reporting limit (RL)

number of non-detects. number of values reported as "<RL"

percentage of detects. number of detected values/total number of values * 100

minimum detect. the minimum detected value, which may be at or above the reporting limit

maximum detect. the maximum detected value

minimum reporting limit. the lowest reporting limit

maximum reporting limit. the highest reporting limit

mean. the arithmetic average

standard deviation. a measure of variability

coefficient of variation. standard deviation/mean

In addition, data sets will be identified that display a range of detected values of more than two orders of magnitude and/or a coefficient of variation greater than one (those data sets may be representative of more than one population).

7A.6.3 Preparation of Ambient Data. Ambient data sets will be formed for each analyte by removing values from the expanded data that appear to lie outside the ambient populations. The choice of "outlier" removal methods will depend on the frequency of detection.

For data sets with a high frequency of detection, suspected outliers will be identified and removed using an outlier removal technique based on normality testing. This method consists of removing data points one at a time until normality testing shows that the remaining data are normally or log-normally distributed. Either the original or the log-transformed data will be used, depending on the results of normality testing conducted on the data after each value is removed. If a normal or lognormal distribution cannot be obtained in a reasonable number of iterations, or if the resulting data set appears to be inconsistent with graphical inflections in the data, additional information will be used to form the ambient data set. Additional information may include geochemical relationships such as chemical ratios, spatial distribution of samples, or graphical characteristics.

Ranked data plots will be constructed for data sets with a low frequency of detection. Outlier values will be removed based on visual examination of those plots. If possible, a simple rule will be developed to remove extreme values, while still retaining those that can be used to characterize ambient conditions. For example, it may be appropriate to remove all concentrations that exceed the next lowest concentration by more than a factor of two. Additional information such as geochemical relationships or spatial distribution of samples may be used in conjunction with graphical methods to identify ambient data sets.

7A.6.4 Calculation of the Mean and Standard Deviation. The mean and standard deviation will be determined for each ambient data set because both values are needed to calculate upper limits. If the frequency of detection is high, conventional statistical methods will be used, and non-detects will be set equal to one-half the reporting limit.

The maximum likelihood method (MLE) described by Gibbons (1994), or the robust probability plotting procedure presented by Helsel (1990) will be used to estimate the mean and standard deviation for data sets with a low frequency of detection. If multiple reporting limits are present, the most frequently occurring limit will be employed in the calculations.

7A.6.5 Calculation of Upper Limits. The choice of methods used to calculate upper limits of ambient data will be based primarily on sample size. In general, a less conservative approach can be used if the data set is large. Methods that may be used include the 95th or 99th percentile or the 95th or 99th upper confidence limit on the 95th or 99th percentile.

Equations that are presented in Gilbert (1987) and Helsel and Hirsch (1992) will be used for calculating upper limits on ambient data sets. Those limits will represent the upper range of ambient conditions for metals in Area I soil.

7A.6.6 Reporting Procedures. Determination of ambient concentrations will be documented in a technical memorandum that will be prepared in conjunction with the first calculation of ambient concentrations. The report is expected to contain the following elements:

- **Purpose of the project** and updated DQOs.
- **Data preparation procedures** that were used, such as handling of censored (i.e., "non-detect") data, transformations, and adjustments to remove unwanted variability caused by

influencing factors (e.g., grain size, soil type, anthropogenic activity).

- **Data characterization results** including summary statistics, graphical representations of the data, and map showing spatial data distributions.
- **The equations** used to calculate the ambient concentration limits, and the resulting limits.
- **Statistical assumptions,** sources of uncertainty, and interpretation and use of the resulting ambient concentration limits.
- **Data gap identification** to be used for modification of sampling plan.
- **Tables** showing: (1) raw and prepared data, (2) summary statistics, (3) expanded and ambient data, and (4) a summary of ambient concentrations and other pertinent statistical results (e.g., normality test results).
- **Figures** showing: (1) normal probability plots for expanded and ambient data sets with a high frequency of detection, (2) ranked data plots for all expanded and ambient data sets, and (3) other data characteristics such as variations in metals concentrations related to influencing factors.

7A.6.7 Modification of Proposed Approach. The method described above works well in cases where most of the data in an expanded data set come from one ambient population. Because data characteristics have not been defined at the site, it is expected that additional and/or modified statistical techniques may be warranted in some instances. For example, some metals such as lead and copper tend to display unusual distributions across an investigative area due to different sorption or binding mechanisms. In such cases, geochemical relationships such as the lead/zinc ratio may provide useful information for preparing ambient data sets. Also, if ambient data for a particular analyte are neither normally nor lognormally distributed, a non-parametric statistical method may be used to calculate the ambient concentration.

7A.6.8 Use of Additional Data. Data collected for projects other than Benicia may provide information on data characteristics such as distribution, central tendency, and variability. A review of soil concentration data from nearby sites will be conducted in the initial stages of the project as shown in Figure 7A-1. Data from sites with similar geologic material and anthropogenic influences will be particularly useful.

Data collected using different sampling and/or analytical methods may also be incorporated into the ambient evaluation. For example, x-ray fluorescence (XRF) methods can produce multiple, high quality analytical results in a short period of time. Any data that are included in the ambient analysis must be generated using documented and accepted sampling and laboratory methods.

7A.7 Interpretation and Use of Ambient Concentrations

Ambient metals concentrations will be used as assessment criteria to evaluate analytical data collected during Area I environmental investigations. As described above, ambient concentrations will be calculated 2 times. Results from the initial calculation will be used as interim criteria for comparison with existing site investigation data. Data that exceed ambient levels will be subjected to further analysis such as risk assessment, or may trigger additional site investigation or remediation.

Data that fall below ambient levels will not be further analyzed. For this reason, the procedure for determining ambient

concentrations was designed to have a relatively high false positive rate and low false negative rate. A false positive occurs if a value exceeds ambient but does not represent significant contamination, and a false negative occurs if a value from a contaminated sample does not exceed ambient. Because of the high false positive rate associated with the statistical approach, sample values that exceed ambient do not necessarily represent contaminated conditions; they represent possibly contaminated conditions that warrant further evaluation.

At the completion of the Area I site investigation, ambient concentrations will be recalculated using the same statistical procedures that were used in the initial determination. The purpose of the second calculation will be to confirm (and adjust, if necessary) the initial calculation using data that are more representative of Area I as a whole. Final ambient concentrations will be used in the Area I risk evaluations.

7A.8 References

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7A.9 Definitions

Ambient Concentrations include both naturally occurring concentrations of chemicals, and anthropogenic concentrations of chemicals form human-made, non-site sources.

Ambient data sets consist of data that represent ambient conditions, and are used to calculate ambient concentrations.

The term **"background"** is not specifically used in this Plan except in reference to other documents.

The **DTSC approach** is a technique for extracting ambient data sets from larger expanded data sets, and determining ambient concentrations from the ambient data sets.

Expanded data sets consist of site characterization data that are typically collected to assess the magnitude and extent of possible contamination.

A **normal probability plot** is a plot used to determine how well the data fit the normal distribution. Quantiles of sample data are plotted against quantiles of the standardized normal distribution.

An **outlier** is an observation whose value is quite different than other observations in the data set.

A **ranked data plot** is an X-Y plot of the data from smallest to largest at evenly spaced intervals.

Table 7A.1

Data Quality Objectives for Area I Ambient Evaluation

State the Problem:
Determine ambient concentrations of metals for Area I soil.

Decisions:

- What are the ambient concentrations of metals in Area I soil?
- Are the metals present at ambient concentrations that can be quantitatively evaluated, or are most of the concentrations below laboratory reporting limits?
- What are the statistical data characteristics of individual metals in Area I soil (e.g., central tendency, dispersion, skewness, distribution)?
- Do ambient concentrations of metals in Area I soil vary according to soil type, grain-size, bedrock geology, or off-Arsenal sources of contamination? Are the variations large enough to necessitate special data analysis procedures or separate ambient concentration limits?
- Can ambient concentrations of metals in Area soil be determined using primarily site investigation data, with limited sampling from off-site or uncontaminated areas?

Identify Inputs:

- Historical information on industrial practices and land use at the Arsenal and within the surrounding area.
- Analytical results for 19 metals in soil samples collected from Area I site investigation soil borings and test pits.
- Analytical results from investigations conducted at near-by sites (e.g., Tourtelot).
- Analytical results obtained by alternate sampling and/or analytical methods (e.g., XRF).
- Locations of all soil samples.
- Bedrock geology and soil type for Area I.
- Parent material, grain-size, and USCS classification of investigation soil samples.

Physical Study Boundaries:

- Ambient concentration limits calculated according to this Plan should only be used as assessment criteria for Area I. As data are collected from other areas of the Arsenal, the validity of using Area I data in ambient calculations will be evaluated on a case-by-case basis.
- Ambient concentration limits will be calculated for the following constituents: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tin, vanadium, and zinc.

Practical Study Boundaries:

- Ambient values for metals in Area I soils will be calculated 2 times: once after a minimum required number of samples have been collected, and again upon completion of the Area I site investigation.
- Expanded data sets used in the initial and final calculations of ambient concentration limits will include samples distributed across Area I, including a minimum of 10 samples from each of 4 sub-areas.

Temporal Study Boundaries:

- Soil samples collected in accordance with the QAPP will generate data that will be useable for the duration of the Arsenal investigation, remediation, and closure activities.
- The applicability of older, existing data will be determined on a case-by-case basis.

Table 7A.1

Data Quality Objectives for Area I Ambient Evaluation

General Site Decision Rules:

- If 25 samples have been collected from each of the main parent materials (i.e., bedrock, fill, and alluvial soil), then statistical analysis will be conducted to determine if separate ambient values should be calculated for each material.
- If 25 samples have been collected from <24 inches in depth and from >24 inches in depth, then statistical analysis will be conducted to determine if separate ambient values should be calculated for shallow and deep soil in Area I.
- If expanded data sets are characterized by a high frequency of detection; ambient data sets will be created by removing outliers until the data are normally or lognormally distributed.
- If the outlier removal method does not produce a normal or lognormal population in a reasonable number of iterations, alternative methods will be used such as (1) nonparametric statistical methods to determine upper limits, (2) geochemical relationships to identify ambient and contaminated conditions, and (3) additional sample collection to further define data characteristics.
- If expanded data sets are characterized by a low frequency of detection; graphical methods combined with additional tools such as geochemical relationships will be used to create ambient data sets.

Tolerable Limits on Decision Errors:

- The chemical analyses will provide definitive data by conforming to accuracy, precision, and completeness objectives set forth in the Arsenal-Wide QAPP.
- Unusable data (qualified as "R") will not be included in expanded data sets.
- Estimated data qualified by "J" will be used in the ambient evaluation, and will be treated in the same manner as non-qualified data.
- Data not collected under the Benicia QAPP may be included in the evaluation of ambient concentrations only if it has undergone a quality control review approved by USACE and the appropriate regulatory agencies.
- Statistical results will be clearly and completely reported, including values for power, actual and specified significance level, and degree of confidence (if appropriate).

Optimize Design for Study:

- Most data used for determination of ambient concentrations will be collected during the normal course of site investigation activities. Consequently, the scope of work for collecting data for ambient determination will be described within individual Field Site Investigation Plans (FSIPs).
- In general, investigation sample locations will be selected to address specific DoD features or processes and to maximize the potential of detecting impacts from past DoD use.
- Additional samples, as necessary, will be added to individual site investigations for ambient determination purposes.
- To the extent practical, the Area I field investigation will be sequenced to collect data from various Area I sub-areas and parent materials so that ambient concentrations can be calculated early in the site investigation.
- Analytical results from initial samples will be monitored closely to identify matrix or interference problems early in the investigation. Preparation or analytical methods may be modified as a result.