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NAB LITTLE CREEK
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MEMORANDUM METHODS FOR PREPARING THE HUMAN HEALTH RISK ASSESSMENT SITE 12 NAB LITTLE CREEK VA

5/25/1999

CH2MHILL

Methods for Preparing the Human Health Risk Assessment for NAB Little Creek Site 12

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This memorandum presents the methods that will be used to prepare the human health risk assessment for NAB Little Creek Site 12. Figure 1 shows the layout of Site 12.

1. Data Selection

Samples collected during the Remedial Investigation (RI) (Foster Wheeler Environmental Services, Inc., 1994), the Phase I Supplemental RI (SRI) (Foster Wheeler Environmental, 1996), and the Phase II SRI (CH2M HILL) will be evaluated in the risk assessment. The nature of the site-related contamination has been evaluated during multiple investigations. Based on investigation results and the historical site use, it has been clearly determined that the site related contamination is limited to volatile organic compounds (VOC). Therefore, only the VOC analyses data will be evaluated in the risk assessment. The inorganic data will not be evaluated in the risk assessment since the detected inorganic constituents are not considered to be due to site use or history.

A Geoprobe was used to collect groundwater samples for screening purposes during the RI and the Phase I SRI. These groundwater samples will not be used in the quantitative risk evaluation. Geoprobe samples are generally very turbid due to the sampling procedure. Geoprobe samples are not representative of the groundwater that would be contacted by a human receptor who uses water from a well as a potable water supply. Because there is an adequate amount of groundwater data from monitoring wells, it is not necessary to use the Geoprobe samples in the risk assessment.

Only validated data will be evaluated in the risk assessment. During the Phase II SRI a round of groundwater samples were collected and analyzed by a Close Support Laboratory (CSL). These data were not validated, and will not be evaluated in the risk assessment.

1.1. RI Data

Four surface water and four sediment samples were collected from the canal adjacent to Site 12 during the RI and analyzed for Target Compound List (TCL) VOCs and Target Analyte List (TAL) metals. The VOC results from this sampling will be used in the risk assessment. Eighteen groundwater samples were collected using a Geoprobe to characterize the nature and extent of groundwater contamination in order to determine the placement of monitoring wells. As discussed above, the data from the Geoprobe groundwater samples

will not be used in the risk assessment. Four monitoring wells were installed and sampled. The samples were analyzed for TCL VOCs and will be evaluated in the risk assessment.

1.2. Phase I SRI Data

Soil, groundwater, surface water, and sediment samples were collected during the Phase I SRI. Two soil borings were drilled at Site 12 and three samples were collected from each boring. One of the samples from each of the two borings was collected from the 0-2 foot interval and is considered surface soil. The samples were analyzed for TCL VOCs and TAL metals. Five additional borings were drilled and were used to install monitoring wells. One subsurface soil sample and one sample from the clay confining layer were collected from each boring. The subsurface soil samples were analyzed for full TCL organics. The samples collected from the clay confining layer will not be used in the risk assessment due to the depths of these samples (greater than the 10 feet below ground surface that may be contacted by a construction worker). The VOC analyses results from the surface and subsurface soil samples will be evaluated in the risk assessment.

Groundwater samples were collected from nine monitoring wells and analyzed for full TCL organics and TAL inorganics. As discussed above, only the VOC analyses data will be evaluated in the risk assessment, due to the nature of the site contamination.

Four surface water and sediment samples were collected from the canal upgradient of Site 12. The surface water and sediment samples were analyzed for TCL VOCs and TAL metals. These samples will be evaluated as background samples for the surface water and sediment evaluation.

1.3. Phase II SRI Data

Twelve sediment samples were collected from six locations within the canal and analyzed for five chlorinated VOCs and selected inorganics. Two sediment samples were collected at each location from depths of 0 to 6 inches and 12 to 24 inches. Six surface water samples were collected at locations adjacent to the site and analyzed for five chlorinated VOCs and selected inorganics. Two additional surface water samples were collected but will not included in the risk assessment since they were analyzed for inorganic constituents only (calcium, iron, magnesium, manganese, potassium, and sodium). Only the VOC analysis results from the surface water and sediment samples will be evaluated in the risk assessment.

Prior to the installation of additional monitoring wells, groundwater screening samples were collected from eight monitoring wells and 11 Geoprobe locations. Samples were analyzed by a CSL for six chlorinated VOCs, and five of the samples were sent to an offsite laboratory for confirmatory analysis. These groundwater samples and the CSL samples (which have not been validated) will not evaluated in the risk assessment.

The screening samples were used to identify locations to install additional monitoring wells and multi-level samplers (MLS). Five additional monitoring wells and 9 MLS were installed in the shallow aquifer. Each MLS has between 2 and 7 sampling ports. Three wells were also installed in the confined aquifer. A total of 67 groundwater samples were collected from all new and existing wells in the shallow aquifer. Three samples were collected from the confined aquifer. All samples were analyzed for the six chlorinated VOCs, and several

inorganic constituents. The VOC results from this sampling effort will be evaluated in the risk assessment.

2. Data Handling

Only data which have been fully validated will be used in the risk assessment. The following bullets discuss how data that have been qualified will be evaluated, and additional data handling issues.

- Estimated values flagged with a J qualifier will be treated as unqualified detected concentrations.
- Data qualified with an R (rejected) will not be included in the risk assessment.
- Data qualified with a B (blank contamination) will be used in the risk assessment as if it is non-detected and one-half the sample quantitation limit will be used.
- For duplicate samples, the higher of the two concentrations will be used. The duplicates will be counted as one sample.
- One-half the sample quantitation limit will be used for cases where no detectable contaminant quantities were found in that sample but the contaminant was detected in that medium at the site.

3. Selection of Contaminants of Potential Concern

The methodology presented in EPA Region III's *Selection of Exposure Routes and Contaminants of Concern by Risk-Based Screening*, January 1993, will be followed to determine which constituents will be evaluated quantitatively in the risk assessment. The following bullets discuss this methodology as it pertains to the Little Creek Site 12 risk assessment.

- Soil data will be compared to the current EPA Region III Risk-Based Concentrations (RBCs) for residential and industrial soil. The residential soil RBCs will be used to select the COPCs for the residential and trespasser/visitor scenarios. The industrial soil RBCs will be used to select the COPCs for the industrial/construction exposure scenarios. RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.
- Groundwater data will be compared to the current EPA Region III RBCs for tap water. RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.
- Sediment data will be compared to RBCs calculated using the methodology in EPA Region III's *Selection of Exposure Routes and Contaminants of Concern by Risk-Based Screening*, January 1993 for calculating soil RBCs but using sediment specific exposure parameters and updated toxicity values. RBCs for noncarcinogenic constituents will be based on a hazard quotient of 0.1 and RBCs for carcinogenic constituents will be based on a carcinogenic risk of 1E-6. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.
- Surface water data will be compared to RBCs calculated using the methodology in EPA Region III's *Selection Exposure Routes and Contaminants of Concern by Risk-Based Screening*, January 1993 for calculating groundwater RBCs but using surface water specific

exposure parameters and updated toxicity values. RBCs for noncarcinogenic constituents will be based on a hazard quotient of 0.1 and RBCs for carcinogenic constituents will be based on a carcinogenic risk of 1E-6. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.

4. Exposure Assessment

Table 1 details the exposure pathways that will be evaluated in the risk assessment. As shown in the table, groundwater is not currently used as a potable water supply. The shallow groundwater (Columbia Aquifer) is not used at the base and is not considered for future use at the base. The shallow groundwater is not capable of supporting a potable supply due to the low yield. The deeper aquifer (Yorktown Aquifer) is not currently used at the base and discharges directly from the base to the bay. Groundwater is evaluated as a potential future potable water supply, although this scenario is unlikely. It is assumed that adult residents would be exposed through ingestion, and dermal contact and inhalation while showering. Child residents could be exposed through ingestion, and dermal contact while bathing.

The primary area of potential soil contamination at the site is beneath the asphalt parking lot in the vicinity of multi-level sampler LS12-ML11. The soil in this area has been disturbed to a depth of at least 2 feet as the result of the demolition of the former dry cleaners and the construction of the current parking lot. Therefore, there is no contact with this soil. The soil beneath the parking lot was not sampled during the RI, Phase I SRI, or Phase II SRI. Samples were collected from just above the water table (4 to 6 feet) in this area during pre-RI investigations and no contaminants were detected. This data has not been validated.

The soil (surface and subsurface soil) adjacent to the parking lot (between the parking lot and the canal) was sampled during the Phase I SRI. Current site workers and trespassers/visitors (adults and adolescents) could be exposed to this surface soil through ingestion, dermal contact, and inhalation of volatiles and particulates. It is assumed that in the future if any kind of excavation activities take place at the site the subsurface soil could become surface soil and site workers, trespassers/visitors, or future residents could be exposed to the soil (both current surface and subsurface soil). Construction workers could be exposed to the surface and subsurface soil during construction activities.

The drainage canal adjacent to the west side of the site flows north-to-south and connects Lake Bradford to Little Creek Cove. The water level in the canal is typical between 1 and 3 feet deep. During the majority of the year, except during heavy rains, the canal is stagnant with no perceptible flow. There is an abundance of sediment in the canal, which results in the formation of pools. It is unlikely that people would swim in the canal, however it was assumed that adult and adolescent trespassers/visitors may wade in the canal and be exposed to the surface water and sediment. There is no fishing in the canal adjacent to the site. People do fish in the mouth of Little Creek Cove, however this is 1 mile downgradient of Site 12, and dilution of contamination from Site 12 would be expected. Therefore, fish ingestion will not be evaluated.

Tables 4.1 through 4.28 detail the exposure parameters that will be used for each of the exposure pathways listed in Table 1 for quantitative evaluation.

The 95 percent upper confidence limit of the mean (95UCL) will be calculated for media in which three or more samples were collected. The w-test will be used to determine if the

data fit a lognormal or normal distribution. If the results of the w-test are inconclusive, a normal distribution will be assumed for data sets with 10 or fewer samples, and a lognormal distribution will be assumed for data sets with greater than 10 samples. The appropriate distribution will then be used to calculate the 95UCL. The lower of the 95UCL or the maximum detected concentration will be used as the exposure concentration. For data sets with fewer than three samples, the maximum detected concentration will be used as the exposure point concentration.

The most contaminated well or group of wells from each aquifer (Columbia and Yorktown) will be selected to analyze risks associated with future exposure to groundwater from the aquifer. The maximum detected concentration of each constituent from all of the wells within an aquifer at the site will be used to select the COPCs for each aquifer. The Foster and Chrostowski shower model will be used to determine exposure to volatiles from groundwater while showering for an adult resident. The concentration of contaminants in the water will be adjusted to account for loss due to volatilization for the dermal contact while showering adult residential exposure pathway.

5. Toxicity Assessment

Toxicity values for use in the risk assessment will be obtained from Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) databases. If information is not available from these two sources, toxicity values from the EPA Region III Risk Based Concentration Table will be used. If information is not available from the preceding sources, EPA Region III risk assessors will be consulted.

Oral toxicity values will be adjusted from administered to absorbed doses for evaluating dermal exposure. Oral absorption factors obtained from EPA Region III (received from Linda Watson June 23, 1997) will be used to adjust the oral toxicity factors to dermal toxicity factors.

6. Risk Assessment Deliverables

The risk assessment will be conducted following EPA's *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessment)*, January 1998. Therefore, there are ten different types of standard tables that will be prepared for the risk assessment. Tables 1 and 4 are provided with this memorandum. Tables 2 and 3 will be provided together as the next interim deliverable. Tables 5 and 6 will be provided together as the third deliverable. Tables 7 through 10 will be provided in the RI report, along with all the previous tables.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Little Creek NAB-Site 1

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Groundwater	Groundwater	Upper Aquifer - Tap Water	Resident	Adult	Dermal	On-Site	None	Groundwater not currently used on site as a water supply.
						Ingestion	On-Site	None	Groundwater not currently used on site as a water supply.
					Child	Dermal	On-Site	None	Groundwater not currently used on site as a water supply.
						Ingestion	On-Site	None	Groundwater not currently used on site as a water supply.
	Surface Soil	Surface Soil	Soil adjacent to asphalt parking lot	Industrial Worker	Adult	Dermal	On-Site	Quant	Site workers could contact surface soil not covered by asphalt.
						Ingestion	On-Site	Quant	Site workers could contact surface soil not covered by asphalt.
				Trespasser/Visitor	Adult	Dermal	On-Site	Quant	General public can access the site and may contact surface soil.
						Ingestion	On-Site	Quant	General public can access the site and may contact surface soil.
					Adolescents	Dermal	On-Site	Quant	General public can access the site and may contact surface soil.
						Ingestion	On-Site	Quant	General public can access the site and may contact surface soil.
		Air	Emissions from exposed soil	Industrial Worker	Adult	Inhalation	On-Site	Quant	Site workers may inhale vapors and dust from areas of site not covered by asphalt.
				Trespasser/Visitor	Adult	Inhalation	On-Site	Quant	General public can access the site and inhale vapors and dust from areas of site not covered by asphalt.
					Adolescents	Inhalation	On-Site	Quant	General public can access the site and inhale vapors and dust from areas of site not covered by asphalt.
Current/Future	Surface Water	Surface Water	Drainage canal along west side of site	Trespasser/Visitor	Adult	Dermal	On-Site	Quant	General public can access the site and may contact surface water.
						Ingestion	On-Site	Quant	General public can access the site and may contact surface water.
					Adolescents	Dermal	On-Site	Quant	General public can access the site and may contact surface water.
						Ingestion	On-Site	Quant	General public can access the site and may contact surface water.
		Animal Tissue	Fish from drainage canal along west side of site	Fisher	Adult	Ingestion	On-Site	None	Fishing does not occur in canal adjacent to site.
		Animal Tissue	Fish from drainage canal downgradient of site	Fisher	Adult	Ingestion	Off-Site	None	Fishing may occur downgradient of the site, however due to dilution, the surface water concentrations would be much lower, resulting in lower fish tissue concentrations.
	Sediment	Sediment	Drainage canal along west side of site	Trespasser/Visitor	Adult	Dermal	On-Site	Quant	General public can access the site and may contact sediment.
						Ingestion	On-Site	Quant	General public can access the site and may contact sediment.
					Adolescents	Dermal	On-Site	Quant	General public can access the site and may contact sediment.
						Ingestion	On-Site	Quant	General public can access the site and may contact sediment.
Future	Groundwater	Groundwater	Upper Aquifer - Tap Water	Resident	Adult	Dermal	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Dermal	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
		Air	Upper Aquifer -Water Vapors at Showerhead	Resident	Adult	Inhalation	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Inhalation	On-Site	None	Children are assumed not to shower.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Little Creek NAB-Site 1

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Yorktown Aquifer - Tap Water	Resident	Adult	Dermal	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Dermal	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
						Ingestion	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
		Air	Yorktown Aquifer -Water Vapors at Showerhead	Resident	Adult	Inhalation	On-Site	Quant	Although unlikely, groundwater could be used as a potable water supply in the future.
					Child	Inhalation	On-Site	None	Children are assumed not to shower.
	Soil*	Soil	Site Soil	Industrial Worker	Adult	Dermal	On-Site	Quant	Site workers could contact soil not covered by asphalt.
						Ingestion	On-Site	Quant	Site workers could contact soil not covered by asphalt.
				Trespasser/Visitor	Adult	Dermal	On-Site	Quant	General public can access the site and may contact soil.
						Ingestion	On-Site	Quant	General public can access the site and may contact soil.
					Adolescents	Dermal	On-Site	Quant	General public can access the site and may contact soil.
						Ingestion	On-Site	Quant	General public can access the site and may contact soil.
				Resident	Adult	Dermal	On-Site	Quant	If site used for future residential development, residents could contact soil.
						Ingestion	On-Site	Quant	If site used for future residential development, residents could contact soil.
					Child	Dermal	On-Site	Quant	If site used for future residential development, residents could contact soil.
						Ingestion	On-Site	Quant	If site used for future residential development, residents could contact soil.
				Construction Worker	Adult	Dermal	On-Site	Quant	Exposure to soil during construction activities.
						Ingestion	On-Site	Quant	Exposure to soil during construction activities.
		Air	Emissions from exposed soil	Industrial Worker	Adult	Inhalation	On-Site	Quant	Site workers may inhale vapors and dust from soil.
				Trespasser/Visitor	Adult	Inhalation	On-Site	Quant	General public can access the site and inhale vapors and dust from soil.
					Adolescents	Inhalation	On-Site	Quant	General public can access the site and inhale vapors and dust from soil.
				Resident	Adult	Inhalation	Off-Site	Quant	If site used for future residential development, residents could inhale vapors and dust from soil.
					Child	Inhalation	Off-Site	Quant	If site used for future residential development, residents could inhale vapors and dust from soil.
				Construction Worker	Adult	Inhalation	On-Site	Quant	Exposure to emissions from soil during construction activities.

* Surface Soil and Subsurface Soil combined.

TABLE 4.26

VALUES USED FOR DAILY INTAKE CALCULATIONS

Little Creek Site 12

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Emissions from exposed soil
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	see Table ----	- -	see Table ---	- -	Chronic Daily Intake (CDI) (mg/kg-day) =
	CA	Chemical Concentration in Air	mg/m^3	see Table ----	- -	see Table ---	- -	CA x IN x ET x EF x ED x 1/BW x 1/AT
	FDC	Fugivite Dust Concentration in Air	kg/m^3	1.32E+09	EPA, 1996	1.32E+09	EPA, 1996	
	VF	Volatilization Factor for volatile constituents	m^3/kg	calc	EPA, 1996	calc	EPA, 1996	
	IN	Inhalation Rate	$m^3/hour$	0.83	EPA, 1991	0.83	EPA, 1991	
	ET	Exposure Time	hr/day	24	- -	24	- -	CA (mg/m^3) = CS (1/FDC + 1/VF)
	EF	Exposure Frequency	days/year	350	EPA, 1991	219	EPA,1993	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	EPA, 1989	3,285	EPA, 1989	

* Includes surface/subsurface soil.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

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F A X

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Site 12 Figure for HHRA Memo of Understanding (DRAFT)

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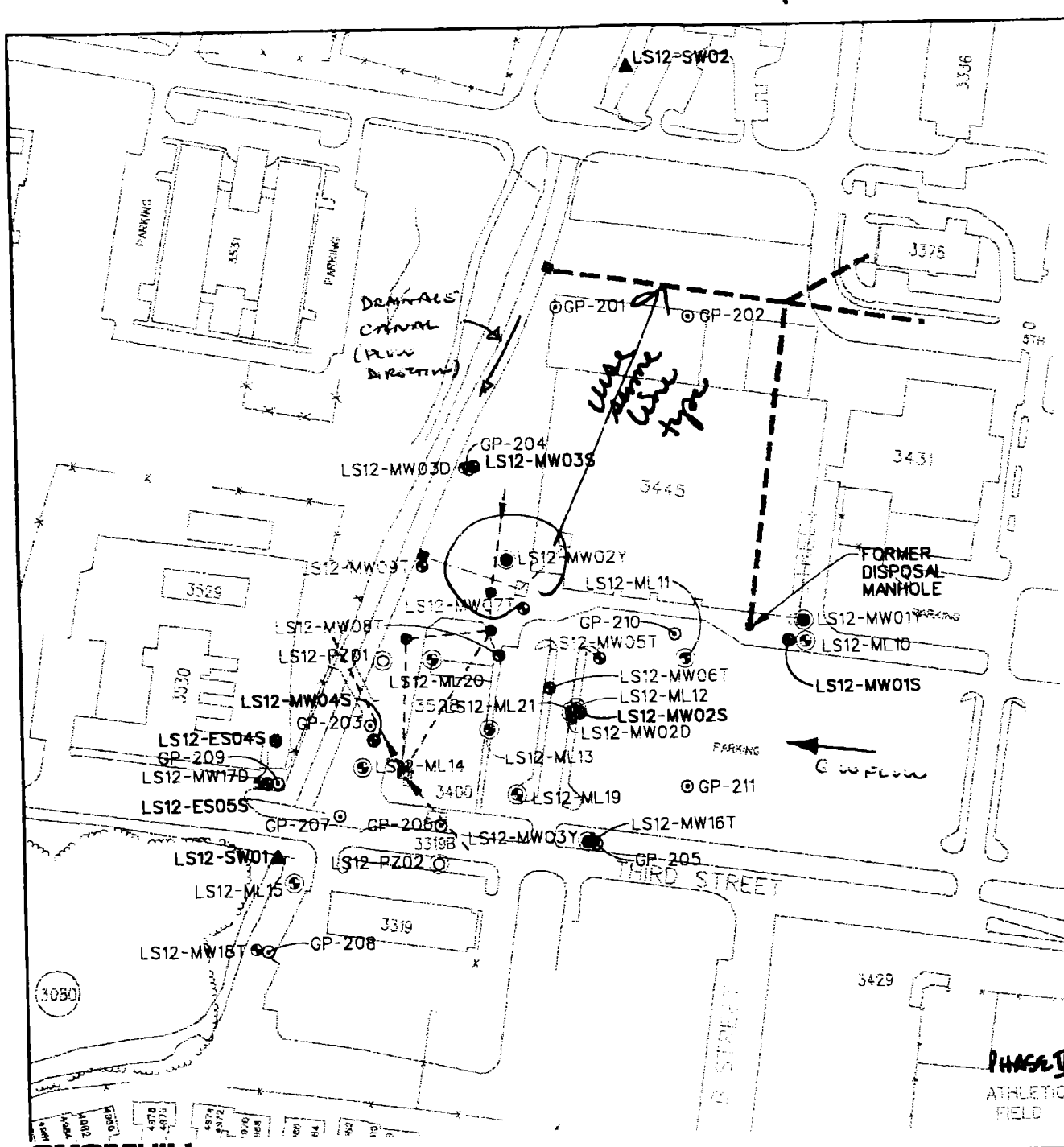

FIGURE 3-3
PHASE II DIRECT-PUSH AND GROUNDWATER LOCATIONS
PHASE II SRI SITE 12
NAB LITTLE CREEK
VIRGINIA BEACH, VIRGINIA