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FINAL WORK PLAN REMEDIAL INVESTIGATION 80TH DIVISION RESERVE SITE

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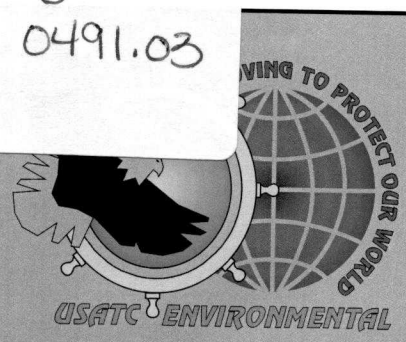
MALCOLM PIRNIE



FINAL

WORK PLAN

REMEDIAL INVESTIGATION

80TH DIVISION RESERVE SITE
FORT STORY, VIRGINIA

Installation Restoration Program
Fort Story, Virginia

U. S. Army Transportation Center
Fort Eustis, Virginia

and

U.S. Army Corps of Engineers
Baltimore District

November 2002

0285-917-250

FINAL

WORK PLAN

REMEDIAL INVESTIGATION
80TH DIVISION RESERVE SITE
FORT STORY, VIRGINIA

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

AND

U.S. ARMY TRANSPORTATION CENTER
FORT EUSTIS, VIRGINIA

CONTRACT DACA31-00-D-0043
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NOVEMBER 2002

MALCOLM PIRNIE, INC.
701 Town Center Drive, Suite 600
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0285-917-250

WORK PLAN
REMEDIAL INVESTIGATION
80TH DIVISION RESERVE SITE
FORT STORY, VIRGINIA

SCOPE

Malcolm Pirnie, Inc. is under contract with the U.S. Army Corps of Engineers (USACE), Baltimore District, to develop a Work Plan for the remedial investigation at the 80th Division Reserve Site, Fort Story, Virginia. This Work Plan has been developed to address investigation protocols, quality assurance and quality control applications, and health and safety issues for the field investigations to be conducted at the site.

APPROVALS

1. **Work Plan – Reviewed by:**

Title	Signature	Date
Project Officer	_____	_____
Project Manager	_____	_____
Technical Director	_____	_____
Site QA/QC Officer	_____	_____

2. **Employee Acknowledgement** (To be signed by all Malcolm Pirnie and subcontractor employees prior to performing sampling on-site):

I acknowledge that I have reviewed the information in this Work Plan and understand the required activities and procedures necessary to ensure QA/QC and health and safety for sampling activities at Fort Eustis.

Employee Signature	Company	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Employee Signature	Company	Date

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1.1 BACKGROUND

The Department of Defense (DOD) initiated investigations at its facilities to evaluate potential environmental impacts, if any, associated with prior suspected hazardous material releases. The Installation Restoration Program (IRP) was developed by DOD in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) to implement this investigation and remedial process.

Fort Story is participating in the IRP in which DOD has been investigating hazardous waste sites by identifying, evaluating, and controlling the migration of hazardous contaminants.

1.2 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Baltimore District, has developed a Scope of Service, dated 20 May 2002, which is included in **Appendix A**, for a Remedial Investigation /Feasibility Study (RI/FS) at the 80th Division Reserve Site at Fort Story, Virginia. Malcolm Pirnie has prepared the Work Plan in accordance with the USACE Scope of Services for performance of the RI.

Malcolm Pirnie is performing the RI as a contractor to the USACE. The methodology and activities described herein will serve as the general operating procedures for field personnel performing the fieldwork during the RI.

The RI Work Plan is comprised of three major components: a Field Investigation Plan (FIP), a Site-Specific Chemical Data Acquisition Plan (CDAP), and a Site-Specific Safety and Health Plan (SSHP). The FIP (**Section 3** and supporting Sections) establishes the investigation objectives, provides the project approach and rationale, and outlines the methods and activities that will be followed by the field personnel performing the field investigations. The CDAP (**Section 5**) presents the detailed standard operating procedures that will be utilized by project personnel to develop a site database of appropriate data quality to

support a risk assessment. The SSHP (**Section 10**) details health and safety protocol, referencing OSHA regulations, which will be followed by field personnel during performance of the site work.

A generic Quality Assurance Project Plan (QAPP) (dated March 2002) and SSHP (dated December 1994) for the 80th Division Reserve Site at Fort Story have been previously submitted to and approved by the USACE and the Virginia Department of Environmental Quality (VDEQ). A site-specific CDAP and SSHP are submitted as part of the Work Plan for this project (Sections 5 and 10, respectively). Any revisions or additions to the information or data presented in the generic plans that relate to the 80th Division Reserve Site RI will be outlined and discussed in these site-specific plans.

1.3 PROJECT PURPOSE

The purpose of the FIP is to define the tasks for: identifying potential contamination; delineating the extent of contamination; identifying contamination migration; and assessing risk from the site at Fort Story. The results of the RI will determine the need for further action based on the presence of contaminants in the soil and groundwater.

1.4 PROJECT SCOPE

This FIP addresses the necessary sampling and analytical tasks to provide information for the following:

- Characterization of the nature and extent of contamination in soils and groundwater associated with the site.
- Quantitative assessment of the risk to human health and ecological receptors.
- Recommendations for future action at the site based on the RI findings.

- Development and screening of remedial alternatives through the following process:

  - Identification of remedial action objectives (RAOs).
  - Identification of potential technologies that will satisfy the RAOs.
  - Screening of technologies based on effectiveness and implementability.
  - Assembling of technologies into alternatives.

- Detailed evaluation of alternatives with respect to nine criteria as developed by EPA to address the statutory requirements and preferences of CERCLA.

- Preparation of a Proposed Plan and Decision Document (DD) for the 80th Division Reserve Site.

2.1 LOCATION AND DESCRIPTION

2.1.1 Facility Location

Fort Story is located on Cape Henry in Virginia Beach, Virginia. Fort Story is bounded by the Atlantic Ocean and the Chesapeake Bay to the north, and by the Virginia Seashore State Park to the south. The 80th Division Reserve Site (DRS) LARC area at Fort Story is located north of Da Nang Road and east of Hospital Road. The site operated as a lighter, amphibious, resupply, cargo (LARC) washing and maintenance area. The location of the DRS is presented on **Figure 2-1**.

2.1.2 Site Description

The Fort Story 80th DRS area contains a 50 foot by 70 foot concrete pad surrounded by asphalt on the west, south, and east sides. The north side is bordered by sand that was used as the DRS staging area. Over time, this staging area apparently became contaminated with by-products (primarily petroleum products) of the washing and maintenance operations. A 1,000 gallon used oil UST, 250-gallon antifreeze aboveground storage tank (AST), and a former drum storage area were located west of the wash pad.

2.2 HISTORY

2.2.1 Facility History

On 10 March 1914, the Virginia General Assembly ceded 343.1 acres, located at Cape Henry in Princess Anne County, to the U.S. Government "to erect fortifications and for other military purposes". On July 24, 1916, this newly acquired tract of land was named Fort Story in honor of Major General John Patton Story.

In 1917, the 2nd and 5th Coast Artillery Companies established the military garrison at Fort Story. From 1917 through 1925, the installation continued to develop as a small coastal artillery garrison consisting of little more than its armament.

During World War I, Fort Story was integrated into the Coast Defenses of Chesapeake Bay, which included Fort Monroe and Fort Wool. On 9 June 1925, Fort Story was designated a Harbor Defense Command, but the change in designation added little to the dwindling post-war activity of the garrison.

As World War II approached, Fort Story began an extensive development. Many of the facilities, which exist today, were constructed at that time, and the installation increased in size to 1,439 acres. In the 1940's, the construction included temporary artillery batteries, theater, chapel, fire station, mess halls, barracks, Officer and NCO clubs, shops additional powder magazines and projectile rooms, six underground storage bunkers and 19 seacoast searchlights. By September 1944, Fort Story began a transition from a heavily fortified coast artillery garrison to a convalescent hospital. At the closing of World War II, Fort Story again changed missions. This time is assumed the role which it sill has today, to train units and individuals for amphibious operation. Fort Story was officially transferred to the Transportation Corps in July 1948 as a subpost of the Transportation Training Command, Fort Eustis, Virginia.

2.2.2 Site History

The 80th Division Reserve site operated as a lighter, amphibious, resupply, cargo (LARC) washing and maintenance area. The site contains a 50 x 70 foot concrete pad surrounded by asphalt on the west, south and east sides. The north side is bordered by sand that was used as the LARC staging area. Over time, this staging area apparently became contaminated with by-products (primarily petroleum products) of the washing and maintenance operations. A 1,000-gallon used oil underground storage tank (UST), 250-gallon antifreeze aboveground storage tank (AST), and a former drum storage area were located west of the wash pad.

2.3 PREVIOUS INVESTIGATIONS

A summary of previous investigations and studies conducted at

this site is provided below.

Final Site Assessment Report, Montgomery-Watson, May 1994

Montgomery Watson conducted an investigation from February to May 1994 to evaluate the presence of possible soil contamination in the LARC staging area of the site and around the existing concrete pad. Elevated levels of total petroleum hydrocarbons (TPH) – heavy oils and lead were detected in the shallow soils adjacent to the former drum storage area, tank area, and wash pad area. Based on the limited vertical extent of contaminated soil, excavation of soil and off-site treatment and disposal was feasible.

Site Characterization Report, Environmental Restoration Company (ERC), June 1994

ERC conducted a site characterization of the site in 1994. Based on the site characterization, two areas of soil contamination and one area of groundwater contamination were identified at the site. TPH and lead contamination was discovered in the shallow soil of the LARC staging area. These contaminants are most likely the result of bilge water discharge and sandblasting. TCE and PCE were detected in monitoring well MW-4.

Removal Action Final Report, IT Corporation, August 1995.

From April through July 1995, IT Corporation completed a removal action of contaminated soil from the LARC staging area and from the tank area. Approximately 3,500 tons of TPH-contaminated soils and 30 tons of PCE-contaminated soil were excavated from the site and transported off-site for thermal desorption. Significant quantities of contaminated soils remain in both areas. The areas were backfilled with clean fill.

2.4 GEOGRAPHY AND CLIMATE

2.4.1 Geography

Land features encountered at Fort Story consist of linear sand ridges, sand flats, and wetland areas. The topography is dominated by a series of prominent linear, well-drained sand ridges that roughly bisect the Fort Story area. The central ridges trend parallel to the coastline and are characterized by maximum elevations in excess of 85 feet, National Geodetic Vertical Datum (NGVD) of 1929. A second series of sand ridges located on Fort Story are comprised of an active dune complex located adjacent to the coastline. The coastal sand ridges attain maximum elevation in excess of 25 feet NGVD. Broad, poorly drained sand flats are located adjacent to the sand ridge areas. Land surface elevations in the sand flat areas typically range between 5 and 10 feet, NGVD. Wetland areas, which are common features of the sand flats, occur locally in closed depressions. South of the central sand ridges, the Fort Story topography consists of an extensive wooded, wetland area, formerly a back-bay, lagoonal feature. Most of the installation's facilities and operations are confined to the sand ridge and sand flat areas.

2.4.2 Climate

Historical climatological data for the Fort Story area is recorded at the Norfolk-Virginia Beach Airport, and is available from the National Oceanic and Atmospheric Administration (NOAA) through the National Climatic Data Center. The Norfolk-Virginia Beach Airport is located approximately 8 miles west of Fort Story.

Mild winters and hot summers characterize Fort Story climate. Temperatures are affected by air flowing through the area from the Atlantic Ocean. Average relative humidity is high in the area, with an afternoon average humidity of approximately 60 percent, which rises in the nighttime to 80 percent. In Winter, the average temperature is 41°F, with the lowest temperature recorded at 5°F for the period of record. The average Summer temperature is 76°F with a highest recorded temperature of 104°F.

The greatest percentage of precipitation occurs between April and September, which encompasses most of the growing season. The maximum amount of rainfall recorded in the area was 9.95 inches in a 1-day period.

2.5 GEOLOGIC/HYDROGEOLOGIC SETTING

The Virginia Coastal Plan sediments consist of an eastward thickening wedge of generally unconsolidated, interbedded sands and clays with minor occurrences of gravel and shell frangments. Within the Fort Story area, the sediments are in excess of 3,500 feet thick and are underlain by crystalline basement rocks. Utilizing well data from the region, Meng and Harsh determined the distribution of the principal aquifer units within these sediments. Their analysis indicated that the hydrogeologic framework of the coastal plain sediments in the Fort Story vicinity consists of six aquifer units separated by intervening semi-confining units. In order of increasing depth from ground surface, these aquifers include:

- The Columbia Aquifer, which is the water table aquifer, comprised of undifferentiated Holocene age sediments.
- The Yorktown – Eastover Aquifer, which occurs within the Yorktown and Eastover formations of Pliocene and Miocene age, respectively.
- The Chickahominy – Piney Point Aquifer, which occurs within the Chickahominy and Piney Point formations of Eocene Age and the Old Church Formation of Oligocene Age, where present.
- The Upper, Middle, and Lower Potomac Aquifers, which occur within the Potomac Group of Cretaceous age.

The Columbia, Yorktown – Eastover, and Chickahominy – Piney Point aquifers and intervening semi-confining units comprise roughly the upper one-quarter of the total thickness of the coastal plain sediments in the Fort Story area. The remaining sediment thickness, in turn, consists of Upper, Middle, and Lowe, aquifers

and intervening semi-confining units that comprise the Potomac Group.

Meng and Harsh indicate that the thickness of the Columbia Aquifer in the Fort Story area is approximately 120 feet and separated from the underlying Yorktown – Eastover Aquifer by the Yorktown semi-confining layer, which has an approximate thickness of 40 feet. The lithology of the Columbia Aquifer is characterized primarily as Holocene beach sand and nearshore marine sand, which commonly contains pebbles, shell fragments and blocks of coquinite. James Montgomery, Inc. has performed slug tests on 28 wells on the base. Hydraulic conductivities average 8.21×10^{-3} centimeters per second (cm/sec). The underlying Yorktown semi-confining unit is comprised of the upper portion of the Yorktown formation and described as marine silt with occasional interbeds of fine sand and coquina.

The Yorktown – Eastover Aquifer underlies the Yorktown confining unit and is encountered between the depths of 160 and 440 feet below ground surface.

Based on depth to water measurements obtained from the 28 monitoring wells that JMM installed for the PA/SI and three other studies, the water table occurs at an average depth of 10 feet in the Fort Story area. Generalized water table contours in the Fort Story area are characterized by the presence of a local groundwater divide in the vicinity of the central sand ridge complex. Groundwater elevations in excess of 10 feet are encountered in this area. Groundwater levels decline to approximately 3 feet in coastal sand ridges to the north. South of the central sand ridge complex, groundwater levels decline to approximately 8 feet in the vicinity of the wetland area. Based on these data, the general ambient groundwater flow directions are northward toward the coastline and southward toward the wooded wetland, from the central sand ridge area.

2.5.1 Site Data

The DRS area is characterized by Holocene Age sand deposits. The sand is typically described as fine to medium grained, poorly graded, subrounded and occasionally slightly silty.

The measured depth to groundwater at the site ranged from 7.47 feet below ground surface to 5.07 feet below ground surface. Based on water level data from on-site and nearby off-site wells, the water table elevation ranges from approximately 8 feet NGVD in southern portion of the site to less than 5 feet NGVD in the unpaved, wash rack area. Additionally, the water level data suggest the possible existence of a cone of depression in the vicinity of the wash rack supply well located at the southwestern corner of the wash rack area. The minimum groundwater level elevation within the cone of depression is approximately 4 feet NGVD. Though locally variable in magnitude and direction, the prevailing hydraulic gradient for the site is in a northward direction toward the coastline. For an adjacent area of Fort Story with similar sands, hydraulic conductivity values ranged from 1.21×10^{-2} to 1.24×10^{-2} centimeters per second (cm/sec).

The proposed investigation focuses on delineating the extent of contamination in site groundwater and confirmation/verification of certain metals and organic compounds in soil. The data will also be used to make recommendations as to future remedial activities to be conducted at the site.

The following subsections provide methodologies for each field investigative technique to be used. More specific methodologies for certain activities are provided in the generic Quality Assurance Project Plan (QAPP) and in **Section 5** of this plan. Potential health and safety concerns for each investigation activity are addressed in the Fort Story generic Site Safety and Health Plan (SSHP) and in **Section 10** of this Plan.

3.1 FIP RATIONALE

The main objective of the RI is to determine the nature and extent of any contamination in site media and characterize migration potential. The data generated from the chemical and physical analysis will be of sufficient quality to represent site conditions for determining the need for additional remedial response or support preparation of decision documents for no further actions. To achieve these objectives, the RI program incorporates procedures defined in the USEPA's document entitled "Data Quality Objectives Process for Superfund", Interim Final Guidance, EPA540-R-93-071, September 1993. To assist in the interpretation of data, the Superfund program has developed the following two descriptive data categories:

- *Screening Data with Definitive Confirmation*. Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. At least 10 percent of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data QA/QC elements include the following:

  - Sample documentation;
  - Chain of Custody;

- Sampling design approach;
- Initial and continuing calibration;
- Determination and documentation of detection limits;
- Analyte identification and quantification;
- Analytical error determination; and
- Definitive confirmation.

- *Definitive Data*. Definitive data are generated using rigorous analytical methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. For the data to be definitive, either analytical or total measurement error must be determined. Definitive data QA/QC elements include the following:

  - Sample documentation
  - Chain of Custody
  - Sampling design approach
  - Initial and continuing calibration
  - Determination and documentation of detection limits
  - Analyte identification and quantification
  - QC blanks (trip, method, rinse)
  - Matrix spike recoveries
  - Performance Evaluation (PE) samples (when specified)
  - Analytical error determination
  - Total measurement error determination

These data categories replace the references to analytical levels, quality assurance objectives and data use categories discussed in the generic QAPP.

3.1.1 Site-Specific Data Categories

The data category for samples collected at the site will be Definitive Data for off-site laboratory chemical analysis of soil and groundwater. The following SW-846 and USEPA methodologies

will be used during the RI.

Water Samples

- SW-846 ICP Method 6010 series with extraction 3005 for total and dissolved TAL metals
- SW-846 Method 8081A with extraction 3520 for TCL pesticides
- SW-846 Method 8082 with extraction 3520 for TCL PCBs
- SW-846 GFAA Method 7470 with extraction 3005 for mercury
- SW-846 Method 8260B with extraction 5030B for TCL volatiles
- SW-847 Method 8270C with extraction 3520 for TCL semivolatiles
- Method 160.1 for total dissolved solids (TDS)
- Method 160.2 for total suspended solids (TSS)

Soil Samples

- SW-846 8270C with extraction 3550 for TCL semivolatile organics
- SW-846 Method 8081/8082 with extraction 3550 for TCL pesticides and PCBs
- SW-846 8260B with extraction 5035 for TCL volatile organics
- SW-846 ICP Method 6010 with extraction 3050 for total TAL metals
- SW-846 GFAA Method 7471A with extraction 3050 for mercury
- Method 9045 for pH
- Lloyd Kahn Method for total organic carbon (TOC)

IDW Samples:

- SW-846 ICP 6010/7470A for mercury with extraction 1311 for TCLP metals
- SW-846 8082 with extraction 3520 (water) or 3550 (soil) for TCL PCBs

- SW-846 8270C with extraction 1311 for TCLP semivolatile organics
- SW-846 8260B with extraction 1311 for TCL volatile organics
- SW-846 Method 8015B with extraction 5030 (water) or 5035 (soil) for TPH gasoline range
- SW-846 Method 8015M with extraction 3520 (water) or 3550 (soil) for TPH diesel range
- Method 1010 for ignitability
- Method 1110 for corrosivity (water only)
- Method 7.3.4.2/9034 (water) and 7.3.4.2/9030 (soil) for sulfide reactivity
- Method 7.3.3.2/9014 for cyanide reactivity

A CLP-equivalent data package will be generated for the analytical data. In addition to the standard SW-846 methodology items, other items will be submitted with the data so that a CLP-equivalent package will be generated. A description of the standard SW-846 methodology items and the additional items to enhance the package to a CLP-equivalent are provided in **Table 3-1**.

The CLP-equivalent data that will be generated will be sufficient for data validation in accordance with EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Inorganics and EPA Region III Modifications to the National Functional Guidelines for Organic Data Review, and the data will be used in the quantitative risk analysis. URS Consultants, Inc. will provided data validation in 100% of the samples for this project.

3.1.2 Existing Data Assessment

To better define data gaps and establish a comprehensive field investigation approach, an assessment of the existing database as it relates to the nature and extent of contamination and support of the risk assessment is necessary. The identification of data needs

based on the uses and decisions we are to make is critical in establishing the field investigation approach for the project. These data needs focus on the following:

- Evaluating site physical characteristics such as topography, geology, and hydrogeology;
- Determining the nature and extent of petroleum impacts to groundwater contamination;
- Determining the presence/absence of trace levels of chlorinated organics in site groundwater; and
- Verifying the concentration of trace metals in site soils;

3.2 SOIL SAMPLE COLLECTION

Hollow stem auger split spoon sampler will collect thirty soil samples from 10 locations at depths of 0 to 6 inch, 1 to 3 feet, and 4 to 6 feet below land surface (BLS) throughout the site in accordance with the methodology presented in the generic QAPP Section B2.1.3.

Sample locations for both surface and subsurface soil locations are presented in **Figure 3-1**.

Sample homogenization procedures are described in Section B2.1.3 of the generic QAPP. However, volatile sample fractions will not be homogenized. VOC samples will be collected directly from the sampling device with En Core® Samplers (3 En Core® samplers required for each sample). Specific procedures for sampling with the En Core® Sampler are provided in Appendix B of the generic QAPP.

A portion of the soil obtained from each sample will be jarred and screened with a Photoionization Detector (PID) for VOCs in accordance with the generic QAPP Section B2.1.3

Additional bulk samples for VOC analysis support (i.e., percent solids) will be collected directly from the sampling device, and placed into one 125-ml amber glass jar and stored on ice. Prior to placement into the sample jars, all soil not requiring VOC analysis will be homogenized as previously described. Soil samples will be collected in the following order: VOCs, SVOCs, and inorganics. Container type and volume, preservation, and holding time requirements for the samples are listed in **Table 3-2**. The En Core® samples will be shipped at the end of each day's sampling to ensure that they are extracted before the limited holding time expires.

Any residual or excess soil during borehole installations and after transfer to sample containers will be containerized as described in **Section 3.5**.

3.3 MONITORING WELLS

Installation

Five groundwater monitoring wells (MW-7, MW-8, MW-9, MW-10, and MW-11) will be installed using a hollow stem auger drill rig and completed as flush-mounted wells in accordance with the procedures described in the generic QAPP section B2.1.1.

Well Development

Each well will be developed no sooner than 24 hours after construction using the methodology described in the generic QAPP in Section B2.1.1.

Prior to sampling the existing wells, because the wells have not been sampled since 1994, each well shall be re-developed to purge any sediment from the casings.

Development water from the wells will be collected and disposed of in accordance with **Section 3.5** of the Work Plan.

Water Level Measurements

Water levels will be measured three times during one individual tidal cycle (one during approximate high tide, one during approximate low tide, and one during the transition period between high and low tide) in the existing and newly constructed monitoring wells during field investigation activities to provide a more complete database for establishing groundwater contours. Water level measuring procedures are described in Section B2.1.1 of the generic QAPP.

Groundwater Monitoring Well Sampling

Prior to groundwater sampling, each well will be inspected to ensure that it is intact and secure. The locking cap will be removed and the depth to water measured and recorded. The bottom of the well will also be measured and recorded. Water level and bottom of well depth will be measured using an electronic water level probe, to the nearest 0.01-foot.

Groundwater samples shall be collected from the five newly installed wells and from the five existing wells (MW-1, MW-2, MW-3, MW-5, and MW-6). Groundwater samples will be collected using a low flow submersible pump in accordance with Section B2.1.1 of the generic QAPP.

3.4 DECONTAMINATION PROCEDURES

Cross contamination of samples from any source is to be avoided. To achieve this, all equipment used in sampling must be clean and free from the residue of any previous samples. All non-dedicated sampling equipment must be cleaned prior to being used and reused. All sampling equipment including split spoons, stainless steel scoops and bowls, and hand auger will be decontaminated using the following procedure:

- Wash and scrub with Alconox or equivalent
- Rinse with tap water

- Rinse with nitric acid
- Rinse with methanol
- Rinse with analyte-free deionized (DI) water
- Air dry

The submersible pumps used for groundwater purging and sampling will also be decontaminated prior to use and between wells. The decontamination process includes pumping a soapy solution (Alconox) through the pump followed by pumping tap water, methanol, and finally DI water.

The water level meter, water quality instruments (e.g., pH meter, conductivity meter, etc), and other equipment will be decontaminated by thoroughly washing internal and external surfaces with low-phosphate, laboratory grade detergent (Alconox) and rinsing with DI water prior to use. Heavy equipment such as split spoons and drilling augers will be steam cleaned prior to use and between locations.

Decontamination fluids will be containerized awaiting proper disposal. Containerized materials will be staged on-site awaiting Fort Story pick-up and transfer to their storage area. Malcolm Pirnie will maintain a log of the container and contents.

3.5 CONTROL AND DISPOSAL OF CONTAMINATED MATERIALS

Soil Cuttings

Drill cuttings generated during monitoring well installation will be containerized in U.S. Department of Transportation (DOT) approved, 55-gallon steel drums with the contents identified on weather-resistant labels attached to drum exteriors.

The containerized soil cuttings will be analyzed for RCRA Characteristics, Total Petroleum Hydrocarbons (TPH) – Gasoline and Diesel Range Organics (GRO and DRO, respectively), and Polychlorinated Biphenyls (PCBs) to determine its waste classification for disposal purposes. A detailed sampling

procedure is presented in Section B2.1.8 of the generic QAPP.

Groundwater

Groundwater discharged from monitoring wells during purging, development and sampling activities will be collected in a 250-gallon plastic container. Groundwater that may be pushed out of the ground during soil boring activities will be allowed to infiltrate into the ground at each site if the following conditions are met:

- There is no free product observed present such as LNAPLs and DNAPLs.

- The infiltrating groundwater is being returned to the same water-bearing zone from which it is being purged.

Groundwater data from each monitoring well will be utilized as the basis for determining if purge and development water is non-hazardous or hazardous. Total results from the groundwater monitoring will be utilized to determine if the containerized water exceeds regulatory limits. Additional samples will be collected and analyzed for TPH GRO and DRO.

Three possible disposal scenarios for the containerized purge water are listed in accordance with Section B2.1.8 of the generic QAPP

Waste Personal Protective Equipment

Depending on the levels of personal protection used during the field investigation, some disposable personal protective equipment (PPE) will be generated. Every attempt will be made to wash surface contamination off so that PPE (e.g., latex gloves and other disposable items) may be disposed of as ordinary trash. Non-hazardous disposable items will be contained and disposed of in a dumpster or via a licensed waste hauler, as appropriate.

Decontamination Fluids

Decontamination fluids containing solvents and acids will be contained separately from each other and from other Investigation derived wastes (IDW) and disposed of properly by Fort Story. Waste methanol and nitric acid will be collected in separate containers during decontamination procedures and will be contained separately.

Drum Management

Malcolm Pirnie will maintain a log of the drums and drum contents during the field investigations in accordance with Section B2.1.8 of the generic QAPP.

3.6 SAMPLE PRESERVATION AND HANDLING PROCEDURES

Detailed procedures regarding sample labels, sample numbering system, and chain of custody will be followed in accordance with Section B3 of the generic QAPP. Container type and volume, preservation, and holding time requirements for the samples are listed in **Table 3-2**. Sample containers are preserved by the analytical laboratory prior to shipment to Malcolm Pirnie.

3.7 SITE SURVEYING

A site survey will be completed using horizontal and vertical control to accurately locate and document the newly installed monitoring wells. A professional land surveyor licensed in the State of Virginia will be utilized for the survey. Survey procedures will be conducted in accordance with standard professional practice and regulatory requirements as set forth by the Virginia Board for Architects, Professional Engineers, Land Surveyors, Certified Interior Designers and Landscape Architects (APELSCIDLA).

Specific tasks will include surveying the horizontal location and elevations (top of the concrete pad, top of the PVC well, and top of the steel outer casing) of all groundwater monitoring wells installed

for this field investigation. The horizontal location will be surveyed to the nearest 1.0 foot using the Virginia State Plane Coordinate System and elevations surveyed to the nearest 0.01 foot.

3.8 SITE RESTORATION

Upon completion of field investigation activities, the site will be restored to its original condition as feasible. This will include the following:

- Ensuring the removal of all waste including drummed materials, unused materials and solid waste.
- Ensuring that all borings have been abandoned in a safe and aesthetic manner.
- Ensuring that any areas damaged due to site activities are identified and a plan for corrective action, if required, submitted to Fort Story.

The following sections outline the specific remedial investigation (RI) field activities to be performed at the 80th Division Reserve Site. Due to the presence of petroleum hydrocarbons and metals in site soils, as well as petroleum hydrocarbons and chlorinated organics in site groundwater at concentrations greater than EPA Region III screening criteria, further investigation is warranted.

Specific activities are based on the U.S. Army Corps of Engineers (USACE) Scope of Services for the project dated 20 May 2002. Data from previous investigations performed by others was used to optimize the field program, which is detailed here.

4.1 SITE VISIT

Malcolm Pirnie personnel conducted a site reconnaissance to the 80th Division Reserve Site to become familiar with the surrounding topography and land usage in the vicinity of the site. The location and accessibility of existing and newly installed monitoring wells was also verified. Specifically, locations of monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, and MW-6 were identified.

4.2 FIELD INVESTIGATION STRATEGY

The field investigation program has been developed to augment the existing site database by:

- Installation of monitoring wells to supplement the data gathered during previous investigations and to fill necessary data gaps.

- Delineation of the existing groundwater plume by installation of additional monitoring wells and sampling of new and existing monitoring wells primarily to further characterize the nature and extent of groundwater contamination associated with the site and for use in assessing risk.

- Verify the presence of chlorinated hydrocarbons in groundwater in the vicinity of monitoring well MW-4.

- Water level measurements will be conducted during the investigation to provide a database for establishing the ground water contours.

- Collection of surface soil samples throughout the site to assess the nature of contamination and for use in assessing risk.

- Collection of subsurface samples will be collected throughout the site to assess the nature of contamination and for use in assessing risk.

- IDW will be contained in DOT steel drums, staged at a temporary storage location, and sampled by A/E.

- Site surveying will be conducted using horizontal and vertical control to accurately locate and document the existing and newly installed monitoring wells.

- The necessary data management and assessment of environmental data generated through sampling and analysis activities for use in defining the extent of contamination and conducting a baseline risk assessment will be completed by the A/E.

- A quantitative evaluation of the potential current and future risk to human health and the environment from exposure to contaminated media shall be conducted.

A summary of the field investigation target parameters and sample quantities is presented in **Tables 4-1 and 4-2**.

4.3 ENVIRONMENTAL SAMPLING PROGRAM

To further assess the nature and extent of contamination at the site, numerous samples shall be collected from each environmental media present at the site including groundwater and soil. A summary of each sampling program is provided below and analytical requirements, and proposed locations are provided

on **Figure 3-1**.

4.3.1 Sampling Summary

A summary of the RI field sampling program by media is provided below.

Groundwater

Monitoring Well Installation

To supplement the data gathered during previous investigations and to fill data gaps identified, five monitoring wells will be installed and developed at the site. A summary of the additional wells is presented as follows:

- One well (MW-7) will be installed in the area between the former UST and the fenceline to the North.
- One well (MW-8) will be installed approximately 100 feet west of the current AST.
- One well (MW-9) will be installed approximately 60 feet north of former well MW-4.
- One well (MW-10) will be installed approximately 100 feet northeast of the former UST.
- One well (MW-11) will be installed approximately 200 feet northeast of the former UST.

Note: The wells will be constructed of two-inch diameter flush-threaded PVC casing and well screen with a 0.01-inch slot, ten feet in length. Monitoring wells will be screened two feet above and eight feet below the mean season high water table elevation.

Groundwater Sampling

Groundwater samples will be collected from the five newly installed wells and from five existing wells (MW-1, MW-2, MW-3, MW-5, and MW-6).

Prior to sampling the existing wells, because the wells have not been sampled since 1994, each well shall be re-developed to purge any sediment from the casings.

Two rounds of water level measurements shall be conducted during the investigation to provide a database for establishing the groundwater contours.

Soil Samples

Surface Soils

Ten surface soil samples shall be collected by using a split spoon sampler from a hollow stem auger drill rig from a depth of 0 to 6 inches BLS throughout the site to assess the nature of contamination and for use in the subsequent risk assessment. Five of the surface soil samples will be collected from the locations of the five newly installed monitoring wells (MW-7, MW-8, MW-9, MW-10, and MW-11). Three samples will be collected from locations surrounding the area that was removed due to PCE contamination (Area B) as identified in the IT Final Report. In addition, one soil sample will be collected from a location south of the former wash pad and another soil sample will be collected east of the former wash pad.

Subsurface Soils

Twenty subsurface soil samples will be collected by split spoon sampler from depths of 1 to 3 feet and 4 to 6 feet BLS throughout the site to assess the nature of contamination and for use in the subsequent risk assessment. The locations are the same as discussed for the surface soil samples.

4.3.2 Analytical Summary

A summary of the analytical requirements for each matrix is provided below:

- Analysis of groundwater samples from the site will include TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, and TAL metals (total and dissolved fractions) using SW-846 or EPA methods. Samples will also be analyzed for total suspended solids (TSS) and total dissolved solids (TDS) to assess the significance of the total and dissolved metals fractions.

- Analysis of site soil samples (surface and subsurface) will include TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, TAL metals, and total organic carbon (TOC) using SW-846 or EPA methods.

- Field measurements to be conducted will include dissolved oxygen, pH, conductivity, turbidity, redox potential, and temperature for groundwater samples.

This section, in conjunction with other sections of this Plan and the generic QAPP, describes analytical quality control and field quality control used to assess the precision and accuracy of the resulting data.

This site-specific QAPP section discusses the protocols and procedures to be followed in the field for the sampling events and documents any site-specific changes to procedures from the generic QAPP and also provides any supplemental information provided in the generic QAPP or FIP. Additional factors that affect QA/QC such as sample preservation, field equipment, and decontamination procedures are discussed in **Section 3.0** of this Plan.

5.1 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are developed to achieve the level of data quality required for the anticipated data use and are implemented so, that for each task, the data is legally and scientifically defensible. The development of DQOs for a specific site and measurement takes into account project needs, data uses and needs, and data collection. These factors determine whether the quality and quantity of data are adequate for its end use. Sampling protocols have been developed and sample documentation and handling procedures have been identified to realize the required data quality.

The objective of the quality control program is to provide data of acceptable quality. The DQOs for accuracy, precision, completeness, representativeness, and comparability are as follows:

- **Accuracy** is the degree of agreement of a measurement with an accepted reference or true value.

- **Precision** is a measure of mutual agreement among individual measurements of the same property, usually under prescribed conditions.

- **Completeness** is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

- **Representativeness** expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

- **Comparability** expresses the confidence with which one data set can be compared to another.

DQOs will be attained through sound chemical quality management, achieved through the implementation of the generic QAPP during sampling and characterization activities. The CDAP is in accordance with USACE document ER-1110-1-263, particularly Appendix E - Sample Handling Protocol for Low, Medium and High Concentration samples of Hazardous Waste; and USEPA guidance *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations,* EPA QA/R-5, October 1987.

5.1.1 Field DQOs

The field program for the 80th Division Reserve Site will be evaluated on the project field DQOs. These are quantitative and qualitative statements used to assess the quality of the data required. Field DQOs will be used to measure the performance of the field investigation program and their impact on the final results. The sampling activities may introduce potential sources of uncertainty or biases that may affect the overall confidence in the final measurements.

The evaluation of field DQOs with respect to precision, accuracy, representativeness, completeness and comparability criteria is presented as follows:

- **Precision.** In terms of the precision DQO, the consistent use of sample collection, documentation, handling and transportation procedures as described in the generic CDAP during all sampling activities should provide data of acceptable quality. Field measurements will be made to the required levels of precision as described in Section 6.3 of the generic CDAP. Field measurement equipment will be properly calibrated and the field investigation program properly documented. In addition, sufficient MS/MSD (one per 20 samples per matrix type) and duplicate samples (10 percent of samples) will be collected from the sediment and surface water to evaluate precision.

- **Accuracy.** In terms of the accuracy DQO, a sufficient number of field blank samples (one sample for deionized and tap water used for decontamination), equipment rinsate samples (one per sampling equipment type per day) and trip blank samples (one trip blank for each cooler containing aqueous volatile organic samples) will be collected to determine whether contamination was introduced from outside the sample matrix. In addition, the field logbooks and sampling forms will be completed accurately. Samples will be located within 1 foot of locations described in **Section 4.0** of this Work Plan. Field monitoring equipment will be calibrated properly pursuant to the requirements of Section 6.3 of the generic CDAP to ensure accurate measurements are taken.

- **Representativeness.** The representative DQO will be met by collecting data that are representative of site conditions. Samples will be collected from all media potentially impacted and from designated sample locations that are upgradient, on-site, and downgradient. This field DQO will be achieved by using procedures that maintain the sample, as close as possible, it its original condition when contained. Careful preservation and handling of field samples will contribute to acceptable field representativeness.

- **Completeness.** The completeness of the QC data will be evaluated by comparing the number of samples collected to

the number of samples required as listed in **Table 4-1** of this Plan. A completeness goal of 90 percent has been established. All field documentation such as sampling forms and the field logbooks will be properly completed. In addition, a Daily Quality Control Report will be completed every day that field work is conducted.

- **Comparability.** The comparability DQO will be achieved by using sampling techniques and equipment that are based on USEPA-accepted methods, follow standard operating procedures as stated in this Plan and the generic CDAP and that produce consistent data and measurement.

5.1.2 Analytical DQOs

The site-specific data categories will be **Definitive Data** for off-site laboratory chemical analysis of soil and groundwater samples collected during the 80th Division Reserve RI field program.

The primary laboratory QA objectives include the measurement of precision and accuracy. CompuChem Laboratory will conduct precision and accuracy calculations in its assessment of the data quality. In addition, URS (data validators for the project) will conduct field duplicate precision calculations and will assess the lab's MS/MSD accuracy and precision results. A description of each of these is provided as follows:

Precision

Relative percent difference (RPD) will be used to express precision between two duplicate values in the form of matrix spike and matrix spike duplicate samples (CompuChem lab to perform) and field duplicate samples (URS to perform) and evaluated according to method requirements. Precision is used to evaluate

matrix bias and is not used for method control. The RPD is calculated as follows:

$$RPD = \frac{(V_1 - V_2)\, x\, 100}{\frac{V_1 + V_2}{2}}$$

where: *V1 = value 1*
V2 = value 2

The acceptance criteria for precision are presented for each compound for each analytical method in the CompuChem Quality Manual, Revision 2, October 26, 2001. Although these acceptance criteria for precision are based on pristine lab conditions and are primarily derived from in-house lab data, they will be adopted as the precision measurement criteria for the project. In some cases, method limits may be substituted for the in-house limits because the in-house limits are broader than the method limits or are too broad to be usable.

Accuracy

Accuracy is a measure of the closeness of an individual measurement to the true or expected value. To determine accuracy, a reference material of known concentration is analyzed or a sample that has been spiked with a known concentration is reanalyzed. Percent recovery (%R) is used to express accuracy and will be calculated by CompuChem. The %R is calculated as follows:

$$\%\ recovery = 100\, x\, \frac{SPV - SAV}{SA}$$

where: SPV = Value obtained by analyzing the sample with the spike added
SAV = The background value, value obtained by analyzing the unspiked sample
SA = Concentration of the spike added to the sample

The acceptance criteria for accuracy are presented for each compound for each analytical method in the CompuChem Quality Manual, Revision 2, October 26, 2001. Although these acceptance criteria for accuracy are based on pristine lab conditions and are primarily derived from in-house lab data, they will be adopted as the accuracy measurement criteria for the project. In some cases, method limits may be substituted for the in-house limits because the in-house limits are broader than the method limits or are too broad to be usable.

5.2 LABORATORY ANALYTICAL PROCEDURES

The total number of samples and parameters for analysis are specified in **Table 4-2**. Analytical methods are also specified in this table.

Table 4-1 provides the list of parameters for each sample group for soil and groundwater that will be analyzed for during the duration of the monitoring program.

5.3 DATA MANAGEMENT AND VALIDATION

CompuChem will generate a CLP-equivalent data package for the sediment and groundwater samples collected. Analytical data will be reviewed and validated by URS Corp.

The CLP-equivalent data for the soil and groundwater sampling that will be generated will be sufficient for data validation in accordance with *EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Inorganics* and the *EPA Region III Modifications to the National Functional Guidelines for Organic Data Review*. URS Corp. will prepare analytical qualifications and data review narratives that will be included as an appendix to the draft RI Report.

5.4 ASSESSMENT AND OVERSIGHT

A field audit will be conducted during the initial stages of the field investigations by David Glass (Project QC Officer) and Joanna Bateman (Fort Eustis Remedial Project Manager).

The goal of the field audit is to assess the sampling team's compliance with the requirements of the Sampling and Analysis Plan, specifically the field data quality objectives as presented in Section 5.1.1 of this plan. The field audit will assess the field sampling team's performance as related to precision, accuracy, representativeness, completeness, and comparability as presented in Section 5.1.1.

The audit team has the authority to stop work or provide recommendations to the sampling team for corrective action, if necessary. These recommendations will take the form of specific oral instruction to the sampling team in the field for any changes to procedures or other non-compliance issues noted.

A written report will be prepared and signed by the audit team and submitted to VDEQ within 14 days of completion of the field audit, which provides the results of the audit. The results will include field observations and corrective actions taken.

Malcolm Pirnie will provide detailed Remedial Investigation (RI) Reporting to the U.S. Army Corps of Engineers (USACE) upon completion of field activities. The report will be submitted in Preliminary Draft, Draft, and Final formats, and will outline findings for the site. The RI Reports will address the following:

- Site Description and History
- Previous Investigations
- Data Quality Objectives
- Field Investigation Program
- Site Characteristics
- Nature and Extent of Contamination
- Contaminant Fate and Transport
- Human Health Risk Assessment
- Ecological Risk Assessment
- Conclusions
- Recommendations

A discussion of the human health and ecological risk assessment methodology and procedures is provided in **Appendix B**.

The Data Management Plan (DMP) describes the methodology to document and track the data and results generated during the remedial investigation (RI) field investigations. This plan identifies field and laboratory data documentation formats, procedures and file requirements.

7.1 DAILY SITE LOG BOOK

A log book of the site activities will be kept by the Field Manager documenting the following:

- Personnel on-site;
- Time on-site and off-site;
- Activities conducted;
- Problems and resolutions;
- Deviations from work plan; and
- Weather.

The site log book should be bound, sturdy, of water repellant construction and kept in the possession of the Field Manager. The Site Log Book shall be identified by a site-specific title, as necessary. All entries will be in indelible ink and all pages numbered. On a weekly basis, copies of the preceding weeks activities as recorded in the log book will be sent to the file custodian (Section 7.4).

7.2 STANDARD FIELD LOGS

A number of standard field forms will be used to document site activities. These include:

- Sample Collection Records;
- Sample Chain-of-Custody Record; and
- Daily Field Reports.

Copies of the standard field logs will be kept in files at the Newport News office.

7.3 FIELD BOOKS

During field activities, it will be necessary for the project members to record site-specific data from surveying, sampling activities, etc. This data will be recorded in field books dedicated to this project. The field books will be bound, sturdy, and of water repellent construction, with each page numbered. Each field book will be assigned by the Project Manager to a team member and identified by a site-specific title. The assignment of the field book and its identifier will be recorded in the Daily Site Log Book. Field books will remain in the file at the Newport News office when not in use. Upon filling a field book or completion of the project, the book will be turned over to the file custodian and an entry made in the Site Log Book to that effect. On a weekly basis, copies of the previous week's activities that were recorded in the Field Books will be sent to the file custodian.

7.4 PROJECT FILING

All sample documentation and field forms collected during this project will be stored in the project files at Malcolm Pirnie, Inc., Newport News, Virginia office. Tony Pace will be the file custodian. All project files will be stored in an organized and accessible manner. Upon completion of the project, all documentation will be turned over to Mr. Myron Price, Project Manager for the U.S. Army Corps of Engineers, Baltimore District.

7.5 REPORTING

7.5.1 Progress Reports

Monthly progress reports will be submitted to the USACE. These progress reports will include progress on site activities during the reporting period, problems and resolutions, data collected, deliverables submitted. During field activities weekly progress reports of the fieldwork will be provided to the USACE Project Manager.

7.5.2 Project Deliverables

The draft, final draft, and final versions of the Remedial Investigation/Risk Assessment and Feasibility Study Reports will be sent to the official list of project document recipients as listed in the USACE Scope of Work.

The sequence of the RI field investigations for the 80th Division Reserve Site is provided below.

1. Installation of monitoring wells and collection of soil samples from monitoring well locations
2. Collection of remaining soil samples
3. Development of newly installed and existing monitoring wells
4. Collection of groundwater samples (14 days from well development)
5. Collection of IDW samples
6. Surveying of monitoring well locations and elevations

The following provides a description of the project team organization. **Figure 9-1** provides a summary of this organizational structure.

Myron Price is the U.S. Army Corps of Engineers (USACE) Project Manager in charge of providing technical direction and monitoring the technical performance of Malcolm Pirnie. Joanna Bateman is the Remedial Project Manager at Fort Eustis who also provides technical direction for the project.

For Malcolm Pirnie, Inc., Bill Dee, President, is the President and Greg Matthews, Vice President, is the Officer providing overall project direction. Richard Brownell, Vice President in charge of Hazardous Waste Programs, is the Officer providing technical review.

The Project Manager for Malcolm Pirnie, Inc. is Tony Pace, Senior Project Engineer, who specializes in hazardous waste investigation and remediation. The Deputy Project Manager and Field Manager is Dan Mosher. Health and safety as well as quality assurance will be the responsibility of David Glass.

Malcolm Pirnie, Inc. has a matrix organization structure. Project personnel are drawn from throughout the company irrespective of group or locational assignment. The project personnel are selected based on appropriate skills, experience, and availability. For purposes of this project, tasks and subtasks will be assigned to Task Managers. Personnel working on specific tasks will report on a daily basis to their respective Task Managers. Task Managers, in turn, will work under the daily direction of the Project Manager.

The project personnel responsibilities are summarized below:

Senior Company Officer

Bill Dee, P.E., President, is the Senior Company Officer at the top of the QA/QC chain of command. He interfaces with the Project Officer on QA/QC issues for the project.

Project Officer

The Project Officer, Greg Matthews, P.E., is the representative of Malcolm Pirnie with contract authority. The Project Officer is responsible for the commitment of the resources required to fulfill Malcolm Pirnie's obligation to the USACE. The Project Officer is accountable to both the USACE and Malcolm Pirnie's President.

Technical Review Director

The Technical Review Director, Richard Brownell, P.E., provides guidance on technical matters and reviews all technical documents relating to the project. The Technical Review Director may delegate technical guidance to specially trained individuals under his direction. Don Cohen provides technical review assistance for hydrogeologic investigations.

Project Manager

The Project Manager, Tony Pace, is accountable to the Project Officer throughout the duration of the project, and utilizes the Technical Review Director for any technical assistance. The Manager may delegate authority to expedite and facilitate the implementation of the project plan. The Project Manager is responsible for:

- Review of engineering and interim reports;
- Coordination with USACE;
- Budget control;
- Allocation of resources and staffing to implement the QA/QC program; and
- Allocation of resources and staffing to implement Site Safety and Health Plan (SSHP).

Deputy Project Manager

The Deputy Project Manager, Dan Mosher, is accountable to the Project Officer and Project Manager throughout the duration of the project, and utilizes the Technical Review Director for any technical assistance. The Deputy Project Manager assists the Project Manager in delegating authority to expedite and facilitate the implementation of the project plan. The Deputy Project Manager is responsible for:

- Production and review of engineering and interim reports;
- Budget control;
- Subcontractor performance; and
- Project coordination to implement Work Plan.

Health and Safety Manager

The Health and Safety Manager, Mark A. McGowan, C.I.H., serves as the administrator of Malcolm Pirnie's Corporate Health and Safety program. He is accountable directly to Malcolm Pirnie's President for project health and safety concerns and is responsible for:

- Administering OSHA and DOT compliance training for Malcolm Pirnie field personnel;
- Administering the medical surveillance program;
- Ensuring field personnel having adequate experience with personal protective equipment;
- Providing guidance on data interpretation; and
- Reviewing proposed levels of worker protection.

Site Field Manager

The Site Field Manager, Dan Mosher, will serve as the on-site contact person for Malcolm Pirnie for field investigations and tests. The coordinator will be responsible for the logistics of the field activities. The Field Coordinator will:

- Inspect and replace equipment;
- Prepare daily and interim reports;
- Prepare samples for shipment;
- Coordinate field activities; and
- Schedule sampling and other field activities.

Project and Site Quality Control Officer

The Project and Site QC Officer, David Glass, is responsible for the project specific supervision and monitoring of the QC program and reports to the Project Manager. Additional responsibilities include:

- Ensuring that field personnel are familiar with and adhere to proper sampling procedures, field measurement techniques, and sample identification and chain-of-custody procedures;
- Coordinating with the analytical laboratory for the receipt of samples, the reporting of analytical results and recommending corrective actions to correct deficiencies in the analytical protocol or sampling; and
- Ensuring that QA split samples are provided to the USACE as necessary.

Task Managers

Various Task Managers will provide technical support to the Project Manager for implementation of the Work Plan relative to their respective task and have the following responsibilities:

- Preparing task reports and outlining field requirements;
- Reviewing daily reports and field notebooks;
- Task scheduling;
- Task budget management;
- Task Work Plan coordination; and
- Data validation.

Site Safety and Health Officer

The Site Safety and Health Officer (SSHO), Dave Glass, is responsible for ensuring that the field activities are carried out in accordance with the SSHP. The SSHO will provide technical assistance to the Project Manager and field personnel to assure site safety. In addition, the SSHO will:

- Monitor all field activities;
- Monitor personnel exposure to chemical toxicants;
- Develop emergency response procedures;
- Monitor for temperature stress;
- Establish personnel and equipment decontamination procedures; and

- Stop work in the event unsafe work conditions are encountered.

Field Sampling Team

Field sampling teams will be provided by Malcolm Pirnie, Inc. All personnel will follow the procedures described in this document and associated documents to assure consistency in sample collection.

Subcontractors

Malcolm Pirnie will utilize three subcontracts throughout the project. These subcontractors will include driller, analytical laboratory, and data validator. Specifically, the subcontractors are Fishburne Drilling (driller), CompuChem Laboratory (analytical laboratory), and URS Corp. (data validator).

This section, in conjunction with the generic Site Safety and Health Plan (GSSHP) for Fort Story, dated December 1994, establishes procedures to protect the health and welfare of both sampling personnel and the surrounding community during the performance of the field investigation for 80th Division Reserve Site Remedial Investigation.

The GSSHP addresses the issues and concerns of the overall project site and the ubiquitous hazards that are found on the post. The site-specific SSHP supplements the information in the GSSHP and addresses the chemicals and associated hazards that are unique to the 80th Division Reserve Site.

10.1 SITE DESCRIPTION AND HISTORY

A detailed description of the site, as well as its location and history is provided in **Section 2**.

10.2 HAZARD ASSESSMENT

10.2.1 Description of Field Activities

The RI Work Plan focuses on the detection of soil and groundwater contaminants potentially present at the site. The results of sampling and analysis will be used to assess the nature of contamination and for assessing risk to human health and the environment.

Field investigations for the RI of the site will be to conduct monitoring well installations, environmental media and IDW sampling and well surveying.

10.2.2 Summary of Project Risks

Malcolm Pirnie personnel must be cognizant of the health hazards, chemical, physical, and biological, associated with the individual field activities to be conducted and the physical environment in which the work will take place. A hazards analysis

of each work task is provided in **Table 10-1**. These hazards are discussed below.

Chemical Hazards

While conducting site sampling, a potential exists for exposure to chemical contaminants through ingestion, inhalation, and skin contact. Chemical contaminants previously detected at the site that is regulated by the Occupational Safety and Health Administration (OSHA) is listed in **Table 10-2**. Unidentified risks of exposure to unknown contaminants may exist. These risks will be minimized by the use of protective clothing in conjunction with the PPE requirements, if any, specified in **Section 10.5**, below, for protection from chemical hazards.

No significant inhalation hazards are anticipated for the site sampling activities.

Dermal contact with these contaminants can be avoided through the use of proper personal protective equipment as described in **Section 10.5**, Personal Protective Equipment, below.

General chemical, physical, and toxicological data, protective exposure standards, and first aid procedures for each contaminant of concern are given in **Table 10-2**.

Physical Hazards

Physical hazards associated with field activities at the site may include performing monitoring well installation and soil boring oversight around heavy equipment (e.g., drill rig) and, slips, trips, and falls during all other field activities.

10.3 MEDICAL SURVEILLANCE

As discussed in Section 5.1 of the GSSHP, all personnel who will conduct work on the site will be included in Malcolm Pirnie's Medical Monitoring Program and will have medical clearance.

10.4 TRAINING AND COMMUNICATIONS

All field personnel for this project will be trained as described in Section 6.1 of the GSSHP. Visitors to the site will be provided with health and safety orientation prior to their planned activities.

As described in Section 6.4 of the GSSHP, additional training will include a pre-sampling health and safety briefing.

Hazard communication requirements are presented in Section 6.5 of the GSSHP. Alconox, methanol and nitric acid will be used for decontamination procedures. A copy of their MSDS is presented in Appendix A of the GSSHP and will be carried to the field during site activities.

10.5 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) usage will be in accordance with Section 9.0 of the GSSHP. All sampling activities will be conducted in Level D personal protective equipment. To minimize safety issues and dermal contact with and the spread of contamination from contact with the site soil and groundwater, the following additional equipment will be required:

- Latex and nitrile gloves (during sampling activities)
- Steel-toed and shanked work boots
- Hard hats (during drilling operations)
- Ear plugs (during drilling operations)

Upgrading to higher levels of PPE will be based upon criteria outlined in Section 9.0 of the GSSHP.

10.6 DECONTAMINATION

10.6.1 Personnel Decontamination

Personnel decontamination will be conducted in accordance with

Section 11.0 of the GSSHP. The site shall be equipped with wash/rinse/disposal stations in accordance with the GSSHP. Stations shall be set up and equipped as appropriate for the required level of PPE being employed.

10.6.2 Equipment Decontamination

Section 3.4 of this RI Work Plan specifies the sequential decontamination procedures to be used in the preparation of sampling equipment.

10.7 EMERGENCY OPERATIONS

10.7.1 Emergency Equipment

It is expected that a two or three-person sampling team will be utilized during the sampling activities at the 80th Division Reserve Site. The following safety or emergency equipment will be on-site at all times:

- Cellular phone;
- Class A, B dry chemical fire extinguisher; and
- Emergency eye wash;
- Standard first aid kit.

10.7.2 Emergency Communications

As previously discussed, a cellular phone will be provided to the sampling team. Hand signals for emergency operations are discussed in Section 12.4 of the GSSHP.

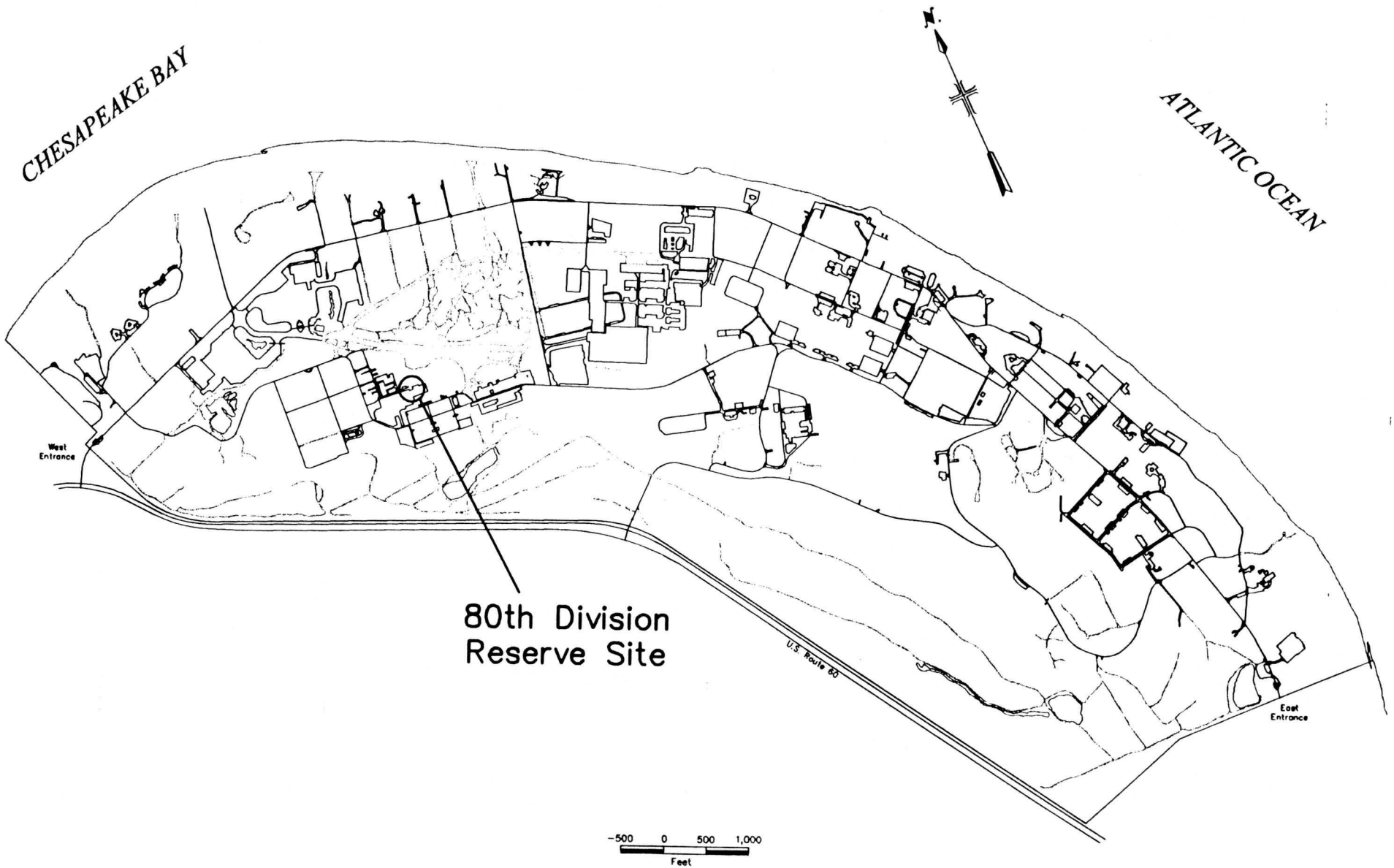
10.7.3 First Aid/Medical Procedures

Detailed emergency first aid procedures for personnel injuries, exposures to contaminants, decontamination, and transportation requirements are provided in Section 12.5 of the GSSHP.

FIGURES

Work Plan
Remedial Investigation
80th Division Reserve Site
Fort Story, Virginia

File: L:\0285 - US Army Corps of Engineers\917 - USACE 80th Div RI_F\Cadd\FIG 3-2.DWG Scale: 1:1 Date: 08/19/2002 Time: 10:14



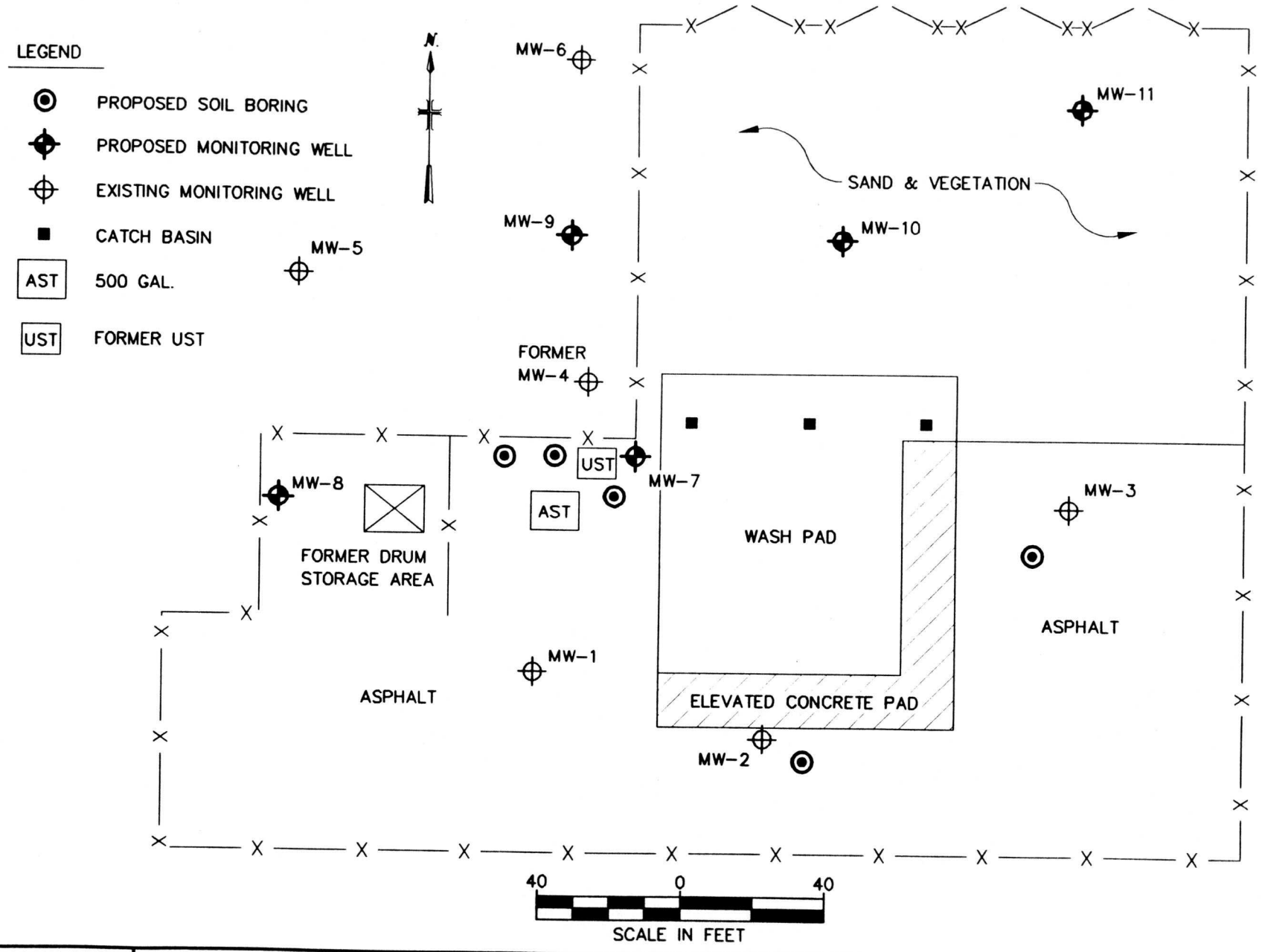
MALCOLM PIRNIE

FORT STORY, VIRGINIA BEACH, VIRGINIA
80th DIVISION RESERVE SITE
VICINITY MAP

MALCOLM PIRNIE, INC.

AUGUST 2002
FIGURE 2-1

File: L:\0285 - US Army Corps of Engineers\917 - USACE 80th Div RI_F\Cadd\FIG 3-1.DWG Scale: 1:1 Date: 08/19/2002 Time: 10:17



MALCOLM PIRNIE

FORT STORY, VIRGINIA BEACH, VIRGINIA
80th DIVISION RESERVE SITE
SAMPLE LOCATION MAP

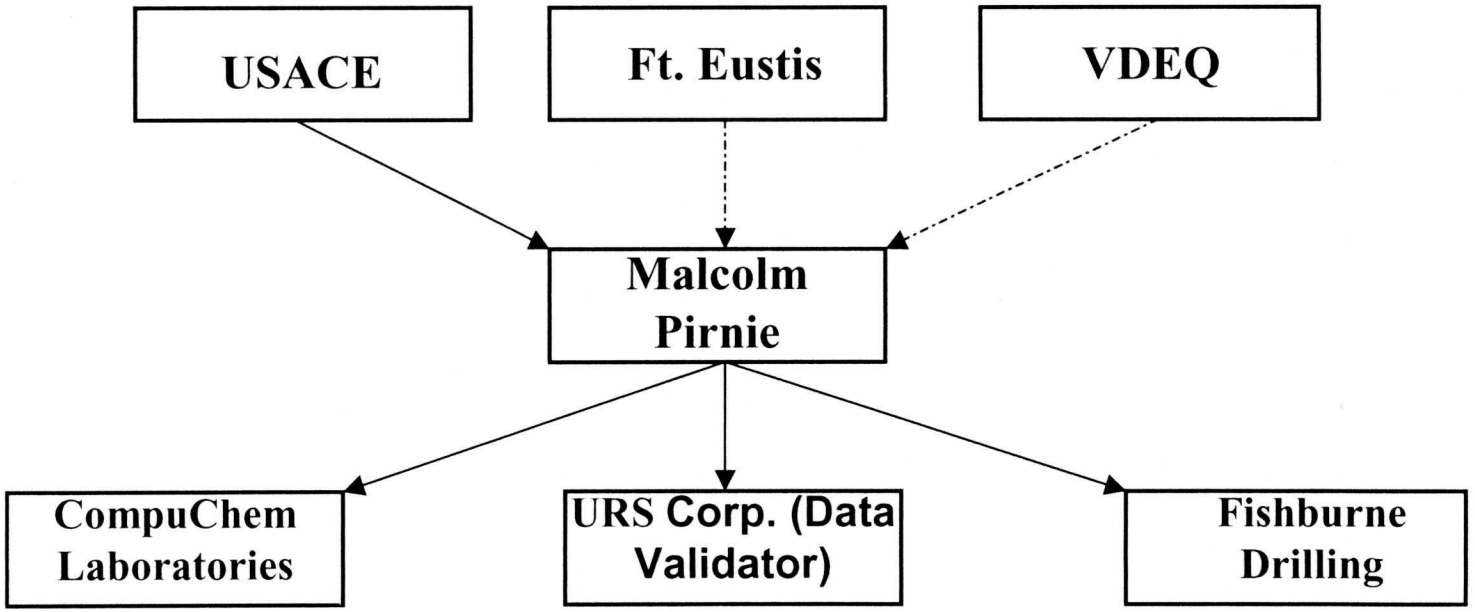
MALCOLM PIRNIE, INC.
AUGUST 2002
FIGURE 3-1

Figure 9-1

Project Team Organizational Structure

Remedial Investigation Work Plan

80th Division Reserve Site



Legend

——→ Direct Reporting Relationship

- - - - → Regulatory/Review & Comment Relationship

TABLES

Work Plan
Remedial Investigation
80th Division Reserve Site
Fort Story, Virginia

TABLE 3-1
LABORATORY DATA PACKAGES

ORGANICS PACKAGE	INORGANICS PACKAGE
CLP Data Package	
Envision Forms Title Page Cross Reference Index Case Narratives Form 1 (Sample Results) Form 2 (Surrogate Recoveries) Form 3 (MS/MSD Recoveries) Form 4 (Method Blank Results) Form 5 (GC/MS Performance Check) Form 6 (Initial Calibration) Form 7 (Continuing Calibration) Form 8 (GC/MS IS Area and RT Summary) Form 8 (GC Analytical Sequence) Form 9 (Pesticide Cleanup Information) Form 10 (Pesticide ID Summary) Dry Weight Logs Extraction/Prep Logs pH Logs Analytical Run Logs Internal COC's Sample COC's Raw Data "J" Values (GC/MS Only) TIC's Data Summary Package Pagination	Ward Forms Title Page Cross Reference Index Case Narratives Form 1 (Sample Results) Form 2A (Initial/Continuing Calibration) Form 2B (CRDL's) Form 3 (Method Blank Results) Form 4 (Interference Check) Form 5A (Spike Recoveries) Form 5B (Post Spike Recoveries) Form 6 (Duplicate Results) Form 7 (LCSS/LCSW Results) Form 8 (Standard Addition Results) Form 9 (ICP Serial Dilutions) Form 10 (Quarterly IDL's) Form 11 (ICP Correction Factor) Form 12 (ICP Linear Range) Form 13 (Prep Log) Form 14 (Run Log) Dry Weight Logs Internal COC's Sample COC's Raw Data Data Summary Package Pagination
SW-846 Data Package	
Standard Items: Envision Forms Title Page Cross Reference Index Case Narratives Form 1 (Sample Results) Form 2 (Surrogate Recoveries) Form 3 (MS/MSD Recoveries) Form 4 (Method Blank Results) Form 5 (GC/MS Performance Check) Form 6 (Initial Calibration) Form 7 (Continuing Calibration) Form 8 (GC/MS IS Area) Form 8 (GC Analytical Sequence) Dry Weight Log Extraction Log Run Logs (GC/MS Only) Internal COC's Sample COC's Analytical Run Logs Additional Items: Raw Data Preparation Logs Data Summary Package TIC's Run Logs pH Logs "J" Values (GC/MS Only) Cross Referenence Index	Standard Items: Quattro Forms Case Narratives Sample Results QC Blank Results Spike/Duplicate Results ICV/CCV (Calibration Data) LCSS/LCSW Results ICP Interference Check Data ICP Linear Range Form 5A (Spike Recoveries) ICP Post Spike Dry Weight Logs Internal COC's Sample COC's Additional Items: Raw Data Preparation Logs Data Summary Package Run Logs pH Logs Cross Referenence Index

TABLE 3-2
CONTAINER TYPE AND HOLDING TIME REQUIREMENTS

ANALYSIS	CONTAINER	PRESERVATION	HOLDING TIME
SOIL			
TAL Metals	500-ml plastic	Cool to 4°C	6 months
TCL VOCs	125-ml amber glass with teflon-lined lid & 3 En Core Samplers	Cool to 4°C	2 days/14 days /40 days (1)
TCL SVOCs	500-ml glass with Teflon-lined lid	Cool to 4°C	14 days/40 days (2)
TCL Pest/PCBs	500-ml glass with Teflon-lined lid	Cool to 4°C	14 days/40 days (2)
Total Organic Carbon	250-ml plastic	Cool to 4°C	28 days
GROUNDWATER			
TAL Metals (Total & Dissolved)	250-ml plastic	one HNO_3 to pH < 2 Cool to 4°C	6 months
Mercury (Total & Dissolved)	500-ml plastic	one HNO_3 to pH < 2 Cool to 4°C	28 days
TCL VOCs	3 - 40 ml glass vials with septa caps	HCl or $NaHSO_4$ to pH < 2 Cool to 4°C	7 days/40 days (3)
TCL SVOCs	2 - 1 liter amber glass	Cool to 4°C	7 days/40 days (3)
TCL Pest/PCBs	2 - 1 liter amber glass	Cool to 4°C	7 days/40 days (3)
TSS	500-ml plastic	Cool to 4°C	7 days
TDS	500-ml plastic	Cool to 4°C	7 days
IDW (Soil)			
TCLP Metals, SVOCs, Pesticides	500-ml plastic	Cool to 4°C	14 days/40 days (2)
TCLP VOCs	125-ml amber glass with Teflon-lined lid	Cool to 4°C	14 days/40 days (2)
PCBs	250-ml amber glass with Teflon-lined lid	Cool to 4°C	14 days/40 days (2)
TPH-DRO	250-ml amber glass with Teflon-lined lid	Cool to 4°C	14 days/40 days (2)
TPH-GRO	125-ml amber glass with teflon-lined lid & 3 En Core Samplers	Cool to 4°C	14 days/40 days (2)
Reactivity (cyanide and sulfide)	250-ml plastic	Cool to 4°C	28 days

TABLE 3-2
CONTAINER TYPE AND HOLDING TIME REQUIREMENTS

ANALYSIS	CONTAINER	PRESERVATION	HOLDING TIME
IDW (Water)			
TCLP Metals	500-ml plastic	Cool to 4°C	14 days/180 days (3)
TCLP Mercury	500-ml plastic	Cool to 4°C	14 days/28 days (4)
TCLP VOCs	3 - 40 ml glass vials with septa caps	Cool to 4°C	14 days/14 days (5)
TCLP SVOCs	2 - 1 liter amber glass	Cool to 4°C	14 days/40 days (2)
TCLP Pesticides	2 - 1 liter amber glass	Cool to 4°C	14 days/40 days (2)
TCL PCBs	2 - 1 liter amber glass	Cool to 4°C	14 days/40 days (2)
TPH DRO	2 - 1 liter amber glass	Cool to 4°C	14 days/40 days (2)
TPH GRO	3 - 40 ml glass vials with septa caps	HCl or $NaHSO_4$ to pH < 2 Cool to 4°C	14 days/40 days (2)
Reactivity (cyanide and sulfide)	250-ml plastic	Cool to 4°C	14 days
Corrosivity	250-ml glass	Cool to 4°C	ASAP
Ignitability	250-ml glass	Cool to 4°C	None

Notes:
(1) 14 days/40 days - Holding times are 2 days for extraction from En Cores, 14 days for extraction glass jars, and 40 days for analysis.
(2) 14 days/40 days - Holding times are 14 days for extraction and 40 days for analysis.
(3) 14 days/180 days - Holding times are 14 days for TCLP extraction and 180 days for analysis.
(4) 14 days/28 days - Holding times are 14 days for TCLP extraction and 28 days for analysis.
(5) 14 days/14 days - Holding times are 14 days for TCLP extraction and 14 days for analysis.

Table 4-1
Analytical Methods and Parameters

ANALYSES WITH PARAMETERS		METHODS (PREP)
TAL METALS		Water:
Aluminum	Magnesium	6010 (3005)
Antimony	Manganese	7470A for mercury
Arsenic	Mercury	
Barium	Nickel	
Beryllium	Potassium	Solids:
Cadmium	Selenium	6010 (3050)
Calcium	Silver	7471A for mercury
Chromium	Sodium	
Cobalt	Thallium	
Copper	Vanadium	
Iron	Zinc	
Lead	Cyanide	
TCL SVOCs		SW-846 8270C
Phenol	2,4-Dinitrophenol	Water: (3520)
bis(2-chloroethyl)ether	4-Nitrophenol	Solids: (3550)
2-Chlorophenol	Dibenzofuran	
1,3-Dichlorobenzene	2,4-Dinitrotoluene	
1,4-Dichlorobenzene	2,6-Dinitrotoluene	
Benzyl alcohol	Diethylphthalate	
1,2-Dichlorobenzene	4-Chlorophenyl-phenyl ether	
2-Methylphenol (o-cresol)	Fluorene	
bis(2-chloroisopropyl)ether	4-Nitroaniline	
3-/4-Methylphenol(m&p-cresol)	4,6-Dinitro-2-methylphenol	
N-Nitroso-di-n-propylamine	N-Nitrosodiphenylamine	
Hexachloroethane	4-Bromophenyl-phenyl ether	
Nitrobenzene	Hexachlorobenzene	
Isophorone	Pentachlorophenol	
2-Nitrophenol	Phenanthrene	
2,4-Dimethylphenol	Anthracene	
Benzoic acid	Di-n-butylphthalate	
bis(2-Chloroethoxy)methane	Fluoranthene	
2,4-Dichlorophenol	Pyrene	
1,2,4-Trichlorobenzene	Butylbenzylphthalate	
Naphthalene	3,3'-Dichlorobenzidine	
4-Chloroaniline	Benzo(a)anthracene	
Hexachlorobutadiene	bis(2-ethylhexy)phthalate	
4-Chloro-3-methylphenol	Chrysene	
2-Methylnaphthalene	Di-n-octylphthalate	
Hexachlorocyclopentadiene	Benzo(b)fluoranthene	
2,4,6-Trichlorophenol	Benzo(k)fluoranthene	
2,4,5-Trichlorophenol	Benzo(a)pyrene	
2-Chloronaphthalene	Surrogate-1,2-Dichlorobenzene-d4	
2-Nitroaniline	Surrogate-2-Chlorophenol-d4	
Dimethylphthalate	Surrogate-2,4,6-Tribromophenol	
Acenaphthylene	Surrogate-2-Fluorophenol	
3-Nitroaniline	Surrogate-p-Terphenyl-d14	
Dibenz(a,h)anthracene	Surrogate-2-Fluorobiphenyl	
Benzo(g,h,i)perylene	Surrogate-Phenol-d5	
Acenaphthene	Surrogate-Nitrobenzene-d5	
Indeno(1,2,3-cd)pyrene		

Table 4-1
Analytical Methods and Parameters

ANALYSES WITH PARAMETERS		METHODS (PREP)
TCL VOCs		SW-846 8260B Water: (5030) Solids: (5035)
Acetone	cis 1,2-Dichloroethene	
Benzene	trans 1,2-Dichloroethene	
Bromoform	1,2-Dichloropropane	
Bromochloroemethane	cis 1,3-Dichloropropene	
Bromodichloroemethane	trans 1,3-Dichloropropene	
Bromomethane	Ethylbenzene	
2-Butanone (MEK)	2-Hexanone	
Carbon disulfide	Methylene chloride	
Carbon tetrachloride	4-Methyl-2-pentanone (MIBK)	
Chlorobenzene	Styrene	
Chloroethane	1,1,2,2-Tetrachloroethane	
Chloroform	Tetrachloroethene	
Chloromethane	Toluene	
Dibromochloromethane	1,1,1-Trichloroethane	
1,2-Dibromo-3-chloropropane	1,1,2-Trichloroethane	
1,2-Dichlorobenzene	Trichloroethene	
1,3-Dichlorobenzene	Vinyl chloride	
1,4-Dichlorobenzene	Xylenes	
1,2-Dibromoethane	Surrogate-Toluene-d8	
1,1-Dichloroethane	Surrogate-p-Bromofluorobenzene	
1,2-Dichloroethane	Surrogate-Dibromofluoromethane	
1,1-Dichloroethene	Surrogate-1,2-Dichloroethane-d4	
TCL PESTICIDES		SW-846 8081A Water: (3520) Solids: (3550)
Aldrin	Endosulfan sulfate	
alpha-BHC	Endrin	
beta-BHC	Endrin aldehyde	
delta-BHC	Endrin Keytone	
gamma-BHC (Lindane)	Heptachlor	
4,4'-DDD	Heptachlor epoxide	
4,4'-DDE	Methoxychlor	
4,4'-DDT	Toxaphene	
Dieldrin	alpha-Chlordane	
Endosulfan I	gamma-Chlordane	
Endosulfan II		
TCL PCBs		SW-846 8082 Water: (3520) Solids: (3550)
PCB 1016	PCB 1248	
PCB 1221	PCB 1254	
PCB 1232	PCB 1260	
PCB 1242		
MISCELLANEOUS PARAMETERS		
TSS		160.2
TDS		160.1
Ignitability		1010/1030
Reactivity, cyanide		7.3.3.2/9014
Reactivity, sulfide		7.3.4.2/9034
Corrosivity		1110
Total Organic Carbon		Lloyd Kahn Method (soil)

TABLE 4-2
SAMPLE SUMMARY
80th DIVISION RESERVE SITE REMEDIAL INVESTIGATION

Sample	TCL VOCs	TCL SVOCs	TCL Pests/ PCBs	Total TAL Metals	Dissolved TAL Metals	Total Suspended Solids	Total Dissolved Solids	Total Organic Carbon	pH
Groundwater Sampling and Analysis									
Groundwater	10	10	10	10	10	10	10	N/A	N/A
Groundwater Duplicates (1)	1	1	1	1	1	1	1	N/A	N/A
Groundwater MS/MSD	1	1	1	1	1	0	0	N/A	N/A
Trip Blank	2	0	0	0	0	0	0	N/A	N/A
Equipment Blank (2)	2	2	2	2	2	0	0	N/A	N/A
Soil Sampling and Analysis									
Surface Soils	10	10	10	10	N/A	N/A	N/A	10	10
Subsurface Soils	20	20	20	20	N/A	N/A	N/A	20	20
Soil Duplicate	3	3	3	3	N/A	N/A	N/A	3	0
Soil MS/MSD	2	2	2	2	N/A	N/A	N/A	0	0
Equipment Blank (2)	2	2	2	2	N/A	N/A	N/A	0	0
Total	53	51	51	51	14	11	11	33	30

Notes:
(1) Duplicates collected at a rate of at least 10 percent of samples.
(2) Equipment Blanks - one per day or one per every 20 samples, whichever is more frequent.

TABLE 10-1
HAZARDS ANALYSIS

Work Task	Slip/ Trip/Fall	Drowning	Heavy Equipment	Dust Inhalation	Vapor/Gas Inhalation	Insects/ Bio Hazards	Exposure to Media
Soil Sampling	X		X			X	X
Well Installation	X		X		X	X	X
Groundwater Sampling	X		X			X	X

TABLE 10-2
TOXICOLOGICAL SUMMARY

Compound	Vapor Pressure (mm Hg)	PEL (mg/m^3)	Odor Threshold (mg/m^3)	Target Organs	Route of Entry	Symptoms and Acute Toxicological Effects	First Aid
Benzene	100	3	4.5	Bone marrow, carcinogen	Inhalation, Ingestion, Skin/Eye contact	Confusion, dizzines, tightning of leg muscles, exciteablitiy passing to stupefied state, coma	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention
Ethylbenzene	10	435	8.7	Skin, eye, mucous membranes, respiratory system	Inhalation, Ingestion, Skin/Eye contact	Skin/eye/nose/throat irritation, dizziness, sense of chest constriction, tremors, loss of consciousness	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention
Xylenes	6.72	435	0.3	Skin, eye, mucous membranes, respiratory system	Inhalation, Ingestion, Skin/Eye contact	Severe skin and eye irritation, motor activity changes, ataxia, and irritability	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention
Toluene	36.7	200 (ppm)	17.6	Skin, eye, mucus membranes, bone marrow, CNS, liver, respiratory system	Inhalation, Ingestion, Skin/Eye contact	Severe skin and eye irritation, CNS impacts, halliucinations, intoxication, coma, bone marrow changes	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention
PCE	15.8	100 (ppm)	31.4	Carcinogen, skin, eye, CNS, heart, gastrointestinal system	Inhalation, Ingestion, Skin/Eye contact	Carcinogen, anesthetic properties, pulmonary changes, dermatitis	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention
TCE	100	100 (ppm)	1.1	Carcinogen, skin, eye, CNS, heart, reproductive system, liver	Inhalation, Ingestion, Skin/Eye contact	Carcinogen, anesthetic properties, jaundice, gastrointestinal changes, pulmonary changes/arrest	Eye: Irrigate Immediately Skin: Wash with soap Breath: Respiratory support. Swallow: Immediate medical attention

Notes:
N/A - Data not available
PEL - OSHA Permissible Exposure Limit
IDLH - Immediately Dangerous to Life and Health
CNS - Central Nervous System
PNS - Peripheral Nervous System

Appendix A
Scope of Work

Work Plan
Remedial Investigation
80th Division Reserve Site
Fort Story, Virginia

CENAB-EN-HM 20 May 2002

SCOPE OF ARCHITECT-ENGINEER SERVICES
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
80th DIVISION RESERVE SITE
FORT STORY, VA

1.0 GENERAL

Malcolm Pirnie, Inc. was contracted by the U.S. Army Corps of Engineers (USACE), Baltimore District to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the 80th Division Reserve site at Fort Story, Virginia under contract DACA31-00-D-0043.

2.0 BACKGROUND

The 80th Division Reserve site operated as a lighter, amphibious, resupply, cargo (LARC) washing and maintenance area. The site contains a 50 x 70 foot concrete pad surrounded by asphalt on the west, south and east sides. The north side is bordered by sand that was used as the LARC staging area. Over time, this staging area apparently became contaminated with by-products (primarily petroleum products) of the washing and maintenance operations. A 1,000-gallon used oil underground storage tank (UST), 250-gallon antifreeze aboveground storage tank (AST), and a former drum storage area were located west of the wash pad. The following is a brief chronology of events describing the environmental investigations at the site:

- *Final Site Assessment Report, Montgomery Watson, May 1994*. Montgomery Watson conducted an investigation from February to May 1994 to evaluate the presence of possible soil contamination in the LARC staging area of the site and around the existing concrete pad. Elevated levels of total petroleum hydrocarbons (TPH) – heavy oils and lead were detected in the shallow soils adjacent to the former drum storage area, tank area, and wash pad area. Based on the limited vertical extent of contaminated soil, excavation of soil and off-site treatment and disposal was feasible.

- *Site Characterization Report, Environmental Restoration Company (ERC), June 1994*. ERC conducted a site characterization of the site in 1994. Based on the site characterization, two areas of soil contamination and one area of groundwater contamination were identified at the site. TPH and lead contamination was discovered in the shallow soil of the LARC staging area. These contaminants are most likely the result of bilge water discharge and sandblasting. TCE and PCE were detected in monitoring well MW-4.

- *Removal Action Final Report, IT Corporation, August 1995*. From April through July 1995, IT Corporation completed a removal action of contaminated soil from the LARC staging area and from the tank area. Approximately 3,500 tons of TPH-contaminated soils and 30 tons of PCE-contaminated soil were excavated from the site and transported off-site for thermal desorption. Significant quantities of contaminated soils remain in both areas. The areas were backfilled with clean fill.

Findings of the site assessment, site characterization, and removal action indicate the following:

- Groundwater contamination (primarily chlorinated organics) is present in the MW-4 area and has not been fully delineated.

- Soil contamination in the LARC staging area and tank area remains.

Based on the presence of contaminants in groundwater and soil at the site, additional investigations in the form of a remedial investigation and feasibility study are warranted.

3.0 OBJECTIVES AND PURPOSE

The primary goal of this project is to conduct a RI/FS for the site in accordance with Virginia Department of Environmental Quality (VDEQ) and EPA Region III regulatory criteria under the U.S. Army Installation Restoration Program (IRP). Specific objectives include the following:

- Characterization of the nature and extent of contamination in soils and groundwater associated with the site.

- Quantitative assessment of the risk to human health and ecological receptors.

- Recommendations for future action at the site based on the RI findings.

- Development and screening of remedial alternatives through the following process:

  - Identification of remedial action objectives (RAOs).
  - Identification of potential technologies that will satisfy the RAOs.
  - Screening of technologies based on effectiveness, implementability, and cost.
  - Assembling of technologies into alternatives.

- Detailed evaluation of alternatives with respect to nine criteria as developed by EPA to address the statutory requirements and preferences of CERCLA.

- Preparation of a Proposed Plan and Decision Document (DD) for the 80th Division Reserve Site as well as the Firefighter Training Area (FTA) and the Auto Craft Building Area sites.

The purpose of the FS is to develop, screen, and evaluate remedial alternatives that are protective of human health and the environment and that are potentially capable of meeting requirements proposed by state and federal regulatory agencies. The FS shall be performed in accordance with the EPA document, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA".

4.0 SCOPE OF WORK

Task 1 – Project Planning and Document Review

The A/E shall conduct project planning activities and document reviews in the form of a review of previous investigations including the Montgomery Watson site assessment, the ERC site characterization, and the IT interim removal action to use as a basis for information and data to be included in the Work Plan and in identifying data gaps.

Task 2 - Project Management

Meetings

The A/E's Project Manager shall attend the following required meetings:

- **Project Initiation Meeting.** Meeting at Fort Eustis to discuss the scope of the project, key issues, Fort Eustis' project expectations, and deliverables. Meeting should take place within 2 weeks after delivery order authorization.

- **Draft RI Report Meeting.** Draft RI Report meeting at Fort Eustis to discuss the comments made by VDEQ and the draft responses to the agency comments. The meeting should not be held until the regulatory agencies have had an opportunity to review the responses. A conference call with VDEQ should be held during the meeting to discuss the comments and responses.

- **Draft FS Report Meeting.** Draft FS Report meeting at Fort Eustis to discuss the comments made by VDEQ.

- **Draft Proposed Plan Meeting.** Draft Proposed Plan meeting at Fort Eustis to discuss the comments made by VDEQ.

- **Public Meeting.** One public meeting is expected.

- **Draft Decision Document Meeting.** Draft DD meeting at Fort Eustis to discuss the comments made by VDEQ.

- **TRC Meeting.** TRC meeting at Fort Eustis to discuss the status of the site.

Project Management

The A/E shall prepare progress reports, as needed. The progress reports shall provide at a minimum the following information:

- Progress during the preceding work period.

- Notification of problems encountered or anticipated and resolutions.

Task 3 - Preparation of Work Plan

A Work Plan shall be prepared in Preliminary Draft, Draft and Final formats to describe the field investigations, QA/QC, and health and safety issues. The Work Plan shall include sections on the field Investigation methodologies and analytical requirements, site-specific QA/QC information, and site-specific health and safety. The A/E shall prepare responses to VDEQ comments to the Draft Work Plan and resolve any issues before a Final Work Plan is prepared.

Task 4 – Field Investigation Activities

Field investigations to be conducted shall include monitoring well installations, environmental media and IDW sampling and well surveying. Each of these components is described below.

Monitoring Well Installations

To supplement the data gathered during previous investigations and to fill data gaps identified, five monitoring wells shall be installed and developed at the site. A summary of the additional wells is presented as follows:

- One well shall be installed in the area between the former UST and fenceline to the north.
- One well shall be installed approximately 100 feet west of the current AST.
- One well shall be installed approximately 60 feet north of former well MW-4.
- One well shall be installed approximately 100 feet northeast of the former UST.
- One well shall be installed approximately 200 feet northeast of the former UST.

Environmental Sampling

To further assess the nature and extent of contamination at the site, numerous samples shall be collected from each environmental media present at the site including groundwater and soil. A summary of each sampling program is provided below.

Groundwater

Groundwater samples shall be collected from the five newly installed wells and from the five existing wells (MW-1, MW-2, MW-3, MW-5, and MW-6). Groundwater shall be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, and TAL metals (total and dissolved fractions) using SW-846 or EPA methods to further characterize the nature and extent of groundwater contamination associated with the site and for use in assessing risk. Groundwater samples shall also be analyzed for total suspended solids (TSS) and total dissolved solids (TDS) to assess the significance of the total and dissolved metals fractions.

Prior to sampling the existing wells, because the wells have not been sampled since 1994, each well shall be re-developed to purge any sediment from the casings.
Two rounds of water level measurements shall be conducted during the investigation to provide a database for establishing the groundwater contours.

Soil

Surface Soils

Ten surface soil samples shall from a depth of 0 to 6 inches below land surface (BLS) throughout the site to assess the nature of contamination and for use in the subsequent risk assessment. The ten surface soil samples will be collected from the following locations:

- The locations of the five newly installed monitoring wells.
- Three locations surrounding the area that was removed due to PCE contamination as identified in the IT Final Report.
- One location south of the former wash pad.
- One location east of the former wash pad.

The samples shall be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, TAL metals, and total organic carbon (TOC) using SW-846 or EPA methods.

Subsurface Soils

Twenty subsurface soil samples shall be collected by hollow stem auger split spoon sampler from depths of 1 to 3 feet and 4 to 6 feet BLS throughout the site to assess the nature of contamination and for use in the subsequent risk assessment. The locations are the same as discussed for the surface soil samples. The subsurface soil samples shall be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, TAL metals, and TOC using SW-846 or EPA methods.

Investigation Derived Waste Management

All investigation derived wastes (IDW) shall be contained in DOT 55-gallon steel drums, staged at a temporary storage location as directed by Fort Eustis, and sampled by the A/E. The IDW shall be sampled for TCLP parameters, RCRA characteristics (ignitability, corrosivity, and releasable cyanide and sulfide), TCL PCBs, and TPH diesel and gasoline range. The A/E shall provide a letter summary of analytical results and disposal requirements. The installation will be responsible for the proper disposition of IDW.

The IDW that will be generated will include soil cuttings from soil borings, purge and development water from monitoring wells, decontamination fluids (e.g., rinse water, nitric acid, and methanol), and contaminated clothing (i.e., gloves, Tyvek, etc.). IDW will be segregated into separate drums as follows: soil cuttings, purge and development water, decontamination fluids, and contaminated clothing.

Well Surveying

A site survey shall be completed using horizontal and vertical control to accurately locate and document the existing and newly installed monitoring wells. A professional land surveyor licensed in the State of Virginia shall be utilized for the survey. Tasks shall include surveying

the horizontal location and elevations (top of the concrete pad, top of the PVC well, and top of the steel outer casing) of all groundwater monitoring wells installed for this field investigation. The horizontal location shall be surveyed to the nearest 1.0 foot using the Virginia State Plane Coordinate System and elevations surveyed to the nearest 0.01 foot.

Task 5 - Data Management and Validation

The A/E shall complete the necessary data management and assessment of environmental data generated through sampling and analysis activities for use in defining the extent of contamination and conducting a baseline risk assessment. A CLP-equivalent data package will be generated and 100% of the data will be validated in accordance with *EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Inorganics* and the *EPA Region III Modifications to the National Functional Guidelines for Organic Data Review.*

Task 6 – Risk Assessment

A quantitative evaluation of the potential current and future risk to human health and the environment from exposure to contaminated media shall be conducted. The assessment shall be conducted pursuant to the requirements of USEPA guidance documents "Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual and "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment".

The human health risk assessment will include four components: (1) hazard identification; (2) exposure assessment; (3) toxicity assessment, and (4) risk characterization. The preliminary identified human health risk scenarios for the site shall include industrial worker (current and future scenario), construction worker for trench and deep basement excavation (future scenario), adult and child resident (future scenario), and industrial worker in a building (future scenario).

The ecological risk assessment will include components such as (1) problem identification, (2) characterization of exposure, (3) characterization of ecological effects and (4) risk characterization. The risk assessment findings will be included in the RI Report.

Additional discussion on and identification of potential human health and ecological receptors and pathways shall be discussed in the Work Plan.

Task 7 – RI Reporting

A summary of RI reporting requirements for this project is provided as follows:

Quality Control Summary/Analytical Results Report (QCS/AR Report)

A preliminary draft, draft, and final QCS/AR Report shall be submitted at the conclusion of the site investigations. The QCS/AR Report shall outline QC practices employed by the A/E including any problems and corrective actions taken and contain consolidation and summary of the DQCRs and shall provide the analytical data generated from the site investigations, summarize any technical difficulties encountered during sample collection and analysis, any laboratory problems and also provide the results of the data validation. The A/E shall submit the draft QCS/AR Report within 90 days of demobilization from the field. The draft and final QCS/AR Report shall be submitted within 15 days of receipt of comments to each report. The following outline shall be followed for the QCS/AR Report:

- Executive Summary
- Section 1 - Introduction
- Section 2 - Summary of Daily Quality Control Reports
- Section 3 - Summary of Field Investigation Program
- Section 4 - Summary of Analytical Data
- Appendices (Daily QC Reports, Chain of Custody Forms, and Data Validation Reports)

Remedial Investigation Report

- *Preliminary Draft RI Report*. A Preliminary Draft RI Report shall be prepared which summarizes the findings of all field investigations conducted and will include site activity logs, diagrams showing sampling locations, and laboratory results. Analysis and a discussion of the data generated during the investigation along with conclusions and recommendations for further action at the site will be included. This report shall be submitted to USACE and Fort Eustis for review and comment. The RI Report shall follow the following outline:

  Executive Summary
  Section 1 – Introduction
  Section 2 – Field Investigation Program
  Section 3 – Site Characteristics
  Section 4 – Nature and Extent of Contamination
  Section 5 – Fate and Transport
  Section 6 – Human Health Risk Assessment
  Section 7 – Ecological Risk Assessment
  Section 8 – Conclusions
  Section 9 – Recommendations
  Appendices (References, Sample Forms, Geologic Data such as boring and well construction logs, and risk assessment toxicity profiles and calculations)
- *Draft RI Report*. A Draft RI Report shall be prepared incorporating comments from USACE and Fort Eustis on the draft. The Draft RI Report shall be submitted to USACE

and Fort Eustis for further comment and to the VDEQ for initial comment.

- *Response to VDEQ Comments*. A Response to Comments Letter shall be prepared that addresses the VDEQ comments to the Draft RI Report. This letter shall be submitted to Fort Eustis for their submission to VDEQ for review. Subsequent follow-up correspondence may be required to address any outstanding issues.

- *Final RI Report*. A Final RI Report shall be prepared incorporating the comments from the draft report. The Final Report shall be submitted to USACE, Fort Eustis, and VDEQ for their information.

Task 8 - Remedial Alternatives Development and Screening

The A/E shall develop a range of distinct management alternatives that will remediate or control any contaminated media as deemed necessary in the RI to provide adequate protection of human health and the environment.

The following steps will be conducted to determine the appropriate range of alternatives:

- Establishment of Remedial Action Objectives
- Identification and Screening of Technologies
- Configuration and Screening of Alternatives

Task 9 - Detailed Analysis of Alternatives

The A/E shall conduct a detailed analysis of alternatives which will consist of an individual analysis of each alternative against a set of evaluation criteria and a comparative analysis of all options against the evaluation criteria with respect to one another. The evaluation criteria are as follows:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume Through Treatment
- Short Term Effectiveness
- Implementability
- Cost

Two other criteria, State Acceptance and Community Acceptance, will be addressed in the Record of Decision and not in the FS.

Task 10 - FS Reporting

A summary of reporting requirements for this project is provided as follows:

- **Preliminary Draft FS Report**. A Preliminary Draft FS Report shall be prepared which will include the development and screening of technologies and alternatives and a detailed analysis of alternatives for the site. This report will be submitted to the USACE and Fort Eustis for review and comment. The format of the report will be as follows:

  Executive Summary
  Section 1 - Introduction (includes summary of RI findings)
  Section 2 - Remedial Action Objectives
  Section 3 - Development and Screening of Technologies
  Section 4 - Development and Screening of Alternatives
  Section 5 - Detailed Analysis of Alternatives
  Section 6 - Comparative Analysis of Alternatives
  References

- **Draft FS Report**. A Draft FS Report shall be prepared incorporating comments from USACE and Fort Eustis on the preliminary draft. The Draft FS Report will be submitted to USACE and Fort Eustis for further comment and to EPA Region III and VDEQ for initial comment. The A/E shall prepare a "Response to Comment" letter addressing any regulatory comments to the Draft FS Report.

- **Final FS Report**. A Final FS Report shall be prepared incorporating the comments from the draft report. The Final Report will be submitted to USACE, Fort Eustis, EPA Region III and VDEQ for their information.

Task 11 - Proposed Plan

Proposed Plan Preparation

The A/E, upon completion of the FS, shall prepare a Proposed Plan to solicit public comments on the recommended alternatives presented in the FS. The Proposed Plan should focus on the comparison of remedial alternatives and the rationale for choosing the recommended alternative.

A preliminary draft, draft and final Proposed Plan shall be prepared. The Proposed Plan shall include brief descriptions of the site including the nature and extent of contamination and baseline risk assessment and a brief summary of the remedial action objectives and development of the remedial alternatives. The format of the Plan shall follow EPA guidance. The A/E shall prepare a "Response to Comment" letter addressing any VDEQ comments to the Draft Proposed Plan.

Task 12 – Decision Document

The A/E shall prepare a preliminary draft, draft, and final Decision Document (DD) in accordance with VDEQ guidance for the 80th Division site as well as the FTA and Auto Craft Building sites. The DD shall outline the proposed remedial alternatives for the sites as agreed upon by the USACE Baltimore District, Fort Eustis, and VDEQ. The document shall document the process and rationale for selection of the preferred alternatives. The Responsiveness Summaries from the public meeting shall be included in the DD. The A/E shall prepare a "Response to Comment" letter addressing any regulatory comments to the Draft DD.

5.0 DELIVERABLES

The A/E shall submit 8 1/2 by 11 inch bound copies of the below listed reports. Documents shall be delivered to all reviewers by overnight delivery. The document submittal list, which contains distribution names and addresses, is provided below.

Work Plan

- Preliminary Draft (30 calendar days from date of receipt of order by the A/E)
- Draft (15 calendar days from date of receipt of comments to preliminary draft)
- Final (30 calendar days from receipt of final comments)

QCS/AR Report

- Draft (90 calendar days from demobilization from the field)
- Draft (15 calendar days from receipt of final comments to preliminary draft)
- Final (15 calendar days from receipt of final comments)

RI Report

- Preliminary Draft (90 calendar days from the field sampling activity)
- Draft (15 calendar days from receipt of comments to preliminary draft)
- Final (30 calendar days from receipt of final comments)

FS Report

- Preliminary Draft (90 calendar days from the field sampling activity)
- Draft (15 calendar days from receipt of comments to preliminary draft)
- Final (30 calendar days from receipt of final comments)

Proposed Plan

- Preliminary Draft (30 calendar days from completion of the FS)
- Draft (15 calendar days from receipt of comments to preliminary draft)
- Final (15 calendar days from receipt of final comments)

Decision Document

- Preliminary Draft (60 calendar days from final public meeting associated with the FS and Proposed Plan)
- Draft (15 calendar days from receipt of comments to preliminary draft)
- Final (30 calendar days from receipt of final comments)

The Work Plan, QCS/ AR Report, RI Report, FS Report, Proposed Plan, and DD shall be distributed to the following agencies:

- Preliminary Draft:
  USACE - 2 copies
  Fort Eustis - 3 copies
- Draft:
  USACE - 2 copies
  Fort Eustis - 3 copies
  VDEQ - 2 copies
- Final:
  USACE - 2 copies
  Fort Eustis - 3 copies
  VDEQ - 2 copies

Appendix B
Risk Assessment Methodology

Work Plan
Remedial Investigation
80th Division Reserve Site
Fort Story, Virginia

BASELINE RISK ASSESSMENT METHODOLOGY

The risk assessment will present an assessment of potential human health and ecological risks associated with contaminants detected at the 80th Division Reserve Site at Fort Story, Virginia. The objectives of the assessment will be to (1) provide an analysis of baseline risks, currently and in the future, in the absence of any major action to control or mitigate site contamination, and (2) to assist in determining the need for and extent of remediation. It provides a basis for comparing a variety of remedial alternatives, and determining, which will be the most protective of human health and the environment. A brief description of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) is provided in the following subsections.

1.0 HUMAN HEALTH RISK ASSESSMENT

The HHRA is an assessment of potential human health risks associated with exposure to contaminants detected at or migrating from the site. The HHRA will follow guidance provided in the following documents:

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, USEPA, 1989
- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part B)*, USEPA, 1989
- *Risk Assessment Guidance for Superfund, Volume I: Human Health. Supplemental Guidance. "Standard Default Exposure Factors"*, USEPA, 1991
- *Selecting Exposure Routes and Contaminants of Concern by Risk-based Screening*, USEPA Region III, 1993
- *Risk-Based Concentration Table*, USEPA Region III, April 2002 (or most recent version when HHRA is actually prepared)
- *Exposure Factors Handbook*, USEPA, 1989
- *Guidance for Data Useability in Risk Assessment, Part 2*, USEPA, 1992
- *Dermal Exposure Assessment: Principles and Applications*, Interim Report, USEPA, 1992

1.1 Objectives

The goal of the HHRA will be to provide a framework for developing the risk information necessary to assist decision-making at the site. Preliminary screening may reduce the level of effort for this HHRA at the site. Specific objectives of the process will be to:

- Provide an analysis of baseline risks (human health) and help determine the need for remedial action at the site.

potential adverse ecological effects of each COPC will be derived from available literature. These summaries, in addition to established criteria, will be used to identify the critical effects of COPCs.

Environmental Effects Quotients (EEQs) will be used to assign risk, while food chain modeling will be used to quantify risks. Wildlife exposure pathways will be estimated for species of various trophic levels through incidental ingestion of soil and sediment, ingestion of surface water, and exposure through food-chain receptors. Toxicity Reference Values (TRVs) will be derived for plants, benthic invertebrates, and other wildlife based on published methodology. Risk estimation will then be based on a calculated hazard quotient (HQ) for each COPC and pathway. The HQ is derived from the Estimated Exposure and the TRV.

- Provide a basis for determining levels of chemicals that can remain at the site and still be adequately protective of public and Fort Story personnel health.

- Provide a basis for comparing potential health impacts of various remedial alternatives at the site.

- Provide a consistent process for evaluating and documenting public health threats at the site.

1.2 HHRA Components

The HHRA phase of the baseline risk assessment process is site-specific. Therefore it may vary in both detail and the extent to which qualitative and quantitative analyses are used, depending on the complexity and particular circumstances of the site, as well as the availability of ARARs and other criteria, advisories and guidance. There are four components to the HHRA: (1) hazard identification; (2) exposure assessment; (3) toxicity assessment; and (4) risk characterization. Each step is described briefly as follows:

- **Hazard identification** involves gathering and analyzing the site data relevant to the human health evaluation and identifying the chemicals of potential concern at each site that are the focus of the risk assessment process. The selection of such chemicals is based on a number of parameters, including the frequency of detection and concentration in each environmental medium, environmental fate and transport characteristics, intrinsic toxicity and the likelihood of human exposure via significant exposure routes.

  Potential ARARs and TBC criteria identified for the site include the following:

  - EPA Region III Risk-based Concentrations
  - Virginia Surface Water Quality Standards
  - Federal Ambient Water Quality Criteria

- **Exposure assessments** are conducted to estimate the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are exposed. In the exposure assessment, reasonable maximum estimates of exposure are developed for both current and future land-use assumptions. Conducting an exposure assessment involves analyzing contaminant releases, identifying exposed populations, identifying all potential pathways of exposure, estimating exposure point concentrations for specific pathways and estimating contaminant intakes for specific pathways. The results of this assessment are pathway-specific intakes for current and future exposures to individual substances.

- **Toxicity assessments** consider the types of adverse health effects associated with chemical exposures, the relationship between magnitude of exposure and adverse effects and related uncertainties such as the weight of evidence of a particular chemical's carcinogenicity in humans. Qualitative and quantitative toxicity data for each chemical of potential concern are summarized, and appropriate guidance levels with which to characterize risks are identified.

- **Risk characterization** summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risk, both in quantitative expressions and qualitative statements. The likelihood and magnitude of adverse health risks are estimated in this step, in the form of non-cancer hazard quotients and cancer risks.

2.0 ECOLOGICAL RISK ASSESSMENT

The ERA is an assessment of potential environmental risks associated with contaminants detected at the site at Fort Story. The ERA follows the following guidance:

- *EPA Region III BTAG Screening Levels*, USEPA, 1995
- "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, dated June 5, 1997
- *Wildlife Exposure Factors Handbook*, USEPA, 1993
- *Region III Interim Ecological Risk Assessment Guidelines*, USEPA Region III, 1994.

2.1 Objectives

Contamination of soils, sediments and surface water, may have an impact on terrestrial and aquatic organisms on or in the vicinity of Fort Eustis through uptake of compounds during feeding and nesting activities and through direct contact with the contaminated media. The objective of the ERA is to determine by qualitative and quantitative assessment the potential threat posed by the site to wildlife utilizing the site or vicinity of the site.

2.2 ERA Components

Evaluating ecological risk involves integrating information on possible chemical exposures with published toxicity data for the chemicals of potential concern. Various steps are involved in conducting such an assessment, and include the following components:

- Determining existing ecological conditions
- Selecting the chemicals of potential concern
- Determining existing or potential ecological receptors to exposure
- Determining available pathways of exposure for the ecological receptors
- Determining exposure point concentrations
- Developing toxicity data and toxic effects information
- Characterizing the exposure and ecological risk

Media contaminants detected at the site will be compared to current Federal and State criteria to select COPCs. These criteria include USEPA Region III BTAG Screening Levels for Ecological Risks, USEPA Region III BTAG Screening Levels for Aquatics in Surface Water, USEPA Ambient Water Quality Criteria for chronic effects in fresh water, and Virginia State Surface Water (Freshwater) Quality Standards. Toxicity profiles summarizing the