

Final Focused Source Remedial Investigation/ Feasibility Study Work Plan

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St. Thomas, U.S. Virgin Islands

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RAC 2 PROGRAM

FINAL

FOCUSED SOURCE REMEDIAL INVESTIGATION/FEASIBILITY STUDY

WORK PLAN

TUTU WELLS SUPERFUND SITE

ST. THOMAS, USVI

OCTOBER 2015

Prepared by:

Demetrios Klerides, P.E., BCEE
Project Manager
HDR

Reviewed by:

Bradley Williams, Ph.D.
RAC 2 Program Manager
HDR

Approved by:

Melissa LaMacchia
RAC 2 Quality Assurance Manager
HDR

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ACRONYMS

AALA	American Association for Laboratory Accreditation
ANSETS	Analytical Services Tracking System
ARAR	Applicable or Relevant and Appropriate Requirement
ATV	Acoustic Televiewer
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CAL	Caliper
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CO	Contracting Officer
COC	Chain of Custody
COPC	Chemical of Potential Concern
CRP	Community Relations Plan
CSM	Conceptual Site Model
CVOC	Chlorinated Volatile Organic Compound
DCE	cis-1,2-dichloroethylene
DESA	Division of Environmental Science and Assessment
DESR	Data Evaluation Summary Report
DNAPL	Dense Non-Aqueous Phase Liquid
DPNR	Department of Planning and Natural Resources
EAB	Enhanced Anaerobic Bioremediation
EDD	Electronic Data Deliverable
EDP	Electronic Data Processor
EPA	United States Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
FR	Fluid Resistivity
FS	Feasibility Study
FSRI/FS	Focused Source Remedial Investigation/Feasibility Study
FT	Fluid Temperature
gpm	gallons per minute
HASP	Health and Safety Plan
HDR	Henningson, Durham and Richardson Architecture and Engineering, P.C. in association with HDR Engineering, Inc.
HHRA	Human Health Risk Assessment
HPFM	Heat Pulse Flowmeter
IAG	Interagency Agreement
IDW	Investigation Derived Waste
LAGA	LAGA Industries, Ltd
LOE	Level of Effort
MCL	maximum contaminant limits
ug/l	microgram per liter
NCP	National Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program

Non-RAS	Non-Routine Analytical Services
NPL	National Priorities List
NTU	Nephelometric Turbidity Units
OSWER	Office of Solid Waste and Emergency Response
O&M	Operation and Maintenance
PAR	Pathways Analysis Report
PCE	Tetrachloroethylene
PO	Project Officer
PP	Proposed Plan
psi	pounds per square inch
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality control
QMP	Quality Management Plan
RA	Remedial Action
RAC	Remedial Action Contract
RAGS	Risk Assessment Guidelines for Superfund
RAO	Remedial Action Objective
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSCC	Regional Sample Control Center
SOP	Standard Operating Procedure
SOW	Statement of Work
SAS	Specific Analytical Services
STR	Sampling Trip Report
TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
TOC	Total Organic Carbon
Tutu	Tutu Wells Superfund Site
UFP	Uniform Federal Policy
USDOJ	United States Department of Justice
USVI	United States Virgin Islands
VOC	Volatile Organic Compound
WAM	Work Assignment Manager

SECTION 1 - INTRODUCTION

1.1 General Information

This Work Plan was prepared for the United States Environmental Protection Agency (EPA) by Henningson, Durham and Richardson Architecture and Engineering, P.C. in association with HDR Engineering, Inc. (HDR), for the Focused Source Remedial Investigation/Feasibility Study (FSRI/FS) for the Tutu Wells (Tutu) Superfund Site (the Site), located in St. Thomas, U.S. Virgin Islands (USVI) (Figure 1). The results of remedial investigations (RIs) completed since 1987 identified four sources of chlorinated volatile organic compound (CVOC) and/or benzene, toluene, ethylbenzene, and xylene (BTEX) groundwater contamination (Figure 2). The Tutu Site was included on the National Priorities List (NPL) in September 1995.

The FSRI/FS is being performed under Work Assignment Number 031-RICO-021D, under the EPA Remedial Action Contract (RAC) 2 Contract Number EP-W-09-009. This Work Plan was prepared based upon the Statement of Work (SOW) and discussions with the EPA during the scoping meeting held at the EPA Region 2 office in New York City on April 23, 2015. The focus of this Work Plan is the Curriculum Center (Figure 3) located in the northern portion of the Tutu Superfund Site.

As outlined in the SOW, the purpose of the FSRI/FS is to investigate the overall nature and extent of the contamination at the Curriculum Center, evaluate risks to human health and the environment and identify and evaluate remedial alternatives in support of a Record of Decision (ROD).

This Work Plan presents the FSRI/FS planning process and is based on information that is available at the present time. EPA will review the FSRI/FS report and provide comments that will guide the remaining work and may modify the currently proposed work.

Tasks that will be conducted during the FSRI/FS of the project include:

- Information gathering and background research, including review of existing files from EPA and USVI records;
- Limited site surveys and reconnaissance;
- Surface geophysical surveys;
- Borehole geophysics;
- Packer groundwater sampling;
- Monitoring well installation;
- Groundwater sampling;
- Groundwater elevation measurements;
- Matrix diffusion sampling and analysis; and
- Completion of Reports.

The technical approach and schedule to complete the site characterization work and FSRI/FS are included in this work plan. This effort includes evaluating existing data and on-going site remedial practices, identifying data gaps, performing a limited amount of field work, and aiding in defining the overall Conceptual Site Model (CSM)/evaluation strategy.

This Work Plan uses generic place holders for many of the FSRI/FS activities to allow for the preparation of an initial cost estimate. To this end, EPA provided some preliminary qualitative and quantitative details in the SOW which were followed to prepare the cost estimate.

The proposed task list presented above reflects the tasks identified in the SOW. Additional activities for the FSRI/FS will include project administration, data reduction and evaluation, risk assessment, the generation of Remedial Investigation (RI) and Feasibility Study (FS) reports, and remedial alternatives screening and evaluation. A Work Plan Cost Estimate is submitted to EPA as Volume 2. No work beyond that described in EPA's SOW or this Work Plan will be initiated prior to obtaining EPA approval.

1.2 Purpose

The purpose of this Work Plan is to set forth the requirements to successfully complete the FSRI/FS activities to determine the overall nature and extent of contamination and to develop viable remediation alternatives to eliminate, reduce, or control risks to human health and the environment at the Tutu Site, specifically the Curriculum Center. A primary goal of the work assignment is to develop the data necessary to support the selection of an approach for site remediation, and then to use this data in a well-supported Proposed Plan (PP) and Record of Decision (ROD).

SECTION 2 - SITE BACKGROUND INFORMATION

2.1 Site Description

The Tutu Wellfield site is located on the eastern end of St. Thomas, USVI, in the Anna's Retreat section. The site is situated within the upper Turpentine Run surface drainage basin. This basin, which covers approximately 2.3 square miles, trends roughly north-south and is bounded by the steep slopes of the surrounding hills.

Geraghty and Miller completed RI/FS activities at the site from 1992 to 1995 on behalf of the Tutu Environmental Investigation Committee. The ROD for the site was signed on August 5, 1996. During the multi-phased RI conducted by Geraghty & Miller (April 1995), groundwater samples were collected from 51 monitoring wells and 15 supply wells in the Tutu Valley. These samples were analyzed for organic compounds, metals, and various inorganic water quality parameters. In addition, eight rounds of groundwater samples were collected and analyzed from the water supply well.

The results of the groundwater sampling identified four main plumes of contamination at the Tutu Wells Site: two CVOC plumes (northern and southern) and two BTEX (Texaco and Esso) plumes. Since the focus of this work plan is the Curriculum Center, the following sections focus on Curriculum Center not the Texaco, Esso and Southern plumes. Details on the Tutu Site history and progress are available in the Final Pre-Design Report (CDM, 2001). The following historical information has been obtained from the Final Pre-Design Report and the April 2013 Annual Remedial Action Progress Report by CDM Smith.

2.2 Curriculum Center History, Background and Summary of Contamination

The northern-most (upgradient) source of CVOC groundwater contamination is located on the Curriculum Center property, which is currently owned and operated by the USVI Department of Education. According to Arthur D. Little Inc.'s 1994 report, the Curriculum Center building and property were previously occupied by LAGA Industries, Ltd (LAGA), who owned and operated a textile manufacturing plant at this location from 1971 to 1978. The plant included an industrial-sized dry cleaning process that used tetrachloroethene (PCE) as the dry cleaning solvent. Testimony by former LAGA employees (Smith and Richards) indicated that spent PCE and residue from the dry cleaning process were disposed in an outdoor pit located to the north of the building. However, the accuracy of this testimony was questioned by LAGA after re-interviewing the employees and based on the fact that no "pit" was located during the RIs.

The northern CVOC plume, which originates at the Curriculum Center, was identified in the 1995 RI to extend approximately 1,600 feet south, in the direction of the groundwater flow, to a point just southeast of Four Winds Plaza, and was estimated to be 500 feet wide (Figure 2). The highest concentrations of total CVOCs occurred in shallow zone monitoring wells near the source, where CVOC concentrations greater than 1,000 microgram/liter (ug/l) were detected. Concentrations of VOCs in the northern part of the northern plume had not decreased with time, nor had the shape or general extent of VOC contamination changed in this area. This pattern suggested the presence of a continuing source of VOCs to groundwater in the vicinity of the

Curriculum Center. Deeper groundwater zones (> 50 feet below ground surface (bgs)) at the Curriculum Center were not investigated during the RI.

The principal CVOCs detected in the northern plume were cis-1,2- dichloroethene (DCE), PCE, and trichloroethene (TCE). Vinyl chloride was also detected at high concentrations in the northern plume, but its detection was restricted to the immediate vicinity of the Curriculum Center. The maximum concentrations detected in the northern plume during the RI were DCE at 2,100 ug/l, vinyl chloride at 1,300 ug/l, PCE at 360 ug/l and TCE at 78 ug/l, all of which exceeded their respective maximum contaminant limits (MCLs).

In the southern part of the northern CVOc plume, south of Tillett Gardens, volatile organic compound (VOC) concentrations were generally lower than near the Curriculum Center. The highest concentrations of VOCs detected in this part of the plume during the RI were PCE at 140 ug/l, DCE at 100 ug/l and TCE at 33 ug/l. Unlike the northern part of this plume, VOC concentrations in the southern part of the plume were higher in deeper monitoring wells than they were in shallow wells.

During the RI, underground piping that contained oil and 30% PCE solvent was discovered by EPA and the Department of Planning and Natural Resources (DPNR) beneath the Curriculum Center building. This piping did not appear on the as-built plans provided to EPA. In March 1995, EPA was able to trace the piping from the floor drainpipes to a room that apparently held the PCE reclamation still to the former dry cleaning room. There was no evidence of leakage in the section of pipe investigated; however, the full extent of the piping and its integrity remained unknown.

During the RIs at the Curriculum Center, 3 to 1,800 ug/l of PCE was detected in eight samples at the north-central side of the main building in the vicinity of the former discharge pipe and presumed former waste pit. TCE was detected in four samples at concentrations from 1 to 130 ug/l. One chlorinated VOC, 1,1,1-trichloroethane (TCA), was detected above EPA's soil screening levels. Although no samples were collected from beneath the building, it was suspected that higher concentrations of chlorinated VOCs may be present in the soil beneath the building or in the unsaturated bedrock. The elevated concentrations of chlorinated VOCs in groundwater adjacent to and immediately down gradient of the Curriculum Center indicated a high probability that an additional source of PCE is present in the bedrock.

At the northeast corner of the Curriculum Center, in an area where a drain from the paint shop sink discharged to the ground, BTEX compounds exceeded EPA's soil screening levels in two surface soil samples. Benzene was detected at 2,700 ug/l and toluene was detected at 500,000 ug/l.

Pre-design field investigations were completed by CDM at the Tutu site from August 1998 through October 1999 to further define the extent of CVOcs in Curriculum Center soil and site-wide groundwater and to collect hydrologic and geologic information to be used in the remedial designs (RDs). CDM installed and/or collected environmental samples from seven shallow interior building soil borings, nine shallow exterior building soil borings, seven deep soil borings, nine monitoring wells, two extraction wells, and 26 vapor probes.

Subfloor pipe tracing was completed at the Curriculum Center using building architectural drawings, visual observation, hand augering, and concrete coring. The objective was to determine unknown discharge points. Six core holes inside the building and three hand auger boreholes outside the building were drilled to confirm the existence of known and suspected pipes. Solvents encountered in the pipes was sampled and removed by wet vacuuming.

CVOC contamination existed at the Curriculum Center in the unconsolidated vadose zone. The existence of vadose-zone contamination was confirmed during the soil vapor extraction (SVE) pilot study completed from October to November 2000. Based upon data collected during this test, the extent of vadose-zone contamination is limited to the immediate area of the work shop behind the Curriculum Center. Approximately 40 pounds of CVOCs were removed during a 5-day SVE performance test, with a final mass removal rate of approximately four pounds per day.

2.2.1 Site-specific Hydrogeology

The water table is located in bedrock roughly 15-30 feet below land surface. Bedrock is an andesitic tuff and/or andesitic breccia that is volcanogenic sedimentary rock. These rocks have a primary (matrix) and secondary (fracture) porosity where the advective groundwater flow is occurring through the secondary fracture porosity and primary matrix porosity acts as a potential storage zone of contaminants.

The saturated portion of bedrock can be divided into two zones:

- An upper, more productive, zone extends from the water table (15 to 30 feet bgs to a depth of 80 feet);
- A lower, less productive, zone extends from 80 to 140 feet bgs.

Groundwater flow in the upper zone is relatively fast. However, the fate and transport of CVOCs will likely be strongly retarded by matrix diffusion in the porous bedrock. Groundwater in the upper zone contains high concentrations of DCE and lesser concentrations of PCE and TCE. These data suggest that this shallow water table zone was highly anaerobic and reductive dechlorination degraded the PCE to TCE, DCE and VC. Since shallow groundwater is typically aerobic due to the addition of oxygen-rich surface recharge, this unique hydrogeologic condition may have been driven by co-metabolic processes associated with the past presence of petroleum hydrocarbon where aerobic bacteria would consume the oxygen while biodegrading the hydrocarbons turning a typically aerobic aquifer to an anaerobic aquifer resulting in the anaerobic biodegradation of CVOCs. Groundwater containing CVOCs in the shallow zone extends from Curriculum Center to just north of the Texaco service station (approximately 500 feet). The back-diffusion of CVOCs from the pore water to the groundwater flowing through the fractures could explain the lack of mass reduction in the down gradient wells.

Groundwater flow in the lower zone is relatively slow and the groundwater contains high concentrations of PCE. While groundwater flow in this zone is low due to a low hydraulic conductivity, this zone contains the high PCE concentrations in groundwater. PCE concentrations in groundwater have been detected as high as 478,500 ug/l (in April 2011) indicating the likely past presence of dense non-aqueous phase liquid (DNAPL). This

concentration profile, where the highest concentrations of CVOC are located in lower hydraulic conductivity bedrock, is consistent with past experience in porous sedimentary bedrock. CVOC concentrations appear to decrease at depths below approximately 120 to 140 feet, although elevated CVOC concentrations were detected as deep as 183 feet bgs in boring H-2A. Observed fracturing below 140 feet at each of the drilled and logged locations suggests limited vertical PCE migration below this depth.

Remedial Progress

The RD for the Curriculum Center soil and site-wide groundwater was completed in September 2001. A groundwater extraction and treatment system was constructed at the Curriculum Center (referred to as GWTF #1) by March 2004 to achieve hydraulic control and remove CVOC groundwater contamination. The extraction system consists of three groundwater extraction wells RW-7, RW-9 and RW-6. Extraction wells RW-7 and RW-9 were screened across the shallow, more productive portion of the aquifer, and RW-6 was screened across the deeper, less productive portion of the aquifer. At GWTF #1, extraction well RW-7 is operated on a continuous basis and extraction well RW-9 operates as required to maintain the required groundwater elevation, typically during heavy rain events. Since startup, the average and maximum flow rate at GWTF #1 was 24 and 58 gallons per minute (gpm), respectively. In addition, extraction well RW-6 is operated once per week for approximately one hour at a flow rate of two gpm, until the extraction well pump shuts down due to low water conditions in the well. The Operation and Maintenance (O&M)), which consists of operation, maintenance and monitoring activities, has been performed by the USVI Government since April 2013. Groundwater monitoring is routinely completed at site-wide groundwater monitoring wells to assess remedial action (RA) progress. Groundwater sampling was completed on a quarterly basis from system start-up until April 2007 and annual groundwater sampling has been performed thereafter. Samples are collected from 30 groundwater monitoring wells and residential wells at each groundwater sampling event. Groundwater monitoring levels are collected on a monthly basis from 36 monitoring wells.

An SVE system which includes two SVE wells (SVE-1 and SVE-7) was constructed at the Curriculum Center to remediate the unsaturated zone source of the CVOC groundwater contamination. The location of SVE-7 coincides with RW-7, which was constructed as a dual-phase extraction well. The SVE system was operated for approximately two years. Due to a significant decrease in SVE influent concentrations since system startup and achievement of asymptotic conditions, it was determined that the SVE system was no longer cost-effective and the system was shutdown in April 2006.

Injection and monitoring wells were installed at the Curriculum Center to support the completion of an enhanced anaerobic bioremediation (EAB) pilot study, which was completed following treatment system startup. Based on the results of initial phase of the pilot study, no additional pilot testing or bioremediation was completed.

SECTION 3 - TASK DESCRIPTIONS AND ASSUMPTIONS

3.1 Task 1- Project Planning and Support

3.1.1 Subtask 1.1: Project Administration

HDR will provide project administration and management support during the investigation to complete the work assignment. The HDR project team will consist of the Program Manager, Project Manager, Project Specialists, Hydrogeologists/Scientists, and support staff, as appropriate. The Project Manager will be the primary interface between the EPA Work Assignment Manager (WAM) and technical staff. The Project Manager will manage day to day activities, interface with the EPA WAM on a weekly basis, provide bi-weekly invoice inputs to HDR's automated financial management system, attend project meetings, oversee and coordinate the project, and manage project staff, budget, and task schedules. Project Administration and Management time has been estimated to direct and manage efforts including staffing plans, budget tracking, and project scheduling; and establishing internal quality management procedures.

The activities included in Project Administration include project initiation, financial and recordkeeping/filing, monthly coordination and preparation of monthly reports, weekly status calls with the WAM and associated follow-up calls for a 24 month period.

Efforts will be made to minimize production of hardcopy documents, where appropriate, in favor of electronic deliverables and transmittals. Where hardcopies are produced HDR will use paper made from a minimum of 50% post-consumer recovered materials in accordance with the contract requirements.

3.1.2 Subtask 1.2: Scoping Meetings

The HDR project team attended scoping meetings at EPA's Region 2 office in New York City on April 23, 2015. Minutes of the scoping meetings were prepared and distributed to EPA.

3.1.3 Subtask 1.3: Site Visit

The HDR project team and the EPA WAM will schedule a four-day site visit in June 2015 to develop an understanding of the Site layout and identify the location of geophysical surveys and intrusive activities such as geophysical logging, packer testing, bedrock coring for matrix diffusion analysis, and monitoring well installation. The HDR Project Manager and hydrogeologist are expected to attend the site visit.

3.1.4 Subtask 1.4: Develop Work Plans and Budget Estimate

The SOW requires HDR to develop a draft FSRI/FS Work Plan. This Work Plan was prepared by HDR in accordance with the contract terms and conditions, and with input from the project team based on information from the SOW and project schedule, as well as EPA guidance, background/existing documentation, the scoping meeting, and technical direction provided by the EPA. The Work Plan provides a detailed description of each project task.

3.1.5 Subtask 1.5: Negotiate and Revise Work Plans and Budgets

Following the preparation of this Work Plan, HDR will negotiate the Work Plan with EPA via teleconference. HDR will prepare teleconference meeting minutes and submit a revised Work Plan and budget that will incorporate the agreements made in the negotiation teleconference. HDR will submit the revised Work Plan and budget in both hardcopy and electronic formats (e.g., Word .doc files and Excel spreadsheets).

3.1.6 Subtask 1.6: Evaluate Existing Data and Documents

HDR will review and evaluate existing site background information, including all studies and investigations completed at the Site provided or identified by the EPA WAM. This information will be used/presented in the FSRI/FS. The data presentation format in the FSRI report will be submitted to EPA for review and approval.

The data and documents to be reviewed and evaluated include, but are not limited to the following:

- EPA files and records (Tutu Wellfield RI/FS, Remedial Design, Remedial Action and LTRA Reports for OU1)
- USVI files and records

Existing information considered critical for the planning and successful completion of the FSRI includes, among other items, information on local geology and hydrogeology, groundwater elevations to establish flow directions, physical aquifer characteristics, historical and current analytical data, and reports on potential contamination source areas.

3.1.7 Subtask 1.7: Quality Assurance Project Plan

HDR will prepare a Quality Assurance Project Plan (QAPP) for the FSRI/FS in accordance with the current Uniform Federal Policy (UFP) for QAPP guidance and procedures and HDR's approved Quality Management Plan (QMP) and QAPP for the contract.

The QAPP will provide for collection of data sufficient to delineate site-related contamination in potentially affected media, to the extent necessary to select an appropriate remedy; to evaluate cross-media contaminant transport as necessary to support the assessment of risks associated with potential or actual exposures to site-related contamination under current and reasonably likely future conditions; and to evaluate remedial alternatives that address site-related contamination.

The QAPP will describe the project objectives and organization, functional activities, field activities and protocols, and quality assurance/quality control (QA/QC) protocols used to achieve the desired Data Quality Objectives (DQOs). Draft and Final QAPPs will be prepared. Information to be provided in the QAPP includes:

- Project sampling objectives;
- A project organizational chart;
- Standard Operating Procedures (SOPs) for the field investigation activities, including

required sampling equipment;

- Quantitative and/or qualitative criteria to evaluate achievement of objectives;
- Sample documentation and chain-of-custody (COC) procedures;
- Sample handling, preservation, and shipment procedures;
- A table of sample numbers, matrices, locations, collection frequencies, and analytical methods;
- A breakout of samples to be analyzed via the EPA Contract Laboratory Program (CLP), the EPA Region 2 Division of Environmental Science and Assessment (DESA) Laboratory, and other Non-CLP providers;
- Calibration and maintenance procedures and requirements;
- QA/QC protocols and sample requirements;
- Requirements for project assessments/audits;
- Procedures for data reduction, validation, and reporting;
- Description of report deliverables; and
- Corrective action procedures.

3.1.8 Subtask 1.8: Health and Safety Plan

HDR will prepare a site-specific Health and Safety Plan (HASP) that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures and a contingency plan in accordance with 40 Code of Federal Regulations (CFR) 300.150 of the National Contingency Plan (NCP), and 29 CFR 1910.120 (l)(1) and (l)(2). The HASP will cover the initial site characterization activities, as well as any anticipated future field work efforts. A copy of the HASP will be submitted to EPA.

3.1.9 Subtask 1.9: Non-Routine Analytical Services (Non-RAS) Analyses

For all analytical services required as part of the FSRI/FS, HDR will follow the Field and Analytical Services Teaming Advisory Committee (FASTAC) approach described in the EPA Region 2 SOP “Policy for Implementing the National Strategy for Procuring Analytical Services for all Office of Solid Waste and Emergency Response (OSWER) Programs (Superfund, Resource Conservation and Recovery Act [RCRA] and Brownfields) (EPA 2009). For all non-time critical data collection projects, the FASTAC approach requires that a sequential decision tree for procuring Superfund analytical services be followed, which includes:

- Tier 1: EPA Region 2 DESA laboratory (with Environmental Services Assistance Team [ESAT] support);
- Tier 2: National Analytical Services Contract laboratories (CLP and Non-RAS);
- Tier 3: Region Specific Analytical Services (SAS) Contract laboratories; and
- Tier 4: Contractor, interagency agreement (IAG), and Field Contractor Subcontract laboratories.

Prior to acquiring analytical services by subcontract, HDR will make use of the Tier 1, 2, and 3 alternatives listed above. HDR will follow the FASTAC strategy unless written direction is provided by the EPA to deviate from it.

HDR will prepare Laboratory Services Requests (e.g., statements of work) for all non-RAS parameters. The Laboratory Services Request(s) will include the following elements:

- Digestion/analytical methods;
- Data deliverable requirements;
- Quality control (QC) requirements;
- Estimated number of samples;
- Method restrictions and penalties for non-compliance;
- Turn-around times;

HDR will also develop QC criteria for each parameter provided in the approved QAPP that will be incorporated in the Laboratory Service Request, and when requested, HDR will provide copies of Laboratory Services Requests for review by the EPA WAM.

Non-RAS analyses will be performed by laboratories currently certified or accredited for the matrix and analysis to be conducted by either the National Environmental Laboratory Accreditation Program (NELAP), American Association for Laboratory Accreditation (AALA), a current certification issued by a program conducted, or approved, by a State and acceptable to EPA, or currently participating in the EPA CLP.

HDR will provide oversight of subcontract laboratories through periodic performance evaluation sample analyses and/or on-site audits of operations. HDR will be prepared to implement corrective actions in any cases in which the subcontract laboratory's performance does not meet the standards called for in the work assignment.

Validation of all Non-RAS analysis data generated by laboratories subcontracted by HDR will be performed by a data validator subcontracted by HDR. All data procured through Non-RAS laboratories requires validation by personnel not connected to the laboratory performing the analysis. Validation of data generated using Tier 1 and Tier 2 of the FASTAC strategy will be performed by EPA Region 2 and the EPA data validation contractor.

3.1.10 Subtask 1.10: Meetings

Both initial technical review and progress meetings will be required during the course of this work assignment. HDR assumes participation will be needed in a total of 12 progress meetings. HDR estimates that each meeting will be attended by two (2) people, and that each meeting will last five (5) hours. Ten of the meetings are assumed to be held at the EPA Region 2 New York City office and two of the meetings will be in the USVI to update local authorities on the status of the project. As per EPA direction in the April 2015 scoping meeting, technical support to EPA Region 2 Legal Department and United States Department of Justice (USDOJ) will also be included under this activity as part of meetings. HDR will utilize public transportation to attend project meetings whenever possible in New York City. The anticipated meeting schedule is

included in Figure 10. Draft minutes will be prepared within five calendar days following each meeting and final minutes will be completed upon review and comment by EPA.

3.1.11 Subtask 1.11: Subcontract Procurement

All anticipated subcontract procurement activities will be completed under this subtask. Twelve subcontractors would be procured to complete field work or technical support activities related to completion of the SOW (bulleted below). In addition, as discussed in the April 2015 scoping meeting, the procurement of two geophysical subcontractors with proprietary technologies will be sole-sourced by HDR and justification provided to EPA. In addition, three of the proposed subcontracts will require consent from the EPA Contracting Officer (CO) before an agreement is executed. Coordination of the subcontracted activities will be included under Subtask 1.12 (Perform Subcontract Management).

- Utility Clearance;
- Downhole Geophysical Investigation (including fluid temperature, fluid resistance, caliper, heat pulse flow meter (static and pumping), and acoustic televiewer logging);
- Geophysical Surveying (Seismic, Willow Stick, Aestus);
- Bedrock coring and well drilling (including installation of bedrock monitoring wells, packer testing; redevelopment of existing wells; collection of samples for matrix diffusion);
- Equipment rental;
- Investigation-Derived Waste Management, Transportation and Disposal;
- Analytical Services (not performed by EPA laboratories);
- Surveyor;
- Stenographer; and
- Cultural Resources.

HDR will require subcontractors to submit their green policies and request options with the subcontractors to implement green remediation strategies to the proposed FSRI tasks. Any impacts on the costs for the subcontracting services will be presented as part of the cost analysis that will be completed during the procurement effort.

3.1.12 Subtask 1.12: Subcontract Management

HDR will complete the necessary management and oversight of any subcontractor(s) required for FSRI/FS activities. HDR will ensure that the work proceeds according to contract requirements, review and approve subcontractors' invoices, and issue any necessary contract modifications.

HDR will perform subcontract management, including:

- Implementing procedures for subcontractor management;

- Monitoring of subcontractor progress and performance;
- Maintaining subcontracting systems and records;
- Issuing subcontract modifications (if warranted);
- Reviewing and approving subcontractor invoices;
- Maintaining subcontract files;
- Coordinating subcontractor activities with EPA; and
- Closing each subcontract.

Any departure from a subcontractor's scope of work will be reported to the HDR Project Manager so that a proper determination can be made as to the need to modify the subcontractor's scope of work and/or compensation. Significant issues will be brought to the attention of the EPA WAM immediately. After an evaluation of a proposed change and receipt of the EPA CO's consent (if required), a subcontract modification may then be issued to effect the change. A change of any subcontractor's scope of work will not be made without a prior determination of appropriateness, and will be made only by modification of the subcontract.

All subcontractor invoices will be submitted to HDR for review and approval. After approval by the Project Manager or designee, the invoice will be submitted to the HDR Accounting Department for inclusion in the project invoice.

3.1.13 Subtask 1.13: Pathways Analysis Report (PAR)

HDR will prepare a Pathways Analysis Report (PAR) in accordance with OSWER Directive 9285.7-01D-1 dated December 2001 entitled, "*Risk Assessment Guidelines for Superfund Part D*" (RAGS Part D) (EPA 2001) and input from the EPA Regional Risk Assessor assigned to the Site. The PAR will be submitted 21 days after submission of the Data Evaluation Summary Report (DESR) described in Subtask 6.4.

The PAR will describe the risk characterization process and how the risk assessment will be prepared, in order to allow the risk assessors to ensure that the proper guidance and methodologies are followed. The PAR will contain information necessary for a reviewer to understand how the risks at the Site will be addressed, including the statistical treatment of the data, the methods to select the contaminants of concern, the exposure pathways, receptors, parameters to be used and current toxicological values. It will include RAGS, Part D Tables 1 through 6, as well as the necessary explanatory text. Because the PAR includes RAGS, Part D tables 1 through 6, it cannot be completed until all analytical data are available. If HDR recommends modeling be completed as part of the Human Health Risk Assessment (HHRA), a description of the model(s) and an explanation of the inputs and assumptions will be included in the PAR so that their appropriateness can be determined. Outputs/results will be provided in the Draft HHRA.

The PAR will precede preparation of the Draft HHRA (Subtask 7.1) for the Site. The PAR will present the methodologies used for the background review, data evaluation, exposure assessment, toxicity assessment, and associated RAGS Part D tables required for the Draft HHRA. Preparation of the Draft HHRA, which is contingent upon approval of the PAR by EPA Region 2, is discussed in detail in Section 3.7.1 of this Work Plan.

3.2 Task 2 - Community Relations

The HDR project team will provide community involvement support to EPA throughout the FSRI/FS in accordance with the EPA Superfund Community Involvement Handbook, Office of Emergency and Remedial Response, EPA 540-K-05-003, April 2005, and direction from the EPA WAM.

3.2.1 Subtask 2.1: Community Interviews

Not Applicable

3.2.2 Subtask 2.2: Community Relations Plan (CRP)

HDR will prepare a draft CRP that presents an overview of the community's concerns and covers the following elements:

1. Site background including location, description and history;
2. Community overview including a community profile, concerns and involvement;
3. Community involvement objectives and planned activities, with a proposed schedule for performance of these activities;
4. A mailing list of contacts and interested parties;
5. Names and addresses of the information repositories and public meeting facility locations;
6. A list of acronyms; and
7. A glossary.

HDR is prepared to submit the draft CRP within 30 days after receiving direction from the EPA. EPA will review and provide comments on the draft CRP, and HDR will submit the final CRP incorporating all EPA review comments within 14 days of receiving the final EPA comments.

It is assumed that background information is publicly available, either online or from publications provided to HDR, and that no travel will be needed to gather additional information. Further, it is assumed that the EPA will consolidate any comments provided by other agencies (local) on the CRP before providing them to HDR.

3.2.3 Subtask 2.3: Public Meeting Support

HDR will provide community relations support for two public meetings/availability sessions/open houses (public meetings) to be held at a location to be specified in the vicinity of the Site. HDR will perform the following activities:

- Arrange the two public meetings, including the selection and reservation of a meeting space as directed by the EPA. It is assumed that public space will be available at no cost to the government or HDR;
- Attend public meetings or availability sessions, prepare draft and final meeting summaries, and prepare presentation materials/handouts;

- Prepare Draft Visual Aids in Power Point HDR will prepare 25 PowerPoint slides and 50 handouts for the public meetings. HDR will develop final visual aids incorporating all of EPA comments.
- Provide a stenographer/court reporter for the two public meetings. A full-page original and a “four on one” page copy of the transcripts (along with an electronic copy of the transcripts) for each public meeting will be provided to the EPA, with additional copies placed in the information repositories as required. The electronic copy of the transcripts will be provided in the most recent EPA-approved word processing format.

3.2.4 Subtask 2.4: Fact Sheet Preparation

HDR will support the preparation of fact sheets, information letters, or updates by completing the following support activities:

- Draft Information Letters/Updates/Fact Sheets – Draft Information Letters/Updates/Fact Sheets will be prepared by HDR with review by the EPA WAM. HDR will research, write, edit, design, lay-out, and photocopy the Information Letters/Updates/Fact Sheets.
- Final Information Letters/Updates/Fact Sheets - HDR will prepare final Information Letters/Updates/Fact Sheets incorporating EPA technical review comments. After EPA approval, HDR will photocopy the Information Letters/Updates/Fact Sheets and attach mailing labels before delivering them to EPA from where they will be mailed.

Two black and white Information Letters/Updates/Fact Sheets, six to eight pages in length, with two illustrations per Information Letters/Updates/Fact Sheet. The Final Information Letters/Updates/Fact Sheets with mailing labels will be provided to the EPA three days prior to a public meeting/event as specified in the deliverables table of the SOW.

3.2.5 Subtask 2.5: Proposed Plan Support

Not Applicable.

3.2.6 Subtask 2.6: Public Notices

EPA will prepare newspaper announcements/public notices in support of the two public meetings anticipated to be held for the Site. HDR will place the newspaper announcements/public notices in the most widely read local newspapers. HDR estimates that for each of the two public meetings, one ad will be placed in a large newspaper and the other ad will be placed in a small town newspaper.

- EPA will notify HDR at least 28 days prior to the date of each public meeting. HDR will reserve space in the two newspapers (depending on newspaper deadlines – generally requires 1 to 2 weeks advance reservation). Each notice will appear in the newspapers approximately one week prior to each respective meeting date.
- HDR will provide three copies of each public notice to EPA within 14 days before public meetings/events.

3.2.7 Subtask 2.7: Information Repositories

Not Applicable.

3.2.8 Subtask 2.8: Site Mailing List

HDR will update the existing mailing list for community relation activities for the Site, including newly elected public officials, names of persons interviewed by EPA, and interested persons identified through the public meetings and through EPA points of contact, and other contacts provided by EPA. The initial mailing list will be provided by EPA in a Microsoft Excel or database format. It is estimated that the mailing list will consist of approximately 100 entries that will need to be reviewed and updated. The project team will provide EPA with an electronic version of the updated mailing list as requested by EPA. The mailing list will be provided to EPA on compact disk in a software format acceptable to EPA. Actual mailing of any information to the community will be performed by EPA.

3.2.9 Subtask 2.9: Responsiveness Summary Support

HDR will provide administrative and technical support for the Site Responsiveness Summary. HDR will provide assistance in compiling and summarizing comments received during the public comment period on the Proposed Plan and the Feasibility Study. It is estimated that 25 separate comments (including duplicate comments) and 25 technical responses will have to be compiled and summarized.

HDR will prepare a responsiveness summary that presents a concise and complete summary of significant oral and written comments that EPA receives from the public during the public comment period of the FS and Proposed Plan. HDR will compile, organize, and summarize all written and verbal comments received during the public comment period and assist EPA in developing responses to the comments. Policy-oriented comments will be addressed by EPA.

Following receipt of all public comments from EPA (generally the last day of the public comment period), HDR will submit a Draft Responsiveness Summary to EPA for review. The Final Responsiveness Summary will be submitted following receipt of EPA's comments on the Draft Responsiveness Summary.

3.3 Task 3: Field Investigation

As described in the April 2, 2015 SOW for the FSRI/FS, the FSRI will investigate the overall nature and extent of contamination, the FS will develop remedial alternatives, and a Technical Impracticability waiver will be prepared, if appropriate. During the investigation, the field work will consist of water level monitoring, surface geophysical surveys, borehole drilling/coring, monitoring well installations, borehole geophysics, packer testing, and groundwater sampling to determine the nature and extent of groundwater contamination and to support the preparation of a RI and a FS.

HDR will complete the following field activities or combination of activities for data acquisition in accordance with the EPA-approved QAPP developed in Task 1.

3.3.1 Subtask 3.1: Site Reconnaissance

HDR will review site surveys, including property, boundary, utility rights-of-way, and topographic information, by using existing database information. Information available at the time will become part of the CSM. As progress is made in determining areas to be investigated, access to these areas will be requested. HDR will complete the following activities as part of the site reconnaissance:

- Topographic survey
- On-property and adjacent properties building and other structures delineation
- Storm/sanitary sewer line delineation
- Establishment of sampling points
 - Locations of new and existing wells, geophysical survey areas, and on-site conditions;
 - New wells will be surveyed following installation. The survey will provide the elevations at each well for ground, top of outer casing and top of inner casing. Horizontal coordinates of the center of the well will also be provided.
- Photographic Documentation: HDR will take representative photographs to document the FSRI field activities and significant events or observations made during the FSRI/FS. These activities will include mobilization, investigation activities, collection of samples, and demobilization. HDR will document these activities with photographs so that a clear record of the procedures and activities required to carry out each activity is provided. HDR will store and maintain these photographs in electronic form and submit them to EPA on disk or other form of electronic submittal. For each photograph, HDR will provide the time, date, location, and a brief explanation of what is being photographed.
- HDR's subcontracted surveyor will measure the horizontal location and vertical elevation of all newly installed wells at Curriculum Center.

3.3.2 Subtask 3.2: Mobilization and Demobilization

HDR will provide the necessary personnel, equipment, and materials for mobilization and demobilization to and from the Site. One mobilization and demobilization is anticipated. During mobilization, the equipment and materials necessary for the field program will be procured and transferred to the Site. The necessary personnel, equipment and materials for conducting the field activities will be assembled during mobilization.

HDR understands the locations of the source area and impacted monitoring wells and the surrounding areas. We also understand the treatment shed onsite will be available as a limited staging area. Details on the mobilization area, including health and safety zones, the project field office, and investigation derived waste (IDW) staging areas will be presented in the site-specific QAPP and HASP.

Mobilization will consist of the following:

- Prepare a list of required field equipment;
- Prepare requisitions to rent equipment, as necessary;
- Identify field office space and arrange for staging area for contractor equipment;
- Arrange for field office utilities, as necessary;
- Prepare requisitions to purchase expendable field supplies, as necessary;
- Set-up of health and safety field files;
- Arrange delivery, storage and setup of all equipment, as necessary;
- Receive field activity and health and safety equipment;
- Perform general site preparation/organization;
- Conduct initial health and safety briefing for site personnel; and
- Set-up field computer equipment, office equipment, furniture and field office supplies.

Upon completion of the field activities, demobilization will occur. The following activities will be performed:

- Complete site restoration activities and cleanup;
- Arrange for the transportation and disposal of wastes, including IDW, from the Site;
- Return rental equipment;
- Terminate field office lease and disconnect utilities; and
- Demobilize field, office and computer equipment.

3.3.3 Subtask 3.3: Hydrogeologic Assessment/Monitoring Well Installation, Development, and Testing

The primary objective of the FSRI is to delineate the nature and extent of contamination in the bedrock aquifer. The source is known, but the mechanisms of transport and the interaction between the upper and lower zones is not well understood. Therefore, the FSRI/FS will focus on documenting the nature and extent of the contamination at the Curriculum Center, determining the fate and transport processes that effect the migration of CVOCs, evaluating the risks to human health and the environment, and identifying and evaluating remedial alternatives in support of a ROD. The scope of work for the FSRI is outlined below:

3.3.3.1 *Surface Geophysical Evaluation*

A Surface Geophysical Evaluation will be completed using three different surface geophysical methods. Seismic techniques will be used to determine the depth and shape of the bedrock surface. This data will be used to identify locations where CVOCs could have pooled in low areas on the surface and entered bedrock. An Aestus GeoTrax electrical conductivity survey will be conducted to assess the potential location and distribution of high concentrations of CVOCs

within bedrock. A Willowstick geophysical survey will be conducted to identify water bearing fractures that could be transporting CVOCs through the bedrock aquifer.

3.3.3.1.1. Seismic Survey

A seismic geophysical survey will be completed at the Site (Figure 4) to determine the depth and shape of the top of bedrock. This will be completed using seismic methodologies that measure the propagation of a mechanical perturbation of the earth generated by a controlled energy source. As the wave propagates in the subsurface, the wave will reflect and refract at boundaries of differing geologic density. Analysis of the reflection patterns and velocity changes of these waves can provide insight into depth and shape of the bedrock surface and the identification of preferential pathways such as faults or fractures.

Seismic reflection may be used to complete the seismic survey. The general principle of seismic reflection is to send elastic waves (using an energy source such as sledgehammer or shotgun) into the Earth, where each layer within the Earth reflects a portion of the wave's energy back and allows the rest to refract through. These reflected energy waves are recorded over a predetermined time period (called the record length) by receivers that detect the motion of the ground in which they are placed. On land, the typical receiver used is a small, portable instrument known as a geophone, which converts ground motion into an analogue electrical signal. Each receiver's response to a single shot is known as a "trace" and is recorded, then the shot location is moved along and the process is repeated. Typically, the recorded signals are subjected to significant amounts of signal processing before they are ready to be interpreted. In general, the more complex the geology of the area under study, the more sophisticated are the techniques required to remove noise and increase resolution. The seismic survey will produce a dataset and map showing the depth and shape of the top of bedrock.

3.3.3.1.2. Aestus Survey

An Aestus GeoTrax Survey will be completed to delineate subsurface anomalies that can be consistent with high concentrations of aqueous CVOCs and DNAPL in bedrock. It is anticipated that the Aestus GeoTrax Survey will complete up to 11 transects as shown on Figure 5. The Aestus GeoTrax Survey will produce a 2-D visualization for each transect and possibly a 3-D visualization of the Site.

3.3.3.1.3. Willowstick Survey

A Willowstick geophysical survey will be completed to identify bedrock fractures that control groundwater flow at the Site. The technology measures the magnetic field produced by the distribution of electric current to track patterns that help characterize preferential groundwater flow. It differs in many ways from traditional resistivity and other electromagnetic (EM) methods. First, it capitalizes on the fact that water content is a dominant factor in enhancing the subsurface electrical conductivity of soil and rock. Second, by directly energizing a conductive groundwater medium with strategic electrode placement, the electric field can more effectively "illuminate" the target of interest with less interference from overlying layers.

The Willowstick geophysical survey will be completed in a vertical dipole configuration at two locations (Figure 6). This particular approach and the corresponding layout of the surveys will greatly aid in gathering more in depth information regarding the connections and pathways in the

subsurface. The survey grid pattern proposed for these surveys can be seen in attached Figure 7 (small red crosses “+”). The 50 foot grid spacing will yield a total of approx. 900 data points.

The data gathered from this investigation should yield comprehensive information about the groundwater flow in the subsurface. The final magnetic contour maps will show the magnitude of the processed magnetic field data and the inferred extent of saturation and/or preferential flow paths. This information can then be used to better understand the potential groundwater pathways in groundwater at the Site. The Willowstick geophysical survey produce maps that will include; a magnetic field contour map, a predicted magnetic contour map, and a 3D inversion model of the distribution of electric current flow (horizontal and vertical positions of preferential flow paths).

3.3.3.2 *Matrix Diffusion Evaluation*

A Matrix Diffusion Evaluation will be completed at two locations to document the potential presence and vertical distribution of CVOCs in bedrock pore water. The bedrock has been identified as an andesitic tuff/breccia during previous investigations at the site. Andesitic tuff/breccia is a volcanogenic sedimentary rock. Published literature documents the effective porosity of tuff and breccia to be up to 30 percent (P. K. Harvey et al, 2005). This data shows that the CVOCs could be diffusing into the pore water contained in the effective porosity of the sedimentary bedrock. The CVOCs in the pore water could back-diffuse out of the bedrock and act as a continuing secondary source of CVOCs to groundwater. The matrix diffusion data will be used to better understand of the fate and transport of CVOCs in the bedrock and better understand potential remedies and remedial time frames.

The bedrock at two locations will be continuously cored from the top of bedrock to a depth of up to 200 feet below land surface. Selected portions of bedrock at the fracture face and at the center of bedrock blocks will be collected, processed, and analyzed real-time in an on-site laboratory to determine the concentration of CVOCs in the crushed rock samples. A real-time on-site laboratory will be used to analyze the samples using Triad approach so that the data can be used to determine the depth of CVOCs at each location. Up to 20 samples of bedrock will also be collected and analyzed for physical properties including percent moisture, wet and dry bulk density, specific gravity and organic carbon. These results will be used to convert the laboratory results into pore water concentrations.

Rock coring will be conducted using an HQ-size core barrel, generating cores measuring 5 foot long by 2 ½ inches in diameter. A triple-tube core barrel will be used to minimize disturbance to the core. The core samples will be retained inside a second inner stainless steel tube, split lengthwise, inside the inner tube. The split tube will be removed from the outer tube and one half of the split tube will be removed to expose the core. The recovered core section will then be placed in aluminum foil-lined poly-vinyl chloride (PVC) trays out of direct sunlight and windy conditions to minimize volatilization of organic contaminants, logged and sampled for VOCs.

The recovered core will be inspected by the geologist or hydrogeologist for sample locations based on lithology, presence of fractures, bedding plane partings, and evidence for groundwater and/or DNAPL fluid flow. All observations will be recorded in the core log.

The samples collected for CVOC analysis will be processed on site (trimmed to remove the outer portion of the sample impacted by coring, crushed, and transferred into pre-preserved [methanol-

filled] extraction vials). Samples will be crushed using an Enerpac™ or comparable system capable of generating approximately 6,000 pounds per square inch (psi) of pressure. The VOC samples will be analyzed on-Site by the subcontractor.

Sample locations for CVOC analysis will be based on fracture distributions and lithology, with samples to be collected both from the fractures and the intervening unfractured rock matrix. Following the collection of the CVOC samples, samples for physical characterization and total organic carbon (TOC) will be collected. After completion of this sampling, the remainder of the core will be transferred into core boxes.

Prior to sampling, the core will be photographed. Rock crushing and sampling activities will follow procedures outlined in Protocol for Collecting and Analyzing Rock Core Samples for Volatile Organic Chemical Concentrations and Physical Property Measurements (Parker et al, 2005). All sampling and processing equipment will be decontaminated between samples following procedures included in the Site QAPP. One equipment blank sample will be collected per day during rock coring to demonstrate the effectiveness of the decontamination process. One duplicate sample will be collected for every 20 original rock core samples. The results of the CVOC analysis in combination with the other analysis will be used to calculate rock pore water concentrations. Once the boring has been drilled and borehole geophysics has been completed, the borehole will be grouted to land surface using neat cement grout.

3.3.3.3 *Capture Zone Evaluation*

A Capture Zone Evaluation will be completed to more fully understand the radius of influence and hydraulic capture of the existing groundwater extraction system. This will be completed by collecting continuous water levels using transducers in six existing wells and six additional transducers in selected wells. A transducer will be set in six additional wells in the beginning of field activities at the Site to measure and record water levels. The water levels from the transducers in the existing and new wells will be evaluated to document the radius of influence of pumping by turning the groundwater extraction off until the water level in each extraction well and each monitoring well has recovered to static conditions. This is anticipated to take a few hours. The pumps will be turned back on when static conditions have been reached. The water level data collected by the transducer will be downloaded at the end of the field activities and the transducers in the new wells will be removed from the wells and returned to the subcontractor.

A synoptic round of water levels will be collected a few days prior to the synoptic groundwater sampling event. All manual groundwater elevations will be measured from the surveyed inner casing measuring point using an electronic interface probe. All data will be recorded and presented in tabular form. The water levels will be subtracted from the measuring point elevations at the wellhead to calculate the potentiometric elevation of the aquifer at each location. These data will be plotted on a plan view map for the shallow and deep water bearing zones to document the potentiometric surface. These data will also be used to better understand the radius of influence and capture of the groundwater extraction system in each watering bearing zone. HDR estimates that 29 monitoring wells and recovery wells will be included in the groundwater elevation surveys.

Barometric data may also be collected by transducers to document the potential affect changes in barometric pressure could have on the water levels. Rainfall measurements will be obtained

during the field program from the nearest precipitation station or airport to evaluate precipitations potential effect on groundwater levels.

3.3.3.4 *Borehole Geophysics*

Borehole geophysics will be completed in nine existing wells and six new wells. Prior investigations included borehole geophysical surveying including caliper, fluid conductivity, temperature, TV camera, and flow meter. Additional geophysical methods are proposed for this investigation considering the advances in borehole geophysical methods since the prior investigation. These advances include heat pulse flow meter and acoustic televiewer logs. Borehole geophysics will be conducted in boreholes/wells during the investigation to help determine discrete water-bearing depths in the fractured bedrock, the strike and dip of various bedrock features, the flow within, and in and out of the fractures, and to provide information for packer testing and the installation of wells.

HDR anticipates that up to nine wells existing will be investigated using downhole geophysics. HDR reviewed the well construction logs of the existing wells to assess their suitability for borehole geophysics. Wells constructed with stainless steel screens were excluded from the borehole geophysics survey due to limitations of the electrical geophysical methods.

The following suite (or subset) of borehole geophysical logging will be completed by a geophysical subcontractor at the selected boreholes and wells:

1. Fluid Temperature (FT)
2. Fluid Resistivity (FR)
3. Caliper (CAL)
4. Heat Pulse Flowmeter (HPFM), under ambient and pumping conditions
5. Acoustic Televiewer (ATV)

Unlike the other borehole geophysical data, the HPFM data are acquired at discrete depths. Depths to be tested will be determined after review of the other borehole geophysical data. The HPFM data will provide information regarding the vertical flow rate and direction in the borehole at discrete depths in order to determine the depths where water is entering and leaving the borehole under ambient conditions. Data will be recorded in digital form in the field in a portable computer, and will be processed in the office using commercially licensed software. The borehole equipment will be decontaminated after logging each borehole.

A preliminary list of wells for the borehole survey is presented in Table 1. This table provides the well construction details, the geophysical methods for each well, and the rationale for surveying the specific wells.

3.3.3.5 *Well Drilling and Installation*

Six monitoring wells will be installed (Figure 8) to collect groundwater samples that will be used to define the nature and extent of groundwater containing CVOCs. The scope of work in this task will include geophysical logging of selected existing wells to better understand the bedrock fractures that will be used to guide the depth of the new monitoring wells. Each newly drilled borehole will also be geophysical logged to identify bedrock fractures and groundwater samples

will be collected from discrete intervals using inflatable packers to document the vertical extent of CVOCs in groundwater. These wells will be used to:

- define the nature and extent of VOCs;
- confirm CVOC anomalies identified in the Aestus survey; and
- complete the Willowstick survey.

One shallow bedrock well and five deep bedrock wells will be installed (Figure 8). Following the initial site characterization, HDR will evaluate relevant available information, including the results of the initial borehole geophysical investigation in the new and existing monitoring wells, packer groundwater sampling, the proximity to potential source areas, identified data gaps, accessibility/practicality, and other information obtained during the site characterization or from other sources, to determine the number of new wells deemed necessary, their locations and well construction details. HDR will discuss with EPA the selection criteria, proposed well locations, and well construction details, and submit it to EPA for review prior to installation of any new wells. The proposed locations and well construction details for the new monitoring wells will be discussed with EPA in a teleconference call, and the wells will be installed after EPA approval of the locations and construction details.

These wells will also be used to support the Aestus and Willowstick surface geophysical surveys. The drilling and testing phase on the fractured bedrock aquifer will proceed through the following sequence of steps to ensure that the groundwater contamination in the bedrock aquifer is adequately delineated.

1. The 9.875 inch diameter borehole for the shallow bedrock well will be drilled ten feet into competent bedrock using dual pneumatic percussion rotary or an ODEX-type casing system to reduce the chances of borehole collapse. A 6-inch diameter surface casing will be grouted into the top of bedrock to seal the remainder of the borehole off from potential hydraulic connection between the overburden and the underlying bedrock. After waiting 24-hours for the grout to harden, the bedrock will be drilled using air rotary drilling techniques and a down-hole pneumatic hammer to the target depth for the upper more productive zone wells at 80 feet bgs. The actual well depth may be adjusted based on the results from the initial hydrogeologic and geophysical surveys conducted during the investigation.
2. The 9.875 inch diameter borehole for the deep bedrock wells will be drilled to 90 feet below grade using dual pneumatic percussion rotary or an ODEX-type casing system to reduce the chances of borehole collapse. A 6-inch diameter surface casing will be grouted from land surface to the bottom of the borehole to seal the remainder of the borehole off from potential hydraulic connection between the overburden and the underlying bedrock. After waiting 24-hours for the grout to harden, the bedrock will be drilled using air rotary drilling techniques and a down-hole pneumatic hammer to the target depth for the upper more productive zone wells at 140 feet bgs. The well depths may be adjusted based on the results from the initial hydrogeologic and geophysical surveys conducted during the investigation.

3. Borehole geophysics will be completed in each newly drilled borehole to characterize the bedrock, locate bedrock fractures, and establish flow conditions. Borehole geophysical methods are discussed in Section 3.3.3.4.
4. Groundwater samples will be collected from discrete intervals of bedrock using inflatable packers. Packer groundwater sampling methods are discussed in Section 3.3. 3.6.
5. Once the borehole geophysical logging and packer groundwater sampling have been completed in the shallow borehole, a 2-inch diameter PVC well will be constructed in the borehole to prevent portions of shallow bedrock from collapsing in the borehole. The shallow well will be constructed with 10-feet of schedule 40 PVC screen (20-slot) and sufficient PVC riser to reach 3 feet above land surface. The screen will be surrounded by an appropriately sized sand pack from the bottom of the borehole to 5 feet above the top of the screen. Bentonite pellets (2-feet) will be placed on top of the sand pack to prevent the grout from penetrating the sand pack. The remainder of the borehole will be filled with neat cement grout using the tremie method. A protective locking cap will be secured to the 6-inch steel casing with a 2x2foot cement pad.
6. The deep bedrock wells will be completed as open-hole wells. A protective locking cap will be secured to the 6-inch steel casing with a 2x2 foot cement pad.

A drilling subcontractor, licensed to drilling in the USVI, will obtain any necessary permits for each borehole prior to mobilization to the Site. A HDR geologist will log the drilling and geology to note any changes in stratigraphy and degree of fracturing (particularly water bearing fractures) within the subsurface. Once the target depth is reached, the borehole will be developed using air lift development methods. The air lift method involves lowering the drill string and tooling (air hammer) into the borehole and directing compressed air into the existing water column to discharge the water, along with any residual drilling fluids, at the surface. Development will continue at each borehole until turbidity measurements for the discharged groundwater are recorded at less than 50 nephelometric turbidity units (NTU) for three consecutive measurements taken at 10 minute intervals or until development at an individual borehole has proceeded for two hours.

3.3.3.6 *Packer Groundwater Sampling*

Packer sampling will be conducted on those intervals identified as containing potentially significant water bearing fracture zones during the borehole geophysical survey. Packer sampling will assist in quantifying the yield from discrete fracture zones and analytical data derived from water quality samples collected within these discrete intervals will provide a vertical groundwater contamination profile within the bedrock aquifer. The packer testing will be completed using a straddle packer apparatus (double packers) to isolate the selected fracture/water producing zone identified during the geophysical survey. The packer apparatus will consist of two pneumatic rubber seals, separated by a 10 to 20 foot length of perforated steel pipe. The pump will be situated inside the pipe. Testing will be accomplished by inflating the Viton® coated rubber seals with compressed air (or nitrogen), isolating a fracture zone from the rest of the borehole, and pumping groundwater from between the seals before collecting a groundwater sample. Transducers may be placed above, below and within each fracture zone to be sampled to ensure isolation has been achieved. Each isolated fracture zone will be pumped at

the maximum sustainable rate for a minimum time of 15 minutes. HDR assumes that up to three discrete intervals will be tested at each well.

3.3.4 Monitoring Well Installation, Development and Testing

This activity is included in Section 3.3.3 above.

3.3.5 Subtask 3.5: Environmental Sampling

Groundwater samples will be collected from the 23 existing wells and six newly installed wells (29 bedrock monitoring wells). The groundwater samples will be collected in accordance with USEPA Region II Low Flow Sampling Protocol. Prior to sampling, the wells will be purged until water quality parameters (*e.g.*, pH, specific conductance, and temperature) have stabilized. All samples will be analyzed for the previously established CVOC list of compounds. A detailed description of well purging and groundwater sampling procedures will be provided in the QAPP.

3.3.6 Subtask: 3.6 Ecological Characterization

An ecological characterization will not be completed as part of this scope of work.

3.3.7 Subtask 3.7 Geotechnical Survey

Not Applicable

3.3.8 Subtask 3.8: Investigation Derived Waste Characterization and Disposal

HDR will properly manage and dispose of all IDW in accordance with local and Federal regulations as specified in the QAPP. IDW management services will be provided by a subcontractor.

HDR will arrange for a secure location to stage the IDW. The Waste Management procedures in the HASP will describe how the IDW generated during the field investigation will be handled and managed (staging pad, fencing, tarping, marking, inspection requirements, etc.). IDW will include the following waste streams:

1. Monitoring well development and purge water;
2. Soil cuttings;
3. Residual drilling fluids;
4. Decontamination fluids containing wash/rinse water and decontamination chemicals; and
5. Contaminated debris, including but not limited to contaminated personal protective clothing, plastic sheeting, and consumable sampling equipment.

If field screening or other information indicates that the IDW from a certain location (soil cuttings, groundwater) is likely highly contaminated, this material will be segregated from the other IDW in order to minimize the volume of IDW that will require management as hazardous. IDW determined to be hazardous will be transported by an approved, licensed transporter to an approved treatment, storage, and disposal facility for disposal. HDR will verify whether facilities to be used are currently approved by EPA Region 2. Only an approved disposal facility

will be used for disposal of hazardous IDW. HDR will review the profiles and manifests from the IDW contractor and will recommend a classification and a facility. This recommendation will then be forwarded to EPA for concurrence and approval.

Large quantities of liquid IDW are anticipated to be generated during the well drilling, development, well testing and sampling activities of this RI. The liquid IDW will be collected and stored prior to testing and off-site disposal. Based on the urban nature of the Site, it is expected that the liquid IDW will be first collected at the drilling/monitoring well locations in portable tanks, to allow sediment to settle out, and that pump or vacuum trucks will be used to either transport the liquids to large storage tanks, or directly to a disposal facility, once characterization and pre-approval have been obtained.

HDR is exploring green options for reducing and managing the IDW, including local disposal and recycling options. It may be possible to use methods that reduce or manage the volume of soil cutting and residual drilling mud to reduce the impact of their generation and disposal.

3.4 Task 4: Sample Analysis

HDR will arrange for the analysis of environmental samples collected during the previous tasks, following the FASTAC approach described in the EPA Region 2 SOP “Policy for Implementing the National Strategy for Procuring Analytical Services for all OSWER Programs (Superfund, RCRA and Brownfields) (EPA 2009).

This task includes only the cost of the sample analysis. Efforts associated with sample collection are included in Task 3, efforts associated with shipment and data validation are included in Task 5, and efforts associated with data evaluation are included in Task 6. All sample analysis will be conducted in accordance with the approved QAPP for this work assignment.

3.4.1 Subtask 4.1: Innovative Methods/Field Screening Sample Analysis

Not Applicable

3.4.2 Subtask 4.2: Analytical Services Provided via CLP, DESA or EPA-ERT

HDR will secure Routine Analytical Services (RAS) for the sample analyses available through either the EPA CLP and/or the EPA Region 2 DESA Laboratory in Edison, New Jersey in accordance with the FASTAC approach described in the EPA Region 2 SOP “Policy for Implementing the National Strategy for Procuring Analytical Services for all OSWER Programs (Superfund, RCRA and Brownfields) (EPA 2009). These analyses include target compound list (TCL) VOCs. Other analyses may be required once the scope of work for the characterization of identified potential source areas has been developed. For the investigation, the analysis of TCL VOCs in groundwater is proposed.

3.4.3 Subtask 4.3: Non-Routine Analytical Services

Not Applicable

3.5 Task 5: Analytical Support and Data Validation

HDR will arrange with EPA sample management personnel for the analysis of RAS and Non-RAS environmental samples collected during the field investigation program in accordance with the EPA SOP “Policy for Implementing the National Strategy for Procuring Analytical Services for all OSWER Programs (Superfund, RCRA and Brownfields) (EPA 2009). Analytical services will be produced utilizing the sequential decision tree provided in the SOP. Sample slots for the CLP, the EPA Region 2 DESA Laboratory and/or EPA National Non-RAS contracts will be scheduled with the EPA Regional Sample Control Center (RSCC) in Edison, New Jersey. The following subsections describe the activities HDR will perform.

HDR will ensure that all subcontracted laboratory analyses are performed in accordance with EPA methods, where available, and will submit all analytical data from subcontracted laboratories to EPA in a CLP-deliverable format.

Validation of data generated using Tier 1 and Tier 2 of the FASTAC strategy will be performed by EPA Region 2 and the EPA data validation contractor.

3.5.1 Task 5.1: Collect, Prepare and Ship Samples

During the field program, HDR will prepare and ship all samples collected for off-site analysis under Task 3 in accordance with the procedures outlined in the Site-specific QAPP and the EPA Contract Laboratory Program Guidance for Field Samplers (EPA, 2008). A summary of the field samples, and associated QA/QC samples, to be collected will be provided in the QAPP.

Arrangements will be made for sample shipment and delivery schedules with the RSCC for samples to be analyzed by CLP laboratories, the DESA Laboratory and/or the EPA National Non-RAS contract laboratory. HDR will procure and provide the containers for these samples. Containers for analyses to be conducted by HDR's subcontract laboratories, if required, will be provided by the subcontract laboratories. Arrangements for container delivery and shipment for the analysis at these laboratories will be made between HDR and the subcontractor laboratory. EPA's Scribe sample and data management software tool will be used in the field to prepare shipping documentation.

3.5.2 Task 5.2: Sample Management

HDR will provide comprehensive sample management functions, including COC procedures, information management, sample retention, and data storage, in accordance with the procedures outlined in the Site-specific QAPP, QMP, and contract.

HDR will ensure accurate chain-of-custody procedures for sample tracking, proper sample-preservation techniques, proper sample handling and the use of protective sample packing techniques for shipments to laboratories, and proper sample handling for field analysis, if required. EPA's Scribe sample and data management software tool will be used in the field to prepare shipping documentation.

Communication will be maintained with the RSCC; the EPA DESA Laboratory; and/or subcontracted laboratories regarding the scheduling, tracking, and oversight of the sample analyses, validation, and quality assurance issues. HDR will also implement an EPA-approved

laboratory quality assurance program to provide oversight of in-house and/or subcontract laboratories, as applicable.

Sampling Trip Reports (STRs), which provide information on completed analytical shipments, will be prepared for samples analyzed by the CLP, and sent to the RSCC in Edison, New Jersey. The Analytical Services Tracking System (ANSETS) form will be prepared to track use of the subcontracted laboratories, if required.

3.5.3 Task 5.3: Data Validation

Not Applicable

3.6 Task 6: Data Evaluation

Under this task, HDR will organize and evaluate existing data and data gathered during the RI field effort tasks. Data evaluation begins with the receipt of analytical data from the data acquisition task and ends with the submittal of the Data Evaluation Summary Report.

3.6.1 Subtask 6.1: Data Usability Evaluation

HDR will evaluate the usability of data obtained during the field investigation, including any uncertainties associated with the data. If statistical methods are deemed necessary to evaluate the data, the guidance used will be “Data Quality Assessment: A Reviewer’s Guide” EPA QA/G-9R EPA/240/B-06/002, February 2006. The results of the data usability evaluations will be presented in the Data Evaluation Summary Reports (Subtask 6.4/ Section 3.6.4).

3.6.2 Subtask 6.2: Data Reduction, Tabulation, and Evaluation

HDR will evaluate, interpret, and tabulate data in an appropriate presentation format for final data tables. The data to be tabulated and evaluated will include the validated data generated under this Work Assignment. The usability of the historic data will also be assessed following the criteria described in Subtask 6.1 (Section 3.6.1).

Both the historical and validated data collected as part of this Work Assignment considered to be usable and relevant to the project will be compiled and summarized in tabular format with an independent quality control criterion at each step in the process to prevent transcription and typographical errors.

The data will be entered into an Electronic Data Processor (EDP) using EQuIS 5 software, the data management/storage platform selected by HDR for the project. Electronic data deliverables (EDDs) will be provided and managed according to the *Electronic Data Deliverable (EDD) Comprehensive Specification Manual 1.4 USEPA Region 2* (EPA July 2009).

The following general guidelines will be followed in the preparation of the environmental database and the data for the RI report:

- Tables of analytical results will be organized in a logical manner such as by sample location number, sampling zone, or some other logical format. Groundwater analytical results will be separated into groups based on the hydrogeological framework such as shallow bedrock and deep bedrock. Well identification numbers within each set shall be

assigned in accordance with the alphanumeric system used for the well identification numbers. HDR will coordinate the table organization with the WAM.

- Analytical results will not be organized by laboratory identification numbers because these numbers do not correspond to those used on sample location maps. The sample location/well identification number will always be used as the primary reference for the analytical results. The sample location number will also be indicated if the laboratory sample identification number is used.
- Analytical tables will indicate the sample collection dates.
- The detection limit will be indicated in instances where a parameter was not detected.
- Analytical results will be reported in the text, tables and figures using a consistent convention such as µg/L for groundwater analyses and mg/kg for soil analyses.
- EPA's protocol for eliminating field sample analytical results based on laboratory/field blank contamination results will be clearly explained.
- Discussion of approved sampling results will not be qualified by suggesting that a particular chemical is a common lab contaminant or was detected in the lab blank. If the reported result has passed QA/QC it will be considered valid. In cases where the chemical in question was known to have been used and/or disposed of on site, positively identified at high levels in other environmental media, and passes QA/QC protocols, the sampling results will not be questioned as being due to laboratory contaminants.
- Field equipment rinsate blank analyses results will be discussed in detail if decontamination solvents are believed to have contaminated field samples.

Screening level data generated during the field investigation will be summarized and provided in an Excel format, to allow for a complete evaluation of project-related data.

Graphical soil boring logs/well construction diagrams will be prepared during the data reduction phase to describe the subsurface conditions encountered during intrusive operations. Soil interval information will be entered into the Site database for use in generating cross-section figures.

3.6.3 Subtask 6.3: Modeling Support

Per the SOW, this subtask is an optional requirement. In the event that EPA determines that performance of this subtask is necessary, a WA amendment will be issued to incorporate these requirements into this WA.

HDR will evaluate the existing data collected under the field investigation and make an assessment of the need for modeling to complete an accurate characterization of the nature, extent, distribution and movement of site contamination. This evaluation will also cover the historical distribution and movement of site contamination (forensic modeling) to help identify potential source areas, utilizing the results of the chemical fingerprinting analysis. HDR will provide a technical memorandum to the WAM summarizing the results of this evaluation and its recommendations concerning performance of modeling for this FSRI/FS. Based on its review of

this technical memorandum, EPA will determine whether modeling will be conducted for this FSRI/FS.

In order to ensure that a computer model will be representative of Site conditions, and to prevent the need to revise the computer model, the following information will be supplied to EPA for review before either model is built:

- The objective and scope of the model;
- Basic documentation for the model to be used;
- A list of assumptions to be used in generating the model;
- A list of approximate preliminary input values to be used for the model variables together with the calculations used to determine these input values;
- A rough map, showing the areal extent of the model and the major topographic features to be included;
- Cross section(s) to illustrate the hydrogeologic framework to be used in development of the method;
- The rationale for lateral and vertical boundary conditions such as “no flow” or “constant head” boundaries;
- Calibration targets for piezometric heads and mass balance;
- A description of the types of sensitivity analyses that will be considered and carried out;
- References for all sources of data and assumptions used to develop the model;
- A list of all significant groundwater sources and sinks in the vicinity of the Site that may have an impact on groundwater flow patterns and an explanation of how the model will address these factors.

In the event that EPA determines that performance of either modeling effort is necessary, HDR will discuss the details of the scope prior to proceeding with the work.

3.6.4 Subtask 6.4: Data Evaluation Summary Report (DESR)

Per the SOW, HDR will evaluate and present results in a DESR, to be submitted to the WAM for review and approval. The report will include:

- An evaluation of the historical data and identification of gaps that may be addressed as part of the RI;
- A summary of data gathered as part of the field investigation and identification of data gaps for future investigations; and,
- A presentation of findings and conclusions as to the acceptance of the data validity, areas where data exceed acceptable regulatory or guidance values, and any concerns regarding the data.

One technical memorandum will be prepared that summarizes the results of the field investigation.

3.7 Task 7: Assessment of Risk

The Risk Assessment will determine whether site contaminants pose a current potential risk to human health and the environment in the absence of any remedial action. HDR will address the contaminant identification, exposure assessment, toxicity assessment, and risk characterization. The Risk Assessment will be used to determine whether remediation is necessary at the Site, provide justification for performing remedial action, and determine what exposure pathways need to be remediated.

3.7.1 Subtask 7.1: Baseline Risk Assessment (Human Health)

As specified by EPA during the April 23, 2015 scoping meeting, HDR will perform a groundwater focused Human Health Risk Assessment (HHRA) in accordance with EPA RAGS as described in the Part D tables included in the approved PAR. The requirements for the PAR are described in Subtask 1.13 (Section 3.1.13). The HHRA will incorporate the information presented in the Draft PAR. The PAR will be commented on by the EPA, and the draft HHRA report will not be initiated before receipt of EPA's comments on the PAR, which will be incorporated into the draft HHRA.

The HHRA report will be prepared in accordance with applicable EPA guidance documents, including, for example, RAGS, the Exposure Factors Handbook (EPA, 2009), and site-specific guidance provided by EPA Region 2. The following subsections present the principal elements to be addressed in the Draft and Final HHRA reports.

Draft Groundwater Focused Human Health Risk Assessment Report

HDR will prepare a Draft HHRA Report covering the following requirements:

- **Hazard Identification.** HDR will identify and describe the Chemical of Potential Concern (COPCs) based on their presence and distribution in on-site media and their intrinsic toxicological properties.
- **Characterization of Site and Potential Exposure Pathways.** HDR will identify and characterize exposure setting and human receptor populations.
- **Exposure Assessment.** The exposure assessment will identify the magnitude of actual or potential human exposures, the frequency and duration of these exposures and routes by which receptors are exposed. In preparing the exposure assessment, HDR will develop reasonable maximum and central tendency (when appropriate) estimates of exposure for both current and potential land use conditions at the Site. The rationale for use of any site-specific, rather than default, exposure factors will be clearly explained and justified.
- **Toxicological Assessment.** HDR will list all toxicity values (e.g., slope factors and reference doses) for the COPCs and the sources of toxicity values, according to EPA's current toxicity hierarchy (OSWER Directive 9285.7-53). Those chemicals without

toxicity values in Tiers 1 and 2 will be submitted to EPA to determine the appropriate value.

- **Risk Characterization.** During risk characterization, HDR will compare chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, to measured levels of contaminant exposure and levels predicted through environmental fate and transport modeling. These comparisons will be used to estimate non-cancer hazards and cancer risks and determine whether concentrations of contaminants at or near the Site are affecting or could potentially affect human health.
- **Identification of Limitations/Uncertainties.** HDR will identify critical assumptions and uncertainties in the report (examples of uncertainties and limitations such as background concentrations, modeling inputs, toxicity data, environmental data, will be provided).
- **Conceptual Site Model (CSM).** Based on contaminant identification, exposure assessment, toxicity assessment, and risk characterization, HDR will develop a CSM.

Final Groundwater Focused Human Health Risk Assessment Report

Following a review of the comments provided by EPA Region 2 on the Draft HHRA report, any clarifications required will be discussed with the EPA Region 2 Risk Assessment staff. Following resolution of these comments, a Final HHRA incorporating final EPA comments on the Draft HHRA, will be submitted to EPA.

3.7.2 Subtask 7.2: Screening Level - Ecological Risk Assessment

As specified by EPA during the April 23, 2015 scoping meeting, HDR will not prepare an Ecological Risk Assessment.

3.8 Task 8: Treatability Study and Pilot Testing

Treatability studies and/or pilot testing will be at the discretion of the EPA. The need for additional studies has not been determined at this time.

Technologies that may be suitable for the site will be identified as early as possible to determine whether there is a need to conduct treatability studies to better estimate costs and performance capabilities. At present, it is unknown whether bench-scale testing and/or a pilot-scale study will be necessary. Should bench-scale testing and/or a pilot-scale study be determined to be necessary, HDR will submit a testing plan identifying the types and goals of the study(ies). The bench-scale testing and/or pilot-scale study shall determine the suitability of remedial technologies to site conditions and problems.

3.8.1 Subtask 8.1: Literature Search

HDR will research viable technologies which may be applicable to the contaminants of concern and the site conditions encountered. HDR will provide a technical memorandum summarizing the literature research.

3.8.2 Subtask 8.2: Treatability Study Work Plan Addendum (Optional)

Upon implementation of this requirement by EPA, HDR will prepare a draft addendum to the FSRI/FS work plan describing its approach for performance of the treatability study, participate in negotiations to discuss the final technical approach and costs required to accomplish the treatability study requirements, and prepare a final work plan addendum and supplemental budget incorporating the agreements reached during the negotiations.

The Treatability Study Work Plan addendum will describe the technology to be tested, test objectives, test equipment or systems, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety procedures, and residual waste management. The DQOs for the treatability study will also be documented. If Pilot-Scale treatability studies are to be done, the Treatability Study Work Plan will also describe pilot plant installation and startup, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed off-site, permitting requirements will be addressed. A schedule for performing the treatability study will be included with specific dates for each task and subtask, including EPA review periods. Key milestones that should have completion dates specified included, but are not limited to, the procurement of contractors and the completion of sample collection, the performance period, sample analysis, and report preparation.

The Treatability Study Work Plan will describe in detail the treatment process and how the proposed vendor or technology will meet the performance standards for the site. The Treatability Study Work Plan will address how discharge or disposal requirements for any and all treated material, air, water, and expected effluents. Additionally, the Work Plan will explain the proposed final treatment and disposal of all material generated by the proposed treatment system.

3.8.3 Subtask 8.3: Conduct Treatability Studies (Optional)

HDR will conduct the approved treatability studies in accordance with the approved treatability study work plan, developed under task 8.2 (Section 3.8.2), QAPP, and HASP, as necessary, to determine whether the remediation technology or vendor of the technology can achieve the performance standards.

3.8.4 Subtask 8.4: Treatability Study Report (Optional)

HDR will prepare and submit the Treatability Study Evaluation Report that describes the performance of the technology. The study results will clearly indicate the performance of the technology or vendor compared with the performance standards established for the site. The report will also evaluate the treatment technology's effectiveness, implementability, cost, and final results compared with the predicted results. The report will also evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

3.9 Task 9: Remedial Investigation Report

HDR will develop and deliver an RI report that accurately establishes the Site characteristics such as media contaminated, extent of contamination, contaminant migration, and the physical boundaries of the contamination. Pursuant to this objective, HDR will obtain only the minimally

essential amount of detailed data necessary to determine the key contaminant(s) movement and extent of contamination. The key contaminant(s) must be selected based on persistence and mobility in the environment and the degree of hazard. The key contaminant(s) identified in the RI will be evaluated for receptor exposure and an estimate of the key contaminant(s) level reaching human or environmental receptors will be made. HDR will use existing standards and guidelines such as drinking-water standards, water-quality criteria, and other criteria accepted by the EPA as appropriate to determine nature and extent.

The RI Report will be written in accordance with "Guidance for Conducting Remedial Investigation/Feasibility Studies under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)," OSWER Directive 9355.3-01, October 1988, Interim Final (or latest version) and "Guidance for Data Usability in Risk Assessment," (EPAI540/G-90/008), April 1992.

3.9.1 Subtask 9.1: Draft Remedial Investigation Report

HDR will submit a Draft RI Report pursuant to the RI/FS schedule presented in this Work Plan. The Draft RI Report will include the following sections:

- 1) Executive Summary
- 2) Introduction
 - a. Purpose of the Report
 - b. Site Background - HDR will summarize all available information regarding the following:
 - i. Site Description
 - ii. Site History
 - iii. Previous Investigations
 - iv. Previous Remedial Action
 - v. Report Organization
- 3) Study Area Investigation
 - a. HDR will incorporate into the RI all field activities associated with site characterization, including appropriate physical and chemical monitoring of the following:
 - i. Surface Features (e.g.; topographic mapping, natural and manmade features)
 - ii. Field Methodologies
 - iii. Contaminant Source Investigations
 - iv. Description of formation cuttings, type, sorting and drilling rates
 - v. Geological/Geophysical Investigations
 - vi. Groundwater Investigations
 - vii. Human Populations Survey (census data will be summarized for this section)

- b. HDR will include all prepared technical memoranda documenting field activities; they will be included in an appendix and summarized in this report chapter.
- 4) Physical Characteristics of the Study Area
 - a. HDR will include results of field activities conducted to determine physical characteristics, including as appropriate the following:
 - i. Geology
 - ii. Hydrogeology
 - iii. Meteorology
 - iv. Demography and Land use
- 5) Nature and Extent of Contamination – Screening values used to determine nature and extent of contamination will be agreed to by HDR and EPA before issuing a draft RI.
 - a. HDR will present the results of site characterization, both natural and chemical components and contaminants as appropriate in the groundwater:
 - i. Sources (summarized from previous investigations)
 - ii. Soils and Vadose Zone (summarized from previous investigations)
 - iii. Groundwater
 - iv. Surface Water and Sediments (summarized from previous investigations)
 - v. Air (summarized from previous investigations)
 - vi. Subsurface gases (summarized from previous investigations)
- 6) Contaminant Fate and Transport
 - a. Potential Routes of Migration (e.g., air , groundwater, soils)
 - b. Contaminant Persistence
 - i. HDR will describe the estimated persistence in the study area environment and physical, chemical, and/or biological factors of importance for the media of interest
 - c. Contaminant Migration
 - i. HDR will discuss factors affecting contaminant migration for the media of interest (e.g., sorption onto soils, solubility in water, movement of groundwater, etc.)
 - ii. HDR will discuss modeling methods and results if applicable.
- 7) Baseline Risk Assessment
 - a. Human Health Risk Assessment
 - i. Hazard Identification
 - ii. Exposure Assessment
 - iii. Toxicity Assessment

- iv. Risk Characterization/Uncertainty Discussion
- b. Environmental Evaluations
- 8) Summary and Conclusions
 - a. Summary
 - i. Nature and Extent of Contamination
 - ii. Fate and Transport
 - iii. Risk Assessment
- 9) Conclusions
 - a. Data Limitations and Recommendations for Future Work
 - b. Recommended Remedial Action Objectives
- 10) References
- 11) Tables and Figures
- 12) Appendices (i.e., log books, soil boring logs, test pit/trenching logs, monitoring well construction diagrams, private and public well records, analytical data, and QA/QC evaluation results).

3.9.2 Subtask 9.2: Final Remedial Investigation Report

After EPA review of the Draft RI Report, HDR will incorporate final EPA comments and submit the Final RI Report.

3.10 Task 10: Remedial Alternatives Screening

This task includes work efforts to develop appropriate remedial alternatives to undergo full evaluation. The alternatives will encompass a range including innovative treatment technologies consistent with the regulations outlined in the NCP, 40 CFR Part 300, and the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (OSWER Directive 9355.3-01) and other OSWER Directives, including 9355.4-03, October 18, 1989, and 9283.1-06, May 27, 1992, "Considerations in Groundwater Remediation at Superfund Sites", or more recent guidance, policies or procedures.

HDR will investigate only those hazardous waste management alternatives that will remediate or control groundwater remaining at the Site, as deemed necessary in the RI, to provide adequate protection of human health and the environment. The potential alternatives will encompass, as appropriate, 1) a range of alternatives in which treatment is used to reduce the toxicity, mobility and/or volume of wastes but vary in the degree to which long-term management of residuals or untreated waste is required, 2) one or more alternatives involving containment with little or no treatment, and 3) a no-action alternative. The current remedial technology utilized by the municipal water department will be included in any evaluation of remedial alternatives for the Site.

The screening will note the degree to which alternatives may offer opportunities for green or sustainable remediation, consistent with EPA's August 2009 policy and EPA Region 2's current guidance.

3.10.1 Subtask 10.1: Draft Remedial Alternatives Screening Technical Memorandum

HDR will prepare a draft Technical Memorandum presenting the potential remedial alternatives and including the following information:

- Establish Remedial Action Objectives (RAOs). Based on existing information, HDR will identify site-specific RAOs which will be developed to protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).
- Establish General Response Actions (GRAs). HDR will develop GRAs for each medium of interest by defining containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the RAOs as well as the chemical and physical characteristics of the Site.
- Identify & Screen Applicable Remedial Technologies. HDR will identify and screen technologies based on the developed GRAs. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other Site characteristics will be considered. This screening will be based primarily on a technology's ability to effectively address the contaminants at the Site, but will also take into account a technology's implementability and cost. HDR will select representative process options, as appropriate, to carry forward into alternative development. HDR will identify the need for treatability testing for those technologies that are probable candidates for consideration during the detailed analysis.
- Develop Remedial Alternatives. HDR will develop media-specific, or Site-wide remedial alternatives, as appropriate, in accordance with the NCP.
- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost. HDR will screen alternatives to identify the potential technologies or process options that will be combined into media-specific alternatives. The developed alternatives will be defined with respect to size and configuration of the representative process options; time for remediation; rates of flow or treatment; spatial requirements; distances for disposal; and required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct, viable options are available and developed, HDR will screen the alternatives that undergo the detailed analysis to provide the most promising process options. The alternatives will be screened on a general basis with respect to their effectiveness, implementability and cost.

3.10.2 Subtask 10.2: Final Remedial Alternatives Screening Technical Memorandum

After the EPA's review of the Draft Technical Memorandum, HDR will incorporate EPA comments and submit the Final Technical Memorandum.

3.11 Task 11: Remedial Alternatives Evaluation

This task includes efforts associated with the assessment of individual alternatives against each of the nine current evaluation criteria and a comparative analysis of all options against the evaluation criteria. EPA will make the determination regarding the final selection of remedial alternatives.

The nine evaluation criteria HDR will employ in the evaluation of the remedial alternatives are:

- Overall protection of human health and the environment;
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility or volume through treatment;
- Short-term effectiveness;
- Implementability – technical and administrative;
- Cost;
- State acceptance; and
- Community acceptance.

3.11.1 Subtask 11.1: Draft Remedial Alternatives Evaluation Technical Memorandum

HDR will prepare a Draft Technical Memorandum which addresses the following:

- 1) a technical description of each alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and
- 2) a discussion that profiles the performance of each alternative with respect to each of the evaluation criteria.

HDR will provide a table summarizing the results of this analysis. Once the individual analysis is complete, the alternatives will be compared and contrasted to one another with respect to each of the evaluation criteria listed above.

3.11.2 Subtask 11.2: Final Remedial Alternatives Evaluation Technical Memorandum

After the EPA's review of the Draft Technical Memorandum, HDR will incorporate EPA comments and submit the Final Technical Memorandum.

3.12 Task 12: Feasibility Study Report

HDR will develop an FS Report consisting of a detailed analysis of alternatives and cost-effectiveness analysis in accordance with NCP 300.430(e) or the most recent guidance.

3.12.1 Subtask 12.1: Draft Feasibility Study Report

HDR will prepare a Draft FS report and submit it for EPA review according to the schedule in the RI/FS work plan. To expedite the development of the FS report, HDR will maintain close contact with the EPA WAM and provide draft chapters of the FS report for review as they are developed.

The FS Report will contain the following:

- Feasibility Study Objectives
- Remedial Objectives
- General Response Actions
- Identification and Screening of Remedial Technologies
- Remedial Alternatives Description
- Detailed Analysis of Remedial Alternatives.
 - HDR's technical feasibility considerations will include the careful study of any problems that may prevent a remedial alternative from mitigating site problems. Therefore, the Site characteristics from the RI will be kept in mind as technical feasibility of an alternative is studied. Specific items to be addressed will include the reliability (operation over time), safety, operation and maintenance, ease with which the alternative can be implemented, and time needed for implementation.
- Summary and Conclusions

3.12.2 Subtask 12.2: Final Feasibility Study Report

After EPA review of the Draft FS Report, HDR will incorporate EPA comments and submit the Final FS Report.

3.13 Task 13: Post FSRI/FS Support

HDR will provide technical support required for the preparation of the ROD for the Site, excluding those activities already addressed under Subtask 2.2 (Community Relations Plan) of this work assignment.

3.14 Task 14: Work Assignment Closeout

Upon notification from EPA that all technical work performed under this Work Assignment is complete; HDR will perform the necessary activities to close out this work assignment in accordance with contract requirements. After work assignment close out activities have been completed, HDR will retain the work assignment files in accordance with contract clause H.36 – Retention and Availability of Contractor Files.

3.14.1 Subtask 14.1: Revised Work Plan Budget

As part of work assignment closeout, HDR will provide a revised work plan budget with the actual costs incurred and an estimate to complete the closeout activities. The revised work plan budget shall be submitted to EPA within 30 days of closeout direction

3.14.2 Subtask 14.2: Document Indexing

At the conclusion of his work assignment, HDR will organize the Work Assignment files in its possession in accordance with the current approved EPA file index structure (e.g., Administrative Record Index, EPA Superfund Site File Index, and/or RAC 2 Guidelines for Closeout of Work Assignment, 15 August 2000), and provide an index to the EPA Project Officer (PO). A file review will be performed to ensure that all file elements are present and are in order, and that any duplicate or draft technical report copies are removed from the project file. At a minimum, the index will contain the following information:

- Project Name and Work Assignment Number (in a heading on top of the list)
- Document Date (The documents indexed will be sorted chronologically by date, beginning to end), description / subject of document, who sent the document and who received the document.

The documents to be indexed include, but will not be limited to, all final deliverables, work assignment amendments, and working files that may need to be accessed to provide information on why certain technical decisions were made.

3.14.3 Subtask 14.3: Document Retention/Conversion

Following document indexing, all relevant paper files and major deliverables will be converted into an appropriate electronic long-term storage format (Word, Excel, and/or PDF, as applicable), and one copy will be submitted to the EPA WAM and one copy to the EPA Records Manager, pursuant to the requirements of Clause D.1, “Electronic Submission of Deliverables.”

HDR will retain a copy of converted files in the same electronic long-term storage format submitted to the EPA.

SECTION 4 - PROJECT MANAGEMENT APPROACH

4.1 Project Organization

The project organizational structure is provided in Figure 9.

4.2 Key Personnel

Bradley Williams is the Program Manager for the EPA Region 2 RAC under which the Tutu Groundwater Superfund Site FSRI/FS will be conducted.

The Project Manager is Demetrios Klerides. The Project Manager is responsible for the development of the Work Plan; acquisition of scientific, engineering, or additional specialized technical support; and other aspects of the day-to-day activities associated with the project. The Project Manager identifies staff requirements, directs and monitors progress, ensures implementation of quality procedures and adherence to applicable codes and regulations, and is responsible for performance within the established budget and schedule.

Project team members include project task leads and key technical personnel from various technical disciplines. They are: Edward Schwetz, Remedial Investigation Task Leader, Christoph Stannik for field activities; Vincent Carbone, Dan St. Germain, and Mike Lehtinen for geology and modeling/hydrogeology; Carol Zurlo for environmental chemistry; Michael Musso, P.E., for human health risk assessment; Shannon Kling, P.E., for the feasibility study; Melissa LaMacchia for community relations and cultural resources; James Woolcott, CIH, for health and safety; Melissa LaMacchia, for quality assurance and project quality control. Technical discipline leads will oversee activities related to their expertise and provide their input, as needed, to the Project Manager.

4.3 Project Schedule

A project scoping meeting was held on April 23, 2015. Table 2 lists the major project deliverables. Figure 10 is the overall baseline project schedule.

4.4 Cost Estimate

The estimated cost and level of effort (LOE) hours and assumptions for completing the scope of work described in this Work Plan are included in the Work Plan Cost Estimate, which has been submitted under a separate cover as Volume 2.

SECTION 5 - REFERENCES

CDM 2001. CDM Federal Programs Corporation. Final Pre-Design Report, Tutu Wells (Soil and Groundwater) Site, St. Thomas, U.S. Virgin Islands, Work Assignment Nos. 008-RDRD-021D and 009-RDRD-021D. Prepared for EPA. February 1, 2001.

CDM 2004. CDM Federal Programs Corporation. Final Interim Remedial Action Report, Curriculum Center Soil and Site Wide Groundwater, Tutu Wellfield Site, St. Thomas, U.S. Virgin Islands, Work Assignment No. 152-RARA-021D. Prepared for EPA. September 27, 2004.

CDM Smith 2013. April 2013 Annual Remedial Action Progress Report, Tutu Wells (Soil and Groundwater) Site, St. Thomas, U.S. Virgin Islands, Work Assignment No. 003-RALR-021D. Prepared for EPA. August 16, 2013.

EPA, 1988. Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. October 1988, OSWER Directive 9335.3-01.

EPA, 1989. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part A). EPA/540/1-89/002. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. December 1989.

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EPA, 1991b. Information Resources Management Policy Manual, Chapter 13 – Locational Data. April 8, 1991.

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EPA, 2002a. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, Groundwater Forum Issue Paper, OSWER, EPA/542-S-02-001, May 2002.

EPA, 2002b. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). EPA 530-D-02-004. November 2002.

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EPA, 2005a. Ecological Soil Screening Level (Eco-SSLs). March 2005.

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EPA, 2006. Data Quality Assessment: A Reviewer's Guide" EPA QA/G-9R EPA/240/B-06/002, February 2006.

EPA, 2007, Guidance for Preparing Standard Operating Procedures (SOPs). USEPA, Office of Environmental Information, EPA/600-B-07-001, April 2007.

EPA 2008a. Contract Laboratory Program Guidance for Field Samplers. USEPA, Office of Superfund Remediation and Technology Innovation. EPA/540-R-07-06. July 2008.

EPA, 2008b. A Guide for Assessing Biodegradation and Source Identification of Organic Groundwater Contaminants using Compound Specific Isotope Analysis (CSIA). Office of Research and development, National Risk Management Laboratory, EPA/600-R-08/148, December 2008.

EPA, 2009a. Region 2 Policy for Implementing the National Strategy for Procuring Analytical Services for all OSWER Programs (Superfund, RCRA, and Brownfields), Standard Operating Procedure. SOP HW-32, Revision 7. August 2009.

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EPA, 2009d. User's Guide and Background Technical Document for USEPA Region 9's Preliminary Remediation Goals (PRG) Table.

EPA, 2009e. Integrated Risk Information System, Online.

EPA, 2009f. Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. April 2009.

TABLES

Table 1: Preliminary List of Wells
Focused Source RI/FS
Tutu Wells Groundwater Superfund Site, St. Thomas, U.S. Virgin Islands

Wells for Downhole Geophysics						
Well ID	Well Diameter	Intake zone	Screen Elevation (ft amsl)	Screen Interval (ft bgs)	Geophysics Parameters	Rationale
MW-15	6 inch	Open hole	163.95 to 142.75	15 to 36.2	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Geologic Interpretation, side gradient, connectivity, fracture identification
MW-1D	6 inch	Open hole	195.14 to 105.14	70 to 90	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Proximity to centerline, concentration in GW, fracture identification, analysis for future cross hole testing
RD-5	4 inch	PVC	156.91 to 146.91	33 to 43	Conductivity, heat pulse, SP	Fracture identification of shallow contaminant migration,
VIHA -1	4 inch	Open hole	193.16 to 59.16	41 to 175	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Upgradient, Fracture ID, potential for willowstick, potential for cross hole pump testing
MW-4D	6 inch	Open hole	128.29 to 104.99	47.7 to 71	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Paired well control point, Potential willowstick
IW-1S	4 inch	Open hole	162.85 to 146.23	40 to 56.62	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Shallow , near source and fracture ID, potential willowstick.
RW-6	6 inch	Open hole	122.17 to 72.17	80 to 130	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Proximity to source area, fracture identification, analysis for future cross hole testing
IW-1	6 inch	Open hole	127.79 to 107.69	75 to 95.1	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Pair with IW-1s, determination of potential vertical migration routes, geologic interpretation
BP-3	4 inch	Open hole	162.71 to 143.03	39.8 to 59.08	Caliper, Conductivity, heat pulse, SP, Video and Acoustic Televiwer	Vertical movement, geologic interpretation.

Please note many wells were excluded from downhole analysis due to their construction with stainless steel prohibiting the use of several electrical methods.

Legend:

ft- feet

amsl - above mean sea level

bgs- below grade surface

Table 2: Summary of Major Submittals
Focused Source RI/FS
Tutu Wells Groundwater Superfund Site, St. Thomas, U.S. Virgin Islands

SUBTASK / DELIVERABLE	NUMBER OF COPIES	DUE DATE
1.2 Scoping Meeting Minutes	2**	5 days after scoping meeting
1.4 Draft FSRI/FS Work Plan and Draft Budget	2**	45 days after scoping meeting
1.5 Final FSRI/FS Work Plan and Budget	3**	15 days after conclusion of negotiations
1.7 Draft Quality Assurance Project Plan (QAPP)	0*	30 days after work plan approval
1.7 Final QAPP	1	15 days after receipt of EPA review comments on draft QAPP
1.8 Draft Health and Safety Plan (HASP)	0*	30 days after work plan approval; to be submitted with draft QAPP
1.8 Final HASP	1	15 days after receipt of EPA review comments on draft HASP; to be submitted with final QAPP
1.10 Meeting Minutes	1	5 days after each meeting
1.13 Pathways Analysis Report (PAR)	2*	21 days after submission of Data Evaluation Report, under task 6.4
2.2 Draft Community Relations Plan (CRP)	0*	30 days after receipt of direction from EPA
2.2 Final Community Relations Plan	1	14 days after final comments from EPA on draft CRP
2.3 Public Meeting Transcript	1	14 days after the Proposed Plan public meeting
2.4 Fact Sheets	1	10 days prior to each public meeting
2.6 Public Notices	1	One for each Public meeting, three weeks before the respective public meeting
2.8 Site Mailing List	0*	Four weeks prior to the first Public meeting
2.9 Responsiveness Summary Support	1	21 days after public meeting
5.3 Data Validation Report	1	30 days after receipt of all analytical results from laboratory
6.4 Data Evaluation Report	1	30 days after completion of subtask 6.2
7.1 Draft Baseline Human Health Risk Assessment (HHRA) Report	0*	30 days after approval of PAR
7.1 Final Baseline HHRA Report	1	14 days after receipt of EPA review comments on Draft HHRA

Table 2: Summary of Major Submittals
Focused Source RI/FS
Tutu Wells Groundwater Superfund Site, St. Thomas, U.S. Virgin Islands

SUBTASK / DELIVERABLE	NUMBER OF COPIES	DUE DATE
7.2 Draft Screening Level Ecological Risk Assessment (SLERA) Report	0*	TBD as finalized in approved work plan performance schedule
7.2 Final SLERA Report	1	14 days after receipt of EPA review comments on Draft SLERA
8.1 Treatability Literature Search Technical Memorandum	1	TBD as finalized in approved work plan performance schedule
9.1 Draft RI Report	0*	90 days after completion of field investigation
9.2 Final RI Report	1	30 days after receipt of EPA review comments on Draft RI report
10.1 Draft Remedial Alternatives Screening Technical Memorandum	0*	60 days after EPA approval of Final RI Report
11.1 Draft Remedial Alternatives Evaluation Technical Memorandum	0*	80 days after EPA approval of Final RI Report
12.1 Draft FS Report	0*	30 days after receipt of EPA review comments on technical memoranda.
12.2 Final FS Report	1	30 days after receipt of EPA review comments on draft FS report
14.1 Revised Work Plan Budget	2**	30 Days after receipt of closeout direction
14.2 Document Retention/Conversion	2*	Within 45 days after EPA notification of WA completion

-All deliverable copies will be submitted to the WAM unless otherwise directed by EPA. An electronic copy of all documents will be submitted to EPA.

0* -where indicated, only an electronic copy shall be sent to the WAM

** One copy of the deliverable will be submitted to the PO and CO; the remainder will be submitted to the WAM.

FIGURES



0 500 ft
SCALE
(1 in. = 500 ft)

Figure 1
Site Location Map

Tutu Wellfield Site, St. Thomas, USVI



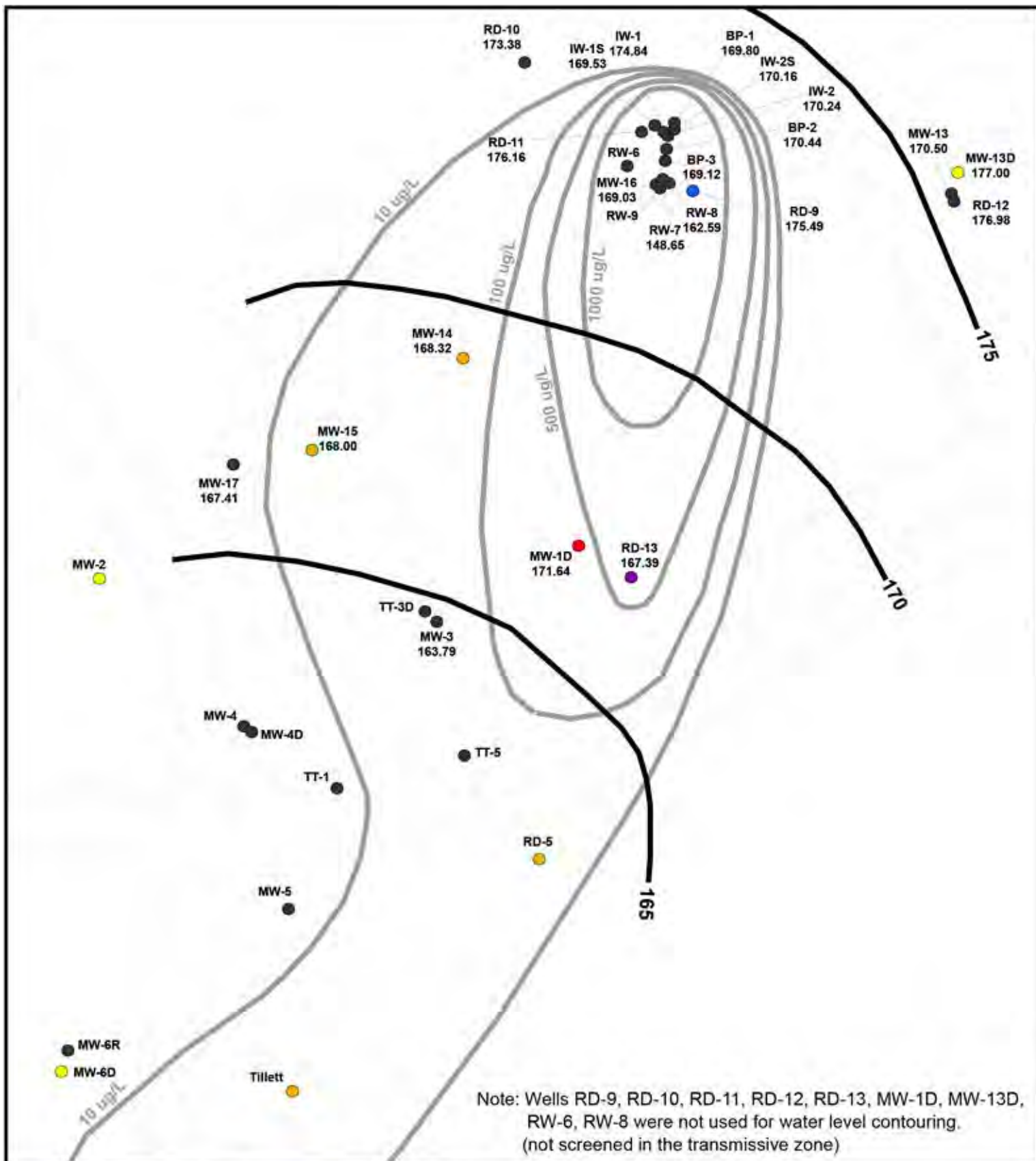
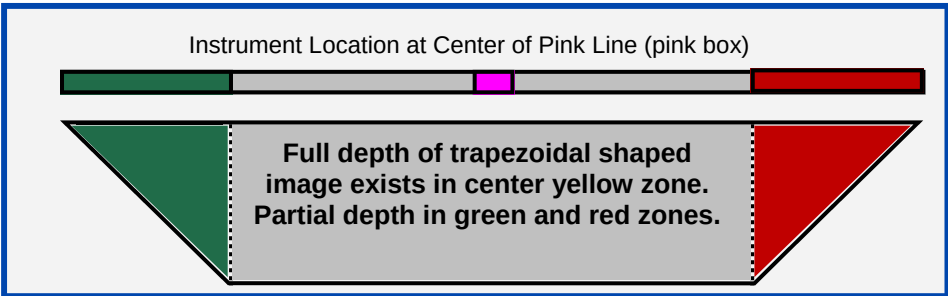
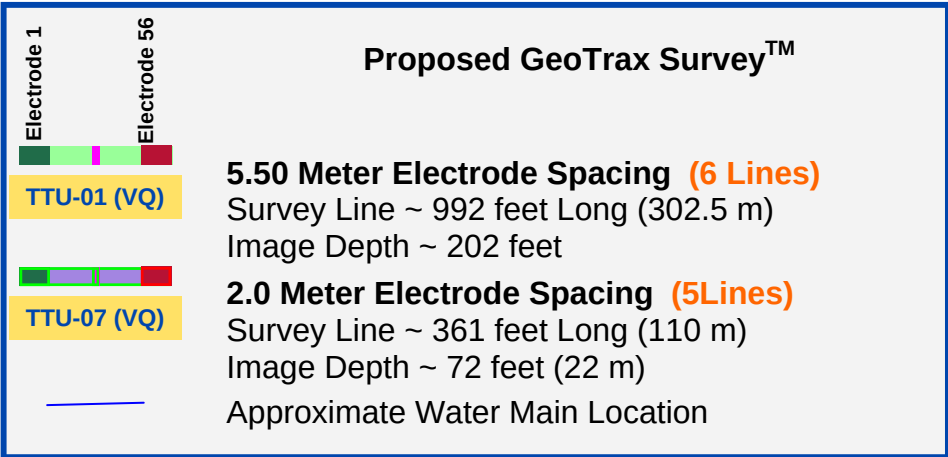
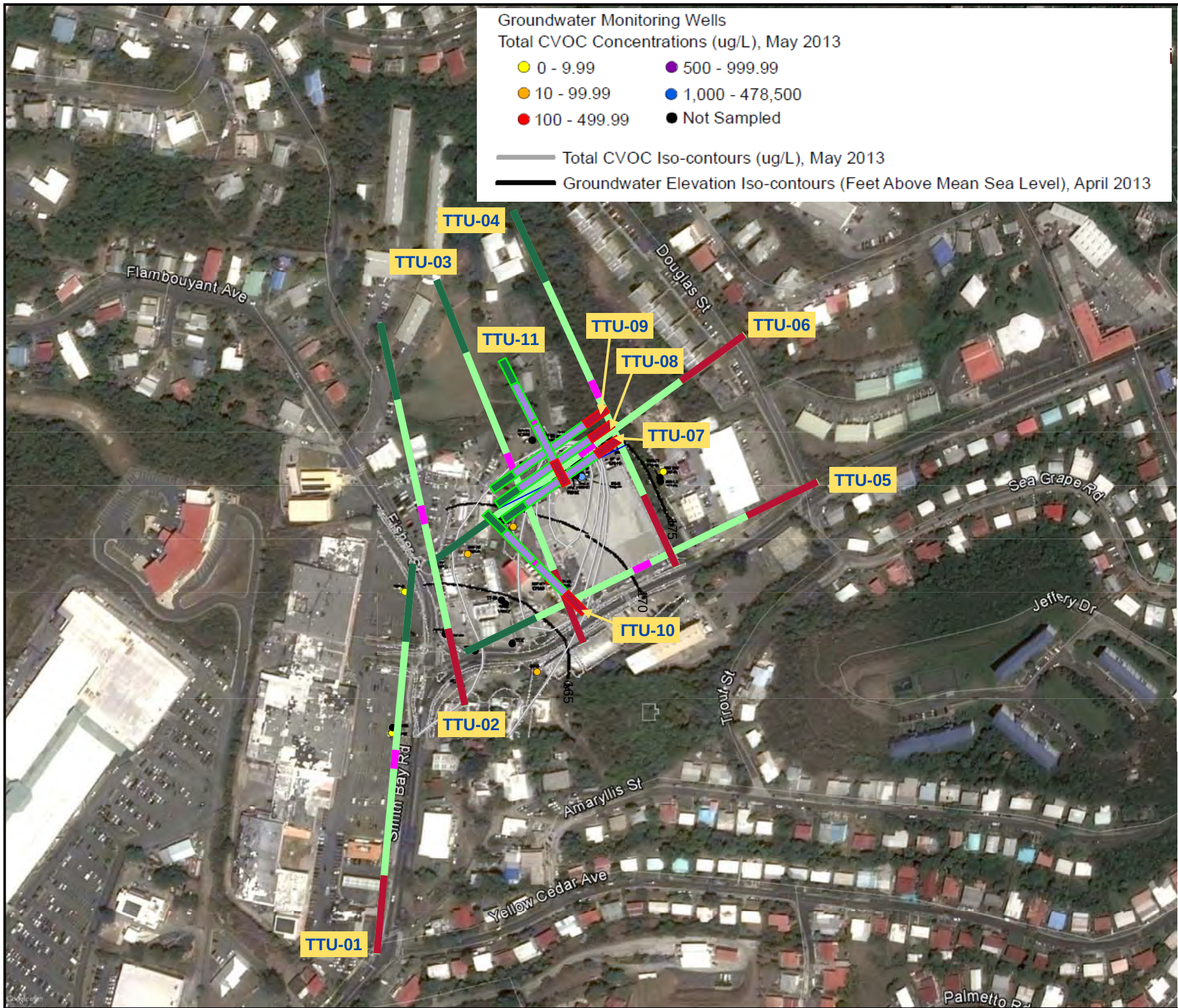


Figure 3
Curriculum Center Site Map

Tutu Wellfield Site, St. Thomas, USVI

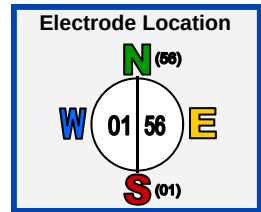
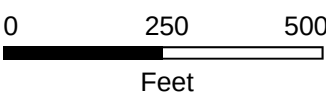




Total Number of GeoTrax Survey™ Lines = 11
SITE MAGNETIC DECLINATION = 14° W

NOTE:

1. Number of survey lines performed and final GeoTrax Survey™ alignments and lengths to be determined in field by Aestus in consultation with client; survey locations/lengths may need to be adjusted based on obstacles/restrictions at site and or draft subsurface images obtained at the site.



Reference: Aerial ©2013 Google, CNES / Astrium (Licensed Google Earth Pro Image)

Source: Aestus, LLC

Figure 5
Aestus Survey Transects
Tutu Wellfield Site, St. Thomas, USVI



Vertical Dipole Cross-Sectional View

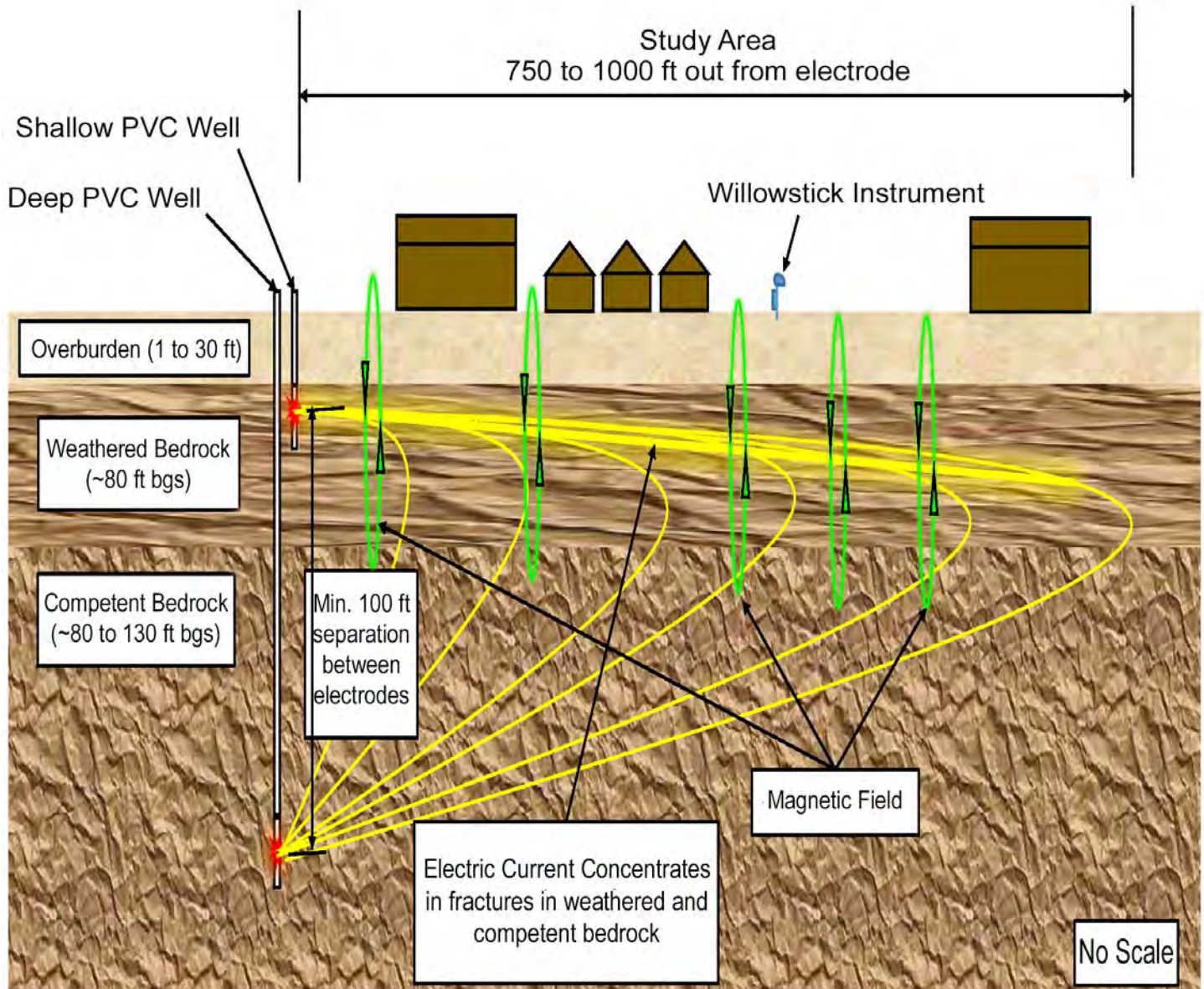


Figure 6
Willowstick Dipole Configuration

Tutu Wellfield Site, St. Thomas, USVI



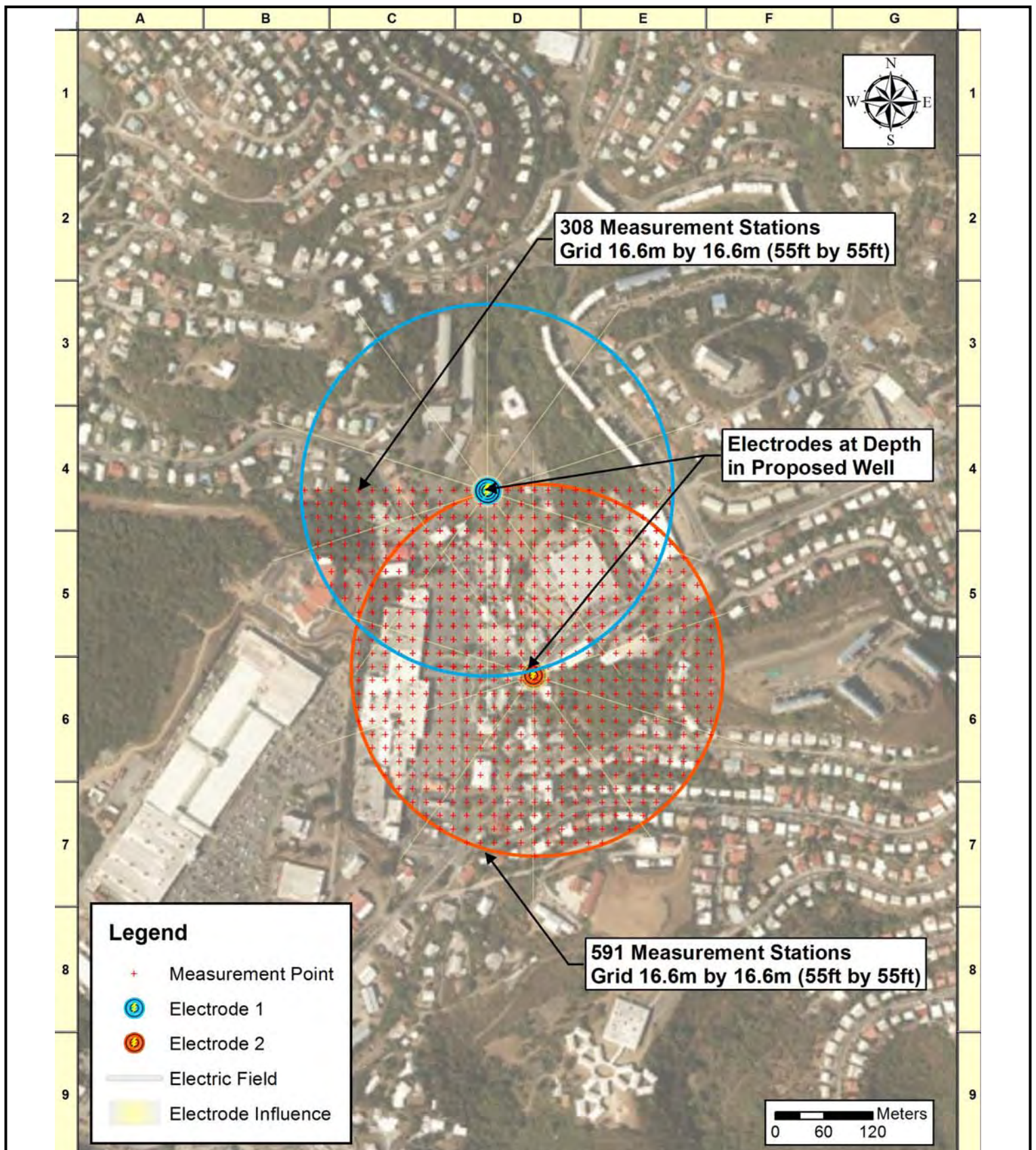
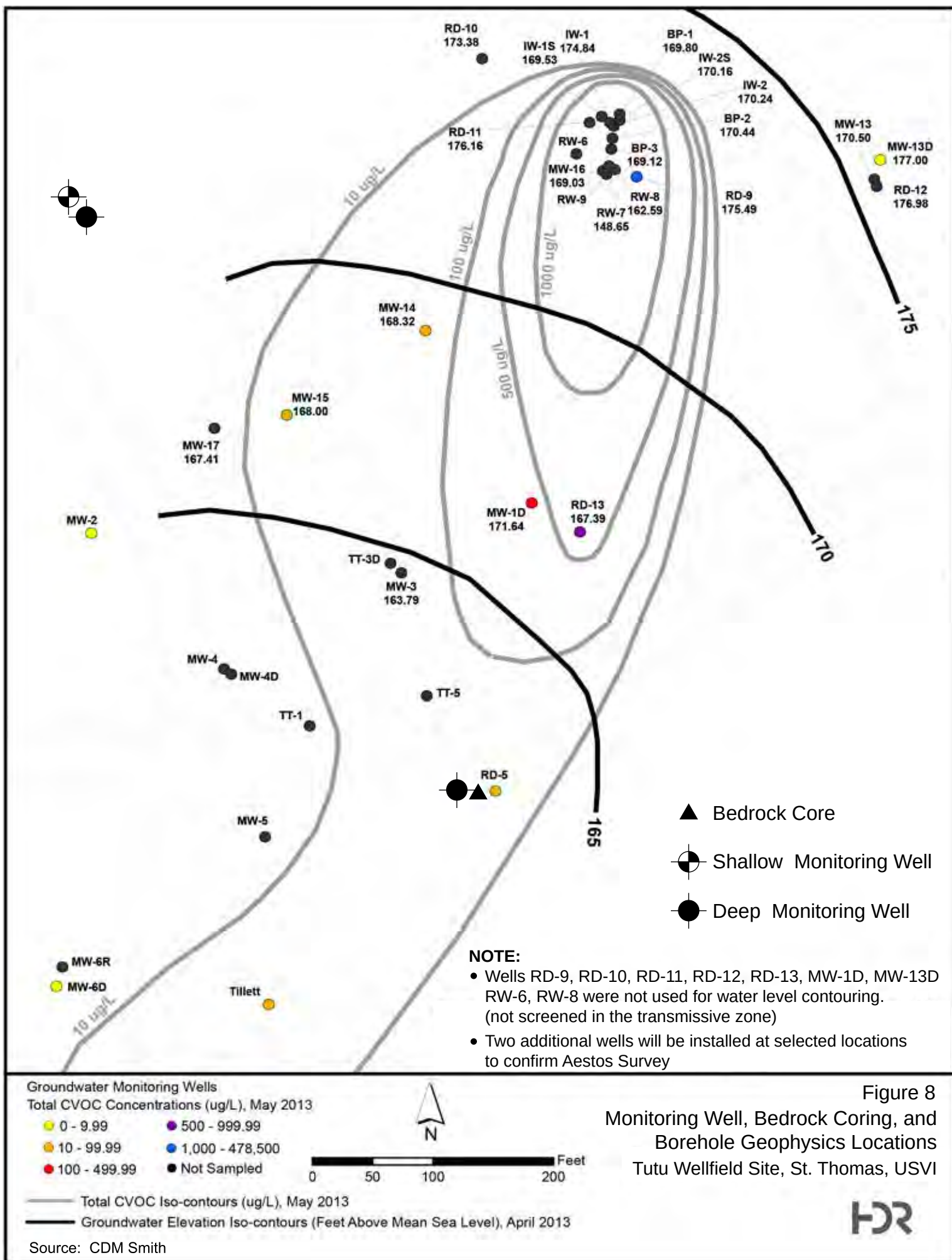


Figure 7
Willowstick Grid Pattern

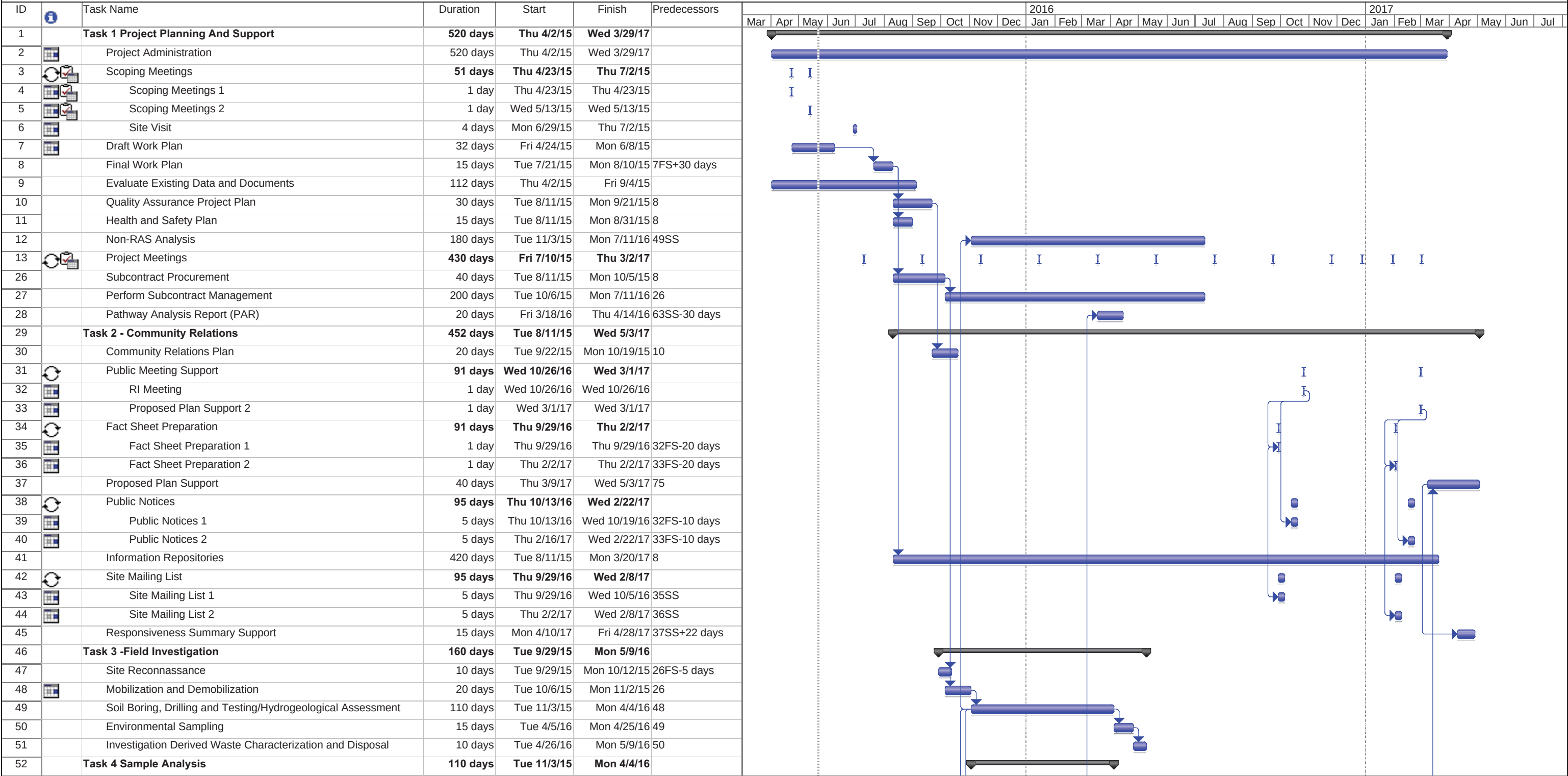
Tutu Wellfield Site, St. Thomas, USVI







WA # 031-RICO-021D
Tutu Wells Site Focused RI/FS
St. Thomas, USVI
Project Schedule



Tutu Initial Project Schedule.mpp
Date: Fri 5/22/15

Task

Split

Progress
 Milestone

Summary

Project Summary

External Tasks
 External Milestone

Deadline

Figure10

WA # 031-RICO-021D
Tutu Wells Site Focused RI/FS
St. Thomas, USVI
Project Schedule

