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Final

Post-Removal Supplemental Confirmatory Sampling and Analysis Plan Solid Waste Management Unit (SWMU) 6

Former Naval Ammunition Support Detachment Vieques, Puerto Rico

Prepared for

Department of the Navy

NAVFAC ATLANTIC

Contract No.
N62470-08-D-1000
CTO-111

December 2010

Prepared by

CH2MHILL®

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Final

Post-Removal Supplemental Confirmatory Sampling and Analysis Plan

SWMU 6

Former Naval Ammunition Support Detachment Vieques, Puerto Rico

Contract Task Order 111

December 2010

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL

Virginia Beach, Virginia

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Acronyms and Abbreviations

AHA	activity hazard analysis
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Standards and Materials
AVS/SEM	acid volatile sulfide/simultaneously extractable metals
CA	corrective action
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	contract laboratory program
COC	chain of custody
COD	coefficient of determination
CSM	Conceptual Site Model
CTO	Contract Task Order
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DoD	U.S. Department of Defense
DOI	Department of the Interior
DQO	Data Quality Objectives
°C	degrees Celsius
DQE	data quality evaluation
DQI	data quality indicator
EBS	Environmental Baseline Survey
EIS	Environmental Information Specialist
EQB	Environmental Quality Board
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
FID	Flame Ionization Detector
FTL	Field Team Leader
GC	gas chromatograph
GW	Groundwater
H&S	Health & Safety
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HHRA	Human Health Risk Assessment
ICAL	Initial Calibration
ICP	inductively coupled plasma
ICV	Second Source Calibration Verification
IDL	Instrument Detection Limit

IDW	investigation-derived waste
IR	Navy Installation Restoration
IS	Internal Standards
LCS	laboratory control sample
LCL	lower confidence level
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management Systems
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MACTEC	MACTEC Inc.
MEC	munitions and explosives of concern
MDL	method detection limit
mg/kg	milligrams per kilogram
ml	milliliter(s)
mm	millimeter(s)
MOV	Municipality of Vieques
MPC	Measurement Performance Criteria
MSA	method of standard additions
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
MTBE	methyl tert butyl ether
MW	monitoring well
N/A	not applicable
NaOH	sodium hydroxide
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NIRIS	Navy Installation Restoration Information System
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ORP	oxidation-reduction potential
OU	operable unit
OVM	organic vapor monitor
PA/SI	Preliminary Assessment/Site Investigation
PAH	polycyclic aromatic hydrocarbons
PAL	project action limit
PCB	polychlorinated biphenyl
PDF	portable document format
PDS	post-digestion spike
PEST/PCB	pesticides/polychlorinated biphenyls
PID	photoionization detector
PM	Project Manager
POC	Point of Contact
PREQB	Puerto Rico Environmental Quality Board

QA	quality assurance
QAMS	Quality Assurance Management Section
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RAB	Restoration Advisory Board
RAGs	Risk Assessment Guidance for Superfund
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
RPM	Remedial Project Manager
RRT	relative retention times
RSD	relative standard deviation
RSL	Regional Screening Level
RT	retention time
SAP	Sampling and Analysis Plan
SNEDD	Supplemental Naval Installation Restoration Information Solution Electronic Data Deliverable
SOP	standard operating procedure
SSC	Site Safety Coordinator
SSC-HW	Site Safety Coordinator Hazardous Waste
SVOA	semivolatile organic analytes
SVOC	semivolatile organic compounds
SW	surface water
SWO	Safe Work Observation
TAT	turnaround time
TCLP	Toxicity Characteristic Leaching Procedure
TBD	to be determined
TOC	Total organic carbon
U.S.	United States
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTL	upper tolerance level
VOA	volatile organic analytes
VOC	volatile organic compound
WCHEM	wet chemistry

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Executive Summary

This Sampling and Analysis Plan (SAP) is prepared to support the supplemental post-removal confirmatory sampling at Solid Waste Management Unit (SWMU) 6, located at the former Naval Ammunition Support Detachment (NASD) in the western portion of Vieques, Puerto Rico. This SAP includes 37 worksheets that detail various aspects of the supplemental confirmatory sampling and serves as a guideline for the field activities and data assessment. This SAP was developed in general accordance with two guidance documents: 1) U.S. Environmental Protection Agency (USEPA), *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (USEPA, 2002), and 2) Intergovernmental Data Quality Task Force (IDQTF), *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) (IDQTF, 2005).

This SAP was prepared under the United States Navy (Navy) Comprehensive Long-Term Environmental Action (CLEAN) Contract N62470-08-D-1000, Contract Task Order 0111, for submittal to the Naval Facilities Engineering Command (NAVFAC) Atlantic Division, USEPA Region 2, the Commonwealth of Puerto Rico Environmental Quality Board (EQB), and the United States Fish and Wildlife Service (USFWS). The Navy, USEPA, EQB, and USFWS work jointly as the former NASD Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Environmental Restoration Program (ERP) Technical Subcommittee.

In 2009, a removal action was conducted at SWMU 6 to remove waste debris and impacted soil, followed by confirmation sampling and site restoration activities (Shaw Environmental and Infrastructure, Inc. [Shaw], 2010). However, as a result of the debris and soil excavation, the environmental setting changed from a predominantly terrestrial habitat to a shallow, open water lagoon, which is hydraulically connected to and tidally influenced with the adjacent Laguna Kiani complex. The site now supports a relatively diverse community of marine fish and invertebrates, along with foraging wildlife such as wading birds.

Following the removal action at SWMU 6, confirmatory sampling to support a post-removal risk assessment was conducted to ensure that potential risks to human health and the environment had been adequately addressed. However, the site was significantly altered during removal activities, and resulting environmental conditions and exposure pathways to human and ecological receptors changed compared to those assumed in the removal action work plan (Shaw, 2007). In addition, there was some uncertainty regarding the quality and usability of the surface soil and sediment volatile organic compound (VOC) data collected during the confirmation sampling. Based on the above information, supplemental confirmatory sampling based on the newly created environmental setting is warranted to help generate an appropriate dataset for the post-removal risk assessment. Therefore, the objectives of the post-removal supplemental confirmatory sampling event are to perform limited additional soil removal adjacent to Route 200, sufficiently characterize the post-removal conditions in all SWMU 6 media (i.e., soil, sediment, and surface water), and determine if there are current and/or potential future unacceptable risks to receptors (human and ecological) that will require additional investigation, remedial/removal action, or management.

The SWMU 6 post-removal supplemental confirmatory sampling event will include the collection of 7 surface water and 13 sediment (or surface soil in areas where open water is not present) samples. In addition, 10 co-located background surface water and sediment samples will be collected from nearby lagoons: 3 from Laguna Kiani, 3 from Laguna El Pobre, and 4 from Laguna

Punta Arenas adjacent to Highway 200 to the west of SWMU 6. Qualitative biological surveys of fish and invertebrates will be conducted within SWMU 6 and the background lagoons to support the assessment of ecological conditions.

This SAP will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for the intended use (i.e., post-removal human health and ecological risk assessments. The laboratory information cited in this SAP is for Mitkem Laboratories Inc. of Warwick, Rhode Island, which will provide analytical services for this investigation.

Resumen Ejecutivo

Este Plan de Muestreo y Análisis (SAP, por sus siglas en inglés) se ha preparado para apoyar el muestreo confirmatorio suplementario posterior a la remoción que se llevó a cabo en la Unidad de Manejo de Desperdicios Sólidos (SWMU, por sus siglas en inglés) 6, que está localizado en el Antiguo Destacamento Naval de Apoyo de Municiones (NASD, por sus siglas en inglés) en la porción oeste de Vieques, Puerto Rico. Este SAP incluye 37 hojas de trabajo que detallan los varios aspectos del muestreo confirmatorio suplementario a la vez que sirven de guía para las actividades de campo y la evaluación de datos. Este SAP se desarrolló siguiendo en general la guía de dos documentos: 1) Agencia de Protección Ambiental de los EEUU (USEPA), *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (USEPA, 2002), y 2) Intergubernamental Data Quality Task Force (IDQTF), *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) (IDQTF, 2005).

Este SAP se preparó bajo el Contrato Naval de Acción Ambiental Abarcadora a Largo Plazo (CLEAN, por sus siglas en ingles) de la Marina de los Estados Unidos, Contrato Número N62470-08-D-1000, Orden de Trabajo del Contrato 0111, para entregarse a las Facilidades Navales del Comando de Ingeniería (NAVFAC, por sus siglas en inglés) División del Atlántico, USEPA Región 2, la Junta de Calidad Ambiental del Estado Libre Asociado de Puerto Rico (JCA), y el Servicio Nacional de Pesca y Vida Silvestre de los Estados Unidos (USFWS, por sus siglas en inglés). La Marina, USEPA, la JCA, y USFWS trabajan en conjunto dentro del Subcomité Técnico de NASD para el Programa de Restauración Ambiental (ERP, por sus siglas en inglés) de la Ley de Respuesta, Responsabilidad y Compensación Ambiental (CERCLA, por sus siglas en inglés).

En el año 2009, se llevó a cabo una acción de remoción en SWMU 6 para remover desperdicios como escombros y suelos impactados, seguida por un muestreo confirmatorio y actividades de restauración del sitio (Shaw Environmental and Infrastructure, Inc. [Shaw], 2010). Sin embargo, como resultado de la excavación de suelos y de los escombros, la topografía ambiental cambió de un hábitat predominantemente terrestre, a una laguna poco profunda con salida al mar, la cual está conectada hidráulicamente e influenciada por la marea con el complejo adyacente de la Laguna Kiani. En la actualidad el sitio alberga una comunidad relativamente diversa de peces marinos e invertebrados, junto con vida silvestre tales como aves de orilla.

Luego de la acción de remoción en el SWMU 6, se llevó a cabo un muestreo confirmatorio para apoyar la evaluación de riesgos posterior a la remoción, para asegurar que los riesgos potenciales a la salud humana y al ambiente han sido tratados adecuadamente. Sin embargo, el sitio fue alterado significativamente durante las actividades de remoción, y las condiciones ambientales y la ruta de exposición para las personas y receptores ecológicos cambiaron comparadas con las que se asumieron en el plan de trabajo de acción de remoción (Shaw, 2007).

Además, hubo alguna incertidumbre en relación a la calidad y uso de los datos de suelos de superficie y los compuestos orgánicos volátiles (VOC, por sus siglas en inglés) de los sedimentos recolectados durante el muestreo de confirmación. En base =a la información mencionada, es necesario un muestreo confirmatorio suplementario de las condiciones ambientales recién creados para ayudar a generar un conjunto de datos adecuados para la evaluación de riesgos posterior a la remoción. Por lo tanto, los objetivos del evento de muestreo confirmatorio suplementario posterior a la remoción, se limitarán a la remoción de suelos adyacentes a la Ruta 200, caracterización

adecuada de las condiciones luego de la remoción en el SWMU 6 (ej., suelos, sedimentos, y agua de superficie), y determinar si hay riesgos inaceptables actualmente y/o potencialmente en el futuro para receptores (humanos y ecológicos) que ameriten una investigación adicional, remediación/acción de remoción o manejo.

El evento de muestreo confirmatorio suplementario posterior a la remoción para el SWMU 6 incluirá la colección de 7 muestras de agua de superficie y 13 de sedimentos (o suelos de superficie en aéreas donde no haya presencia de agua). Además, se recogerán de lagunas cercanas 10 muestras de trasfondo de aguas de superficie y muestreo de sedimentos co-localizados: 3 de la Laguna Kiani, 3 de la Laguna El Pobre y 4 de la Laguna Punta Arenas, adyacente a la Carretera 200 al oeste del SWMU 6. Se llevarán a cabo evaluaciones biológicas cualitativas de peces e invertebrados dentro del SWMU 6 y las lagunas de trasfondo para apoyar la evaluación de condiciones ecológicas

Este SAP ayudará a asegurar que los datos ambientales recogidos o compilados sean científicamente correctos, de calidad conocida y documentada, y adecuados para el uso diseñado (ej., evaluaciones de riesgos humanos y ecológicos luego de la remoción). La información de laboratorio citado en este SAP será enviada a Mitkem Laboratories Inc. of Warwick, Rhode Island, el cual provee servicios analíticos para esta investigación.

SAP Worksheet #1 — Title and Approval Page

Final
Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
SWMU 6
Former Vieques Naval Training Range
Vieques, Puerto Rico
December 2010

Prepared for:
Department of the Navy
Naval Facilities Engineering Command
Atlantic Division
6506 Hampton Boulevard
Norfolk, VA 23508-1278

Prepared by:

CH2MHILL

5700 Cleveland Street, Suite 101
Virginia Beach, VA 23462
Office phone # 757-671-6219

Prepared under:
Navy CLEAN 1000 Program
Contract N62470-08-D-1000
Contract Task Order – 111

QA Review Signature:

Brett Doerr
Vieques Environmental Manager

Other Approval Signatures:

Kevin Cloe
NAVFAC – Remedial Project Manager

Daniel Rodriguez
USEPA Region 2 – Remedial Project Manager

Wilmarie Rivera
PREQB – Remedial Project Manager

12/15/10

Richard Henry
USFWS – Remedial Project Manager

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SAP Worksheet #2 — SAP Identifying Information

Site Name/Number: Solid Waste Management Unit (SWMU) 6 at the former Naval Ammunition Support Detachment (NASD), Vieques, Puerto Rico
Operable Unit (OU): N/A
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000
Contract Title: Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) Program 1000
Work Assignment Number (optional): Contract Task Order (CTO) 111 (Post-Removal Supplemental Confirmatory Sampling and Analysis Plan [SAP])

1. This SAP was prepared in general accordance with the requirements of the Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP) (IDQTF, 2005) and United States (U.S.) Environmental Protection Agency (USEPA) Guidance for QAPPs, USEPA QA/G-5, Quality Assurance Management Section (QAMS) (USEPA, 2002)
2. Regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
3. This SAP is a project-specific SAP
4. Dates of scoping sessions:

Scoping Session	Date
Vieques Environmental Technical Subcommittee Meeting—San Juan, Puerto Rico	January 26, 2010
Vieques Site Visit and Wrap-up Meeting- Vieques, Puerto Rico	January 27 and 28, 2010
Conference call on Sediment Pore-water sampling at SWMU 6	February 24, 2010
Vieques Environmental Technical Subcommittee Meeting – Manhattan, New York	March 10 and 11, 2010

5. Dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Final Work Plan, Removal Actions, SWMU 6, SWMU 7, AOC J, and AOC R	December 2007
Final Master Standard Operating Procedures, Protocols, and Plans	April 2010

SAP Worksheet #2 — SAP Identifying Information (continued)

6. Organizational partners (stakeholders) and connection with lead organization:
   - **USEPA Region 2 –** Federal regulatory stakeholder overseeing CERCLA Vieques environmental restoration program (ERP) implemented by lead organization
   - **Puerto Rico Environmental Quality Board (PREQB) –** Commonwealth regulatory stakeholder overseeing CERCLA Vieques ERP implemented by lead organization
   - **United States Fish and Wildlife Service (USFWS) –** Land owner of land transferred from lead organization and on which SWMU 6 ERP activities are conducted
   - **National Oceanic and Atmospheric Administration (NOAA) –** Marine habitat stakeholder and technical advisor to USEPA
7. Lead organization (see Worksheet #7 for detailed list of data users):
   - U.S. Department of Navy (Navy)
8. The omitted SAP elements excluded and provide an explanation for their exclusion below:
   - Crosswalk table is excluded as all required information is provided in this SAP.

SAP Worksheet #3 — Distribution List

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Kevin Cloe	Vieques Remedial Project Manager (RPM)/Agency Point of Contact (POC)	Navy	757-322-4736	kevin.cloe@navy.mil	A	CL	A
Chris Penny	Vieques Program Coordinator/No project-specific role	Navy	757-322-4815	christopher.penny@navy.mil	CL	CL	CL
Dan Hood	Vieques RPM/No project-specific role	Navy	757-322-4630	daniel.r.hood@navy.mil	CL	CL	CL
Madeline Rivera	Vieques Environmental Restoration Program Site Manager /On-island coordination	Navy	757-286-6457 (cell)	Madeline.rivera@navy.mil	A		A
John Noles	Biologist/Technical input	Navy	757-322-4891	john.noles@navy.mil	HC		A
Daniel Rodriguez	Vieques RPM/ Regulatory agency POC	USEPA	787-741-5201 787-671-9879 (cell)	rodriguez.daniel@epa.gov	A	CL	A
Carl Soderberg	Caribbean Environmental Protection Division Director	USEPA	787-977-5814	soderberg.carl@epa.gov	CL		CL
Aerial Iglesias	Branch Chief USEPA Region II, Caribbean Environmental Protection Division	USEPA	787-977-5890		CL		CL
Sergio Lopez	QC Specialist/Technical input and draft document review	USEPA	732-321-6778	lopez.sergio@epa.gov	A		A
Michael Sivak	Human Health Risk Assessment (HHRA) Lead/Technical input and draft document review	USEPA	212-637-4310	sivak.michael@epa.gov	A		A
Diana Cutt	Geology/Hydrogeology Lead/Technical input and draft document review	USEPA	212-637-4311	cutt.diana@epa.gov	A		A
Mindy Pensak	Ecological Risk Assessment (ERA) Lead/Technical input and draft document review	USEPA	732-321-6705	pensak.mindy@epa.gov	A		A
Pedro J. Nieves, Esq.	President/No project-specific role	PREQB	787-767-8056	pedronieves@jca.gobierno.pr	CL		CL
Wilmarie Rivera	Vieques RPM/ Regulatory agency POC	PREQB	787-767-8181 (x6141) (work) 787-365-8573 (cell)	wilmarierivera@jca.gobierno.pr	A	CL	A
Katarina Rutkowski	Technical Support Consultant for Environmental Quality Board (EQB)/contractor primary POC	TRC	860-298-6202	krutkowski@trcsolutions.com	A		A

SAP Worksheet #3 — Distribution List (continued)

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Mike Barandiaran	Refuge Manager/No project-specific role	USFWS	787-741-2138	Mike_barandiaran@fws.gov			A
Susan Silander	Caribbean Islands Refuges Supervisor/No project-specific role	USFWS	787-851-7258 (x38)	susan.silander@fws.gov	CL		CL
Richard Henry	Vieques RPM/ Land management agency POC/No project-specific role	USFWS	732-906-6987	richard_henry@fws.gov	A	CL	A
Felix Lopez Arroyo	Environmental Contaminants Specialist/Technical input and draft document review/No project-specific role	USFWS	787-851-7297(x226)	felix_lopez@fws.gov	A		A
William Tucker	Technical Support Consultant for USFWS/USFWS contractor primary POC/No project-specific role	MACTEC	352-332-3318	watucker@mactec.com	A		A
Jan Nielsen	Navy QA officer	Navy	757-322-8339				
Diane Wehner	Regional Resource Coordinator/Technical input and draft document review/No project-specific role	NOAA	732-872-3030	diane.wehner@noaa.gov	A		A
Brett Doerr	Contractor Environmental Manager/contractor primary POC	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	A	A	A
Bill Hannah	Project Manager	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	A	A	A
Barrie Selcoe	Human Health Risk Assessment Lead	CH2M HILL	281-721-8527	Barrie.selcoe@ch2m.com			
John Martin	Field Team Leader/Ecological Risk Assessment Lead	CH2M HILL	352-384-7122 352-359-5717 (cell)	john.martin@ch2m.com			A
Monica Marrow	Administrative Record Coordinator	CH2M HILL	757-671-6272	Monica.marrow@ch2m.coml			A
Mike Zamboni	Project Chemist	CH2M HILL	709-376-5301	mike.zamboni@ch2m.com			A
John Tomik	Activity Manager	CH2MHILL	757-671-6295	john.tomik@ch2m.com			CL
Anita Dodson	CH2M HILL/Navy Program Chemist/ SAP review	CH2MHILL	757-671-6218	Anita.dodson@ch2m.com	CD		
Mark Orman	CH2M HILL/Contractor Health and Safety Lead/Health and Safety officer	CH2MHILL	414-847-0597 414-712-4138 (cell)	Mark.orman@ch2m.com			CD
Angela Barch	CH2M HILL/Environmental Information Specialist (EIS)/Data tracking and management	CH2MHILL	678-530-4073 404-353-7757 (cell)	Juan.acaron@ch2m.com			CD
Bhavana Reddy	Critigen/Data Manager	Critigen	703-462-3784	Bhavana.reddy@critigen.com			CD
Dia Whitaker	CH2M HILL/SSC/Field Team	CH2MHILL	813-426-4989 (cell)	Dia.whitaker@ch2m.com			HC
Paul Favara	CH2M HILL Project QA officer	CH2MHILL	352-335-5877 x52396	Paul.favara@ch2m.com			CD

SAP Worksheet #3 — Distribution List (continued)

Name of SAP Recipients	Title/Project Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	D	DF	F
Ed Lawler	Project Manager	Mitkem Laboratories, Inc.	401-732-3400	elawler@mitkem.com			HC
John Heyman	PEL PM	PEL, Inc	813-888-9507				CD
Jason Brenneman	Faulkner PM	Faulkner, Inc.	813-621-8168				CD
Laura Maschoff	Project Manager	DataQual Environmental Services	636-330-1327				CD
Roberta W. Britton	Not Applicable (N/A)	Restoration Advisory Board (RAB)	978-463-9660	bdbritt7@gmail.com		CD	
Michael P. Connelly Pagán	N/A	RAB	787-741-4442	mpcbieke@yahoo.com		A	
Michael Diaz	N/A	RAB	787-667-2804	diazmmdo@aol.com		CD	
Wanda Bermudez	N/A	RAB	787-435-2841	wbromero@yahoo.com		CD	
Colleen McNamara	N/A	RAB	787-380-2545	lacolina@hughes.com		A	
Stacie D. Notine	N/A	RAB	N/A	N/A		HC	
Jorge Fernandez Porto	N/A	RAB	787-726-2839	jfporto@onelinkpr.net		CD	
Hector Julian Camacho	N/A	RAB	787-741-8261	vieques357@yahoo.com		HC	
Luis Lionel Sanchez Carambot	N/A	RAB	787--741-3110	sanchezcarambot@yahoo.com		CD	
Lirio Marquez D'Acunti	N/A	RAB	787-726-2839	liriomarquez@gmail.com		None	
Adelina Cruz Colon	N/A	RAB	787-741-4562			CL	

A = All DF = Draft Final
CL = Cover Letter F = Final
CD = Compact Disc HC = Hard Copy
D = Draft

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SAP Worksheet #4 — Project Personnel Sign-Off Sheet

Name	Organization/Title/Project Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Kevin Cloe	NAVFAC Atlantic/ Vieques RPM/ Lead agency POC	757-322-4736			
Daniel Rodriguez	USEPA/ Vieques RPM/ Regulatory agency POC	787-741-5201 787-671-9879 (cell)			
Wilmarie Rivera	PREQB/Vieques RPM/ Regulatory agency POC	787-767-8181 (x6141)			
Richard Henry	USFWS/Vieques RPM/ Land management agency POC	732-906-6987			
Anita Dodson	CH2M HILL/Navy Program Chemist/ SAP review	757-671-6218			
Brett Doerr	CH2M HILL/ Contractor Environmental Manager/Navy contractor primary POC	757-671-6219			
Bill Hannah	CH2M HILL/Contractor PM/Logistics and administration	757-671-6277			
Mark Orman	CH2M HILL/Contractor Health and Safety Lead/Health and Safety officer	414-847-0597 414-712-4138 (cell)			
Angela Barch	CH2M HILL/Environmental Information Specialist (EIS)/Data tracking and management	678-530-4073 404-353-7757 (cell)			
Barrie Selcoe	CH2M HILL/ Human Health Risk Assessment Lead	281-721-8527			
John Martin	CH2M HILL/ FTL/Ecological Risk Assessment Lead	352-384-7122 352-359-5717 (cell)			
Mike Zamboni	CH2M HILL/Project Chemist	709-376-5301			
Ed Lawler	Mitkem/Project Manager	401-732-3400			
John Heyman	PEL/Project Manager	813-888-9507			
Jason Brenneman	Faulkner/Project Manager	813-621-8168			
Laura Maschoff	DataQual Environmental Services/Data Validator	636-330-1327			
Bhavana Reddy	Critigen/Data Manager	703-462-3784			
Dia Whitaker	CH2M HILL/SSC/Field Team	813-426-4989 (cell)			

Signed versions of Worksheet #4 will be kept on file at CH2M HILL along with other project documents.

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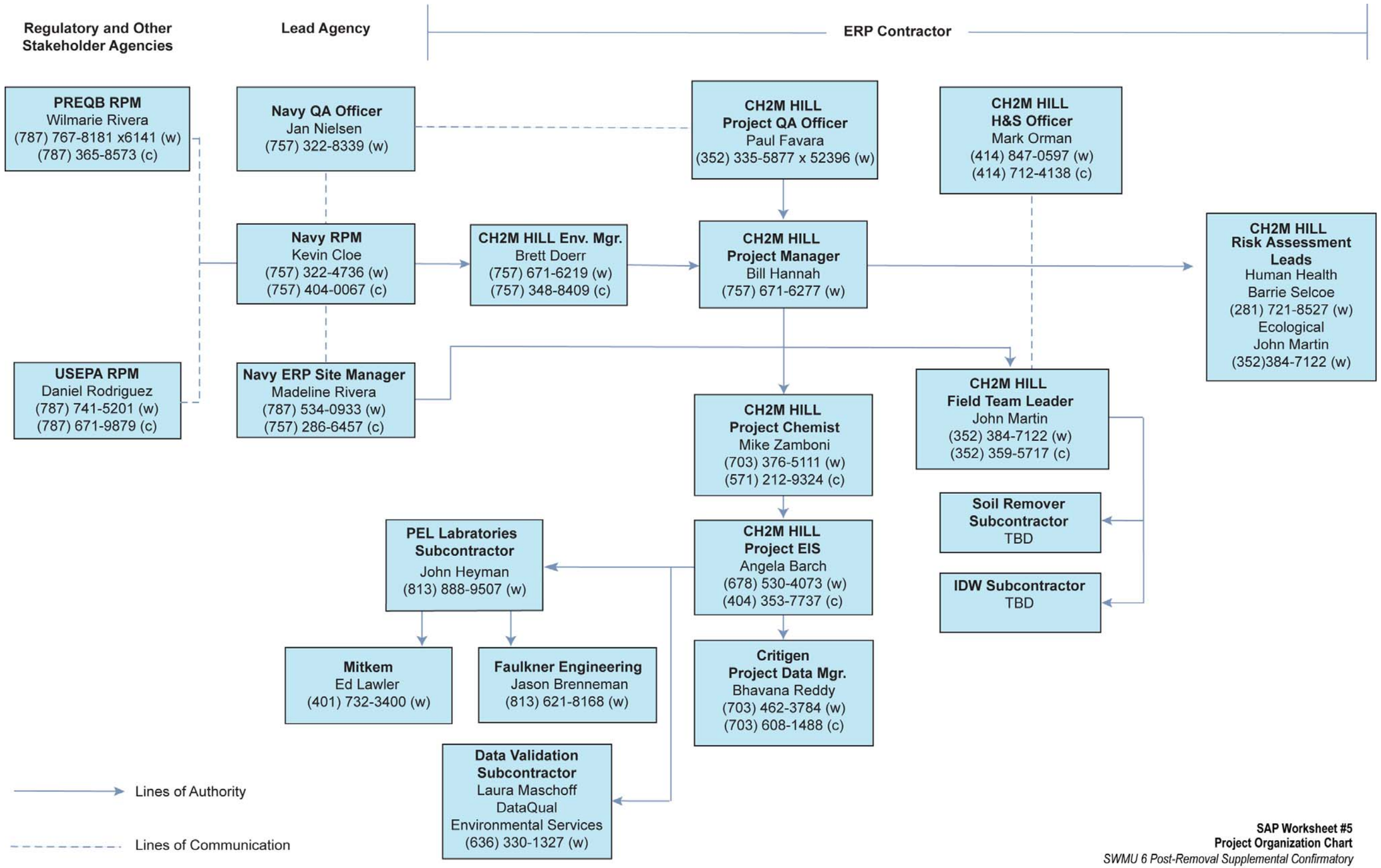
SAP Worksheet #5 — Project Organizational Chart



SAP Worksheet #5
Project Organization Chart
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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SAP Worksheet #6 — Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Communication to/from Navy (e.g., submission of SAP for review; receipt of regulatory comments, etc.)	Navy RPM	Kevin Cloe	757-322-4736	Primary POC for Navy (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from USEPA (e.g., receipt of SAP for review; submission of USEPA comments)	USEPA RPM	Daniel Rodriguez	787-741-5201 787-671-9879 (cell)	Primary POC for USEPA (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from PREQB (e.g., receipt of SAP for review; submission of PREQB comments)	PREQB RPM	Wilmarie Rivera	787-767-8181 (x6141)	Primary POC for PREQB (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from USFWS (e.g., receipt of SAP for review; submission of USFWS comments)	USFWS RPM	Richard Henry	732-906-6987	Primary POC for USFWS (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Navy Quality Assurance (QA)/Quality Control (QC) input	Navy QAO	Jan Nielsen	757-322-8339	Provides review comments to Navy contractor on pre-draft SAP via e-mail through Kevin Cloe. Provides overall Navy guidance via direct communication with Navy contractor QAO, as warranted.
Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.)	CH2M HILL Environmental Manager	Brett Doerr	757-671-6219	Primary POC for Navy contractor (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other contractor staff, as appropriate.
Project administration and logistics	CH2M HILL PM	Bill Hannah	757-671-6277	Direct communication (via e-mail, telephone, hardcopy, or in-person, as warranted) to/from Navy contractor project staff to ensure appropriate project implementation.
Health and safety expectations and procedures	CH2M HILL Health and Safety Officer	Mark Orman	414-847-0597 414-712-4138 (cell)	Review of Health and Safety Plan (HASP). Direct communication (via e-mail, telephone, hardcopy, or in-person, will be notified within 24 hours of incident) to/from Navy contractor project staff to ensure implementation of appropriate health and safety procedures.
Implementation of sampling activities; SAP changes in the field; field corrective actions; daily field progress reports.	CH2M HILL FTL	John Martin	352-384-7122 352-359-5717 (cell)	Documentation of deviations from work plan made in field logbooks and rationale for deviations, made within 24 hours of deviation; assistance in material procurement and delivery; injection oversight and implementation; deviations made only with approval from contractor PM and/or environmental manager. See Worksheet 32 Assessment Findings and Corrective Action (CA) Responses and Worksheet 32-1 CA Form. FTL will e-mail or fax daily field progress reports to contractor PMs weekly; telephone communication with PMs on as-needed basis

SAP Worksheet #6 — Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Ensure staff health and safety in the field	CH2M HILL Site Safety Coordinator (SSC)	Dia Whitaker	813-874-0777 813-426-4989 (cell)	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
Data tracking from collection through upload to database	CH2M HILL EIS	Angela Barch	678-530-4073 404-353-7757 (cell)	EIS will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff. Tracking involves receipt of electronic and hardcopy data from laboratory and data validator. EIS communicates with CH2M HILL project chemist, laboratory PM, and data validator PM, as warranted, to ensure adherence to project analysis and validation requirements. EIS also coordinates data upload with contractor database manager.
Uploading project data and maintaining the database to ensure data are stored properly and can be retrieved by the EIS.	Critigen Database Manager	Bhavana Reddy	703-471-1441	Once contractor chemist ensures data are appropriate for upload to database, EIS submits data electronically to contractor database manager, who uploads data to database.
Reporting Lab Data Quality Issues	Laboratory PM (PEL)	John Heyman	813-888-9507	All QA/QC issues with project field samples will be reported by the lab to the EIS, Project Chemist, and Contractor QAO via e-mail within 2 business days.
Reporting Lab Data Quality Issues	Laboratory PM (Mitkem Laboratories)	Ed Lawler	401-732-3400	All QA/QC issues with project field samples will be reported by the lab to the EIS, Project Chemist, and Contractor QAO via e-mail within 2 business days.
Quality Control on Laboratory Data, Release of analytical data for upload to database	CH2M HILL Project Chemist	Michael Zamboni	703-376-5301	See Worksheets 24, 25, and 28 for analytical CAs. Upon review of validated data to ensure adherence to project requirements, project chemist communicates via e-mail to EIS that data are ready for release (i.e., upload to database).
Technical Support and Reporting	CH2M HILL Human Health Risk Assessment Lead,CH2M HILL Ecological Risk Assessment Lead	Barrie Selcoe John Martin	757-671-6219; 352-384-7122	Risk assessments leads will oversee preparation of human health and ecological risk assessments.
Validated data	DataQual Environmental Services, Data Validator PM	Laura Maschoff	636-330-1327	Data validator provides data validation reports (electronic and hardcopy) that provide the data qualifiers and associated explanations.

SAP Worksheet #7 — Personnel Responsibilities

Name	Title	Organizational Affiliation	Responsibilities
Kevin Cloe	Vieques RPM	Navy	Environmental restoration program (ERP) activities implemented under this SAP
Jan Nielsen	QAO	Navy	Navy review of SAP and QA input
Madeline Rivera	Vieques ERP Site Manager	Navy	On-island Navy liaison; provides logistical support for implementation of environmental restoration program activities under this SAP
Brett Doerr	Environmental Manager	CH2M HILL	Responsible for ERP at Vieques; primary Navy contractor point of contact (POC); assists in data evaluation and interpretation; reviews report; as the technical lead, oversees preparation of reports; and provides recommendations on path forward
Bill Hannah	PM	CH2M HILL	Project administration; coordinates staffing; monitors project performance; directs and oversees project staff
Anita Dodson	Program Chemist	CH2M HILL	Provides program level review and support of the UFP-SAP.
Mike Zamboni	Project Chemist	CH2M HILL	Establishes laboratory scope of work; ensures selected laboratory can meet project-required analytical protocol; primary communications with laboratory and data validator; performs data quality evaluation to determine availability of analytical data
Barrie Selcoe	Human Health Risk Assessment Lead	CH2M HILL	Supervises, guides, and reviews human health risk assessment
John Martin	FTL , Ecological Risk Assessment Lead	CH2M HILL	Supervises field injection, sampling and coordinates all field activities; ensures onsite compliance with work plan. Supervises, guides and reviews ecological risk assessment
Mark Orman	Health and Safety Officer	CH2M HILL	Responsible for overall Navy CLEAN program health and safety performance; reviews project-specific HASP; interacts with SSC to ensure project-specific safety of field personnel
Dia Whitaker	SSC	CH2M HILL	Oversees and ensures safety of onsite personnel; responsible for use and completion of all field work related H&S paperwork
Angela Barch	Environmental Systems Specialist	CH2M HILL	Manages sample tracking; coordinates assimilation of data from field collection through analysis, validation, and upload to environmental database; performs data queries for data evaluation and report writing
Bhavana Reddy	Database Manager	Critigen	Uploads validated data to environmental database
Sharyn Lawler	Quality Assurance Director	Mitkem Laboratories	Responsible for laboratory QA program and review of QC data
Cassie Mosher	Organics Department Manager	Mitkem Laboratories	Responsible for oversight, QC, and data review of organics laboratory
Dawne Smart	Inorganics Department Manager	Mitkem Laboratories	Responsible for oversight, QC, and data review of inorganics laboratory
Ed Lawler	Project Manager	Mitkem Laboratories	Laboratory POC and overall manager for analytical work
John Heyman	Project Manager	PEL Laboratories	Coordination with Mitkem Laboratories and Faulkner Engineering
Jason Brenneman	Project Manager	Faulkner Engineering	Responsible for oversight, QC, and data review of grain size analyses
Laura Maschoff	Project Manager and Data Validator	DataQual Environmental Services	Responsible for validating analytical data in accordance with project-specific UFP-SAP
TBD	Data Validator	TBD	Responsible for validating analytical data in accordance with project-specific UFP-SAP
TBD	Soil Removal Subcontractor	TBD	Responsible for removal of surface soils
TBD	TBD	Investigation-derived Waste (IDW) Subcontractor	Responsible for transport and disposal of IDW deemed necessary for offsite disposal

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SAP Worksheet #8 — Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/ Receiving Training	Personnel Titles/Affiliation	Location of Training Records/Certificates
Field activities	Hazwoper 40-hour Training, 8 hour refreshers, as applicable	Various qualified training organizations	Training of CH2M HILL and subcontractors will be verified as current prior to starting field activities by SSC	All field personnel	FTLs, field team members, and SSC (CH2M HILL personnel); IDW subcontractor; and soil removal subcontractor	CH2M HILL Human Resources Department for CH2M HILL personnel; subcontractor organizations for field subcontractors
Field activities	CPR/First Aid Training	Various qualified training organizations	Training will be verified as current prior to starting field activities	CH2M HILL SSC	CH2M HILL SSC	CH2M HILL Human Resources Department
Field activities	SSC-hazardous waste (SSC-HW) training	Various qualified training organizations	Training will be verified as current prior to starting field activities by SSC.	CH2M HILL SSC	CH2M HILL SSC	CH2M HILL Human Resources Department

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SAP Worksheet #9a — Project Scoping Session Participants Sheet

Project Name: Post-Removal Supplemental Confirmatory Sampling					
Projected Date(s) of Sampling: January 2011				**Site Name:** SWMU 6	
PM: Bill Hannah				**Site Location:** Vieques, Puerto Rico	
Dates of Session: January 26, 2010 **Scoping Session Purpose:** Determine if supplemental sampling is necessary at the SWMU 6 site					
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**	**Project Role**
Kevin Cloe	Vieques RPM	Navy	757-322-4736	kevin.cloe@navy.mil	Primary Navy POC
Chris Penny	NAVFAC Atlantic	Navy	757-322-4815	christopher.penny@navy.mil	Navy Vieques Coordinator
Daniel Hood	Vieques RPM	Navy	757-322-4630	daniel.r.hood@navy.mil	Navy POC for munition related items
Pedro Ruiz	Vieques Site Manager	Navy	787-630-9881	pedroruizwork@gmail.com	Navy site coordinator
Stacin Martin	Senior Technical Advisor	Navy	787-322-4780	Stacin.martin@navy.mil	Navy additional POC for munition related items
Daniel Rodriguez	Vieques RPM	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk evaluation
Diana Cutt	Geology/Hydrogeology Lead	USEPA	212-637-4311	Cutt.diana@epa.gov	Technical input and review of geology/hydrogeology
Mindy Pensak	Ecological Risk Assessment Lead	USEPA	732-321-6705	Pensak.mindy@epa.gov	Technical input and draft document and ecological risk assessment review
Tom Hall	MEC Support Contractor to EPA	TECHLAW			Technical input and review of munitions related items on behalf of EPA
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6141	wilmarierivera@jca.gobierno.pr	Primary PREQB POC.
Jim Pastoric	Technical Support Contractor to PREQB,	UXO PRO MEC			Technical input and review of munitions related items on behalf of EQB
Katarina Rutkowski	Technical Support Contractor to PREQB, Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of EQB; Primary TRC POC

SAP Worksheet #9a — Project Scoping Session Participants Sheet (continued)

Project Name: Post-Removal Supplemental Confirmatory Sampling	
Projected Date(s) of Sampling: January 2011	**Site Name:** SWMU 6
PM: Bill Hannah	**Site Location:** Vieques, Puerto Rico
Dates of Session: January 26, 2010 **Scoping Session Purpose:** Determine if supplemental sampling is necessary at the SWMU 6 site	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Phil Rury	Technical Support Contractor to PREQB, Ecological Risk Assessment Lead	TRC	978-656-3590	PRury@trcsolutions.com	Technical input and review of ecological risk aspects on behalf of EQB
Diane Wehner	Ecological Risk Assessor	NOAA	732-872-3030	Diane.wehner@noaa.gov	Technical input and draft document review/No project-specific role.
Richard Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Tim Garretson	Munitions Response Lead	CH2M HILL	757-287-5222	timothy.garretson@ch2m.com	Address munition related items
John Tomik	Activity Manager	CH2M HILL	757-671-6259	john.tomik@ch2m.com	Vieques Activity Manager
Brett Doerr	Environmental Manager	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	Navy contractor primary POC
Bill Hannah	Project Manager	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	Navy contractor project manager
John Martin	Ecological Risk Assessor	CH2M HILL	352-384-7122	john.martin@ch2m.com	Navy contractor lead ecological risk assessor
Barrie Selcoe	Human Health Risk Assessor	CH2M HILL	281-721-8527	barrie.selcoe@ch2m.com	Navy contractor lead human health risk assessor
Felicia Arroyo	Vieques Site Manager	CH2M HILL	757-671-6205	felicia.arroyo@ch2m.com	If on the island may help with logistics at site
Tim Flood	Facilitator	TME	727-867-2610	tflood@me.com	Facilitator at meetings

Comments/Decisions: See meeting minutes from January 26, 2010 Environmental Restoration Program Technical Subcommittee Meeting below.
Action Items: See below
Consensus Decisions: See below

SAP Worksheet #9a — Project Scoping Session Sheet (continued)

Excerpt from the January 26, 2010 Environmental Restoration Program/ Munitions Response Program Technical Subcommittee Meeting Minutes

SWMU 6 Post-Removal Confirmatory Supplemental Sampling Scoping

The relevant background information that has resulted in the potential need to perform additional post-removal confirmatory sampling at SWMU 6 is explained as:

1. EPA and EQB have raised some concerns regarding the quality of the sediment VOC data collected by Shaw due to the sampling techniques employed.
2. The site setting was originally terrestrial, but the removal action has resulted in the majority of the site being a shallow marine setting.
3. Although not required by the SAP, no surface water samples were collected at the now shallow marine site.

The question was posed: Do we need more data or are the existing data sufficient to characterize post-removal conditions and assess risks?

It is suggested to identify the "older" data outside the removal action area. Questions are raised as to what background data has been collected for the site. Originally the assumption was to use west Vieques soil background data, but the site became an aquatic site, so there is an uncertainty as to whether soil or sediment background data are now appropriate. If sediment data are appropriate, then we don't necessarily have applicable background data. The soil background data were collected during the RI and were collected specifically for SWMU 6. However, their location may be too close to SWMU 6 based on the depositional area adjacent to channel.

Based on the above, the team consensus is that additional data are needed, including background. Therefore, the team reviewed the SWMU 6 "seed" file showing the preliminary CSM, data needs, analytical parameters, and data use.

The source, contaminants of interest, and physical characteristics of the site (see Key elements file provided in the meeting) are explained.

Although Shaw incorrectly filled the encore samplers (not according to EPA SOPs), encore sampling will not work at this site due to the soft nature of the sediment and so an alternative method for sampling VOCs would need to be employed. It is noted that historical data and current data do not show issues with VOCs however, so additional VOC sampling may not be needed.

At SWMU 6, the lagoon is a few inches to a few feet in depth. It is believed that there are probably not a lot of big fish (more of a nursery area), small crustaceans, wading birds, crabs, and jelly fish. It is also known as an open hydrologic connection the lobe to the north of the site and, thus, the site is tidally influenced.

One small debris area on the south side of the road within SWMU 6 showed elevated PCBs in post-removal confirmatory sample. This area will be addressed by scraping more soil in the area and taking new confirmatory soil samples post-soil removal. This location is isolated from the main disposal area and lagoon and will be addressed separately.

SAP Worksheet #9a — Project Scoping Session Sheet (continued)

From a refuge management perspective, the site will not have walking trails. On HHRA scenario, there is no activity planned for that area to "draw" the visitors. Also noted is that the lagoon will likely fill in over time as the mangroves become established and fill in the area.

Next, the conceptual sampling approach is explained. Sediment and surface water in the lagoon will be sampled, as well as sediment in the lobe to the north just outside of the lagoon (i.e., closest area for deposition adjacent to site). There will also be surveys of benthic macroinvertebrates at sediment locations (community survey) and qualitative surveys of fish, birds, and mammals (observe wildlife, wading birds, seasonally, different times of the day).

During the discussion of the sampling approach, the team is asked to review the potential for porewater sampling in place of the surface water sampling.

As a result of this meeting, CH2M HILL will revise the CSM to show the lagoon open to the northern lagoon. No decisions were made at this meeting and it has been decided to wait until the site visit on January 28, 2010 to make a decision on data needs and the sampling approach for SWMU 6.

SAP Worksheet #9b — Project Scoping Session Participants Sheet

Project Name: Post-Removal Supplemental Confirmatory Sampling	
Projected Date(s) of Sampling: January 2011	**Site Name:** SWMU 6
PM: Bill Hannah	**Site Location:** Vieques, Puerto Rico
Dates of Session: January 27 and 28, 2010 **Scoping Session Purpose:** Site visit and determine the data needs and sampling approach for SWMU 6	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Kevin Cloe	Vieques RPM	Navy	757-322-4736	Kevin.cloe@navy.mil	Primary Navy POC
Madeline Rivera	Vieques Environmental Restoration Program Site Manager	Navy	757-286-6457 (cell)	Madeline.rivera@navy.mil	On-island coordination
Daniel Hood	Vieques RPM	Navy	757-322-4630	daniel.r.hood@navy.mil	Navy POC for munition related items
Pedro Ruiz	Vieques Site Manager	Navy	787-630-9881	pedroruizwork@gmail.com	Navy site coordinator
Stacin Martin	Senior Technical Advisor	Navy	787-322-4780	Stacin.martin@navy.mil	Navy additional POC for munition related items
Daniel Rodriguez	Vieques RPM	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk evaluation
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6141	wilmarierivera@jca.gobierno.pr	Primary PREQB POC.
Jim Pastoric	Technical Support Contractor to PREQB,	UXO PRO MEC			Technical input and review of munitions related items on behalf of EQB
Katarina Rutkowski	Technical Support Contractor to PREQB, Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of EQB; Primary TRC POC

SAP Worksheet #9b — Project Scoping Session Participants Sheet (continued)

Project Name: Post-Removal Supplemental Confirmatory Sampling	
Projected Date(s) of Sampling: November 2010	**Site Name:** SWMU 6
PM: Bill Hannah	**Site Location:** Vieques, Puerto Rico
Dates of Session: January 28, 2010 **Scoping Session Purpose:** To come to a determination on the data needs and sampling approach for SWMU 6	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Phil Rury	Technical Support Contractor to PREQB, Ecological Risk Assessment Lead	TRC	978-656-3590	PRury@trcsolutions.com	Technical input and review of ecological risk aspects on behalf of EQB
Diane Wehner	Ecological Risk Assessor	NOAA	732-872-3030	Diane.wehner@noaa.gov	Technical input and draft document review/No project-specific role.
Richard Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Mike Barandarian	Refuge Manager	USFWS	787-741-2138	Mike_barandiaran@fws.gov	Refuge manager
Tim Garretson	Munitions Response Lead	CH2M HILL	757-287-5222	timothy.garretson@ch2m.com	Address munition related items
John Tomik	Activity Manager	CH2M HILL	757-671-6259	john.tomik@ch2m.com	Vieques Activity Manager
Brett Doerr	Environmental Manager	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	Scope development and technical review. Primary CH2M HILL POC.
Bill Hannah	Project Manager	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	Project Management
John Martin	Ecological Risk Assessor	CH2M HILL	352-384-7122	john.martin@ch2m.com	Technical input and review.
Barrie Selcoe	Human Health Risk Assessor	CH2M HILL	281-721-8527	barrie.selcoe@ch2m.com	Technical input and review.
Tim Flood	Facilitator	TME	727-867-2610	tflood@me.com	Meeting facilitator

Comments/Decisions: See telephone conversation record from February 26, 2009 conference call.
Action Items: See below.
Consensus Decisions: See below.

SAP Worksheet #9b — Project Scoping Session Participants Sheet (continued)

Excerpt from the January 28, 2010 Environmental Restoration Program/ Munitions Response Program Technical Subcommittee Meeting Minutes

SWMU 6 Post-Removal Confirmatory Supplemental Sampling Scoping

Brett Doerr (CH2M HILL) led this discussion following the seed file previously presented on January 26 in San Juan, Puerto Rico.

The team concurred that the source of contamination was from the debris piles that have been removed, and from residual contamination in the sediment, which will also be included as a potential continuing source.

Contaminants of interest were defined as: metals, pesticides, PCBs, and PAHs. Brett added that VOCs are not a significant source at the site based on historical data and the post-removal confirmatory data. Based on the locations of previous samples and the uncertainty of the post-removal confirmatory VOC data, Katarina Rutkowski (TRC) suggested we consider analyzing a subset of the samples for VOCs. Michael Sivak (EPA) noted that in general we do not see significant exceedances of VOCs in the historical media data. Danny Rodriguez (EPA) interjects that if the risk assessors can work with the current VOC data, no further VOC data is needed. Katarina responded that she is not prepared to respond to this issue now. She is concerned not only with the way the samples were collected by the subcontractor Shaw but also with the fact that post-soil removal, much of SWMU 6 is inter-tidal and the soil has become sediment, which is under different screening criteria.

Diane Wehner (NOAA) commented that a new background data set will need to be collected at the site. Brett responded that a new surface water/sediment dataset are being proposed within the lagoon to the south of SWMU 6. Phil Rury (TRC) asked if we should consider collecting sediment pore water sampling rather than surface water. Then, if the pore water results are acceptable, there would be no need to collect surface water. Diane responded that we were not there yet to achieve consensus for this kind of sampling. Danny added that the team will also need to discuss this procedure with Mindy Pinsak (EPA) who is not present. Sediment pore water sampling will be discussed during the ecological risk assessment call. Diane asked how we would get consensus on the number of sampling locations, types, etc. Brett responded that we would need to reach consensus at the March 8 and 9 meetings in New York.

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SAP Worksheet #9c — Project Scoping Session Participants Sheet

Project Name: Post-Removal Supplemental Confirmatory Sampling					
Projected Date(s) of Sampling: November 2010			**Site Name:** SWMU 6		
PM: Bill Hannah			**Site Location:** Conference call		
Dates of Session: February 24 **Scoping Session Purpose:** Conference call to discuss sediment pore-water sampling at SWMU 6					
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**	**Project Role**
Richard Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Daniel Rodriguez	Vieques RPM	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Phil Rury	Technical Support Contractor to PREQB, Ecological Risk Assessment Lead	TRC	978-656-3590	PRury@trcsolutions.com	Technical input and review of ecological risk aspects on behalf of EQB
Diane Wehner	Ecological Risk Assessor	NOAA	732-872-3030	Diane.wehner@noaa.gov	Technical input and draft document review/No project-specific role.
Mindy Pensak	Ecological Risk Assessment Lead	USEPA			Technical input and review of ecological risk evaluation

Excerpt from the February 24, 2010 Environmental Restoration Program/ Munitions Response Program Conference Call

The team discussed the applicability of sediment pore-water sampling at SWMU 6. A consensus was made that sediment pore-water sampling is not necessary at the site. The team had further discussions on which previous samples could be used for risk assessment purposes. Further discussions would be made at the next scoping session in New York.

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SAP Worksheet #9d — Project Scoping Session Participants Sheet

Project Name: Post-Removal Supplemental Confirmatory Sampling	
Projected Date(s) of Sampling: November 2010	**Site Name:** SWMU 6
PM: Bill Hannah	**Site Location:** Vieques, Puerto Rico
Dates of Session: March 10 and 11, 2010 **Scoping Session Purpose:** To finalize the sampling approach for SWMU 6	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Richard Henry	Vieques RPM	USFWS	732-906-6987	Richard_henry@fws.gov	Primary USFWS POC/No project-specific role
Kevin Cloe	Vieques RPM	Navy	757-322-4736	Kevin.cloe@navy.mil	Primary Navy POC
Daniel Hood	Vieques RPM	Navy	757-322-4630	daniel.r.hood@navy.mil	Navy POC for munition related items
Stacin Martin	Senior Technical Advisor	Navy	787-322-4780	Stacin.martin@navy.mil	Navy additional POC for munition related items
Daniel Rodriguez	Vieques RPM	USEPA	787-741-5201 787-671-9879 (cell)	Rodriguez.daniel@epamail.gov	Primary USEPA POC
Michael Sivak	Human Health Risk Assessment Lead	USEPA	212-637-4310	Sivak.michael@epa.gov	Technical input and review of human health risk evaluation
Stan Pauwels	Technical Support Contractor to USEPA, Ecological Risk Assessment Lead	Techlaw, Inc.	207-883-4708 M, W, F 617-918-8669 (Tu,Th)	spauwels@techlawinc.com	Technical input and review of ecological risk evaluation
Wilmarie Rivera	Vieques RPM	PREQB	787-767-8181 x 6141	wilmarierivera@jca.gobierno.pr	Primary PREQB POC.
Katarina Rutkowski	Technical Support Contractor to PREQB, Human Health Risk Assessment Lead	TRC	860-298-6202	krutkowski@trcsolutions.com	Technical input and review of human health risk aspects on behalf of EQB; Primary TRC POC
Phil Rury	Technical Support Contractor to PREQB, Ecological Risk Assessment Lead	TRC	978-656-3590	PRury@trcsolutions.com	Technical input and review of ecological risk aspects on behalf of EQB
Diane Wehner	Ecological Risk Assessor	NOAA	732-872-3030	Diane.wehner@noaa.gov	Technical input and draft document review/No project-specific role.
Brett Doerr	Environmental Manager	CH2M HILL	757-671-6219	brett.doerr@ch2m.com	Scope development and technical review. Primary CH2M HILL POC.
Bill Hannah	Project Manager	CH2M HILL	757-671-6277	bill.hannah@ch2m.com	Project Manager
John Martin	Ecological Risk Assessor	CH2M HILL	352-384-7122	john.martin@ch2m.com	Technical input and review
Barrie Selcoe	Human Health Risk Assessor	CH2M HILL	281-721-8527	barrie.selcoe@ch2m.com	Technical input and review
Sergio Lopez	Quality Assurance	USEPA			Technical input and review
Mindy Pensak	Ecological Risk Assessment Lead	USEPA			Technical input and review of ecological risk evaluation

SAP Worksheet #9d — Project Scoping Session Sheet (continued)

Excerpt from the March 10 and 11, 2010 Environmental Restoration Program/ Munitions Response Program Technical Subcommittee Meeting Minutes

Day 1

SWMU 6 Sampling Approach – Scoping Session

The team confirmed that samples collected during low tide and not underwater will be considered soil in the HHRA and during high tide under water will be considered sediment in the HHRA. Barrie stated that groundwater and surface water at the site will not be evaluated as a potable water source since it is ocean water. Katarina stated that groundwater standards are an ARAR for the site, and there would need to be a use designation to not evaluate potable use. Katarina stated that a GW-2 designation is for groundwater >10,000 TDS, and is not considered a drinking water supply even after treatment. Brett stated that there is no groundwater at the site, just surface water, so groundwater will not be considered in the risk assessment, which is consistent with the approach set forth in the removal action work plan (Shaw, 2007). In fact, the current site conditions (i.e., a marine lagoon) provide even more justification for excluding groundwater than the past site conditions.

Katarina asked if land crab/fish ingestion would be possible in the future and if it would be evaluated. The team had discussions on this. Diane added that land crabs were collected prior to the removal action and could possibly run risks on this data as a worst case scenario.

Consensus – Land crabs will not be evaluated for SWMU 6 as they are not expected to reside/forage within the new site boundaries. RAGS D Table 1 will be revised to indicate a qualitative discussion for this pathway. RAGS D Table 1 will also be modified to add detail regarding why edible fish are not an important scenario at the site. The ecological risk assessment will evaluate bioaccumulation in crabs first to see if there are any impacts; the ecological conclusions will be evaluated to determine if there is accumulation in the crab foodchain, and if so, the human health risk assessors will regroup to discuss how to use the data.

Day 2

SWMU 6 Sampling Approach – Scoping Session

SWMU 6 – Ecological Receptors

John led the discussion on the ecological receptors at SWMU 6 and passed out the sample station media type assignment for the site. He discussed the potential receptors as shown on the CSM. A qualitative survey of the ecological communities at the site, and background areas, will also be performed.

Phil and Diane discussed that the wide variety of fish observed at the site were juveniles. John added that the mangroves will most likely overtake the site in the future.

SWMU 6 – Sampling Approach

John presented the proposed site sampling and background sampling locations. Diane and Mindy added concerns for the three background samples proposed from the lagoon that is hydraulically connected and downstream of the site. Diane added that she had concerns collecting background sampling locations adjacent to the road. Brett stated that this is likely a perfect location to collect comparable samples to our site, since SWMU 6 is also located adjacent to the road and a

SAP Worksheet #9d — Project Scoping Session Sheet (continued)

background data set should be similar to the site conditions (less contamination attributable to the specific site) and not pristine conditions. The team had further discussions on the collection of the background data set.

Consensus – The team concurred on the general locations of the proposed background surface water and sediment samples (to be field-verified and adjusted, as warranted, to optimize the locations with respect to use as background). The team wants to evaluate the background data from the lagoon adjacent to the road and from Laguna Kiani first before combining them as one background data set. If they are different, we need to identify how they differ and determine the appropriate usage. The team will reconvene to discuss the results.

Consensus – Site-related sediment samples located just outside of the SWMU boundary will be positioned in a depositional environment, as best identified during the pre-sampling site visit.

Consensus – One sediment sampling location will be added at the southeast area of SWMU 6 near the road for better coverage in the area that was disturbed by the removal action. The location was drawn on a map during the meeting and agreed upon by the team.

Historic surface water and sediment data will not be used in the future HHRA; only samples collected as part of the upcoming SAP. This includes samples from the canal adjacent to SWMU 6.

Consensus – VOCs will be included in the SWMU 6 analytical protocol due to the uncertainty associated with the VOC sampling methodology used by Shaw during collection of the post-removal confirmatory samples.

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SAP Worksheet #10 — Problem Definition

This worksheet provides a summary of site background and key elements of the conceptual site model (CSM), followed by a narrative description of the problems to be addressed during the proposed post-removal supplemental confirmatory sampling.

Site Background

SWMU 6, the Former Mangrove Disposal Site, is located in a mangrove swamp between two tidally influenced lagoons of the Laguna Kiani complex, along Highway 200 on the former NASD (Figure 1). The site was used for the disposal of general solid waste during the 1960s and 1970s from Navy operations within the former NASD. Waste discarded at the site comprised empty containers of lubricants, oil, solvents, and paints; broken glass; and rubble. No munitions and explosives of concern (MEC) were identified at the site; however, munitions-related items such as inert concrete-filled practice bombs, empty bomb dispensers, and empty shell casings were identified. Items identified at the site were deteriorated from natural corrosion in the saltwater environment.

The Navy ceased facility-wide operations on the former NASD on April 30, 2001, when the land was transferred to the Department of the Interior (DOI), the Municipality of Vieques (MOV), and Conservation Trust. SWMU 6 is located on DOI property that has been designated as a wildlife refuge. Figure 2 is an aerial photograph of SWMU 6 that shows the dense vegetation in the mangrove area and the access restriction boundary around SWMU 6, prior to the removal activities. Highway 200, located adjacent to the site, is an access road to the public beaches located further to the west.

Investigation History

On March 15, 2005, Vieques was placed on the National Priorities List (NPL) that required all subsequent environmental restoration activities for Navy Installation Restoration (IR) sites (including SWMU 6) to be conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) procedures.

Historical environment investigations conducted at SWMU 6 to characterize potential contamination associated with the waste materials included an Initial Assessment Study (EBS, 2000), Environmental Baseline Survey (EBS) (Program Management Company, 2000), and an Expanded Preliminary Assessment/Site Inspection (CH2M HILL, 2000). Most recently, from 2003 to 2009, an Engineering Evaluation/Cost Analysis (EE/CA), a Remedial Investigation (RI) (CH2M HILL, 2007), a Removal Action Work Plan (Shaw, 2007), pre-removal waste characterization human health and ecological risk assessments (CH2M HILL, 2008a; 2008b), and a Removal Action (Shaw, 2010) were completed for the site.

The RI concluded that that the pre-removal conditions at the site did not pose an unacceptable risk to human health or ecological receptors (CH2M HILL, 2007). However, the Navy and regulatory agencies concurred that there was uncertainty associated with this conclusion because soil samples were collected adjacent to the waste rather than directly through the waste due to safety concerns. The agencies also concurred that the waste at SWMU 6 posed an unacceptable uncertainty regarding a potential future source of contamination and therefore warranted removal.

SAP Worksheet #10 — Problem Definition (continued)

A removal action was conducted at the site in 2009 to remove the waste debris and impacted soil, followed by confirmation sampling and site restoration activities (i.e., mangrove planting). The extent of debris removal was based on visual observation; the extent of soil excavation area was defined by pre-removal waste characterization human health and ecological risk assessments (CH2M HILL, 2008a; 2008b), which were summarized in the technical memorandum entitled *Determination of the Disposition of Excavated Soils at SWMU 6* (CH2M HILL, 2008c).

Due to the removal action, the environmental setting was altered from a predominantly terrestrial habitat to a shallow, open water marine habitat that is hydraulically connected to and tidally influenced with the adjacent Laguna Kiani complex. The site now supports a relatively diverse community of marine fish and invertebrates, along with foraging wildlife such as wading birds.

Release History

Based on data presented in the RI Report, several inorganic constituents (antimony, arsenic, copper, iron, lead, thallium, and zinc) within surface soil and antimony within subsurface soil were found to exceed background levels and various screening criteria (CH2M HILL, 2007). Post-removal confirmation samples detected primarily polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and inorganic constituents above screening criteria (Shaw, 2010). Figures 3 through 10 summarize detections and exceedances of screening criteria for VOCs, SVOCs, pesticides/PCBs, and inorganic constituents within surface and subsurface soil from both pre-removal characterization samples in areas not excavated and from post-removal confirmation samples.

Several inorganics were observed above background levels and screening criteria in historic surface water and sediment samples. The pesticides DDD, DDE, and DDT were observed above the ecological screening criteria within sediment samples collected from the canal connecting Kiani Lagoon South and Kiani Lagoon North (CH2M HILL, 2007). Pre-removal characterization samples in areas not excavated and post-removal confirmation samples detected PAHs, PCBs, and inorganic constituents above screening criteria in sediment (Figures 11 through 14).

Conceptual Site Model

Figure 15 presents a generalized conceptual site model of SWMU 6. Various elements of the CSM are discussed below.

Physical Characteristics

The site is predominantly a shallow, open saltwater area that is hydraulically connected to and tidally influenced with the Kiani Lagoon complex at the northern portion of the site (**Figure 2**). Areas around the perimeter of the site are periodically inundated with water due to tidal fluctuations. Sediment and soils consist of silty sand with organic material and well-graded sand with crushed shells.

SAP Worksheet #10 — Problem Definition (continued)

Potential Contaminant Sources and Transport Pathways

Historically, the debris was the potential contaminant source at the site. Although the debris and associated soils were removed from the site in 2009, residual sediment contamination may be present that could pose potential risks to human and ecological receptors. For example, some sediment screening values for protection of aquatic organisms are more stringent than soil screening values for terrestrial organisms. Tidal exchanges may transport contaminants in surface water and suspended sediment from SWMU 6 into Laguna Kiani North.

The two debris removal locations on the south side of Highway 200 are considered a separate exposure area (for PCBs) and separate from the removal area on the north side of the road. Additional removal in this area will address the elevated PCB concentrations.

Receptors

Receptors at the site include both potential human and ecological receptors.

Human

Exposure media and potential human receptor pathways are listed below. It is noted that most (if not all) potential receptors listed below are hypothetical because the site conditions or land use designations preclude or likely preclude the associated exposure scenarios. However, they are assumed as potential scenarios in accordance with the Vieques Master Human Health Risk Assessment Protocol (CH2M HILL, 2010).

- Current/Future Recreational Users: direct exposure to soil, sediment, and surface water
- Future Maintenance Workers: direct exposure to soil
- Future Construction Workers: direct exposure to soil
- Future Industrial Workers: direct exposure to soil
- Future Residents: direct exposure to soil

The removal action at the site was conducted within the area containing debris, including the area containing contamination potentially posing human and ecological risks. This removal action resulted in the study area becoming a shallow marine setting. In this area, human receptors would not be exposed to groundwater since it is now covered by saline surface water. Therefore, groundwater is not a potential exposure medium and is therefore not included in the human health risk assessment.

Potential residential exposures to surface water and continuously inundated sediment will not be quantified separately in the HHRA. However, as a conservative approach, risk estimates for future recreational users can be used to represent potential surface water and sediment risks for residents since recreational users would likely be exposed at similar exposure frequencies and durations as residents. Intermittently-inundated sediment will be treated as surface soil for human health exposures since this type of sediment is available for direct contact when not covered by water.

A quantitative evaluation of land crab ingestion will not be conducted for SWMU 6. Land crabs are not expected to reside and forage within the new site boundaries, but will be qualitatively discussed in the post-removal human health risk assessment.

SAP Worksheet #10 — Problem Definition (continued)

In addition, fish or shellfish (crab) ingestion is not expected, but a qualitative discussion will be prepared. Based on discussions held with EPA and PREQB on January 26, 2010, initially sediment data will be evaluated by the ecological risk assessors to determine whether sediment concentrations may be a concern for bioaccumulation in fish and shellfish. If there may be bioaccumulation at levels of concern, a conversation will be held between EPA, PREQB, and the Navy to develop the path forward. Considerations may include the following:

- Fish or crab home range size
- Modeled concentrations in edible-size fish or crab
- Percentage of fish or crab that a person could obtain from the onsite lagoon
- Percentage of fish or crab in a person's diet
- Where the chemical may partition into fish or crab tissues
- Cooking and preparation methods for fish and crab

Surface water will not be evaluated as a potable water source since it is salt water.

Ecological

Exposure media include:

- Surface water in the lagoon (including the connection with the Kiani Lagoon complex on the north side of the site).
- Surface sediment in the lagoon (including the connection with the Kiani Lagoon complex on the north side of the site).

Potentially complete exposure pathways exist for aquatic receptors exposed to surface water and sediment at SWMU 6. The following receptor groups will be evaluated in the ERA in accordance with the Vieques Master Ecological Risk Assessment Protocol (CH2M HILL, 2010):

- Fish
- Benthic invertebrates (including crabs)
- Aquatic plants (e.g., mangroves)
- Birds
- Mammals

Currently, there are no complete ecological exposure pathways in terrestrial habitats (for purposes of ecological risk assessment, all solid media to be sampled are considered sediment) at SWMU 6. Terrestrial receptors will not be evaluated.

Rooted submerged vascular aquatic plants and algae may be exposed to chemicals directly from the water or (for rooted plants) from sediment. Aquatic invertebrates (e.g., polychaetes) may be exposed to chemicals in surface sediment and/or surface water through dermal contact and ingestion.

SAP Worksheet #10 — Problem Definition (continued)

Animals may be exposed to chemicals through the: (1) inhalation of gaseous chemicals or of chemicals adhered to airborne particulate matter; (2) incidental ingestion of contaminated abiotic media (soil and/or sediment) during feeding or preening activities; (3) ingestion of contaminated water; (4) ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. The following pathways, however, will not be evaluated for wildlife receptors in the ERA:

- Inhalation - The contribution to the total dose from the inhalation route is generally insignificant for upper trophic level ecological receptors relative to ingestion pathways. Thus, the air pathway will not be evaluated for ecological receptors.
- Dermal Contact - Exposure to chemicals present in surface sediment via dermal contact may occur but is unlikely to represent a major exposure pathway for most upper trophic level receptors; therefore, this exposure route will not be evaluated.
- Groundwater - Ecological receptors (and their prey) are not exposed directly to groundwater at this site. Further, water within the site boundaries is at the surface. Therefore, groundwater is not included in the ecological risk assessment.

In addition to the above, direct ingestion of drinking water is only considered when the salinity is below 15 parts per thousand, the approximate toxic threshold for wildlife receptors. This exposure route will be included or excluded based upon measured salinity data collected from the site, although high salinity is expected due to the marine habitat and tidal flushing.

The following upper trophic level receptors have been selected for exposure modeling in the aquatic/wetland habitats of the lagoon:

- Green heron (*Butorides virescens*) - aquatic avian invertivore/piscivore
- Spotted sandpiper (*Actitis macularia*) – aquatic avian invertivore
- Fishing bat (*Noctilio leporinus*) - mammalian piscivore

Lower trophic level receptor species will be evaluated based upon those taxonomic groupings for which medium-specific screening values have been developed. As such, specific species of aquatic biota have not been chosen as receptors because of the limited information available for specific species and because aquatic biota (marine fish and benthic invertebrates) are evaluated on a community level.

Synopsis of Secondary Data

As discussed in the release history section, **Figures 3 through 10** summarize detections and exceedances of screening criteria for VOCs, SVOCs, pesticides/PCBs, and inorganic constituents within surface and subsurface soil from both pre-removal characterization samples in areas not excavated and from post-removal confirmation samples. The information in these figures, in conjunction with the area of removal, helps provide the rationale for the sampling approach presented in this SAP.

SAP Worksheet #10 — Problem Definition (continued)

General Problems to Address

The ERP Technical Subcommittee met in January and March 2010 and agreed that supplemental confirmatory sampling was necessary to determine if the removal action sufficiently eliminated potential risks at the site. Additionally, the ERP Technical Subcommittee concurred that additional soil removal in an area of elevated PCBs (relative to human health screening criteria), followed by confirmatory sampling, will be conducted on the south side of Route 200. Therefore, the objectives of the post-removal supplemental confirmatory sampling event are to perform limited additional soil removal adjacent to Route 200, sufficiently characterize the post-removal conditions in all SWMU 6 media (i.e., soil, sediment, and surface water), and determine if there are current and/or potential future unacceptable risks to receptors (human and ecological) that will require additional investigation, remedial/removal action, or management.

Environmental Questions to be Answered by the Supplemental Confirmatory Sampling

To achieve the objectives stated above, the following environmental questions will be answered via implementation of this SAP:

1. **What are the current (i.e., post-removal) concentrations of contaminants potentially attributable to CERCLA-related releases in environmental media (soil, surface water, sediment) at SWMU 6?**

   This question will be answered by collecting environmental media samples at locations selected by the Vieques ERP Technical Subcommittee during the scoping sessions. The sampling locations were selected to provide sufficient spatial coverage across the site and to represent potentially impacted media associated with SWMU 6, including re-sampling of an area just south of Route 200 following additional soil removal. Answering this question also includes collecting background surface water and sediment samples in lagoon environments similar to that at SWMU 6. A background surface water/sediment data set is not available for comparison to the surface water and sediment collected from the lagoon at SWMU 6. Background samples will be collected from adjacent lagoons and analyzed for inorganic constituents and pesticides for comparison to the site data. The background data set collected from Lagoona Punta Arenas, located to the west and adjacent to Highway 200, will initially be evaluated separately from the other background lagoons before combining them into one background data set, if applicable.

2. **What are the aquatic ecological communities present at SWMU 6?**

   Current aquatic ecological communities have not been evaluated at SWMU 6. Qualitative surveys of fish, birds, and mammals within the site boundary and nearby background areas will be conducted as part of this sampling event to support the characterization of potential ecological risk.

3. **What are the potential human health and ecological risks posed by contamination attributable to SWMU 6, based on data that represent current (post-removal) conditions?**

   Surface water, sediment, and soil results from the supplemental confirmatory sampling event, soil from the pre-removal characterization sampling events (in areas not excavated and outside of the canal adjacent to the site) and soil from post-removal confirmatory sampling (soil data

SAP Worksheet #10 — Problem Definition (continued)

only and not including VOCs) will be evaluated in post-removal human health and ecological risk assessments. Sediment data from areas with greater than 3 feet of water will not be evaluated in the human health risk assessment because exposure in these areas is unlikely. For the ecological risk assessment, the solid media samples from the three sampling events described above will be evaluated as marine sediment since they all represent an aquatic lagoon/mangrove habitat. As a result, sediment samples from the pre-removal characterization (undisturbed locations), post removal confirmatory sampling, and supplemental confirmatory sampling will be combined for the assessment of ecological risk. The results of the post-removal risk assessments will be presented in a post-removal risk assessment report.

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SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

- Who will use the data and what will the data be used for?
  - The Navy, USEPA, EQB, and USFWS will use the data collected to characterize post-removal conditions at SWMU 6 and conduct post-removal human health and ecological risk assessments. The risk assessments will be used to determine if current (post-removal) conditions are sufficiently protective for the site.
- What are the Project Action Limits (PALs)?

  The PALs are defined in the Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2009) and are listed, by constituent group and medium, in Worksheet #15. In general, the PALs are:

  - Vieques human health screening values for soil, sediment, and surface water are the current (as of preparation of the risk assessment) Regional Screening Levels (RSLs) (adjusted for a hazard quotient [HQ] of 0.1 for non-carcinogens) provided by USEPA.
  - Vieques ecological screening values for sediment and surface water are derived from multiple sources, which are listed in the Vieques Master Ecological Risk Assessment Protocol (CH2M HILL, 2010).
  - Soil-to-groundwater leaching screening values are those provided by USEPA.
  - Vieques background soil inorganics screening values are the West Vieques background soil inorganics upper tolerance limits (UTLs) (CH2M HILL, 2002).
  - Where a specific PAL deviates from the above, it is footnoted in the applicable Worksheet #15 table.
  - Results for general chemistry parameters (i.e., total organic carbon (TOC), acid volatile sulfide/simultaneously extractable metals [AVS/SEM], etc.) collected to support the interpretation of ecological risk results will not be compared to strictly-defined PALs, but will be evaluated qualitatively. These parameters are identified in Worksheet #15.
  - In addition to listing the particular analytes, PALs, and quantitation limits (QLs), Worksheets #15 identify where QLs are higher than PALs. Even though QLs may be higher than certain PALs, method detection limits (MDLs) may be closer to or lower than PALs. Theoretically, the laboratory instrument could detect a constituent down to its MDL at concentrations that would then be reported as estimated. A few constituents have PALs below the MDLs. However, this does not adversely affect the ability to make decisions regarding that particular constituent at the site for the following reasons:
    - Of these constituents, only benzo(a)pyrene, dibenz(a,h)anthracene, aroclor-1254, aroclor-1260, and chromium have previously been observed in soil and/or sediment samples at the site. The majority of the other analytes within each analytical group have QLs lower than the PALs. Detections of other constituents within that analytical group would aid in determining if residual contamination is present at the site (e.g., PAHs commonly occur together).
    - PCBs are generally not observed in surface water due to the fate and transport of the constituent (surface water MDLs are above the adjusted RSLs for tap water and the ecological screening criterion).

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

- Sample-specific detection limits will be compared to risk-based screening levels in the HHRA. Chemicals with elevated detection limits that are nondetect in all samples within an environmental medium will not be selected as chemicals of potential concern in that medium and human health risks will not be estimated for these chemicals. However, the potential for elevated detection limits to underestimate risks will be addressed in the uncertainty section of the HHRA. Similarly, in the ecological risk assessment, the potential risks associated with non-detected chemicals having detection limits above ecological screening values will be discussed in the uncertainty section, though they will not be carried forward as contaminants of potential concern.

- Constituents within surface water are compared to the conservative adjusted RSL for tap water for human health screening (i.e., vinyl chloride, tetrachloroethene, benzo(a)pyrene, etc.). However, surface water at SWMU 6 is saline and not potable.
  - It is noted that high salinity conditions, such as those likely to be encountered at SWMU 6, can result in interferences with the inorganics results for surface water, especially those being analyzed by ICP-MS (6020). These interferences can necessitate dilutions (i.e., 20 times is not uncommon for saline conditions). Method 6010 was considered as an alternative, but analyses using this method would still likely require dilutions to overcome interferences, albeit likely less. However, for all analytes proposed using Method 6020 (except for copper), a 20-time dilution would still yield a lower QL than a 5-times dilution using Method 6010. Similar problems with interference are generally not seen for soil/sediment analyses using Method 6020. Therefore, Method 6020, as applicable per analyte, still provides the best balance of sensitivity and matrix interferences. If QLs above PALs result from dilution, the effect on the risk evaluations will be included in the uncertainty section of the risk assessment narrative. In addition, because the degree of salinity will influence the degree of sample dilution, identification of appropriate background sample locations in the field will include field measurements of salinity (via TDS or similar measurement) in order to select background sample locations that are not only similar to SWMU 6 in terms of aquatic setting, but are similar in terms of salinity as well.

- <u>What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?</u>
  - Soil, sediment, and surface water samples will be submitted to an offsite laboratory for analysis (PEL Laboratories of Tampa, Florida; Mitkem Laboratories of Warwick, Rhode Island; and Faulkner Engineering of Tampa, Florida).
  - Based on historical data, chemical groups of interest comprise VOCs, SVOCs (only PAHs), PCBs, pesticides, and total and dissolved inorganic constituents including hexavalent chromium as shown in Worksheet #15.
  - General parameters comprising AVS/SEM, TOC, pH, grain size, ammonia, sulfide, and water quality parameters (i.e., salinity, conductivity, etc.) will be collected to support interpretation of the human and ecological risk assessment results. All solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

- A qualitative survey of fish, bird, and mammal communities occurring at SWMU 6 and background areas will be conducted to support the ecological risk assessment.
- Worksheets #10, #15, and #18 define the matrices, analytical groups, and, where applicable, specific target analytes for SWMU 6.

- How "good" do the data need to be in order to support the environmental decisions?
  - The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of the site conditions and associated risks at SWMU 6. Laboratory methods will meet CERCLA, USEPA Region 2, and Navy guidance and the data will be validated by a third-party validator using national functional guidance, methodology, and laboratory Standard Operating Procedures (SOPs) as described in Worksheet #36.
  - The laboratory will follow the Measurement Performance Criteria (MPC) in Worksheet #12 for field QC samples and Worksheet #28 for laboratory QC samples. These MPC are consistent with the DoD Quality Systems Manual (QSM) as applicable and laboratory in-house limits where the QSM does not apply.
- How much data should be collected (number of samples for each analytical group, matrix, and concentration)?
  - Worksheet #18 contain the number of samples per matrix per analytical group for SWMU 6. Worksheets #15 contain the particular analytes, PALs, and quantitation limits (QLs). Worksheet #17 provides the rationale for the particular sampling at the site.
  - Thirteen sediment samples (considered surface soil for the human health risk assessment in areas where open water is not present) and seven surface water samples will be collected at the site (**Figure 16**).
- Ten co-located surface water and sediment samples will be collected as background samples from nearby lagoons and analyzed for inorganic constituents including hexavalent chromium, and pesticides (**Figure 17**).
  - All solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample.
  - Field measurements of conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), temperature, salinity, and turbidity will be made at each surface water sample location.
- Where, when, and how should the data be collected/generated?
  - Samples will be collected during one field mobilization planned to occur in early 2011.
  - Data will be collected and generated in accordance with the procedures outlined in the UFP-SAP.
- Who will collect and generate the data? How will the data be reported?
  - CH2M HILL field staff will collect the samples.
  - Laboratory analysis will be performed by Mitkem Laboratories.

SAP Worksheet #11 — Project Quality Objectives/Systematic Planning Process Statements

- The data report will include a CLP Level IV-equivalent package. A Level IV equivalent data package includes a case narrative, all field sample results, quality control forms, and raw data. This will include a Supplemental Naval Installation Restoration Information Solution Electronic Data Deliverable (SNEDD) deliverable in Microsoft Excel format and hardcopy of the raw data.
- The data will be reported in the post-removal risk assessment report.

- How will the data be archived?
  - The data will be archived in accordance to procedures dictated in the Navy CLEAN program/contract. At the end of the project, archived data will be returned to the Navy.
- List the PQOs in the form of if/then qualitative and quantitative statements

  The general objectives of the decision analysis process are:
  - To determine if there are any potential risks to human health and the environment at the site following the removal action
  - To determine if the site can be closed out or if additional actions are warranted to mitigate unacceptable risks.

The associated PQO statements are:

- If the human health and ecological risk assessments determine that no potentially unacceptable risks remain at SWMU 6, no further investigation or action at the site will be necessary and a no further action proposed plan and record of decision will be prepared. However, if the risk assessments determine that potential risks remain, the ERP Technical Subcommittee will reconvene to discuss an appropriate path forward for the site (e.g., biota sampling, additional removal, feasibility study).
- Additional soil removal south of Route 200 and collection of confirmatory surface soil (0 – 6 inches) samples for PCB analysis will be performed until the PCB concentrations are below screening criteria.
- The background data sets from the unnamed lagoon (adjacent to Route 200) and from Laguna Kiani will be evaluated separately, before combining as one background data set. If the results suggest the datasets are statistically different (i.e., represent two distinct populations), the ERP Technical Subcommittee will reconvene and identify how the results differ and determine how the data will be used for background comparisons.

SAP Worksheet #12-1 — Measurement Performance Criteria Table

Matrix: Surface Water

Analytical Group: VOC

Concentration Level: Low (SW-846 8260B)

Measurement Performance Criteria Table – Field QC Samples

QC Sample[2]	Analytical Group[1]	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	VOC	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinseate Blank	VOC	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-1.	S
Trip Blank	VOC	One per cooler	Bias / Contamination	Same as method blank.	S & A
Temperature Blank	VOC	One per cooler	Accuracy / Representativeness	2-6°C	S

[1] If information varies within an analytical group, separate by individual analyte.

[2] MS/MSD is described on Worksheet 28.

SAP Worksheet #12-2 — Measurement Performance Criteria Table

Matrix: Surface Water					
Analytical Group: SVOC (PAHs only)					
Concentration Level: SIM (SW-846 8270C_SIM)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Field Duplicate	SVOC	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinseate Blank	SVOC	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-2.	S
Temperature Blank	SVOC	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.

2 MS/MSD is described on Worksheet 28.

SAP Worksheet #12-3 — Measurement Performance Criteria Table

Matrix: Surface Water					
Analytical Group: PEST/PCB					
Concentration Level: Low (SW-846 8081A, 8082)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Field Duplicate	PEST/PCB	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinseate Blank	PEST/PCB	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-3.	S
Temperature Blank	PEST/PCB	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.
2 MS/MSD is described on Worksheet 28.

SAP Worksheet #12-4 — Measurement Performance Criteria Table

Matrix: Surface Water					
Analytical Group: METAL and FMETAL					
Concentration Level: Low (SW-846 6010B, 6020, 7470, 7196A)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Metals (SW-846 6010B, 6020), Mercury (SW-846 7470), and Hexavalent Chromium (SW-846 7196A)					
Field Duplicate	METAL, FMETAL	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinseate Blank	METAL, FMETAL	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-4.	S
Temperature Blank	METAL, FMETAL	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.
2 MS/MSD is described on Worksheet 28.

SAP Worksheet #12-5 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: VOC					
Concentration Level: Low (SW-846 8260B)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Field Duplicate	VOC	One per 10 field samples	Precision	%RPD ≤30%	S & A
Trip Blank	VOC	One per cooler	Bias / Contamination	Same as method blank. Refer to Worksheet 28-5.	S & A
Temperature Blank	VOC	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.
2 MS/MSD is described on Worksheet 28. Equipment blanks are not performed for solid VOCs because these are collected via soil-grabber syringe.

SAP Worksheet #12-6 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: SVOC (PAHs only)					
Concentration Level: SIM (SW-846 8270C_SIM)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Field Duplicate	SVOC	One per 10 field samples	Precision	%RPD ≤30%	S & A
Equipment Rinseate Blank	SVOC	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-6.	S
Temperature Blank	SVOC	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.

2 MS/MSD is described on Worksheet 28.

SAP Worksheet #12-7 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil[3]					
Analytical Group: PEST/PCB					
Concentration Level: Low (SW-846 8081A, 8082)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Field Duplicate	PEST/PCB	One per 10 field samples	Precision	%RPD ≤30%	S & A
Equipment Rinseate Blank	PEST/PCB	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-7.	S
Temperature Blank	PEST/PCB	One per cooler	Accuracy / Representativeness	2-6°C	S

1 If information varies within an analytical group, separate by individual analyte.
2 MS/MSD is described on Worksheet 28.
3 Surface Soil is analyzed for PCBs only at VWW06-SS012 and VWW06-SS013.

SAP Worksheet #12-8 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: METAL					
Concentration Level: Low (SW-846 6010B, 6020, 7471, 7196A)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample[2]	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Metals (SW-846 6010B, 6020), Mercury (SW-846 7471), and Hexavalent Chromium (SW-846 7196A)					
Field Duplicate	METAL	One per 10 field samples	Precision	%RPD ≤30%	S & A
Equipment Rinseate Blank	METAL	One per day	Bias / Contamination	Same as method blank. Refer to Worksheet 28-8.	S
Temperature Blank	METAL	One per cooler	Accuracy / Representativeness	2-6°C	S

[1] If information varies within an analytical group, separate by individual analyte.
[2] MS/MSD is described on Worksheet 28.

SAP Worksheet #12-9 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: WCHEM					
Concentration Level: Low (SW-846 9045C, 9031/SM4500-S2-D, ASTM D1498, and EPA 350.1) and Medium (Lloyd Kahn)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
pH (SW-846 9045C), Sulfide (SW-846 9031/SM4500-S2-D), Ammonia (EPA 353.2), ORP (ASTM D1498), and Total Organic Carbon (TOC) (Lloyd Kahn)					
Temperature Blank	WCHEM	One per cooler	Accuracy / Representativeness	2-6°C	S

[1] If information varies within an analytical group, separate by individual analyte.

SAP Worksheet #12-10 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: GRAINSIZE					
Concentration Level: N/A (ASTM D422)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
N/A: Field QC samples are not planned for grain size (sieve) analysis.					

[1] If information varies within an analytical group, separate by individual analyte.

SAP Worksheet #12-11 — Measurement Performance Criteria Table

Matrix: Sediment and Surface Soil					
Analytical Group: AVSSEM					
Concentration Level: Low (EPA 821_R_91-100)					
Measurement Performance Criteria Table – Field QC Samples					
QC Sample	**Analytical Group[1]**	**Frequency**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Temperature Blank	WCHEM	One per cooler	Accuracy / Representativeness	2-6°C	S

[1] If information varies within an analytical group, separate by individual analyte.

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SAP Worksheet #13 — Secondary Data Criteria and Limitations Table

The table below provides general information on how secondary data will be used in meeting the current project objectives and the limitations on their use in developing the SAP. Secondary data criteria and limitations tables are presented for each site where historical analytical data exist (applicable to the scope of work covered by this SAP), specifically to address the use and limitations of the historical analytical data.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
8 surface soil samples, 5 surface water samples, and 5 sediment samples were collected during the Site Characterization in August and September 1998	Confirmation Study to Determine Possible Dispersion and Migration of Specific Chemicals, US Naval Ammunition Facility, Vieques Island, prepared by ESE in April 1988.	Soil, surface water and sediment samples were analyzed for pH, total chromium, lead, VOCs, xylene, methyl ethyl ketone, and methyl isobutyl ketone.	Site history summaries. Understanding of historical activities that led to a CERCLA-related release.	Not directly associated with SAP development; data may be used to show historical information on pH levels and the speciation of chromium.
Geophysics survey, MEC avoidance survey, installation and sampling of 4 wells (MW-01 through MW-04), 7 surface water samples, 7 sediment samples, 8 surface soil samples, and 4 subsurface soil samples during Expanded PA/SI in April and May 2000	Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Storage Detachment, Vieques Island, Puerto Rico, prepared by CH2M HILL in October 2000.	All samples were analyzed for VOCs, SVOCs, pesticides, PCBs, total and dissolved metals and explosives	Site history summaries. Understanding of historical activities that led to a CERCLA-related release.	Not directly associated with SAP development; data may be used to show historical levels of contaminants prior to removal activities.
15 surface soil samples and the installation and sampling of 4 wells (MW-05 through MW-08), and 7 surface water samples and 12 sediment samples during the RI in June through October 2003.	Final Remedial Investigation Report, Solid Waste Management Unit (SWMU) 6, Former Naval Ammunition Support Detachment, Vieques Island, Puerto Rico, prepared by CH2M HILL in February 2007	Soil samples and sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, explosives and perchlorate. Groundwater and surface water samples were analyzed for VOCs, SVOCs, pesticides, PCBs, total and dissolved metals, explosives and perchlorate, IC anions, and alkalinity	Soil sampling results in areas not excavated will be used in the post-removal risk assessment. Sediment and surface water samples will not be used. Sampling constituents considered COCs were used to select the constituent groups of interest for the sampling covered in this SAP.	Results from the areas not excavated in the removal action and from outside of the canal adjacent to the site will be used, in conjunction with the supplemental confirmatory data, to evaluate post-removal human health and ecological risk assessments. All historical results were used to help select sampling locations and analyses for the supplemental confirmatory sampling. Historical post-removal confirmatory VOC data were not used to eliminate VOCs from the supplemental confirmatory sampling analyses due to uncertainty in the VOC sample collection technique. These data will also not be used in the post-removal risk assessments.
Confirmation soil samples collected following removal action activities	Final Completion Report, Removal Actions SWMU 6, SWMU 7, AOC J, and AOC R, prepared by Shaw in March 2010	Soil post-removal confirmation samples	Sampling results will be used in the post-removal risk assessment.	VOC data will not be used in post-removal risk assessments since the regulatory agencies questioned the sampling method used.

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SAP Worksheet #14 — Summary of Project Tasks

The technical approach for the proposed field activities at SWMU 6 is detailed below. The *Master Standard Operating Procedures, Protocols, and Plans* (CH2M HILL, 2010) addresses the protocols and standard operating procedures (SOPs) to be used for the SWMU 6 supplemental confirmatory sampling.

Mobilization

Prior to mobilization, NAVFAC Atlantic, USEPA, PREQB, and USFWS will be notified to allow for appropriate oversight and coordination.

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities:

- Analytical laboratory
- Data validation
- Investigation-derived waste (IDW) handler

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Prior to beginning any phase of work, CH2M HILL and its subcontractors will have field meetings to discuss the work items and worker responsibilities, and to familiarize workers with the HSP.

Sampling and Analysis

Surface soil samples will be collected from the top six inches of soil using a split spoon or stainless steel hand auger. Soil samples will be collected in accordance of Attachment A-2 and A-4 of the Master Protocols. Sediment samples will be collected from the top 6 inches in accordance with Attachment G-2 of the Master Protocols. Surface water samples will be collected at mid-depth in accordance with Attachment G-1 of the Master Protocols. All samples will be analyzed for the COPCs identified in Worksheet # 10 and #15; background samples will only be analyzed for inorganic constituents and pesticides.

Field water quality parameters to be measured and logged in the field include total depth, temperature, pH, DO, ORP, conductivity, salinity, and turbidity.

Background Sample Location Selection

Target areas for the collection of background chemical and biological data include Laguna El Pobre to the north, Laguna Kiani to the south, and Laguna Arenas to the west of SWMU 6. Sampling locations within each of these areas, as shown in Figure 17, are intended to be located where environmental conditions are generally comparable to those at SWMU 6. The mapped locations are proposed; final locations will be determined during a site reconnaissance where assessments will be made of total depth, sediment physical characteristics (e.g., grain size distribution), and field water quality (i.e., salinity, temperature, dissolved oxygen, and pH). For example, the three locations proposed in the southwestern portion of Kiani Lagoon may actually occur in relatively deep water, which would require searching for shallower areas further west in the lagoon. During the reconnaissance, all field parameters will be measured (as 1-foot depth profiles) at each sampling

SAP Worksheet #14 — Summary of Project Tasks (continued)

location during a high tide event, and a low tide event. Salinity is an important factor affecting aquatic communities in these lagoon systems, and the target is to identify background and SWMU 6 locations with comparable ranges of salinity. This sampling of field parameters will also factor in significant rain events, such that data will be collected when there is no apparent influence of recent or significant stormwater runoff events. Overall, the final identification of specific background locations will be determined considering field water quality, sediment, and environmental setting, in combination with best professional judgment by environmental scientists familiar with the project area.

Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. Decontamination will follow the SOPs in Attachment E-1 of the Master Protocols.

Investigation-Derived Waste Management

IDW will be managed and disposed of in accordance with the Master Waste Management Plan of the Master Protocols. Liquid and solid IDW will be sampled for full TCLP and RCI to determine the disposal options unless historical IDW sample data for this site is deemed sufficient by the disposal subcontractor.

Shipments

All analytical samples will be sent by Fed Ex which has on-island staff. All equipment will be shipped to the Camp Garcia CH2M HILL office on Vieques. All samples will be shipped in accordance with the SOP in the Master Protocols Attachment 1 H-9 "Packaging and Shipping Procedures for Low-Concentration Samples."

Quality Control

All quality control samples are listed on Worksheet 20. In reference to the field tasks, all field work will be overseen by a field team leader who is responsible for the quality control of the sampling and make sure the proper SOPs are followed for each task.

Sample Analysis

The laboratory will maintain, test, inspect, and calibrate analytical instruments (Worksheets #24 and #25). The laboratory will analyze soil, sediment, and surface water samples for various groups of parameters as shown on Worksheets # 15 and #18.

Data Management

The Project EIS, Angela Barch, is responsible for data tracking and storage. In addition a third party data validator will receive all analytical data from the laboratory and the data will be validated prior to its use by the Navy. All validated analytical data will be loaded into the NIRIS database.

SAP Worksheet #14 — Summary of Project Tasks (continued)

Procedures for Recording and Correcting Data

Field data will be recorded in field logbooks.

Project Assessment/Audit: Worksheets #31 and #32

Data Validation: Worksheets #35 and #36

Data Usability Assessment: Worksheet #37.

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SAP Worksheet #15-1 — Reference Limits and Evaluation Table

Matrix: SW

Analytical Group: VOC

Analyte	CAS Number	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
Dichlorodifluoromethane (Freon-12)	75-71-8	39	NC	20	1	0.17	30	155	30
Chloromethane	74-87-3	19	2700	9.5	1	0.32	40	125	30
Vinyl chloride	75-01-4	0.016	NC	0.016	1	0.18	50	145	30
Bromomethane	74-83-9	0.87	120	0.87	1	0.43	30	145	30
Chloroethane	75-00-3	2100	NC	1050	1	0.72	60	135	30
Trichlorofluoromethane(Freon-11)	75-69-4	130	NC	65	1	0.12	60	145	30
1,1-Dichloroethene	75-35-4	34	2240	17	0.5	0.19	70	130	30
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	5900	NC	2950	1	0.23	70	130	30
Acetone	67-64-1	2200	564000	1100	10	1.3	40	140	30
Carbon disulfide	75-15-0	100	NC	50	1	0.19	35	160	30
Methyl acetate	79-20-9	3700	NC	1850	1	0.38	70	130	30
Methylene chloride	75-09-2	4.8	2560	4.8	5	0.66	55	140	30
trans-1,2-Dichloroethene	156-60-5	11	680	5.5	0.5	0.33	60	140	30
Methyl-tert-butyl ether (MTBE)	1634-04-4	12	5000	6.5	1	0.16	65	125	30
1,1-Dichloroethane	75-34-3	2.4	NC	1.2	1	0.15	70	135	30
cis-1,2-Dichloroethene	156-59-2	37	680	18.5	0.5	0.19	70	125	30
2-Butanone	78-93-3	710	NC	355	4	2	30	150	30
Chloroform	67-66-3	0.19	815	0.19	0.5	0.16	65	135	30
1,1,1-Trichloroethane	71-55-6	910	312	156	1	0.14	65	130	30
Cyclohexane	110-82-7	1300	NC	650	1	0.2	70	130	30
Carbon tetrachloride	56-23-5	0.44	1500	0.2	0.5	0.14	65	140	30
Benzene	71-43-2	0.41	110	0.41	0.5	0.17	80	120	30
1,2-Dichloroethane	107-06-2	0.15	1130	0.15	0.5	0.15	70	130	30
Trichloroethene	79-01-6	2	1940	1	0.5	0.19	70	125	30
Methylcyclohexane	108-87-2	NC	NC	1	1	0.74	70	130	30
1,2-Dichloropropane	78-87-5	0.39	2400	0.39	1	0.15	75	125	30
Bromodichloromethane	75-27-4	0.12	NC	0.12	0.5	0.15	75	120	30
cis-1,3-Dichloropropene	10061-01-5	0.43	7.9	0.43	0.5	0.12	70	130	30
4-Methyl-2-pentanone	108-10-1	200	123000	100	4	1	60	135	30

SAP Worksheet #15-1 — Reference Limits and Evaluation Table (continued)

Matrix: SW
Analytical Group: VOC

Analyte	CAS Number	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
Toluene	108-88-3	230	215	107.5	1	0.14	75	120	30
trans-1,3-Dichloropropene	10061-02-6	0.43	7.9	0.43	1	0.3	55	140	30
1,1,2-Trichloroethane	79-00-5	0.24	550	0.24	1	0.2	75	125	30
Tetrachloroethene	127-18-4	0.11	45	0.11	0.5	0.21	45	150	30
2-Hexanone	591-78-6	4.7	NC	4.7	4	0.48	55	130	30
Dibromochloromethane	124-48-1	0.15	NC	0.15	0.5	0.13	75	125	30
1,2-Dibromoethane	106-93-4	0.0065	NC	0.0065	1	0.11	80	120	30
Chlorobenzene	108-90-7	9.1	25	4.55	0.5	0.16	80	120	30
Ethylbenzene	100-41-4	1.5	25	0.75	0.5	0.22	75	125	30
Xylene, total	1330-20-7	20	NC	10	2	0.5	81	121	30
Styrene	100-42-5	160	910	80	1	0.12	65	135	30
Bromoform	75-25-2	8.5	640	4.25	1	0.19	70	130	30
Isopropylbenzene	98-82-8	68	NC	34	1	0.14	75	125	30
1,1,2,2-Tetrachloroethane	79-34-5	0.067	90.2	0.067	1	0.13	65	130	30
1,3-Dichlorobenzene	541-73-1	NC	28.5	14.25	2	0.15	75	125	30
1,4-Dichlorobenzene	106-46-7	0.43	19.9	0.43	3	0.15	75	125	30
1,2-Dichlorobenzene	95-50-1	37	42	18.5	2	0.077	70	120	30
1,2-Dibromo-3-chloropropane	96-12-8	0.00032	NC	0.00032	2	1	50	130	30
1,2,4-Trichlorobenzene	120-82-1	0.41	5.4	0.41	2	0.11	65	135	30
1,2,3-Trichlorobenzene	87-61-6	2.9	NC	2.9	2	0.16	55	140	30
Bromochloromethane	74-97-5	NC	NC	1	1	017	65	130	30
1,2-Dichloroethane-d4 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	70	120	N/A
4-Bromofluorobenzene (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	75	120	N/A
Dibromofluoromethane (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	85	115	N/A
Toluene-d8 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	85	120	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SW is "RSLs Tapwater Adjusted" (May, 2010) and Marine Surface Water ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-2 — Reference Limits and Evaluation Table

Matrix: SW

Analytical Group: SVOC (PAHs only) (SW-846 8270C_SIM)

Analyte	CAS Number	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
Acenaphthene	83-32-9	220	40	20	0.05	0.02	45	110	30
Acenaphthylene	208-96-8	220	NC	110	0.05	0.02	50	105	30
Anthracene	120-12-7	1100	0.18	0.09	0.05	0.02	55	110	30
Benzo(a)anthracene	56-55-3	0.03	NC	0.03	0.05	0.02	55	110	30
Benzo(b)fluoranthene	205-99-2	0.03	NC	0.03	0.05	0.02	45	120	30
Benzo(k)fluoranthene	207-08-9	0.3	NC	0.15	0.05	0.02	45	125	30
Benzo(g,h,i)perylene	191-24-2	110	NC	55	0.05	0.02	40	125	30
Benzo(a)pyrene	50-32-8	0.003	NC	0.003	0.05	0.02	55	110	30
Chrysene	218-01-9	3	NC	1.5	0.05	0.02	55	110	30
Dibenz(a,h)anthracene	53-70-3	0.003	NC	0.003	0.05	0.02	40	125	30
Fluoranthene	206-44-0	150	11	5.5	0.05	0.02	55	115	30
Fluorene	86-73-7	150	NC	75	0.05	0.02	50	110	30
Indeno(1,2,3-cd)pyrene	193-39-5	0.03	NC	0.03	0.05	0.02	45	125	30
2-Methylnaphthalene	91-57-6	15	NC	7.5	0.05	0.02	45	105	30
1-Methylnaphthalene	90-12-0	2.3	NC	1.15	0.05	0.02	53	125	30
Naphthalene	91-20-3	0.14	1.4	0.07	0.05	0.02	40	100	30
Phenanthrene	85-01-8	1100	8.3	4.15	0.05	0.02	50	115	30
Pyrene	129-00-0	110	0.24	0.12	0.05	0.02	50	130	30
2-Fluoroipehnyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	50	110	N/A
Terphenyl-d14 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	50	135	N/A
2,4,6-Tribromophenol (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	40	125	N/A
2-Fluorophenol (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	20	110	N/A
Nitrobenzene-d5 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	40	110	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SW is "RSLs Tapwater Adjusted" (May, 2010) and Marine Surface Water ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-3 — Reference Limits and Evaluation Table

Matrix: SW

Analytical Group: PEST/PCB

Analyte	CAS Number	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
alpha-BHC	319-84-6	0.011	25	0.011	0.01	0.003	60	130	30
beta-BHC	319-85-7	0.037	25	0.037	0.05	0.0012	65	125	30
delta-BHC	319-86-8	0.037	25	0.037	0.05	0.003	45	135	30
gamma-BHC (Lindane)	58-89-9	0.061	0.16	0.061	0.05	0.0024	25	135	30
Heptachlor	76-44-8	0.015	0.0036	0.0036	0.05	0.00396	40	130	30
Aldrin	309-00-2	0.004	0.13	0.004	0.05	0.0016	25	140	30
Heptachlor epoxide	1024-57-3	0.0074	0.0036	0.0036	0.05	0.0014	60	130	30
Endosulfan I	959-98-8	22	0.087	0.087	0.05	0.0043	50	110	30
Dieldrin	60-57-1	0.0042	0.11	0.0042	0.05	0.0027	60	130	30
4,4'-DDE	72-55-9	0.2	0.001	0.001	0.05	0.0038	35	140	30
Endrin	72-20-8	1.1	0.01	0.01	0.05	0.0018	55	135	30
Endosulfan II	33213-65-9	22	0.087	0.087	0.05	0.0016	30	130	30
4,4'-DDD	72-54-8	0.28	0.001	0.001	0.05	0.0026	25	150	30
Endosulfan sulfate	1031-07-8	22	0.087	0.087	0.05	0.001	55	135	30
4,4'-DDT	50-29-3	0.2	0.001	0.001	0.05	0.0011	45	140	30
Methoxychlor	72-43-5	18	0.03	0.03	0.05	0.0018	55	150	30
Endrin ketone	53494-70-5	1.1	0.01	0.01	0.05	0.006	75	125	30
Endrin aldehyde	7421-93-4	1.1	0.01	0.01	0.05	0.0015	55	135	30
alpha-Chlordane	5103-71-9	0.19	0.004	0.004	0.05	0.003	65	125	30
gamma-Chlordane	5103-74-2	0.19	0.004	0.004	0.05	0.0024	60	125	30
Toxaphene	8001-35-2	0.061	0.21	0.061	0.5	0.18	N/A	N/A	N/A
Decachlorobiphenyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	30	135	N/A
TCMX (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	25	140	N/A
Aroclor-1016	12674-11-2	0.26	0.03	0.03	0.1	0.072	25	145	30
Aroclor-1221	11104-28-2	0.0068	0.03	0.0068	0.1	0.086	N/A	N/A	N/A

SAP Worksheet #15-3 — Reference Limits and Evaluation Table (continued)

Matrix: SW

Analytical Group: PEST/PCB

Analyte	CAS Number	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
Aroclor-1232	11141-16-5	0.0068	0.03	0.0068	0.1	0.040	N/A	N/A	N/A
Aroclor-1242	53469-21-9	0.034	0.03	0.03	0.1	0.062	N/A	N/A	N/A
Aroclor-1248	12672-29-6	0.034	0.03	0.03	0.1	0.026	N/A	N/A	N/A
Aroclor-1254	11097-69-1	0.034	0.03	0.03	0.1	0.024	N/A	N/A	N/A
Aroclor-1260	11096-82-5	0.034	0.03	0.03	0.1	0.050	30	145	30
Decachlorobiphenyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	40	135	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SW is "RSLs Tapwater Adjusted" (May, 2010) and Marine Surface Water ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-4 — Reference Limits and Evaluation Table

Matrix: SW

Analytical Group: METAL, FMETAL

Analyte	CAS Number	Analysis Method	RSLs Tapwater Adjusted (µg/L)	Marine Surface Water ESVs (µg/L)	Project Quantitation Limit Goal[1,2] (µg/L)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
						QLs (µg/L)	MDLs (µg/L)	LCL	UCL	RPD
Aluminum	7429-90-5	6010B	3700	NC	1850	100	9.3	80	120	20
Antimony	7440-36-0	6020	1.5	500	1.5	2	0.11	80	120	20
Arsenic	7440-38-2	6020	0.045	36	0.045	2	0.19	80	120	20
Barium	7440-39-3	6010B	730	200	100	10	0.22	80	120	20
Beryllium	7440-41-7	6010B	7.3	100	3.65	3.65	0.12	80	120	20
Cadmium	7440-43-9	6020	1.8	8.8	1.8	1	0.0033	80	120	20
Calcium	7440-70-2	6010B	NC	NC	100	100	39	80	120	20
Chromium	7440-47-3	6020	0.043	50	0.043	2	0.16	80	120	20
Cobalt	7440-48-4	6020	1.1	NC	1.1	1	0.0041	80	120	20
Copper	7440-50-8	6020	150	3.1	3.1	5	0.43	80	120	20
Iron	7439-89-6	6010B	2600	50	50	40	5.5	80	120	20
Lead	7439-92-1	6020	NC	8.1	4.05	1	0.014	80	120	20
Magnesium	7439-95-4	6010B	NC	NC	100	100	9.8	80	120	20
Manganese	7439-96-5	6010B	88	100	44	10	0.35	80	120	20
Mercury	7439-97-6	7470	1.1	0.94	0.55	0.2	0.037	80	120	20
Nickel	7440-02-0	6010B	73	8.2	4.1	4.1	0.93	80	120	20
Potassium	7440-09-7	6010B	NC	NC	500	500	71.7	80	120	20
Selenium	7782-49-2	6010B	18	71	9	9	4.1	80	120	20
Silver	7440-22-4	6020	18	2.24	1	1	0.0044	80	120	20
Sodium	7440-23-5	6010B	NC	NC	300	300	180	80	120	20
Thallium	7440-28-0	6010B	NC	21.3	10.65	10	4.4	80	120	20
Vanadium	7440-62-2	6010B	18	50	9	9	0.44	80	120	20
Zinc	7440-66-6	6010B	1100	81	40.5	20	4	80	120	20
Chromium (hexavalent)	18540-29-9	7196A	0.043	50	0.043	0.06	0.0035	85	115	20

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients. N/A: Not applicable.

[1] The Project Action Limit for SW is "RSLs Tapwater Adjusted" (May, 2010) and Marine Surface Water ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

The potential for dilution to overcome interference during analysis of marine and brackish water samples as a result of high dissolved salts concentrations is discussed in sections 5.4 and the "interference" section of analytical laboratory SOPs 100.0110 and SOP00012, respectively.

SAP Worksheet #15-5 — Reference Limits and Evaluation Table

Matrix: SD, SS									
Analytical Group: VOC									
Analyte	**CAS Number**	**RSLs Residential Soil Adjusted (µg/kg)**	**Marine Sediment ESVs (µg/kg)**	**Project Quantitation Limit Goal[1,2] (µg/kg)**	**Laboratory-specific**		**LCS, MS, and MSD %R and %RPD Limits[3]**		
					QLs (µg/kg)	**MDLs (µg/kg)**	**LCL**	**UCL**	**RPD**
Dichlorodifluoromethane (Freon-12)	75-71-8	18000	NC	9000	2	0.6	35	135	30
Chloromethane	74-87-3	12000	NC	6000	2	0.38	50	130	30
Vinyl chloride	75-01-4	60	NC	30	2	0.6	60	125	30
Bromomethane	74-83-9	730	NC	365	2	1.2	30	160	30
Chloroethane	75-00-3	1500000	NC	750000	2	0.54	40	155	30
Trichlorofluoromethane(Freon-11)	75-69-4	79000	NC	39500	2	1.5	25	185	30
1,1-Dichloroethene	75-35-4	24000	2780	12000	2	0.41	65	135	30
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	910000	NC	455000	2	0.63	70	130	30
Acetone	67-64-1	6100000	NC	3050000	10	1.3	20	160	30
Carbon disulfide	75-15-0	82000	NC	41000	2	0.35	45	160	30
Methyl acetate	79-20-9	7800000	NC	3900000	5	2	70	130	30
Methylene chloride	75-09-2	11000	NC	5500	5	1.2	55	140	30
trans-1,2-Dichloroethene	156-60-5	15000	NC	7500	2	0.39	65	135	30
Methyl-tert-butyl ether (MTBE)	1634-04-4	43000	NC	21500	2	0.43	75	126	30
1,1-Dichloroethane	75-34-3	3300	NC	1650	2	0.34	75	125	30
cis-1,2-Dichloroethene	156-59-2	78000	NC	39000	2	0.62	65	125	30
2-Butanone	78-93-3	2800000	NC	1400000	10	1.4	30	160	30
Chloroform	67-66-3	290	NC	150	2	0.54	70	125	30
1,1,1-Trichloroethane	71-55-6	640000	856	320000	2	0.32	70	135	30
Cyclohexane	110-82-7	120000	NC	60000	2	0.23	70	130	30
Carbon tetrachloride	56-23-5	610	7245	125	2	0.6	65	135	30
Benzene	71-43-2	1100	137	550	2	0.5	75	125	30
1,2-Dichloroethane	107-06-2	430	NC	215	2	0.29	70	135	30
Trichloroethene	79-01-6	2800	41	20.5	2	0.44	75	125	30
Methylcyclohexane	108-87-2	NC	NC	2	2	0.43	70	130	30
1,2-Dichloropropane	78-87-5	890	NC	450	2	0.63	70	120	30
Bromodichloromethane	75-27-4	270	NC	135	2	0.32	70	130	30
cis-1,3-Dichloropropene	10061-01-5	1700	7.31	850	2	0.42	70	125	30
4-Methyl-2-pentanone	108-10-1	530000	NC	265000	10	1.6	45	145	30
Toluene	108-88-3	500000	1085	250000	2	0.29	70	125	30

SAP Worksheet #15-5 — Reference Limits and Evaluation Table (continued)

Matrix: SD, SS

Analytical Group: VOC

Analyte	CAS Number	RSLs Residential Soil Adjusted (µg/kg)	Marine Sediment ESVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/kg)	MDLs (µg/kg)	LCL	UCL	RPD
trans-1,3-Dichloropropene	10061-02-6	1700	7.31	850	2	0.29	65	125	30
1,1,2-Trichloroethane	79-00-5	1100	570	550	2	0.82	60	125	30
Tetrachloroethene	127-18-4	550	57	28.5	2	0.93	65	140	30
2-Hexanone	591-78-6	21000	NC	10500	10	1.3	45	145	30
Dibromochloromethane	124-48-1	680	NC	340	2	0.46	65	130	30
1,2-Dibromoethane	106-93-4	34	NC	17	2	0.82	70	125	30
Chlorobenzene	108-90-7	29000	162	14500	2	0.35	75	125	30
Ethylbenzene	100-41-4	5400	4	2	2	0.69	75	125	30
Xylene, total	1330-20-7	63000	4	4	4	0.68	83	125	30
Styrene	100-42-5	630000	7070	315000	2	0.28	75	125	30
Bromoform	75-25-2	61000	1310	31000	2	0.46	55	135	30
Isopropylbenzene	98-82-8	210000	NC	105000	2	0.6	75	130	30
1,1,2,2-Tetrachloroethane	79-34-5	560	202	280	2	0.59	55	130	30
1,3-Dichlorobenzene	541-73-1	NC	842	5	5	0.45	70	125	30
1,4-Dichlorobenzene	106-46-7	2400	110	55	5	0.65	70	125	30
1,2-Dichlorobenzene	95-50-1	190000	13	6.5	5	0.56	75	120	30
1,2-Dibromo-3-chloropropane	96-12-8	5.4	NC	5.4	5	2.8	40	135	30
1,2,4-Trichlorobenzene	120-82-1	6200	4.8	4.8	5	0.63	65	130	30
1,2,3-Trichlorobenzene	87-61-6	4900	NC	2450	5	0.61	60	135	30
Bromochloromethane	74-97-5	NC	NC	2	2	0.90	70	125	30
4-Bromofluorobenzene (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	85	120	N/A
Toluene-d8 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	85	115	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SD "RSLs Residential Soil Adjusted" (May, 2010) and Marine Sediment ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-6 — Reference Limits and Evaluation Table

Matrix: SD, SS

Analytical Group: SVOC (SW-846 8270C_SIM)

Analyte	CAS Number	RSLs Residential Soil Adjusted (µg/kg)	Marine Sediment ESVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
					QLs (µg/kg)	MDLs (µg/kg)	LCL	UCL	RPD
Acenaphthylene	208-96-8	340000	16	8	3.33	1.33	45	105	30
Acenaphthene	83-32-9	340000	44	22	3.33	1.33	45	110	30
Anthracene	120-12-7	1700000	85.3	42.65	3.33	1.33	55	105	30
Benzo(a)anthracene	56-55-3	150	261	75	3.33	1.4	50	110	30
Benzo(b)fluoranthene	205-99-2	150	1800	75	3.33	1.9	45	115	30
Benzo(k)fluoranthene	207-08-9	1500	1800	750	3.33	2.1	15	125	30
Benzo(g,h,i)perylene	191-24-2	170000	670	335	3.33	3.1	40	125	30
Benzo(a)pyrene	50-32-8	15	430	7.5	3.33	1.8	50	110	30
Chrysene	218-01-9	15000	384	192	3.33	1.3	55	110	30
Dibenz(a,h)anthracene	53-70-3	15	63.4	7.5	3.33	2.6	40	125	30
Fluoranthene	206-44-0	230000	600	300	3.33	1.33	55	115	30
Fluorene	86-73-7	230000	19	9.5	3.33	1.33	50	110	30
Indeno(1,2,3-cd)pyrene	193-39-5	150	600	75	3.33	3	40	120	30
2-Methylnaphthalene	91-57-6	31000	70	35	3.33	1.33	45	105	30
1-Methylnaphthalene	90-12-0	22000	NC	11000	3.33	1.33	77	140	30
Naphthalene	91-20-3	3600	160	80	3.33	1.33	40	105	30
Phenanthrene	85-01-8	1700000	240	120	3.33	1.33	50	110	30
Pyrene	129-00-0	170000	665	332.5	3.33	1.33	45	125	30
2-Fluorobiphenyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	45	105	N/A
Terphenyl-d14 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	30	125	N/A
2,4,6-Tribromophenol (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	35	125	N/A
2-Fluorophenol (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	35	105	N/A
Phenol-d5/d6 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	40	100	N/A
Nitrobenzene-d5 (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	35	100	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] The Project Action Limit for SD "RSLs Residential Soil Adjusted" (May, 2010) and Marine Sediment ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-7 — Reference Limits and Evaluation Table

Matrix: SD, SS[4]										
Analytical Group: PEST/PCB										
Analyte	**CAS Number**	**RSLs Residential Soil Adjusted (µg/kg)**	**Marine Sediment ESVs (µg/kg)**	**Ecological Soil ESVs (µg/kg)**	**Project Quantitation Limit Goal[1,2] (µg/kg)**	**Laboratory-specific**		**LCS, MS, and MSD %R and %RPD Limits[3]**		
						QLs (µg/kg)	**MDLs (µg/kg)**	**LCL**	**UCL**	**RPD**
alpha-BHC	319-84-6	77	0.32	N/A	0.32	1.5	0.96	60	125	30
beta-BHC	319-85-7	270	0.32	N/A	0.32	1.5	0.15	60	125	30
delta-BHC	319-86-8	270	0.32	N/A	0.32	1.5	0.28	55	130	30
gamma-BHC (Lindane)	58-89-9	520	0.32	N/A	0.32	1.5	0.2	60	125	30
Heptachlor	76-44-8	110	0.3	N/A	0.3	1.5	0.2	50	140	30
Aldrin	309-00-2	29	9.5	N/A	4.75	1.5	0.15	45	140	30
Heptachlor epoxide	1024-57-3	53	0.3	N/A	0.3	1.5	0.15	65	130	30
Endosulfan I	959-98-8	37000	0.51	N/A	18500	1.5	0.22	15	135	30
Dieldrin	60-57-1	30	0.715	N/A	0.3575	1.5	0.16	65	125	30
4,4'-DDE	72-55-9	1400	2.2	N/A	2.2	1.5	0.27	70	125	30
Endrin	72-20-8	1800	0.02	N/A	0.02	1.5	0.26	60	135	30
Endosulfan II	33213-65-9	37000	2.4	N/A	18500	1.5	0.29	35	140	30
4,4'-DDD	72-54-8	2000	1.22	N/A	1.22	1.5	0.51	30	135	30
Endosulfan sulfate	1031-07-8	37000	0.36	N/A	18500	1.5	0.2	60	135	30
4,4'-DDT	50-29-3	1700	1.19	N/A	1.19	1.5	0.38	45	140	30
Methoxychlor	72-43-5	31000	29.6	N/A	15500	1.5	0.27	55	145	30
Endrin ketone	53494-70-5	1800	0.02	N/A	0.02	1.5	0.21	65	135	30
Endrin aldehyde	7421-93-4	1800	0.02	N/A	0.02	1.5	0.36	35	145	30
alpha-Chlordane	5103-71-9	1600	2.26	N/A	2.26	1.5	0.16	65	120	30
gamma-Chlordane	5103-74-2	1600	2.26	N/A	2.26	1.5	0.17	65	125	30
Toxaphene	8001-35-2	440	540	N/A	220	50	33.3	N/A	N/A	N/A
Decachlorobiphenyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	55	130	N/A
TCMX (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70	125	N/A
Aroclor-1016	12674-11-2	390	48	8000	48	30	13	40	140	30
Aroclor-1221	11104-28-2	140	48	8000	48	30	12	N/A	N/A	N/A
Aroclor-1232	11141-16-5	140	48	8000	48	30	20	N/A	N/A	N/A
Aroclor-1242	53469-21-9	220	48	8000	48	30	11	N/A	N/A	N/A

SAP Worksheet #15-7 — Reference Limits and Evaluation Table (continued)

Matrix: SD, SS[4]

Analytical Group: PEST/PCB

Analyte	CAS Number	RSLs Residential Soil Adjusted (µg/kg)	Marine Sediment ESVs (µg/kg)	Ecological Soil ESVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
						QLs (µg/kg)	MDLs (µg/kg)	LCL	UCL	RPD
Aroclor-1248	12672-29-6	220	48	8000	48	30	11	N/A	N/A	N/A
Aroclor-1254	11097-69-1	110	63.3	8000	31.65	30	9.5	N/A	N/A	N/A
Aroclor-1260	11096-82-5	220	48	8000	48	30	6.1	60	130	30
Decachlorobiphenyl (surrogate)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60	125	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

1 The Project Action Limit for SD "RSLs Residential Soil Adjusted" (May, 2010) and Marine Sediment ESVs. The Project Action Limit for SS "RSLs Residential Soil Adjusted" (May, 2010) and Ecological Soil ESVs.

2 The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

3 DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

4 SS samples are analyzed only for PCBs at VWW06-SS012 and VWW06-SS013.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-8 — Reference Limits and Evaluation Table

Matrix: SD, SS

Analytical Group: METAL

Analyte	CAS Number	Analysis Method	RSLs Residential Soil Adjusted (µg/kg)	Marine Sediment ESVs (µg/kg)	Project Quantitation Limit Goal[1,2] (µg/kg)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
						QLs (µg/kg)	MDLs (µg/kg)	LCL	UCL	RPD
Aluminum	7429-90-5	6010B	7700000	18000000	3850000	10000	1900	80	120	20
Antimony	7440-36-0	6010B	3100	2000	1000	1000	240	80	120	20
Arsenic	7440-38-2	6020	390	8200	390	500	13	80	120	20
Barium	7440-39-3	6010B	1500000	48000	24000	500	160	80	120	20
Beryllium	7440-41-7	6010B	16000	NC	8000	500	160	80	120	20
Cadmium	7440-43-9	6010B	7000	1200	600	500	50	80	120	20
Calcium	7440-70-2	6010B	NC	NC	10000	10000	3300	80	120	20
Chromium	7440-47-3	6020	290	81000	290	1000	22	80	120	20
Cobalt	7440-48-4	6010B	2300	10000	1150	500	50	80	120	20
Copper	7440-50-8	6010B	310000	34000	17000	500	160	80	120	20
Iron	7439-89-6	6010B	5500000	220000000	2750000	5000	600	80	120	20
Lead	7439-92-1	6010B	400000	46700	23350	800	340	80	120	20
Magnesium	7439-95-4	6010B	NC	NC	10000	10000	2900	80	120	20
Manganese	7439-96-5	6010B	180000	260000	90000	500	160	80	120	20
Mercury	7439-97-6	7471	2400	150	75	20	3.7	80	120	30
Nickel	7440-02-0	6010B	150000	20900	10450	500	160	80	120	20
Potassium	7440-09-7	6010B	NC	NC	50000	50000	5000	80	120	20
Selenium	7782-49-2	6020	39000	1000	500	2500	150	80	120	20
Silver	7440-22-4	6010B	39000	1000	500	500	160	75	120	20
Sodium	7440-23-5	6010B	NC	NC	30000	30000	10000	80	120	20
Thallium	7440-28-0	6010B	NC	NC	1000	1000	340	80	120	20
Vanadium	7440-62-2	6010B	39000	57000	19500	500	160	80	120	20
Zinc	7440-66-6	6010B	2300000	150000	75000	1000	330	80	120	20
Chromium (hexavalent)[4]	18540-29-9	7196A	290	NC	290	1000	138	85	115	30

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients. N/A: Not applicable.

[1] The Project Action Limit for SD "RSLs Residential Soil Adjusted" (May, 2010) and Marine Sediment ESVs.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

[4] All solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-9 — Reference Limits and Evaluation Table

Matrix: SD, SS

Analytical Group: WCHEM

Analyte	CAS Number	Project Quantitation Limit Goal[1,2]	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[3]		
			QLs	MDLs	LCL	UCL	RPD
Oxidation Reduction Potential (ORP)	-90	N/A	N/A	N/A	N/A	N/A	N/A
pH	PH	N/A	N/A	N/A	N/A	N/A	N/A
Total organic carbon (TOC)	TOC	100 mg/kg	100 mg/kg	10 mg/kg	80	120	20
Sulfide	18496-25-8	0.6 mg/kg	0.6 mg/kg	0.14 mg/kg	80	120	20
Ammonia	7664-41-7	1 mg/kg	1 mg/kg	0.12 mg/kg	90	110	20

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] There are no project action limits for these wet chemistry analyses.

[2] The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

[3] DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

SAP Worksheet #15-10 — Reference Limits and Evaluation Table

Matrix: SD, SS				
Analytical Group: GRAINSIZE				
Analyte	**CAS Number[2]**	**Project Quantitation Limit Goal[1] (%)**	**Laboratory-specific[1]**	
			QLs (%)	**MDLs (%)**
GS03 Sieve 3" (75 mm)	SIEVE75.0	N/A	N/A	N/A
GS05 Sieve 2" (50 mm)	SIEVE50.0	N/A	N/A	N/A
GS06 Sieve 1.5" (37.5 mm)	SIEVE37.5	N/A	N/A	N/A
GS07 Sieve 1" (25.0 mm)	SIEVE25.0	N/A	N/A	N/A
GS08 Sieve 0.75" (19.0 mm)	SIEVE19.0	N/A	N/A	N/A
GS10 Sieve 0.375" (9.5 mm)	SIEVE9.5	N/A	N/A	N/A
Sieve No. 004 (4.75 mm)	SIEVE4.75	N/A	N/A	N/A
Sieve No. 010 (2.00 mm)	SIEVE2.0	N/A	N/A	N/A
Sieve No. 020 (850 um)	SIEVE850	N/A	N/A	N/A
Sieve No. 040 (425 um)	SIEVE425	N/A	N/A	N/A
Sieve No. 060 (250 um)	SIEVE250	N/A	N/A	N/A
Sieve No. 080 (180 um)	SIEVE180	N/A	N/A	N/A
Sieve No. 100 (150 um)	SIEVE150	N/A	N/A	N/A
Sieve No. 200 (75um)	SIEVE75	N/A	N/A	N/A
Gravel (%)	GRAVEL	N/A	N/A	N/A
Sand (%)	14808-60-7	N/A	N/A	N/A
Coarse Sand (%)	COARSESAND	N/A	N/A	N/A
Medium Sand (%)	MEDIUMSAND	N/A	N/A	N/A
Fine Sand (%)	FINESAND	N/A	N/A	N/A
Fines (%)	FINES	N/A	N/A	N/A

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

[1] There are no project action limits for GRAINSIZE. QLs and MDLs are not applicable to GRAINSIZE. The project quantitation limit goal is not applicable to GRAINSIZE.

[2] These CAS numbers are contractor-specific.

SAP Worksheet #15-11 — Reference Limits and Evaluation Table

Matrix: SD, SS

Analytical Group: AVSSEM

Analyte	CAS Number[3]	Project Quantitation Limit Goal[1,2] (uMole/g)	Laboratory-specific		LCS, MS, and MSD %R and %RPD Limits[4]		
			QLs (uMole/g)	MDLs (uMole/g)	LCL	UCL	RPD
Acid volatile sulfide	ACIDSO2	0.3	0.3	0.03	30	150	40
Cadmium	7440-43-9	0.13	0.13	0.013	30	150	40
Copper	7440-50-8	0.75	0.75	0.075	30	150	40
Lead	7439-92-1	0.25	0.25	0.025	30	150	40
Mercury	7439-97-6	0.005	0.005	0.0012	30	150	40
Nickel	7440-02-0	1.3	1.3	0.013	30	150	40
Silver	7440-22-4	0.75	0.75	0.075	30	150	40
Zinc	7440-66-6	1.3	1.3	0.13	30	150	40

Shading represents cases where the PAL is less than the laboratory QL. Refer to Worksheet #11 "What are the project action limits" for discussion on how the data will be used and how non-detections at the laboratory QL will be addressed.

NC: No screening level for this compound. N/A: Not applicable.

1 There are no project action limits for AVSSEM. The SEM concentrations are summed and the sum is divided by the AVS concentration. A ratio less than 1 suggests that the metals concentrations are not bioavailable and thus the sediment is not toxic from this respect.

2 The Project Quantitation Limit Goal is 1/2 the PAL, the PAL, or the Laboratory Specific QL, as applicable.

3 Some CAS numbers are contractor-specific.

4 DoD QSM v. 4.1 is the basis for LCS and MS/MSD limits.

DoD QSM v. 4.1 does not provide limits for this compound. In-house limits used.

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SAP Worksheet #16 — Project Schedule

The field investigation activities are anticipated to occur in winter 2010/2011. The official schedule is the Site Management Plan (SMP) schedule that is distributed and updated separately.

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SAP Worksheet #17 — Sampling Design and Rationale

The proposed sampling locations are shown in **Figures 16** (SWMU 6) **and 17** (Background). The locations of the surface soil, sediment, and surface water samples were selected to ensure adequate spatial distribution of samples to assess potential contamination within the site boundaries and to characterize potential transport from the site into the adjacent lobe of Kiani Lagoon. The rationale for each sample is presented below:

- Seven sediment samples (SD003 through SD007, SD009, and SD010) to address spatial distribution of constituents of interest in sediment within the subtidal (continuously inundated) portion of the site. These samples will be evaluated as sediment for human health exposure and as marine sediments for ecological receptor exposure.
- Two surface soil/sediment samples (SS008 and SS011) to address the spatial distribution of constituents of interest within the intertidal (periodically inundated) area of the site. These samples will be evaluated as surface soil for human health exposure and as marine sediment for ecological receptor exposure.
- Five surface water samples (SW003 through SW007) to address spatial distribution of constituents of interest within the open water area of the site. These samples will be co-located with sediment samples (SD003 through SD007).
- Two co-located surface water/sediment samples (SW/SD001 and SW/SD002) to address potential transport of constituents of interest from SWMU 6 to the adjacent Kiani Lagoon lobe via tidal exchanges. Sample locations will be field adjusted to areas of sediment deposition, if possible to ascertain.
- On the south side of Highway 200, two surface soil/sediment samples (SS012 and SS013) collected at the two debris removal areas where elevated PCB concentrations were observed in the post-removal confirmation samples. These samples will be collected and analyzed for PCBs following additional soil removal from these two areas, and will be evaluated as surface soil for human health exposure and as marine sediment for ecological receptor exposure

In addition, 10 background surface water and sediment samples will be collected from adjacent lagoons with similar aquatic settings; three from Laguna Kiani (SW/SD018 through SW/SD020); three from Laguna El Pobre (SW/SD021 through SW/SD023); and four from Lagoona Punta Arenas located further west adjacent to Highway 200 (SW/SD014 through SW/SD017). The background samples will be analyzed for inorganic constituents including hexavalent chromium (total and dissolved for surface water) and pesticides. Solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample. Field measurements of salinity will also be made at each background sample location to ensure that the salinity conditions are similar to SWMU 6.

The number and locations of the sampling points were discussed and concurred upon by the ERP Technical Subcommittee during the scoping sessions outlined in Worksheet #9.

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SAP Worksheet #18 — Sampling Locations and Methods/SOP Requirements Table

Station ID[1]	Sample ID[1]	Matrix	Depth (units)	Analytical Group[2]	Number of Samples (identify field duplicates) [3]	Sampling SOP Reference
VWW06-SW01	VWW06-SW01-MMYY	Surface Water	Mid-depth	VOCs, SVOCs (PAHs), pesticides, PCBs, total and dissolved inorganic constituents including hexavalent chromium	7 native+1duplicate	SOPs C-1, E-1, G-1, H-1, H-4, H-5, and H-6.
VWW06-SW02	VWW06-SW02-MMYY					
VWW06-SW03	VWW06-SW03-MMYY					
VWW06-SW04	VWW06-SW04-MMYY					
VWW06-SW05	VWW06-SW05-MMYY					
VWW06-SW06	VWW06-SW06-MMYY					
VWW06-SW07	VWW06-SW07-MMYY					
VWW06-SW014	VWW06-SW14-MMYY			Background samples: Total and dissolved inorganic constituents including hexavalent chromium, and pesticides	10 native +1 duplicate	
VWW06-SW015	VWW06-SW15-MMYY					
VWW06-SW016	VWW06-SW16-MMYY					
VWW06-SW017	VWW06-SW17-MMYY					
VWW06-SW018	VWW06-SW18-MMYY					
VWW06-SW019	VWW06-SW19-MMYY					
VWW06-SW020	VWW06-SW20-MMYY					
VWW06-SW021	VWW06-SW21-MMYY					
VWW06-SW022	VWW06-SW22-MMYY					
VWW06-SW023	VWW06-SW23-MMYY					
VWW06-SD01	VWW06-SD01-MMYY	Sediment and/or Soil	0-6 inches below ground surface	VOCs, SVOCs (PAHs), pesticides, PCBs, inorganic constituents including hexavalent chromium, and general parameters (pH, TOC, grain size, sulfide, ammonia, ORP, and AVS/SEM)	11 native + 2 duplicate	SOPs A-2, A-4, C-1, E-1, G-1, G-2, H-1, H-4, H-5, and H-6.
VWW06-SD02	VWW06-SD02-MMYY					
VWW06-SD03	VWW06-SD03-MMYY					
VWW06-SD04	VWW06-SD04-MMYY					
VWW06-SD05	VWW06-SD05-MMYY					
VWW06-SD06	VWW06-SD06-MMYY					
VWW06-SD07	VWW06-SD07-MMYY					
VWW06-SS08	VWW06-SS08-MMYY					
VWW06-SD09	VWW06-SD09-MMYY					
VWW06-SD010	VWW06-SD010-MMYY					
VWW06-SS011	VWW06-SS011-MMYY					
VWW06-SD012	VWW06-SS012-MMYY			PCBs (soil)	2 native + 1 duplicate	
VWW06-SD013	VWW06-SS013-MMYY					
VWW06-SD014	VWW06-SD014-MMYY			Background samples: Inorganic constituents including hexavalent chromium, pesticides, pH and ORP	10 native+ 1 duplicate	
VWW06-SD015	VWW06-SD015-MMYY					
VWW06-SD016	VWW06-SD016-MMYY					
VWW06-SD017	VWW06-SD017-MMYY					
VWW06-SD018	VWW06-SD018-MMYY					
VWW06-SD019	VWW06-SD019-MMYY					
VWW06-SD020	VWW06-SD020-MMYY					
VWW06-SD021	VWW06-SD021-MMYY					
VWW06-SD022	VWW06-SD022-MMYY					
VWW06-SD023	VWW06-SD023-MMYY					

1 Sediment samples will be designated SS if standing water is not present

2 In addition to the samples above collected for laboratory analysis, field parameters (pH, temperature, specific conductivity, salinity, ORP, turbidity, and DO) will be measured. Surface water samples will be gauged for depth. Field parameters measured at background locations will be performed at both low tide and high tide, at 1-foot intervals throughout the water column, as discussed in Worksheet #14. All solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample.

3 Other than duplicates, QA/QC samples are not included in this worksheet. Please refer to Worksheet 12 for the required QA/QC samples.

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SAP Worksheet #19 — Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Containers	Sample Volume[2]	Preservation Requirements	Maximum Holding Time[3] (preparation / analysis)
SW	VOC	SW-846 8260B / SOP00039	3 of 40mL VOC vials	40mL	HCl to pH < 2; Cool to 4°C	14 days
	SVOC	SW-846 3510C, 8270C_SIM / SOP00022, SOP00150	2 of 1L Amber	1000mL	Cool to 4°C	7 days / 40 days
	PEST/PCB	SW-846 3510C, 8081A, 8082 / SOP00022, SOP00031, SOP00030	3 of 1L Amber	1000mL, 1000mL	Cool to 4°C	7 days / 40 days
	METAL, FMETAL[4]	SW-846 6010B, 6020, 7470, 7196A / 100.0003, SOP00011, SOP00012, 100.0110, SOP00071, SOP00116	1 of 250mL HDPE	50mL, 25mL	HNO_3 to pH < 2; Cool to 4°C	6 months, 28 days
			2 of 250mL HDPE	25mL	Cool to 4°C	24 hours

SAP Worksheet #19 — Analytical SOP Requirements Table (continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Containers	Sample Volume2	Preservation Requirements	Maximum Holding Time[3] (preparation / analysis)
SD and/or SS[6]	VOC	SW-846 8260B / SOP00039	2 of 40mL VOC vials	5g	5mL DI Water	48 hours to process[5], 14 days to analyze
			1 of 40mL VOC vials	5g	5mL Methanol	14 days
	SVOC[7]	SW-846 3545A, 3550B, 8270C_SIM / SOP00026, SOP0025, SOP00150	1 of 4oz glass jar	20g	Cool to 4°C	14 days / 40 days
	PEST/PCB[7]	SW-846 3545A, 3550B, 8081A, 8082 / SOP00026, SOP00025, SOP00031, SOP00030	1 of 4oz glass jar	15g	Cool to 4°C	14 days / 40 days
	METAL	SW-846 6010B, 6020, 7471, 3060 / 7196A / 100.0100, SOP00011, SOP00012, 100.0110, SOP00071, SOP00133 / SOP00116	1 of 2oz glass jar	0.5g, 0.25g, 6mg	Cool to 4°C	6 months, 28 days, 14 days
			1 of 2oz glass jar	2.5g	Cool to 4°C	30 days, 168 hours
	WCHEM	SW-846 9045C, ASTM D1498, Lloyd Kahn, EPA 350.1 / SOP00038, TBD, 100.0410, SOP00093	1 of 4oz glass jar	10g, 1g, 1g	Cool to 4°C	ASAP (pH and ORP), 14 days (TOC), 14 days (NH_3)
		SW-846 9031, SM4500-S2-D / 110.0016, 100.0018	1 of 4oz amber glass jar	30g	2N ZnAce, no headspace, Cool to 4°C	7 days
	GRAINSIZE	ASTM D422 / D422	1 of 8oz glass jar	8oz	N/A	N/A
	AVSSEM	821-R-91-100 / 100.0103	1 of 8oz amber glass jar	10g	no headspace, Cool to 4°C	14 days

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
2 Provide the minimum sample volume or mass requirement if it differs from the container volume.
3 Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
4 The field team will field-filter FMETALs so that preserved bottleware can be used.
5 The 48 hour holding time for sediment VOCs is from collection to processing (freezing) at the laboratory. It will be evaluated against 'time spent not frozen'. In nearly all instances, soil VOCs are shipped on the day of collection. If it is necessary to hold samples overnight, the samples will be frozen. The date/time into freezer and date/time out of freezer will be recorded.
6 Two surface soil samples will be analyzed for PCBs only.
7 For SVOCs and PEST/PCBs in sediment and surface soil, SOP00026 (automated solvent extraction (ASE) and SW-846 3545A) is used by default. SOP00025 (sonication and SW-846 3550B) may be used if there are instrumental issues with the ASE or if the sample has a high percent moisture.

SAP Worksheet #20 — Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations[2]	No. of Field Duplicates	No. of MS/MSDs[1]	No. of Field Blanks[4]	No. of Equip. Blanks[4]	No. of VOA Trip Blanks[4]	No. of PT Samples[3]	Total No. of Samples to Lab
SW	VOC	7	1	1		1	8		19
	SVOC	7	1	1		1			11
	PEST/PCB	17	2	2		1			24
	METAL	17	2	2		1			24
	FMETAL	17	2	2		1			24
SS	PCBs only	2	1	1		1			6
SD, SS[5]	VOC	11	2	1		1	8		24
	SVOC	11	2	1		1			16
	PEST/PCB	21	3	2		1			29
	METAL	21	3	2		1			29
	WCHEM (pH and ORP only)	10							10
	WCHEM	11							11
	GRAINSIZE	11							11
	AVSSEM	11							11

1 Although the MS/MSD is not typically considered a field QC, it is included here because location determination is often established in the field. 1 MS/MSD will be collected from the site and 1 MS/MSD will be collected from the background locations to due to the potential for different matrix issues.
2 If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
3 The number of Batch or Project-specific proficiency testing (PT) samples are optional but highly recommended.
4 The number of equipment blanks, field blanks, and trip blanks is based on a fundamental assumption of the number of sampling days each site will require. It was assumed that the surface water and sediment sampling will occupy eight days. One equipment blank is collected per day per piece of equipment when equipment is decontaminated. One equipment blank is collected per event when equipment is disposable. Ambient field blanks will not be collected. One trip blank will be placed into each cooler containing volatiles samples (typically one per day).
5 The sediment samples include two locations VWW06-SS008 and VWW06-SS011 that are inundated at high tide, and are analyzed similarly to sediment samples.

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SAP Worksheet #21 — Project Sampling SOP References Table

Reference numbers refer to the SOP number in the Master Protocols.

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOPs A-2	Soil Sampling	CH2M HILL	Stainless steel hand auger or stainless steel spoons	N	
SOPs C-1	Calibration and measurement with Field Instruments	CH2M HILL	Multi-parameter surface water monitoring instrument	N	
SOPs E-1	Decontamination of Personnel and Equipment	CH2M HILL	Decon equipment	N	
SOPs G-1	Surface Water Sampling	CH2M HILL	Kemmerer	N	
SOPs G-2	Sediment Sampling	CH2M HILL	Grab sampler	N	
SOPs H-1	Preparing Field Log Books	CH2M HILL	Log book	N	
SOPs H-4	Chain-of-Custody	CH2M HILL	SOP, tape, custody seals, electronic chain of custody forms	N	
SOPs H-5	Packaging and Shipping Procedures for Samples Not Considered Dangerous Goods	CH2M HILL	SOP	N	
SOPs H-6	Equipment Blank Preparation	CH2M HILL	Sample containers	N	

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SAP Worksheet #22 — Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Resp. Person	SOP Reference
YSI pH probe	Calibrate probe using YSI Auto-Calibration Standard Solution			Daily, before use	Std X-0.2<Reading<Std X+0.2	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
YSI Specific conductance Probe	Calibrate probe using YSI Calibration Standard Solution			Daily, before use	±3%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
Hach Turbidity Meter	Calibrate probe using Hach-Calibration Standard			Daily, before use	0.1 to 10 NTU standard - ±10%; 11 to 40 NTU standard - ±8%; 41 to 100 NTU standard - ±6.5%; >100 NTU standard - ±5%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
YSI Dissolved oxygen and Temperature Probes	Calibrate probe using YSI-Calibration Standard Solution		During calibration of other probes, check these readings against the day's atmospheric pressure and ambient temperature Check sensor for bubbles and membrane for wrinkles or tear	Daily, before use, at the end of the day (if practicable), and when unstable readings occur	±3 mg/L DO of what the tabulated DO is for the measured temperature	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly. Follow manufacturer's instructions to remove bubble or replace torn membrane	FTL	SOP C-1
YSI multi-meter	Calibrate probe using multiple Calibration Standard Solutions	Check mechanical and electronic parts, verify system continuity, check battery, and clean probes. Calibration check.	Visual Inspection	Daily before use, at the end of the day (if practicable), and when unstable readings occur.	Stable readings after 3 minutes pH reads 4.0 +/- 3% conductivity reads 4.49 +/- 3%	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1

SAP Worksheet #22 — Field Equipment Calibration, Maintenance, Testing, and Inspection Table (continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Resp. Person	SOP Reference
PID	Calibrate using ambient air and isobutylene 100ppm calibration gas	Recharge battery daily	Visual Inspection	Daily, before use, at the end of the day (if practicable), and when unstable readings occur	Ambient air reads 0.0 ppm +/- 3% Isobutylene gas reads 100 ppm +/- 3% ambient air reads 0.0 ppm ±3%: (if possible).	Follow instructions in manual to clean sensor. Do not use this instrument if unable to calibrate properly.	FTL	SOP C-1
ORP	Calibrate using ORP standard solution	Check batteries and have a replacement set on hand	Visual inspection	Daily, before use, at the end of the day (if practicable), and when unstable readings occur	±10 mV of the theoretical redox standard value at that temperature	Clean probe with deionized water and calibrate again. Do not use this instrument if unable to calibrate properly	FTL	SOP C-1

SAP Worksheet #23 — Analytical SOP References Table

Lab SOP Number	Title	Revision Date	Revision Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (y/n)
100.0003	Sample Preparation of Aqueous Samples by Acid Digestion for ICP	03/10/09	7	Feb 10	Definitive	SW / METAL, FMETAL	N/A	Mitkem Laboratories	N
100.0016	Preparation of Soil Samples for Sulfide Analysis	05/08/09	0		Screening	SS, SD / WCHEM	N/A	Mitkem Laboratories	N
100.0018	Inorganic Analysis of Sulfides in Aqueous Samples by Standard Methods 4500S^{-2} D Modified	04/05/07	8	Oct 09	Screening	SS, SD / WCHEM	Spectrophotometer	Mitkem Laboratories	N
100.0100	Preparation of Soil Samples by Acid Digestion by SW-846 Method 3050B for Analysis by ICP-MS	03/29/10	0		Definitive	SS, SD / METAL	N/A	Mitkem Laboratories	N
100.0103	Acid Volatile Sulfide and Simultaneously Extractable Metals	02/12/08	7	Feb 10	Screening	SS, SD / AVSSEM	Spectrophotometer, ICP-AES, CVAA	Mitkem Laboratories	N
100.0110	Determination of Metals in Water and Soils by SW-846 Method 6020A Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	03/26/09	0	Mar 10	Definitive	SS, SD, SW / METAL, FMETAL	ICP-MS	Mitkem Laboratories	N
100.0410	Total Organic Carbon in Soil and Solids by Lloyd Kahn Method and SW-846 9060	12/09/08	1	Jan 10	Screening	SS, SD / WCHEM	TOC Analyzer	Mitkem Laboratories	N
110.0026	Handling Evidentiary Materials	02/22/06	6	Feb 10	N/A	N/A	N/A	Mitkem Laboratories	N
110.0027	Documentation Policy and Procedures	04/04/08	7	Feb 10	N/A	N/A	N/A	Mitkem Laboratories	N
20.0003	Logging Workorders and Samples into Omega ME	11/05/09	4		N/A	N/A	N/A	Mitkem Laboratories	N
30.0002	Bottle Order Preparation	09/01/09	9		N/A	N/A	N/A	Mitkem Laboratories	N
30.0003	Sample Receipt, Storage, Tracking, and Disposal	02/03/10	14		N/A	N/A	N/A	Mitkem Laboratories	N
30.0024	Sample and Waste Disposal	10/19/08	8	Nov 09	N/A	N/A	N/A	Mitkem Laboratories	N
D422	Standard Test Method for Particle-Size Analysis of Soils	N/A	N/A	N/A	Screening	SS, SD / GRAINSIZE	Sieve	Faulkner Engineering	N
SOP00011	Digestion of Liquid and Solid Samples for Analysis of Cations	12/03/09	11		Definitive	SW, SS, SD / METAL, FMETAL	N/A	PEL Laboratories	N
SOP00012	Cations by ICP (SW-846 6010B, 6010C, AFCEE 3.0, AFCEE 3.1, AFCEE 4.0, and CLP ILM 4.0); Hardness by 2340B	03/24/10	11		Definitive	SW, SS, SD / METAL, FMETAL	ICP-AES	PEL Laboratories	N
SOP00022	Sample Preparation: SW-846 3510C Separatory Funnel Extraction	04/14/10	19		Definitive	SW / SVOC, PEST/PCB	N/A	PEL Laboratories	N
SOP00025	Sample Preparation: SW-846 3550B Sonication	04/14/10	14		Definitive	SS, SD / SVOC, PEST/PCB	N/A	PEL Laboratories	N
SOP00026	Sample Preparation: Pressurized Fluid Extraction (PFE) Method 3545 and 3545A	01/04/10	15		Definitive	SS, SD / SVOC, PEST/PCB	N/A	PEL Laboratories	N
SOP00030	Sample Analysis for Polychlorinated Biphenyls/ Polybrominated biphenyls by GC/ECD (EPA SW-846 8082)	09/03/09	9		Definitive	SW, SS, SD / PEST/PCB	GC-ECD	PEL Laboratories	Y[4]
SOP00031	Sample Analysis for Organochlorine Pesticides by Capillary Gas Chromatography (SW-846 8081A)	05/22/09	8		Definitive	SW, SS, SD / PEST/PCB	GC-ECD	PEL Laboratories	N
SOP00039	GC/MS Volatile Organics (SW-846 8260B)	03/08/10	14		Definitive	SW, SS, SD / VOC	GC/MS	PEL Laboratories	N
SOP00071	Sample Analysis: Mercury by CVAA Using FIMS (7470A, 7471A, 7471B)	02/05/10	8		Definitive	SW, SS, SD / METAL, FMETAL	CVAA	PEL Laboratories	N
SOP00083	Sample Analysis: pH Determination Aqueous EPA 150.1, Soil/Waste 9045C (Electrometric)	01/06/10	4		Screening	SD, SS / WCHEM	pH Probe	PEL Laboratories	N
TBD	Reserved for ORP Analysis				Screening	SD, SS / WCHEM	ORP Probe	TBD	N
SOP00093	Sample Analysis: Determination of Ammonia (Phenolate) by Flow Injection Analysis SM 4500-NH_3-G / 350.1	02/01/10	6		Screening	SD, SS / WCHEM	Spectrophotometer	PEL Laboratories	Y[2]
SOP00116	Method SM 3500-Cr D / 7196	02/19/10	4		Definitive	SW, SD, SS / METAL, FMETAL	Spectrophotometer	PEL Laboratories	N
SOP00133	Analysis of Hexavalent Chromium Aqueous and Non-Aqueous 3060A and SW-846 7197A	05/22/09	2		Definitive	SD, SS / METAL	N/A	PEL Laboratories	N
SOP00150	Sample Analysis: GC/MS 8270_SIM Semi-Volatile Organics	03/02/10	5		Definitive	SW, SS, SD / SVOC	GC/MS	PEL Laboratories	N

SOP is currently in-review at time of preparation of this Worksheet (April 22, 2010).

1 If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

2 SOP00093 is currently under modification for applicability to solid samples.

3 At the time of preparation of this worksheet, the organization performing analysis is DoD ELAP (Mitkem) or NFESC (PEL) accredited for all analyses for definitive data.
Standard protocol for diluting samples of marine and brackish water to overcome interferences during metals analysis by ICP-MS (6020) and ICP-AES (6010B) are contained within the analytical laboratory's SOPs 100.0110 and SOP00012, respectively.

4 SOP00030 will be modified by bringing the final extract volume to 2mL instead of 10mL and by adjusting the spike concentrations. This will lower the QLs from the standard 0.5ug/L to 0.1ug/L for each Aroclor.

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SAP Worksheet #24 — Analytical Instrument Calibration Table

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
GC/MS	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to SW-846 8260C and SW-846 8270D for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate.	Analyst	SOP00039 SOP00150
	Initial Calibration (ICAL; minimum five-point for all analytes)	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. RSD for RFs for CCCs: VOCs and SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression r ≥ 0.995; Option 3: non-linear regression–coefficient of determination (COD) r^2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate.		
	Second Source Calibration Verification (ICV)	Once after each ICAL.	All project analytes within ± 20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.		
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ±0.06 RRT units	Correct problem, then rerun ICAL. Flagging criteria are not appropriate.		
	Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours of analysis time.	1. Average RF for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. %Difference/Drift for all target compounds and surrogates: VOCs and SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration).	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV.		
	Breakdown Check (DDT Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤20%.		

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SAP Worksheet #24 — Analytical Instrument Calibration Table (continued)

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
GC-ECD	Retention time (RT) window width calculated for each analyte and surrogate	At method set-up and after major maintenance (e.g., column change).	RT width is ±3 times standard deviation for each analyte RT from a 72-hour study.	N/A	Analyst	SOP00030 SOP00031
	Initial Calibration (ICAL; minimum five-point for all analytes)	ICAL prior to sample analysis.	<u>One of the options below:</u> Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995 Option 3: non-linear regression: coefficient of determination (COD) r^2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL. Flagging criteria are not appropriate.		
	Second Source Calibration Verification (ICV)	Immediately following ICAL.	All project analytes within established retention time windows. <u>GC methods:</u> All project analytes within ± 20% of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL. Flagging criteria are not appropriate.		
	Continuing Calibration Verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. <u>GC methods:</u> All project analytes within ± 20% of expected value from the ICAL.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Breakdown Check (Endrin/DDT only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤15% for both DDT and Endrin.	Correct problem, then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤15% for both DDT and Endrin.		

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SAP Worksheet #24 — Analytical Instrument Calibration Table (continued)

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
ICP-AES CVAA	Linear dynamic range or high-level check standard (ICP-only)	Every 6 months	Within ±10% of true value.	N/A	Analyst	SOP00012 SOP00071 100.0103
	Initial Calibration (ICAL; Minimum one high standard and a calibration blank for all analytes via ICP; minimum 5 standards and a calibration blank via CVAA)	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r ≥ 0.995	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.		
	Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes(s) within ±10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.		
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	ICP: within ± 10% of true value CVAA: within ± 20% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Low-level calibration check standard (ICP only)	Daily, after one-point ICAL.	Within ±20% of true value.	Correct problem, then reanalyze. Flagging criteria are not appropriate.		
	Calibration Blank	Refer to Worksheet 28-4 and 28-8	Refer to Worksheet 28-4 and 28-8	Refer to Worksheet 28-4 and 28-8		

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SAP Worksheet #24 — Analytical Instrument Calibration Table (continued)

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
ICP-MS	Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix.	IDLs shall be ≤ LOD	N/A	Analyst	100.0110
	Tuning	Prior to ICAL	Mass calibration < 0.1 amu from the true value; Resolution ≤ 0.9 amu full width at 10% peak height; For stability, RSD ≤ 5% for at least four replicate analyses.	Retune instrument and reanalyze tuning solutions. Flagging criteria are not appropriate. No analysis shall be performed without a valid MS tune.		
	Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of true value.	N/A		
	Initial Calibration (ICAL; Minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r ≥ 0.995	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.		
	Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes within ±10% of true value.	Verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.		
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	All analytes within ± 10% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Low-level calibration check standard	Daily, after one-point ICAL.	Within ±20% of true value.	Correct problem, then reanalyze. Flagging criteria are not appropriate.		
	Calibration Blank	Refer to Worksheet 28-4 and 28-8	Refer to Worksheet 28-4 and 28-8	Refer to Worksheet 28-4 and 28-8		

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SAP Worksheet #24 — Analytical Instrument Calibration Table (continued)

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
Spectrophotometer	Reference Blank (reagent water)	Before beginning standards or sample analysis.	N/A	N/A	Analyst	SOP00133
	Initial Calibration (ICAL; minimum three standards and a calibration blank)	Daily ICAL prior to sample analysis.	r ≥ 0.995	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.		
	Continuing Calibration Verification (CCV)	After every 15 field samples and at the end of the analysis sequence.	Value of CCV within ±10% of true value.	Correct problem then rerun calibration verification and reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.		
	Second Source Calibration Verification (ICV)	Before beginning a sample run.	Value of second source within ±10% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.		
Spectrophotometer	Initial Calibration (minimum six points)	Daily ICAL prior to sample analysis.	Option 1: RSD for each analyte < 20% Option 2: linear least squares regression: r ≥ 0.995 Option 3: non-linear regression: (COD) r^2 ≥ 0.99 (6 points used for 2nd order, 7 for third order)	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.	Analyst	SOP00093
	Peak window position establishment for each analyte	Once per ICAL and at the beginning of the analytical shift	Position shall be set such that one peak will occupy one peak window and that the bottom of the window will be on the baseline.	N/A		
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	Within ±10% of expected value from the ICAL.	Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.		
	Second Source Calibration Verification (ICV)	After every 10 field samples and at the end of the analysis sequence.	Within ±10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.		

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SAP Worksheet #24 — Analytical Instrument Calibration Table (continued)

Instrument[3]	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[2]	SOP Reference[1]
Spectrophotometer	Initial Calibration	As required, or quarterly, whichever is more frequent.	r ≥ 0.995	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.	Analyst	100.0018
	Continuing Calibration	Every 10 samples and at end of run	Within ±10% of true value.	Correct problem, then repeat distilled standards. Flagging criteria are not appropriate.		
pH Meter	Daily Calibration	Each day of use	±0.05 pH units	Use new buffers, recalibrate	Analyst	SOP00083
ORP Probe					Analyst	TBD
TOC Analyzer	Initial Calibration	Every analytical run	correlation coefficient ≥0.995	Check instrument performance, perform corrective maintenance, recalibrate	Mitkem Dept Supervisor	100.0410
	Continuing Calibration	Every 10 samples and at end of run	Total Organic Carbon within ±10%	Check instrument performance, perform corrective maintenance, recalibrate and reanalyze all samples analyzed since the last successful calibration verification.		

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
2 Name or title of responsible person may be used.
3 DoD QSM v. 4.1 is the basis for specifications on this table. Laboratory SOPs and analytical methods are the basis for pH, TOC, ammonia, and sulfide analysis.

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SAP Worksheet #25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
GC/MS	Check for leaks, check gas supply, recondition or replace trap, clean injection port/liner and septa as needed.	Tune (BFB or DFTPP), Continuing Calibration Verification	Monitor instrument performance via tuning mass criteria and Continuing Calibration Verification	Refer to Worksheet 24	Refer to Worksheet 24.	As needed, replace connections, gas line filters, trap, or GC column. Clip column, replace injection port liner, clean injection port, clean source. Repeat tune, calibration or CCV and reanalyze any affected samples. See SOPs for more details.	Analyst	SOP00039 SOP00150
GC/ECD	Check for leaks, check gas supply, clean injection port/liner.	Continuing Calibration Verification	Monitor instrument performance via Continuing Calibration Verification	Refer to Worksheet 24	Refer to Worksheet 24.	As needed, check GC conditions, check for leaks, clip column, clean/replace injection port/ liner. Repeat calibration or CCV and affected samples. See SOPs for more details.	Analyst	SOP00030 SOP00031
ICP-AES ICP-MS	Perform leak test, check pump tubing, clean torch and window, clean filters.	Initial Calibration Verification and Initial Calibration Blank	Monitor instrument performance via Initial Calibration Verification and Initial Calibration Blank	Refer to Worksheet 24	Refer to Worksheet 24.	Check/replace pump tubing, clean torch and window, clean all filters. Repeat calibration or calibration verification and any affected samples. See SOP for more details.	Analyst	SOP00012 100.0103 100.0110
CVAA	Perform leak test, check tubing, clean window, clean filters.	Initial Calibration Verification and Initial Calibration Blank	Monitor instrument performance via Initial Calibration Verification and Initial Calibration Blank	Refer to Worksheet 24	Refer to Worksheet 24.	Replace connections, replace pump tubing, clean all filters. Repeat calibration or calibration verification. See SOP for more details.	Analyst	SOP00071
Spectrophotometer	Perform leak test, check pump tubing.	Initial Calibration Verification and Initial Calibration Blank	Monitor instrument performance via Initial Calibration Verification and Initial Calibration Blank	Refer to Worksheet 24	Refer to Worksheet 24.	Correct the problem and repeat ICV. See SOP for more details.	Analyst	SOP00133 SOP00093 100.0018
pH Meter	Perform routine calibration check	Calibrate meter with pH 4, and 10 solutions	Monitor instrument performance via pH 7 check	Daily	±0.1 pH unit	Clean electrode, re-fill with solution, replace as necessary. Recalibrate.	Analyst	SOP00083
ORP Probe							Analyst	TBD
TOC Analyzer	Check for leaks, fill humidifier vessel, Replace DI water.	Standard Check sample	Monitor instrument performance via Standard Check sample	Daily, after every 10 samples	Total Organic Carbon within ±15%	Replace catalysts, clean tubing or replace tubing.	Analyst	100.0410
Sieves	Clean Surface	N/A	Check physical condition of sieves	Every 6 months	Sieves should be intact	Replace any sieves that are not intact.	Analyst	D4222

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SAP Worksheet #26 — Sample Handling System

Sample Collection, Packaging, And Shipment
Sample Collection (Personnel/Organization): Field Team Leader/CH2M HILL Sample Packaging (Personnel/Organization): Sample Processor or Field Team Member (TBD)/CH2M HILL Coordination of Shipment (Personnel/Organization): Sample Processor or Field Team Member (TBD)/CH2M HILL Type of Shipment/Carrier: Overnight/FedEx
Sample Receipt And Analysis
Sample Receipt (Personnel/Organization): Sample Receipt Personnel/PEL Laboratories; Note all analytical fractions will be shipped directly to PEL. PEL will ship applicable fractions to Mitkem Laboratories and Faulkner Engineering Sample Custody and Storage (Personnel/Organization): Sample Receipt Personnel/PEL Laboratories Sample Preparation (Personnel/Organization): Extractions Personnel/PEL Laboratories, Extractions Personnel/Mitkem Laboratories Sample Determinative Analysis (Personnel/Organization): Analyst/PEL Laboratories, Analyst/Mitkem Laboratories, Analyst/Faulkner Engineering
Sample Archiving
Field Sample Storage (No. of days from sample collection): 90 days Sample Extract/Digestate Storage (No. of days from extraction/digestion): Extracts may be disposed of 90 days after extraction. Biological Sample Storage (No. of days from sample collection): N/A
Sample Disposal
Personnel/Organization: Environmental Health and Safety Officer/PEL Laboratories, Environmental Health and Safety Officer/Mitkem Laboratories, Environmental Health and Safety Officer/Faulkner Engineering Number of Days from Analysis: Samples may be disposed of 90 days after report mail date

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SAP Worksheet #27 — Sample Custody Requirements Table

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be taped to the jar to ensure they do not separate. The following exceptions apply:

- Aqueous VOCs: Labels will not be taped onto the 40mL VOA vials because the tape interferes with the laboratory's robotic autosampler. Instead, indelible ink will be used on a waterproof label.
- Sediment VOCs: Sample vials are pre-weighed; therefore, the laboratory will attach labels to the vials and tape will not be used. Indelible ink will be used on a waterproof label, which will already be affixed to the jar. Sample labels will include, at a minimum, sample ID, date/time collected, preservative, and sampler's initials.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory

Samples will be collected by field team members under the supervision of the field team leader. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4°C until they are received by the laboratory. The chain of custody (COC) will also be placed into the cooler. Coolers will be shipped to the laboratory via FedEx, with the airbill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal)

Please refer to SOP 30.0003 "Sample Receipt, Storage, Tracking and Disposal".

Sample Identification Procedures

Upon opening the cooler, the receiving clerk signs the COC and then takes the temperature using the temperature blank (if absent, then a sample container or infrared thermometer is used). The sample containers in the cooler are unpacked and checked against the client's COC and any discrepancies or breakage is noted on the COC. Next, if any water samples (with the exception of VOC samples) require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. The clerk will deliver the COC (and any other paperwork, e.g., temperature or pH QA notice) to the project manager for LIMS entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample log-in forms to EIS to check sample IDs and parameters are correct.

SAP Worksheet #27 — Sample Custody Requirements Table (continued)

Chain-of-Custody Procedures

Chains of custody will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain of custody will also have the sampler's name and signature. The chain of custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the LIMS database for each sample.

SAP Worksheet #28-1 — Laboratory QC Samples Table

Matrix: SW
Analytical Group: VOC
Analytical Method / SOP Reference: SW-846 8260B / SOP00039

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-1. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-1. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-1.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-1.
Surrogates	All field and QC samples.	Refer to Worksheet 15-1.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-1.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36.

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SAP Worksheet #28-2 — Laboratory QC Samples Table

Matrix: SW
Analytical Group: SVOC
Analytical Method / SOP Reference: SW-846 8270C_SIM / SOP00150

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-2. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-2. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-2.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-2.
Surrogates	All field and QC samples.	Refer to Worksheet 15-2.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-2.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-3 — Laboratory QC Samples Table

Matrix: SW

Analytical Group: PEST/PCB

Analytical Method / SOP Reference: SW-846 8081A, 8082 / SOP00031, SOP00030

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). See Box D-1 of DoD QSM v 4.1.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-3. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-3. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-3.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-3.
Surrogates	All field and QC Samples	Refer to Worksheet 15-3.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-3.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-4 — Laboratory QC Samples Table

Matrix: SW

Analytical Group: METAL, FMETAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7470, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
METALs and FMETALs by SW-846 6010B						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in al samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-4.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-4.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R

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SAP Worksheet #28-4 — Laboratory QC Samples Table (continued)

Matrix: SW

Analytical Group: METAL, FMETAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7470, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Mercury and Filtered Mercury by SW-846 7470A						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. See Box D-1 of DoD QSM v 4.1.
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. Apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-4.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-4.
METALs and FMETALs by SW-846 6020						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .

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SAP Worksheet #28-4 — Laboratory QC Samples Table (continued)

Matrix: SW

Analytical Group: METAL, FMETAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7470, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Interference Check Solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in al samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-4.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-4.
Internal Standards	Every sample.	IS intensity within 30-120% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.	Analyst	Accuracy	IS intensity within 30-120% of intensity of the IS in the ICAL.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R

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SAP Worksheet #28-4 — Laboratory QC Samples Table (continued)

Matrix: SW

Analytical Group: METAL, FMETAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7470, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Hexavalent Chromium and Filtered Hexavalent Chromium by SW-846 7196A						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 the reporting limit and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 the reporting limit and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results See Box D-1 of DoD QSM v 4.1.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-4. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Sample matrix verification (also known as matrix spike)	One for every sample matrix analyzed.	Same as LCS.	If check indicates interference, dilute and reanalyze sample; persistent interference indicates the need to use alternative method or analytical conditions, or to use method of standard additions. Flagging criteria are not appropriate. Verification check ensures lack of reducing condition or interference from matrix. Additional corrective actions are identified in Method 7196A (Sections 7.4 and 7.5).	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate or Laboratory Replicate	Aqueous matrix: One per every 10 project samples per matrix.	Same as MS and refer to Worksheet 15-4. RPD ≤20% for Laboratory Replicate.	Same as MS. Examine project-specific DQOs. Contact the client as to additional measures to be taken. Flagging criteria are not appropriate.	Analyst	Accuracy/Bias, Precision or Precision (if Laboratory Replicate)	Same as MS and refer to Worksheet 15-4. RPD ≤20% for Laboratory Replicate.
Post-digestion matrix spike	One per preparatory batch.	85-115% recovery.	Correct problem and rehomogenize, redigest, and reanalyze samples. Persistent interference indicates the need to use an alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	85-115% recovery.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-5 — Laboratory QC Samples Table

Matrix: SD, SS
Analytical Group: VOC
Analytical Method / SOP Reference: SW-846 8260B / SOP00039

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-5. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-5. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-5.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-5.
Surrogates	All field and QC samples.	Refer to Worksheet 15-5.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-5.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-6 — Laboratory QC Samples Table

Matrix: SD, SS
Analytical Group: SVOC
Analytical Method / SOP Reference: SW-846 8270C_SIM / SOP00150

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-6. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-6. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-6.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-6.
Surrogates	All field and QC samples.	Refer to Worksheet 15-6.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-6.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-7 — Laboratory QC Samples Table

Matrix: SD, SS
Analytical Group: PEST/PCB
Analytical Method / SOP Reference: SW-846 8081A, 8082 / SOP00031, SOP00030

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). See Box D-1 of DoD QSM v 4.1.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-7. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-7. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-7.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-7.
Surrogates	All field and QC Samples	Refer to Worksheet 15-7.	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	Refer to Worksheet 15-7.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-8 — Laboratory QC Samples Table

Matrix: SD, SS
Analytical Group: METAL
Analytical Method / SOP Reference: SW-846 6010B, 6020, 7471, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
METALs by SW-846 6010B						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in al samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-8.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-8.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.

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SAP Worksheet #28-8 — Laboratory QC Samples Table (continued)

Matrix: SD, SS						
Analytical Group: METAL						
Analytical Method / SOP Reference: SW-846 6010B, 6020, 7471, 7196A / SOP00012, 100.0110, SOP00071, SOP00116						
QC Sample[1]	**Frequency / Number**	**Method / SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R
Mercury by SW-846 7471A						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. See Box D-1 of DoD QSM v 4.1.
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. Apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-8.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-8.

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SAP Worksheet #28-8 — Laboratory QC Samples Table (continued)

Matrix: SD, SS						
Analytical Group: METAL						
Analytical Method / SOP Reference: SW-846 6010B, 6020, 7471, 7196A / SOP00012, 100.0110, SOP00071, SOP00116						
QC Sample[1]	**Frequency / Number**	**Method / SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
METALs by SW-846 6020						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.1) .
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Interference Check Solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in al samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within ±20% of true value.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.

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SAP Worksheet #28-8 — Laboratory QC Samples Table (continued)

Matrix: SD, SS

Analytical Group: METAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7471, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-8.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Worksheet 15-8.
Internal Standards	Every sample.	IS intensity within 30-120% of intensity of the IS in the ICAL.	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards.	Analyst	Accuracy	IS intensity within 30-120% of intensity of the IS in the ICAL.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within ±10% of the original measurement. Only applicable for samples with concentrations > 50X LOQ.
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R
Hexavalent Chromium by SW-846 3060, 7196A						
Method Blank	One per preparatory batch.	No analytes detected > 1/2 the reporting limit and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results See Box D-1 of DoD QSM v 4.1.	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.1. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 the reporting limit and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results See Box D-1 of DoD QSM v 4.1.
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.1. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Worksheet 15-8. Limits are as per DoD QSM v. 4.1. In-house statistical laboratory limits are provided when DoD QSM v. 4.1 does not specify.

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SAP Worksheet #28-8 — Laboratory QC Samples Table (continued)

Matrix: SD, SS

Analytical Group: METAL

Analytical Method / SOP Reference: SW-846 6010B, 6020, 7471, 7196A / SOP00012, 100.0110, SOP00071, SOP00116

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample matrix verification (also known as matrix spike)	One for every sample matrix analyzed.	Same as LCS.	If check indicates interference, dilute and reanalyze sample; persistent interference indicates the need to use alternative method or analytical conditions, or to use method of standard additions. Flagging criteria are not appropriate. Verification check ensures lack of reducing condition or interference from matrix. Additional corrective actions are identified in Method 7196A (Sections 7.4 and 7.5).	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate or Laboratory Replicate	Solid Matrix: One per preparatory batch per matrix.	Same as MS and refer to Worksheet 15-8. RPD ≤30% for Laboratory Replicate.	Same as MS. Examine project-specific DQOs. Contact the client as to additional measures to be taken. Flagging criteria are not appropriate.	Analyst	Accuracy/Bias, Precision or Precision (if Laboratory Replicate)	Same as MS and refer to Worksheet 15-8. RPD ≤30% for Laboratory Replicate.
Pre-digestion matrix spikes (solid matrix samples only, Method 3060)	One soluble and insoluble pre-digestion MS analyzed per preparatory batch prior to analysis	MS recoveries within 75-125%.	Correct problem and rehomogenize, redigest, and reanalyze samples. If that fails, evaluate against LCS limits. If corrective action fails, apply J-flag to the analyte in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	MS recoveries within 75-125%.
Post-digestion matrix spike	One per preparatory batch.	85-115% recovery.	Correct problem and rehomogenize, redigest, and reanalyze samples. Persistent interference indicates the need to use an alternative method or analytical conditions, or to use method of standard additions.	Analyst	Accuracy/Bias	85-115% recovery.

[1] DoD QSM v. 4.1 is the basis for specifications on this table. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-9 — Laboratory QC Samples Table

Matrix: SD, SS

Analytical Group: WCHEM

Analytical Method / SOP Reference: SW-846 9045C, ASTM D1498, Lloyd Kahn, SW-846 9031 / SM4500-S2-D, EPA 350.1 / SOP00083, TBD, 100.00410, 100.0016 / 100.0018, SOP00093

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
pH (SW-846 9045C)						
Laboratory Control Sample	One per batch	±10% of true value	Recalibrate and reanalyze all samples in the affected batch.	Analyst, Laboratory Supervisor	Accuracy	±10% of true value
Laboratory Control Sample Duplicate	One per batch	Same as LCS and %RPD ≤20%	Recalibrate and reanalyze all samples in the affect3ed batch	Analyst, Laboratory Supervisor	Accuracy, Bias	Same as LCS and %RPD ≤20%
Laboratory Replicate	One per batch	%RPD ≤20%	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy, Bias	%RPD ≤20%
ORP (ASTM D1498)						
TBD						
Total Organic Carbon (Lloyd Kahn)						
Method Blank	One per batch	< QL	Investigate source of contamination. Rerun method blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< QL
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	80-120%R	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy, Precision	80-120%R
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS. %RPD < 20%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as LCS. %RPD < 20%
Laboratory Quadruplicate	One per batch	%RSD ≤20%	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy, Bias	%RSD ≤20%
Sulfide (SW-846 9031 / SM4500-S2 D)						
Method Blank	One per batch	< 1/2 QL	Investigate source of contamination. Rerun method blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< 1/2 QL
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	80-120%R	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy	80-120%R
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS. %RPD < 20%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as LCS. %RPD < 20%

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SAP Worksheet #28-9 — Laboratory QC Samples Table (continued)

Matrix: SD, SS						
Analytical Group: WCHEM						
Analytical Method / SOP Reference: SW-846 9045C, ASTM D1498, Lloyd Kahn, SW-846 9031 / SM4500-S2-D, EPA 350.1 / SOP00083, TBD, 100.00410, 100.0016 / 100.0018, SOP00093						
QC Sample[1]	**Frequency / Number**	**Method / SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Matrix Spike (MS)	One per batch of 20 or fewer samples	Same as LCS	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy	Same as LCS
Matrix Spike Duplicate (MSD)	One per batch of 20 or fewer samples	Same as MS. %RPD < 20%	Same as MS.	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as MS. %RPD < 20%
Laboratory Replicate	One per batch	RPD ≤20%	Reanalyze.	Analyst, Laboratory Supervisor	Precision	RPD ≤20%
Ammonia (EPA 350.1)						
Method Blank	One per batch	< QL	Correct problem. If required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< QL
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	90-110%	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy	90-110%
Matrix Spike (MS)	One per batch of 20 or fewer samples	Same as LCS.	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy	Same as LCS.
Matrix Spike Duplicate (MSD)	If no MSD in batch	Same as MS. %RPD < 20%	Same as MS.	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as MS. %RPD < 20%
Laboratory Replicate	One per batch of 20 or fewer samples	RPD ≤20%	Reanalyze.	Analyst, Laboratory Supervisor	Precision	RPD ≤20%

[1] Analytical methods and analytical laboratory SOPs are the basis for specifications on this table. All WCHEM data are 'screening' data. Refer to Worksheet#12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-10 — Laboratory QC Samples Table

Matrix: SD, SS						
Analytical Group: GRAINSIZE						
Analytical Method / SOP Reference: ASTM D422 / D422						
QC Sample	**Frequency / Number**	**Method / SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
N/A: Laboratory QC samples are not planned for grain size (sieve) analysis.						

Refer to Worksheet #12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #28-11 — Laboratory QC Samples Table

Matrix: SD, SS

Analytical Group: AVSSEM

Analytical Method / SOP Reference: 821_R_91-100 / 100.0103

QC Sample[1]	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 QL	Redigest and reanalyze	Analyst	Bias, Contamination	No analytes detected > 1/2 QL
Laboratory Control Sample	One per preparatory batch.	Refer to Worksheet 15-11.	Redigest and reanalyze. Discuss with project manager.	Analyst	Accuracy/Bias	Refer to Worksheet 15-11.
Matrix Spike	One per 20 samples	Same as LCS.	Perform post-digestion spike analysis.	Analyst	Accuracy/Bias	Same as LCS.
Laboratory Replicate	One per 20 samples	<20% RPD	Qualify data.	Analyst	Precision	<20% RPD
Post-digestion Spike (PDS)	For analytes where MS fails	75-125%R	Qualify data.	Analyst	Accuracy	75-125%R

[1] Analytical methods and analytical laboratory SOPs are the basis for specifications on this table. All WCHEM data are 'screening' data. Refer to Worksheet #12 for field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data Validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36

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SAP Worksheet #29 — Project Documents and Records Table

Document	Where Maintained
Field Notebooks	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file. Archived at project closeout*.
Chain-of-Custody Records	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Air Bills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
Corrective Action Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
PID/FID readings	Recorded in Field Notebook. Stored in VDMS.
Water quality field parameters collected during surface water sampling	Recorded in Field Notebook. Stored in VDMS.
OVM/OVA readings	Recorded in Field Notebook. Stored in VDMS.
Various field measurements	Recorded in Field Notebook.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by Field Team Leader. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package.
Equipment Calibration Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Run Logs	Hardcopy in the full data package[1]. Archived at project closeout.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the full data package[1]. Archived at project closeout.
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package[1]. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Clean-up Records	Hardcopy in the full data package[1].
Raw Data	Hardcopy in the full data package[1]. Archived at project closeout.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Data Validation Reports	Electronic .pdf copies in the project file. Hardcopy stored with the data package. Archived at project closeout.

* Data archiving will be done in accordance with Navy requirements. CH2M HILL will provide the Navy (currently Bonnie Capito) all data and reports for archiving.

[1] The format of the full hardcopy data package is described in Mitkem SOP 10.0021. CH2M HILL requires a “Level 4” package.

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SAP Worksheet #30 — Analytical Services Tables

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization[1] (name and address, contact person, and telephone number)	Backup Laboratory / Organization (name and address, contact person, and telephone number)
SW	VOC	7	VOCs by SW-846 8270B	Standard 28 Calendar-day TAT	PEL Laboratories 8405 Benjamin Road; Suite A Tampa, FL 33634 POC: John Heyman (813) 888-9507	Mitkem Laboratories 175 Metro Center Blvd Warwick, RI 02886 POC: Ed Lawler (401) 732-3400
	SVOC		SVOCs (PAHs) by SW-846 8270C_SIM			
	PEST/PCB	17	PESTs by SW-846 8081A PCBs by SW-846 8082			
	METAL, FMETAL		METALs and FMETALs (ICP-AES) by SW-846 6010B Mercury and Filtered Mercury by SW-846 7470A Hexavalent Chromium and Filtered Hexavalent Chromium by SW-846 7196A			
			METALs and FMETALs (ICP-MS) by SW-846 6020		Mitkem Laboratories	N/A
SD, SS	VOC	11	VOCs by SW-846 8270B	Standard 28 Calendar-day TAT	PEL Laboratories	Mitkem Laboratories
	SVOC		SVOCs (PAHs) by SW-846 8270C_SIM			
	PEST/PCB	21	PESTs by SW-846 8081A PCBs by SW-846 8082			
	METAL		METALs (ICP-AES) by SW-846 6010B Mercury Mercury by SW-846 7471A Hexavalent Chromium by SW-846 3060, 7196A			
			METALs (ICP-MS) by SW-846 6020		Mitkem Laboratories	N/A
	WCHEM	11	pH by SW-846 9045C ORP by ASTM D1498 Ammonia by EPA 350.1		PEL Laboratories	Mitkem Laboratories
			Total Organic Carbon (TOC) by Lloyd Kahn Sulfide by SW-846 9031 / SM4500-S2-D		Mitkem Laboratories	N/A
	AVS/SEM		Acid Volatile Sulfide/Simultaneously Extractable Metals (AVS/SEM) by 821-R-91-100			
	GRAINSIZE		Grain Size (Sieve Only, No Hydrometer) by ASTM D422		Faulkner Engineering 2734 Causeway Center Drive Tampa, FL 33619 POC: Jason A. Brenneman (813) 621-8168	N/A
SS	PEST/PCB	2	PCBs by SW-846 8082	Standard 28 Calendar-day TAT	PEL Laboratories	Mitkem Laboratories

[1] If the laboratory is not known at time of SAP submission, put "TBD" in the column as a placeholder.

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SAP Worksheet #31 — Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Performance Audit	One during sampling activities	Internal	CH2M HILL	FTL CH2M HILL	Project Field Team CH2M HILL	Bill Hannah PM CH2M HILL	Brett Doerr Environmental Manager CH2M HILL
Safe Work Observation	One per week during field activities	Internal	CH2M HILL	SSC CH2M HILL	Project Field Team CH2M HILL	Mark Orman H & S Officer CH2M HILL	SSC CH2M HILL

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SAP Worksheet #32 — Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action (CA) Response Documentation	Individual(s) Receiving CA Response (name, title, organization)	Timeframe for Response
Field Performance Audit	Field Performance Audit Checklist	Field Team PM Environmental Manager	Within one day of audit	Verbal and CA Form	FTL CH2M HILL	Within one day of receipt of CA Form
Safe Work Observation (SWO)	Safe Work Observation Form	FTL Field Team PM	Immediately (person involved or observed person). Following day (field team). Within 1 week if worthy of elevation (H&S officer)	On SWO Form	FTL and individual being observed, and the PM and if elevated to the H&S officer.	Corrected in the field immediately, and within 1 week if elevated.

SAP Worksheet #32-1 — Corrective Action Form

Person initiating CA _____ **Date** _____

Description of problem and when identified: _____

_____

_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

_____

<u>Sequence of CA:</u> (including date implemented, action planned and personnel/data affected) _

_____

_____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ **Date:** _____

CA initially approved by: _____ **Date:** _____

Follow-up date: _____

Final CA approved by: _____ **Date:** _____

Information copies to:

_____

_____

_____

_____

SAP Worksheet #32-2 — Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ **Date:** _____

Project Location: _____ **Signature:** _____

Team Members

Yes _____ No _____ 1) Is the approved work plan being followed?
Comments _____

Yes_____ No _____ 2) Was a briefing held for project participants?
Comments _____

Yes _____ No _____ 3) Were additional instructions given to project participants?
Comments _____

Sample Collection

Yes _____ No _____ 1) Is there a written list of sampling locations and descriptions?
Comments _____

Yes _____ No _____ 2) Are samples collected as stated in the Master SOPs?
Comments _____

Yes _____ No _____ 3) Are samples collected in the type of containers specified in the work plan?
Comments _____

Yes _____ No _____ 4) Are samples preserved as specified in the work plan?
Comments _____

Yes _____ No _____ 5) Are the number, frequency, and type of samples collected as Specified the work plan?
Comments _____

SAP Worksheet #32-2 — Field Performance Audit Checklist (continued)

Yes _____ No _____ 6) Are QA checks performed as specified in the work plan?
Comments _____

Yes _____ No _____ 7) Are photographs taken and documented?
Comments _____

Document Control

Yes _____ No _____ 1) Have any accountable documents been lost?
Comments _____

Yes _____ No _____ 2) Have any accountable documents been voided?
Comments _____

Yes _____ No _____ 3) Have any accountable documents been disposed of?
Comments _____

Yes _____ No _____ 4) Are the samples identified with sample tags?
Comments _____

Yes _____ No _____ 5) Are blank and duplicate samples properly identified?
Comments _____

Yes _____ No _____ 6) Are samples listed on a chain-of-custody record?
Comments _____

Yes _____ No _____ 7) Is chain-of-custody documented and maintained?
Comments _____

SAP Worksheet #32-3 — Safe Work Observation Form

Project:		**Observer:**	**Date:**
Position/Title of worker observed:		**Background Information/comments:**	
Task/Observation Observed:			

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's CAs/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's CAs/Comments:**
Other…			

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SAP Worksheet #33 — QA Management Reports Table

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliations)
Field Audit Report	One during sampling activities	Submitted with report in which data are analyzed and presented	Project Manager: Bill Hannah/CH2M HILL	Regional Health, Safety, Environment, and Quality Manager: Mark Orman/CH2M HILL Included in project files.
Data Validation Reports	Once, after analysis by laboratory, for all laboratory analytical data except WCHEM and MICRO analyses.	Submitted by the data validator within 21 calendar-days of receipt of analytical data (from laboratory)	Data Validation Subcontractor, Laura Maschoff/DataQual Environmental Services	Project Chemist: Michael Zamboni/CH2M HILL Project EIS: Angela Barch/CH2M HILL Project Manager: Bill Hannah/CH2M HILL
Data Usability Assessments (Data Quality Evaluation)	Once, as an appendix to the report in which data are analyzed and presented.	Along with the project report.	Project Chemist: Michael Zamboni/CH2M HILL	Vieques RPM: Daniel Rodriquez/USEPA and Vieques RPM Wilmarie Rivera/PREQB

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SAP Worksheet #34 — Verification (Step I) Process Table

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Internal	Project Manager: Bill Hannah/CH2M HILL
Chains of Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody will be initialed by the reviewer, a copy of the chain-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Internal	Field Team Leader CH2M HILL Project EIS: Angela Barch/CH2M HILL
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project EIS in the form of laboratory logins.	Internal	Project EIS: Angela Barch/CH2M HILL
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	External	Data Validation Subcontractor: TBD
Documentation of Laboratory Method Deviations	Laboratory Method Deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Internal	Project Chemist: Michael Zamboni/CH2M HILL
Electronic Data Deliverables	Electronic Data Deliverables will be compared against hardcopy laboratory results (10% check).	Internal	Project EIS: Angela Barch/CH2M HILL
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process.	External	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified externally by the third party validator. Also, the data will be verified for completeness by an Environmental Information System (EIS) specialist. A chemist will perform a data quality evaluation.	Internal and External	Respective Laboratory QA Officer Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services Project EIS: Angela Barch/CH2M HILL Project Chemist: Michael Zamboni/CH2M HILL

SAP Worksheet #34 — Verification (Step I) Process Table (continued)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and corrective action forms will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the site manager will be notified to ensure action is taken.	Internal	Project Manager: Bill Hannah/CH2M HILL Project Chemist: Michael Zamboni/CH2M HILL
Corrective Action Reports	Corrective action reports will be reviewed by the project chemist or project manager and placed into the project file for archival at project closeout.	Internal	Project Chemist: Michael Zamboni/CH2M HILL Project Manager: Bill Hannah/CH2M HILL

SAP Worksheet #35 — Validation (Steps IIa and IIb) Process Table

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa[1]	Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Project Chemist: Michael Zamboni/CH2M HILL
IIa	Target Compound List and Target Analyte List	Ensure the laboratory reported all analytes from each analysis group as per Worksheet 15.	Project Chemist: Michael Zamboni/CH2M HILL
IIb[2]	Reporting Limits	Ensure the laboratory met the project-designated quantitation limits as per Worksheet 15. If quantitation limits were not met, the reason will be determined and documented.	Project Chemist: Michael Zamboni/CH2M HILL
IIa	Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
IIa / IIb	Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
IIa	Raw Data	10 percent review of raw data to confirm laboratory calculations.	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
IIb	Onsite Screening	All non-analytical field data will be reviewed against QAPP requirements for completeness and accuracy based on the field calibration records.	Field Team Leader (TBD)
IIa	Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
IIb	Documentation of field QC Sample Results	Establish that all required QAPP QC samples were run and met limits.	Project Chemist: Michael Zamboni/CH2M HILL Data Validation Subcontractor: TBD

[1] IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]

[2] IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

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SAP Worksheet #36 — Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	SW or SD or SS	VOA[1]	"Validating Volatile Organic Compounds by SW-846 Method 8260B"; SOP HW-24 Revision 2; August, 2008	Data Validation Subcontractor: Laura Maschoff/DataQual Environmental Services
		SVOA[1]	"Validating Semivolatile Organic Compounds by SW-846 Method 8270"; SOP HW-22 Revision 4; August, 2008	
		PEST/PCB[1]	"Data Validation SOP of Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B"; SOP HW-44 Revision 1; October, 2006 "Data Validation SOP of Organic Analysis of PCBs by Gas Chromatography SW-846 Method 8082A"; SOP HW 45 Revision 1; October, 2006	
		METAL or FMETAL[1]	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Worksheet 12, QLs and PALs are presented in Worksheet 15, QA/QC criteria for calibrations are presented in Worksheet 24, and QA/QC criteria for laboratory QC samples are presented in Worksheet 28. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in "Evaluation of Metals Data for the CLP Program"; SOP HW-2 Rev.13, ILM05.3; September, 2006. Guidance and qualifiers from USEPA Contract Laboratory Program National Functional Guidelines for inorganic Data Review (EPA, October, 2004) may also be applicable.	
IIa and IIb	SW or SD	WCHEM	WCHEM, GRAINSIZE, and AVSSEM data will not undergo third-party data validation. However, they are still subject to the verification and validation procedures specified in Worksheets 34 and 35. The case narratives will be read, any issues will be investigated, and the impact (if any) on data quality or data usability will be discussed with the project team.	Project Chemist: Michael Zamboni/CH2M HILL
		GRAINSIZE		
		AVSSEM		

[1] 100% of VOA, SVOA, PEST/PCB, METAL, and FMETAL data will be third-party validated. The third-party data validator will also recalculate 10% of results from the raw data.

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SAP Worksheet #37 — Usability Assessment

Data usability evaluation comprises critical assessment of the data with respect to the project objective. Given that the primary objective of the pilot studies is to evaluate the nature and extent of contamination, the comprehensive dataset will be reviewed to determine if it is adequate for making the project-specific determinations.

Some specific examples of data availability and usability protocol are:

- The third-party data validator is the only party that may apply qualifiers to the data. Minor QC exceedances will result in "estimated" data, represented by J, NJ, and UJ qualifiers. Major QC exceedances will result in "rejected" data, represented by R-qualifiers. The effect on availability and usability of rejected results will be evaluated.
- The use of "estimated" data will be discussed in the report. "Estimated" data are generally considered usable for all purposes. The project team may choose to use "rejected" data in a qualitative manner under some circumstances, if the direction of bias and proximity to a project action limit are known. For example, if there were a hypothetical location where a benzene detection was rejected because of an extremely low bias, yet the result was still greater than the project action limit, this rejected result would still be usable for demonstrating that an exceedance has occurred.
- While all non-rejected data are available for use to the project team, non-detect (and attributable to blank contamination) results may not be useful if the QL is greater than the associated project action limit. In these cases, the project team will determine whether or not the laboratory would likely have detected the contaminant if present at or above the PAL (i.e., evaluation of the PAL versus the MDL).
- Ten percent of hardcopy analytical data will be checked against the electronic data to identify discrepancies. This check will be performed manually. The check will verify results and data validation qualifiers. This process is intended to identify discrepancies between the hardcopy and electronic data. If any discrepancies are identified during the ten percent verification, the laboratory will be contacted, the discrepancies will be communicated, and the laboratory will resolve the discrepancies.
- If significant deviation is evident between parent samples and their field or laboratory duplicate, the cause will be investigated. The possibility of a switched sample will be examined. Field duplicates are expected to exhibit greater deviation than laboratory duplicates. Field duplicate and laboratory duplicate reproducibility is outlined in Worksheets 12 and 28.

SAP Worksheet #37 — Usability Assessment (continued)

- Significant biases may be evident based on LCS, MS/MSD, and spiked surrogate exceedances. The third-party data validator will consider QC exceedances and biases when applying qualifiers to data. The project team will consider the direction of bias when determining the usability of qualified data compared to PALs. Low biases are expected to occur more frequently than high biases. In the case of rejected non-detect data, low biases represent the inability of the laboratory to detect contaminants that may or may not be present at the site. The project team will act conservatively and understand that it is not known whether or not these compounds are present below, at, or above the PAL. High biases indicate that a result may be lower than it is reported. When high-biased data are greater than a PAL, the project team will examine the proximity of the result to the PAL to determine whether additional data are needed or if the result should simply be considered a PAL exceedance.
- After completion of the data validation, the distribution of applied data validation qualifiers will be examined to determine if there are patterns that negatively affect the usability of data. This information will be compiled into a DQE, which will be presented as an appendix to the project report.
- Data usability is not decided upon by any one individual or entity. The project team, as a whole, will decide upon the usability of the data.
- Deviations from the SAP sampling and analytical protocols will be reviewed to ascertain whether or not they are significant enough to negatively affect the usability of data.

Notes:

1. Completeness is defined as the percentage of measurements that are judged to be available compared to the total number of measurements made. The objective of the overall completeness goal for this project is set at 95% available data. This goal is inclusive of both field and laboratory analytical data.
2. Discussions of precision, accuracy, representativeness, completeness, and comparability will be included in the data quality review to describe the impact of data quality on project data quality objectives and data usability.

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CH2M HILL 2008a. *Pre-Removal Waste Characterization Human Health Risk Assessment for SWMU 6, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico*. October.

CH2M HILL 2008b. *Pre-Removal Waste Characterization Ecological Risk Assessment for AOCs J and R, SWMUs 6 and 7, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* October.

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ATTACHMENT A
FIGURES

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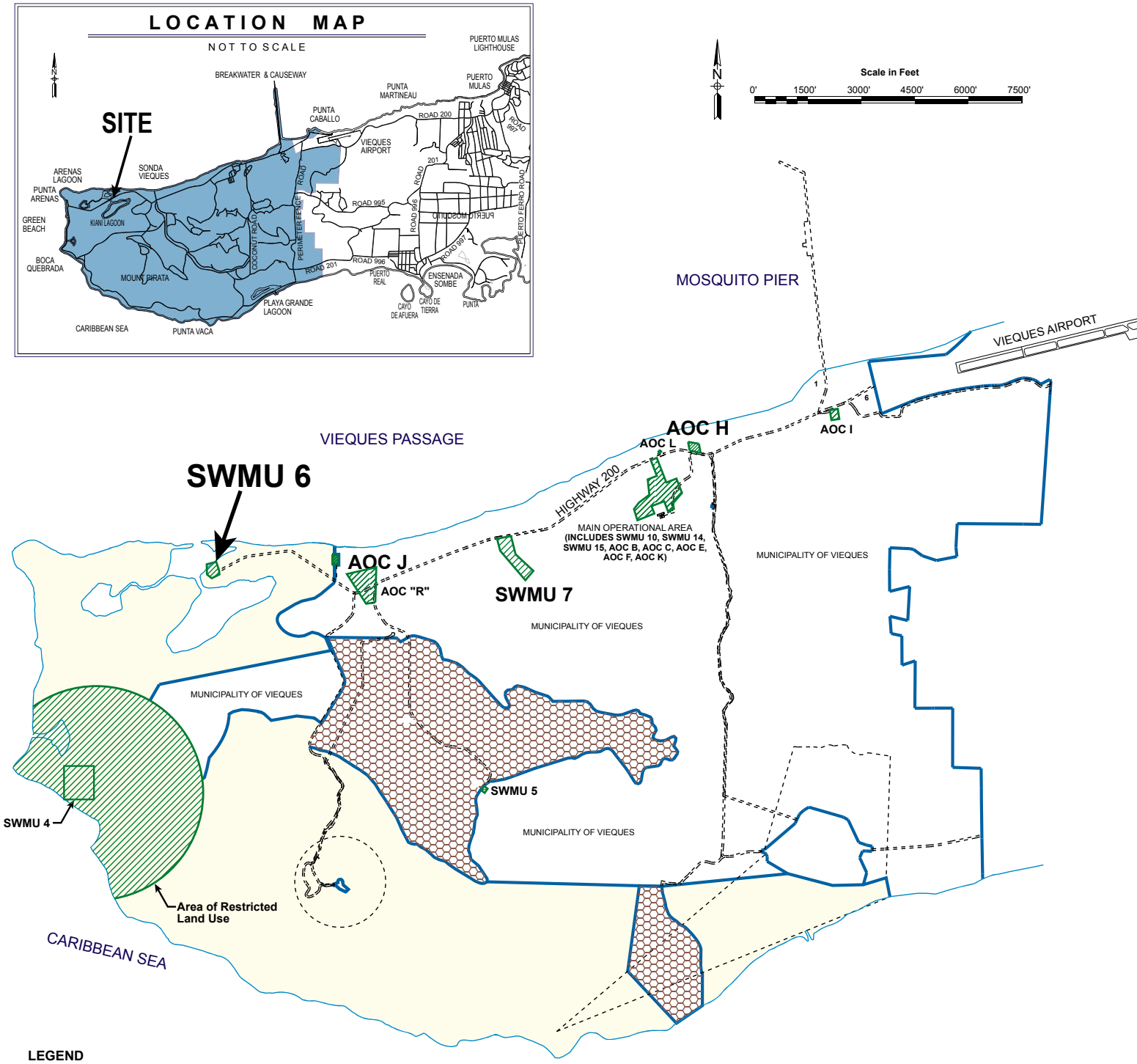


SOURCE:
VIEQUES NASD SURVEY LAND TRANSFER & DISPOSAL OVERALL LOCATION SURVEY
PREPARED BY GLENN & SADLER AND LUIS BERRIOS MONTES & ASSOCIATES

Figure 1
SWMU 6 Site Location Map
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES030810212057TPA / 392485.PP.FR

North

0 300 600 Feet

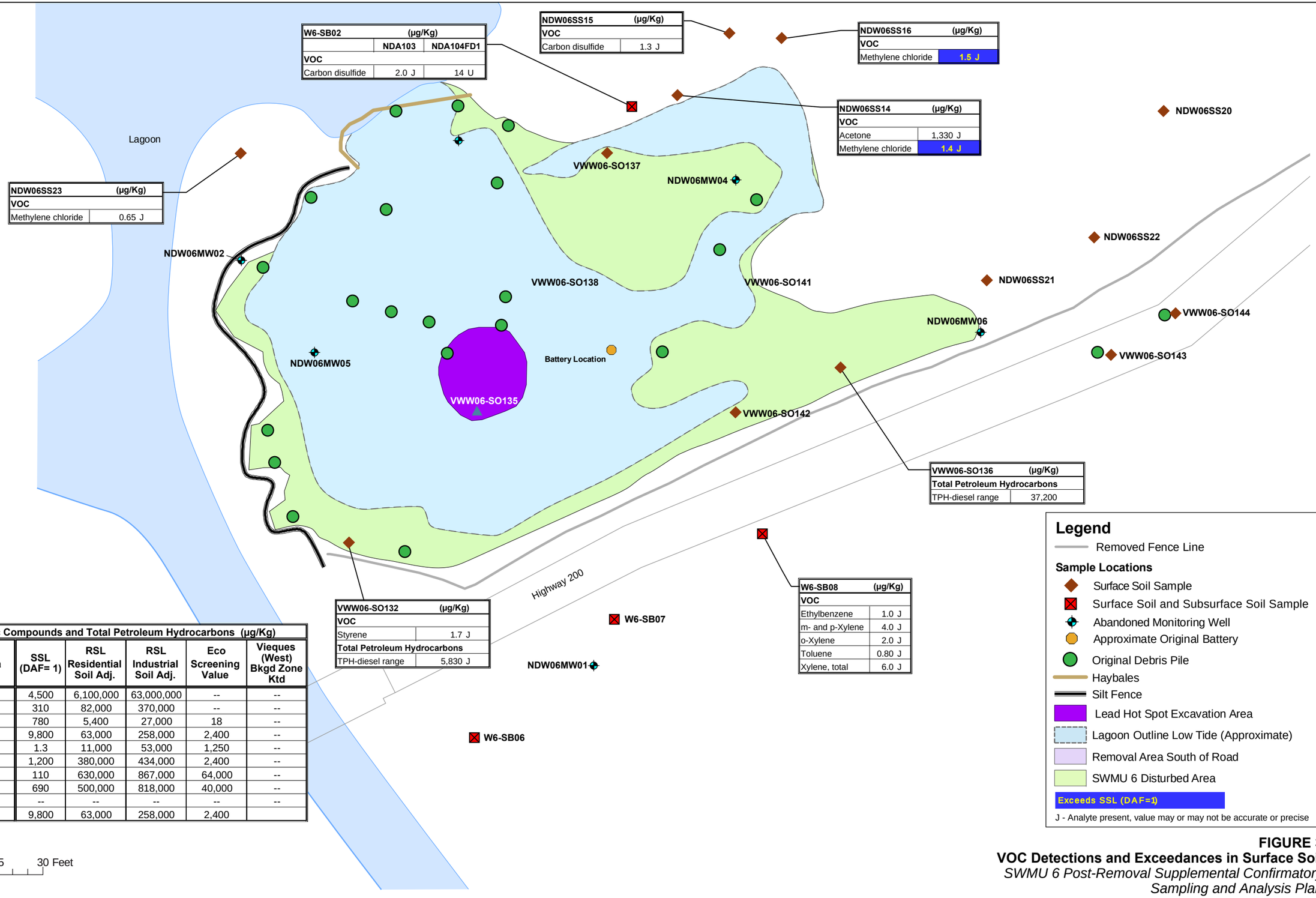
LEGEND

SWMU 6 Access Restriction Boundary

FIGURE 2
Aerial Photograph of SWMU 6
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F2-Aerial Photograph of SWMU 6.ai



Volatile Organic Compounds and Total Petroleum Hydrocarbons (µg/Kg)

Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Eco Screening Value	Vieques (West) Bkgd Zone Ktd
Acetone	4,500	6,100,000	63,000,000	--	--
Carbon disulfide	310	82,000	370,000	--	--
Ethylbenzene	780	5,400	27,000	18	--
m- and p-Xylene	9,800	63,000	258,000	2,400	--
Methylene chloride	1.3	11,000	53,000	1,250	--
o-Xylene	1,200	380,000	434,000	2,400	--
Styrene	110	630,000	867,000	64,000	--
Toluene	690	500,000	818,000	40,000	--
TPH-diesel range	--	--	--	--	--
Xylene, total	9,800	63,000	258,000	2,400	

FIGURE 3
VOC Detections and Exceedances in Surface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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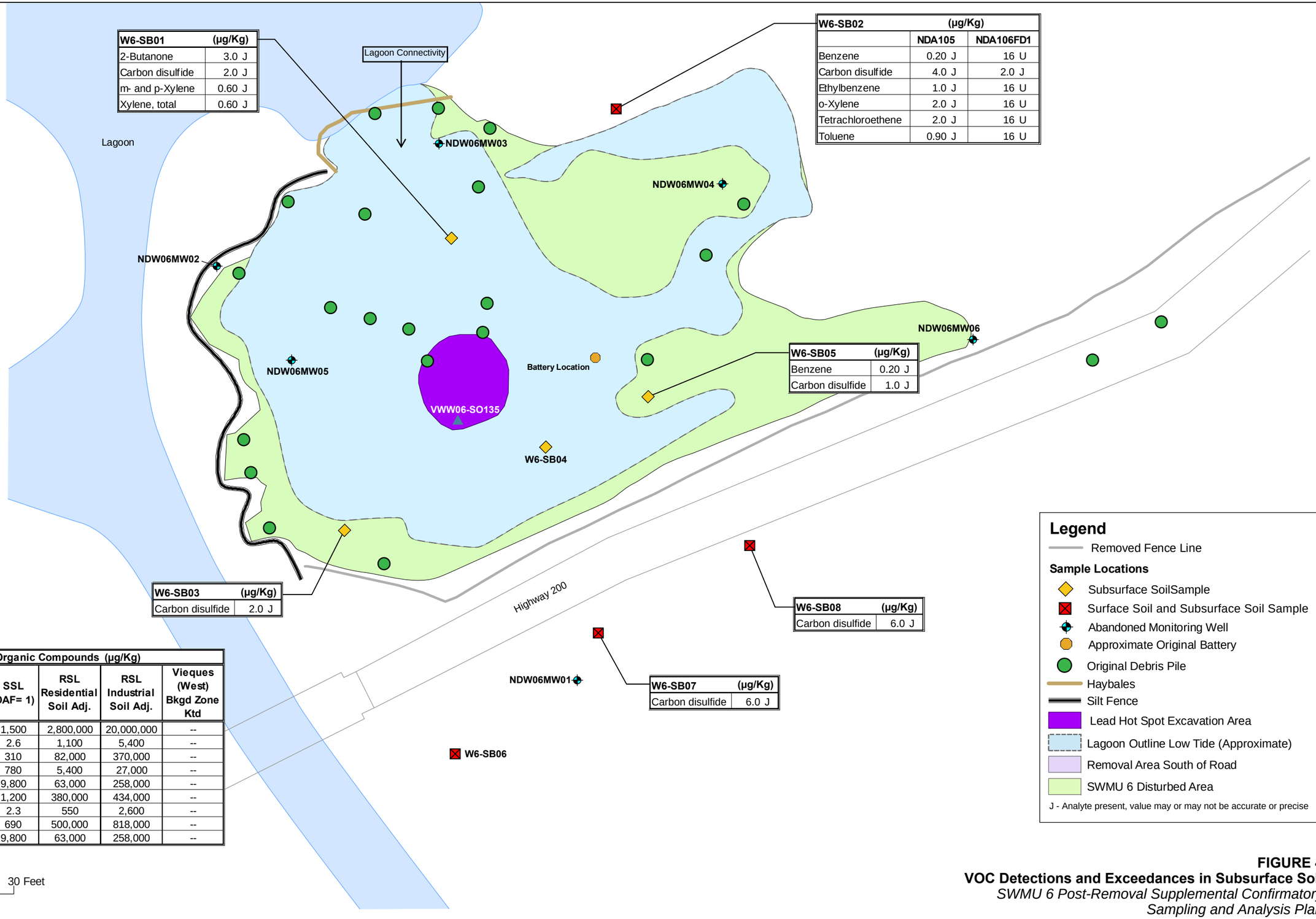
ES042110171949TPA F3-SWMU 6 VOC in Surface Soil-rev1.ai mstuart

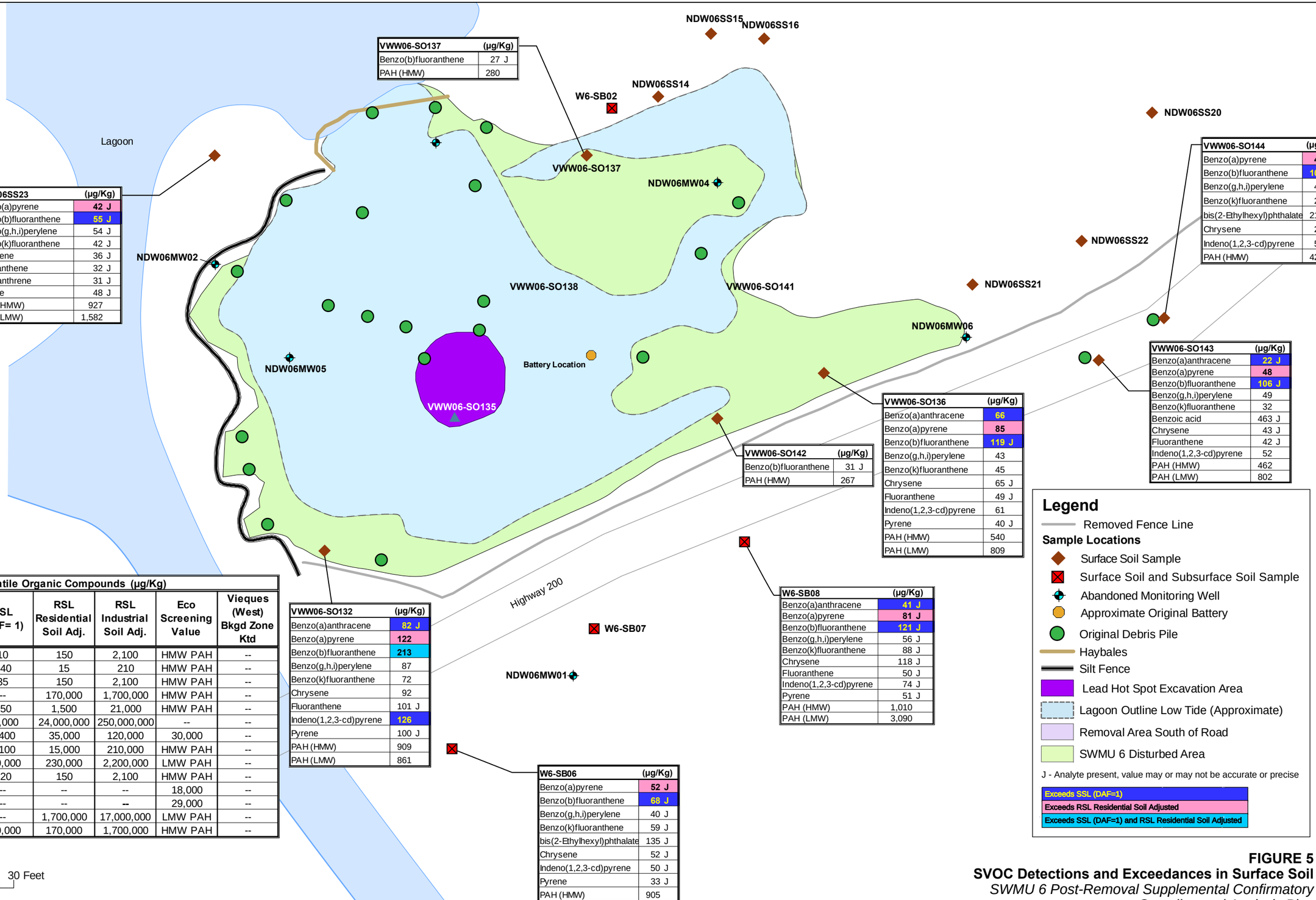


Volatile Organic Compounds (µg/Kg)				
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Vieques (West) Bkgd Zone Ktd
2-Butanone	1,500	2,800,000	20,000,000	--
Benzene	2.6	1,100	5,400	--
Carbon disulfide	310	82,000	370,000	--
Ethylbenzene	780	5,400	27,000	--
m- and p-Xylene	9,800	63,000	258,000	--
o-Xylene	1,200	380,000	434,000	--
Tetrachloroethene	2.3	550	2,600	--
Toluene	690	500,000	818,000	--
Xylene, total	9,800	63,000	258,000	--

FIGURE 4
VOC Detections and Exceedances in Subsurface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F4-SWMU 6 VOC in Subsurface Soil-rev1.ai mstuart



VWW06-SO137	(µg/Kg)
Benzo(b)fluoranthene	27 J
PAH (HMW)	280

NDW06SS23	(µg/Kg)
Benzo(a)pyrene	42 J
Benzo(b)fluoranthene	55 J
Benzo(g,h,i)perylene	54 J
Benzo(k)fluoranthene	42 J
Chrysene	36 J
Fluoranthene	32 J
Phenanthrene	31 J
Pyrene	48 J
PAH (HMW)	927
PAH (LMW)	1,582

VWW06-SO144	(µg/Kg)
Benzo(a)pyrene	42
Benzo(b)fluoranthene	107 J
Benzo(g,h,i)perylene	48
Benzo(k)fluoranthene	28
bis(2-Ethylhexyl)phthalate	211 J
Chrysene	23 J
Indeno(1,2,3-cd)pyrene	59
PAH (HMW)	425

VWW06-SO143	(µg/Kg)
Benzo(a)anthracene	22 J
Benzo(a)pyrene	48
Benzo(b)fluoranthene	106 J
Benzo(g,h,i)perylene	49
Benzo(k)fluoranthene	32
Benzoic acid	463 J
Chrysene	43 J
Fluoranthene	42 J
Indeno(1,2,3-cd)pyrene	52
PAH (HMW)	462
PAH (LMW)	802

VWW06-SO136	(µg/Kg)
Benzo(a)anthracene	66
Benzo(a)pyrene	85
Benzo(b)fluoranthene	119 J
Benzo(g,h,i)perylene	43
Benzo(k)fluoranthene	45
Chrysene	65 J
Fluoranthene	49 J
Indeno(1,2,3-cd)pyrene	61
Pyrene	40 J
PAH (HMW)	540
PAH (LMW)	809

VWW06-SO142	(µg/Kg)
Benzo(b)fluoranthene	31 J
PAH (HMW)	267

W6-SB08	(µg/Kg)
Benzo(a)anthracene	41 J
Benzo(a)pyrene	81 J
Benzo(b)fluoranthene	121 J
Benzo(g,h,i)perylene	56 J
Benzo(k)fluoranthene	88 J
Chrysene	118 J
Fluoranthene	50 J
Indeno(1,2,3-cd)pyrene	74 J
Pyrene	51 J
PAH (HMW)	1,010
PAH (LMW)	3,090

VWW06-SO132	(µg/Kg)
Benzo(a)anthracene	82 J
Benzo(a)pyrene	122
Benzo(b)fluoranthene	213
Benzo(g,h,i)perylene	87
Benzo(k)fluoranthene	72
Chrysene	92
Fluoranthene	101 J
Indeno(1,2,3-cd)pyrene	126
Pyrene	100 J
PAH (HMW)	909
PAH (LMW)	861

W6-SB06	(µg/Kg)
Benzo(a)pyrene	52 J
Benzo(b)fluoranthene	68 J
Benzo(g,h,i)perylene	40 J
Benzo(k)fluoranthene	59 J
bis(2-Ethylhexyl)phthalate	135 J
Chrysene	52 J
Indeno(1,2,3-cd)pyrene	50 J
Pyrene	33 J
PAH (HMW)	905

Semivolatile Organic Compounds (µg/Kg)

Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Eco Screening Value	Vieques (West) Bkgd Zone Ktd
Benzo(a)anthracene	10	150	2,100	HMW PAH	--
Benzo(a)pyrene	240	15	210	HMW PAH	--
Benzo(b)fluoranthene	35	150	2,100	HMW PAH	--
Benzo(g,h,i)perylene	--	170,000	1,700,000	HMW PAH	--
Benzo(k)fluoranthene	350	1,500	21,000	HMW PAH	--
Benzoic acid	34,000	24,000,000	250,000,000	--	--
bis(2-Ethylhexyl)phthalate	1,400	35,000	120,000	30,000	--
Chrysene	1,100	15,000	210,000	HMW PAH	--
Fluoranthene	160,000	230,000	2,200,000	LMW PAH	--
Indeno(1,2,3-cd)pyrene	120	150	2,100	HMW PAH	--
PAH (HMW)	--	--	--	18,000	--
PAH (LMW)	--	--	--	29,000	--
Phenanthrene	--	1,700,000	17,000,000	LMW PAH	--
Pyrene	120,000	170,000	1,700,000	HMW PAH	--

Legend

Removed Fence Line

Sample Locations

- Surface Soil Sample
- Surface Soil and Subsurface Soil Sample
- Abandoned Monitoring Well
- Approximate Original Battery
- Original Debris Pile
- Haybales
- Silt Fence
- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

J - Analyte present, value may or may not be accurate or precise

- Exceeds SSL (DAF=1)
- Exceeds RSL Residential Soil Adjusted
- Exceeds SSL (DAF=1) and RSL Residential Soil Adjusted

North

0 15 30 Feet

FIGURE 5
SVOC Detections and Exceedances in Surface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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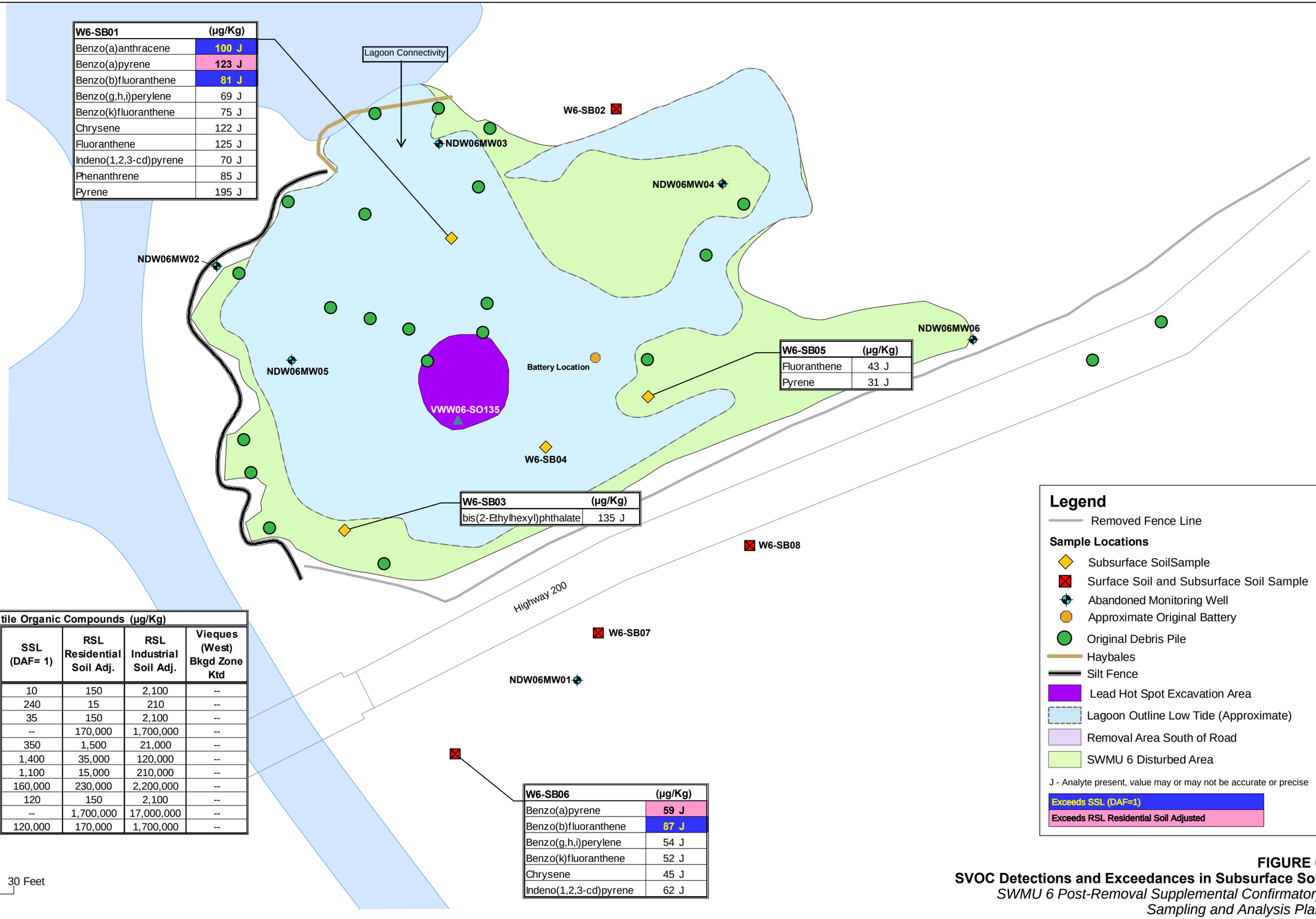
ES042110171949TPA F5-SWMU 6 SVOC in Surface Soil-rev1.ai mstuart



W6-SB01	(µg/Kg)
Benzo(a)anthracene	100 J
Benzo(a)pyrene	123 J
Benzo(b)fluoranthene	81 J
Benzo(g,h,i)perylene	69 J
Benzo(k)fluoranthene	75 J
Chrysene	122 J
Fluoranthene	125 J
Indeno(1,2,3-cd)pyrene	70 J
Phenanthrene	85 J
Pyrene	195 J

W6-SB05	(µg/Kg)
Fluoranthene	43 J
Pyrene	31 J

W6-SB03	(µg/Kg)
bis(2-Ethylhexyl)phthalate	135 J

W6-SB06	(µg/Kg)
Benzo(a)pyrene	59 J
Benzo(b)fluoranthene	87 J
Benzo(g,h,i)perylene	54 J
Benzo(k)fluoranthene	52 J
Chrysene	45 J
Indeno(1,2,3-cd)pyrene	62 J

Semivolatile Organic Compounds (µg/Kg)				
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Vieques (West) Bkgd Zone Ktd
Benzo(a)anthracene	10	150	2,100	--
Benzo(a)pyrene	240	15	210	--
Benzo(b)fluoranthene	35	150	2,100	--
Benzo(g,h,i)perylene	--	170,000	1,700,000	--
Benzo(k)fluoranthene	350	1,500	21,000	--
bis(2-Ethylhexyl)phthalate	1,400	35,000	120,000	--
Chrysene	1,100	15,000	210,000	--
Fluoranthene	160,000	230,000	2,200,000	--
Indeno(1,2,3-cd)pyrene	120	150	2,100	--
Phenanthrene	--	1,700,000	17,000,000	--
Pyrene	120,000	170,000	1,700,000	--

FIGURE 6
SVOC Detections and Exceedances in Subsurface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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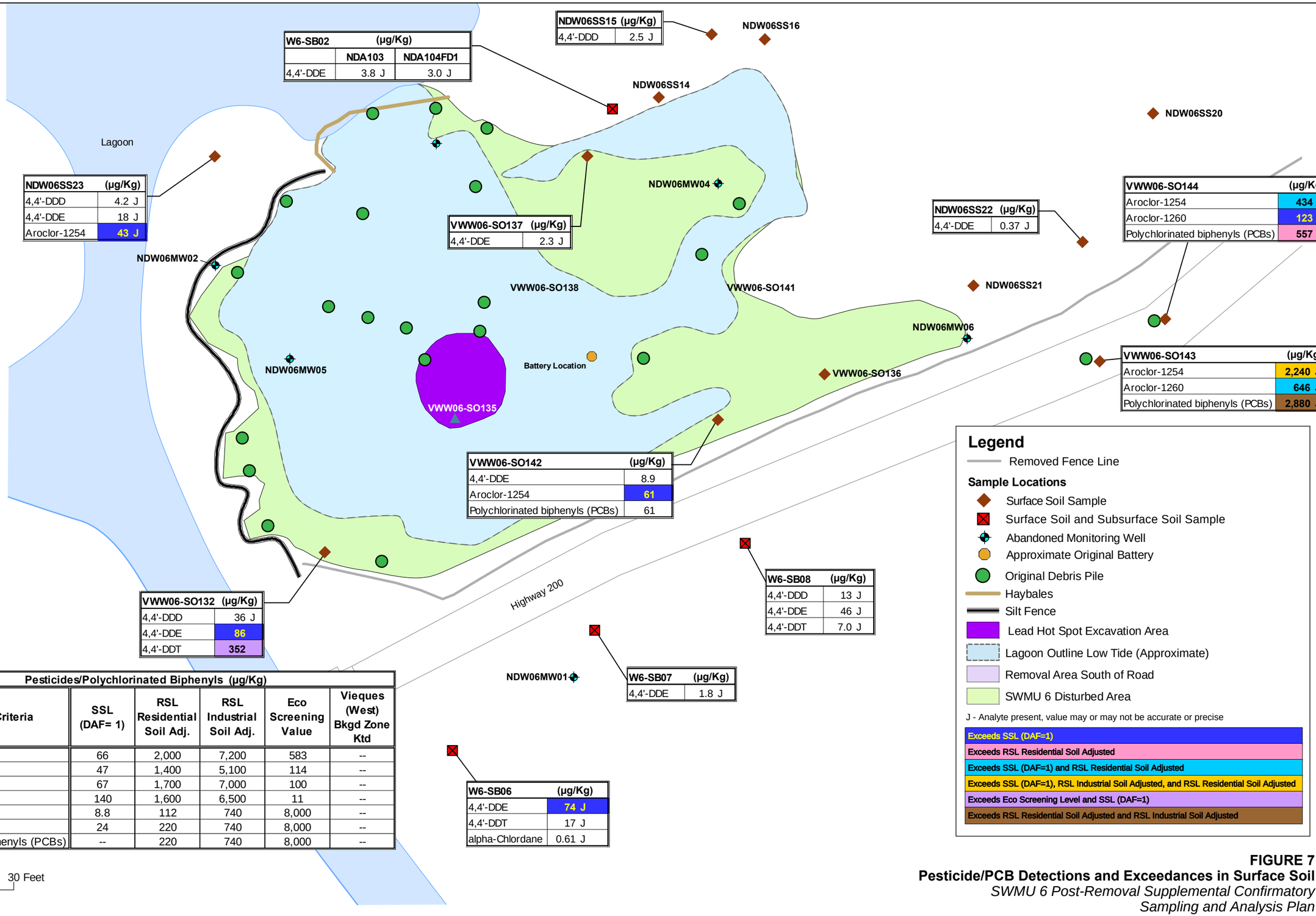
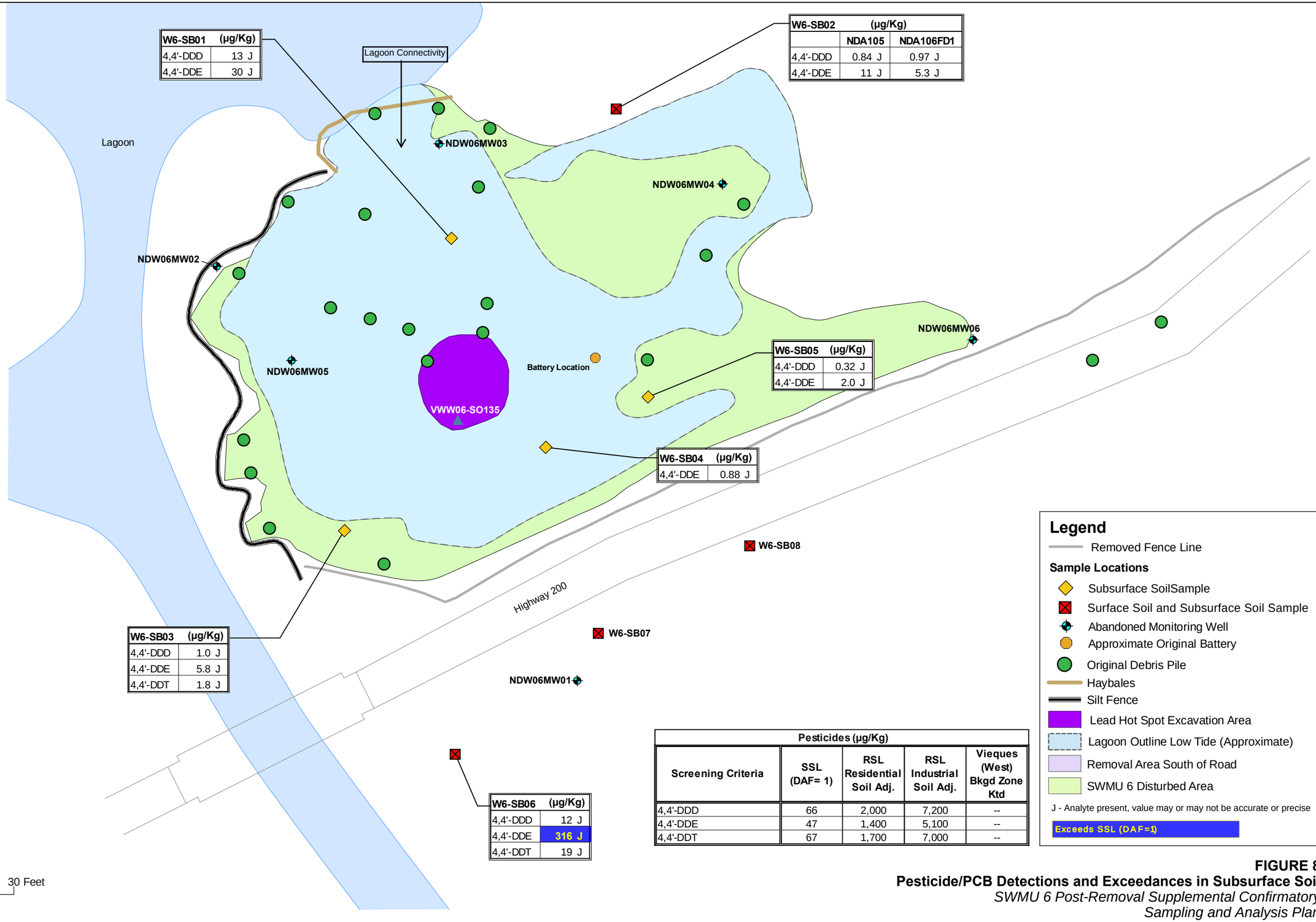
ES042110171949TPA F6-SWMU 6 SVOC in Subsurface Soil-rev1.ai mstuart



Pesticides/Polychlorinated Biphenyls (µg/Kg)					
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Eco Screening Value	Vieques (West) Bkgd Zone Ktd
4,4'-DDD	66	2,000	7,200	583	--
4,4'-DDE	47	1,400	5,100	114	--
4,4'-DDT	67	1,700	7,000	100	--
alpha-Chlordane	140	1,600	6,500	11	--
Aroclor-1254	8.8	112	740	8,000	--
Aroclor-1260	24	220	740	8,000	--
Polychlorinated biphenyls (PCBs)	--	220	740	8,000	--

FIGURE 7
Pesticide/PCB Detections and Exceedances in Surface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

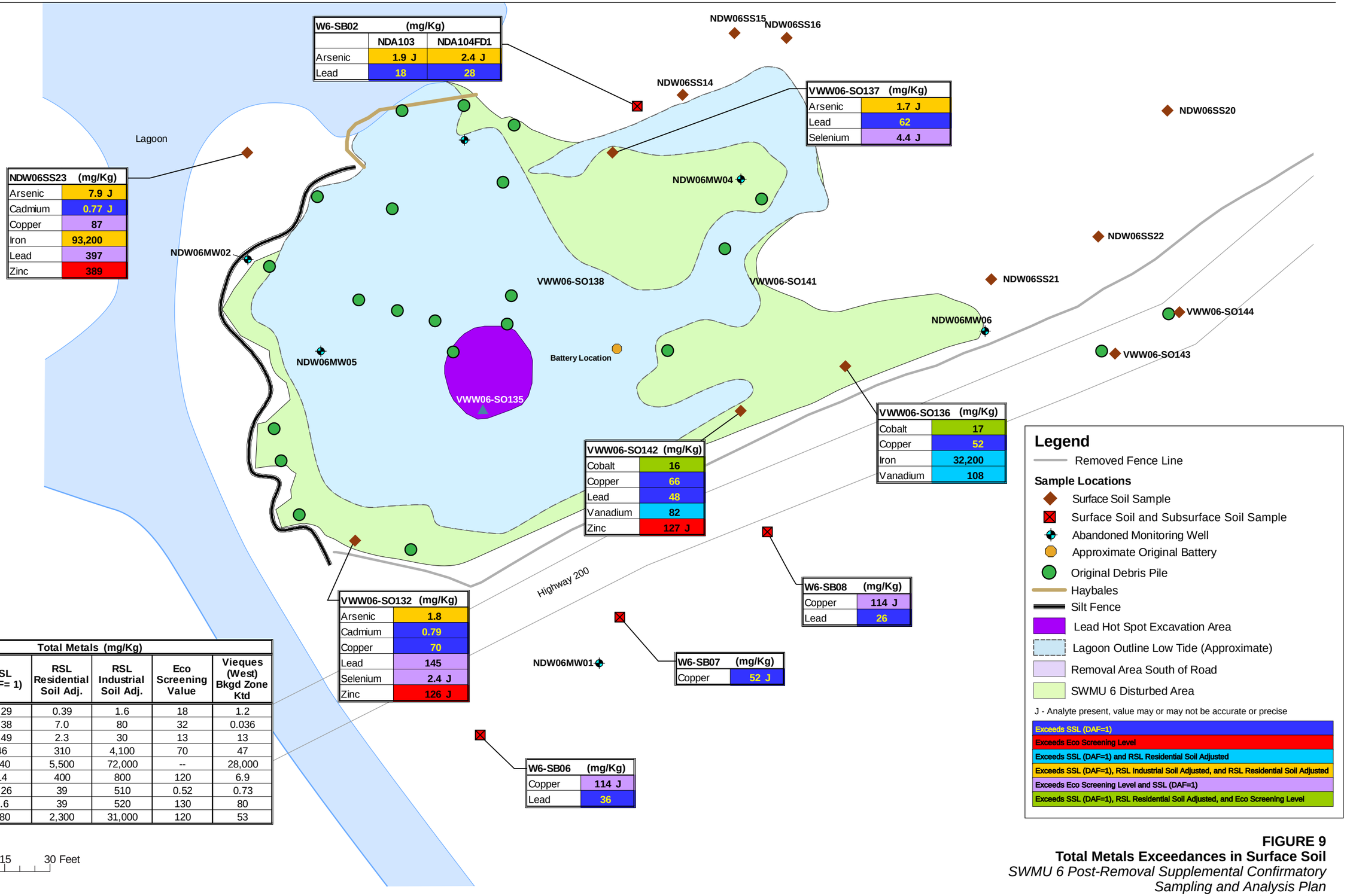


Pesticides (µg/Kg)				
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Vieques (West) Bkgd Zone Ktd
4,4'-DDD	66	2,000	7,200	--
4,4'-DDE	47	1,400	5,100	--
4,4'-DDT	67	1,700	7,000	--

FIGURE 8
Pesticide/PCB Detections and Exceedances in Subsurface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F8-SWMU 6 Pesticides in Subsurface Soil-rev2.ai mstuart



Total Metals (mg/Kg)					
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Eco Screening Value	Vieques (West) Bkgd Zone Ktd
Arsenic	0.29	0.39	1.6	18	1.2
Cadmium	0.38	7.0	80	32	0.036
Cobalt	0.49	2.3	30	13	13
Copper	46	310	4,100	70	47
Iron	640	5,500	72,000	--	28,000
Lead	14	400	800	120	6.9
Selenium	0.26	39	510	0.52	0.73
Vanadium	2.6	39	520	130	80
Zinc	680	2,300	31,000	120	53

FIGURE 9
Total Metals Exceedances in Surface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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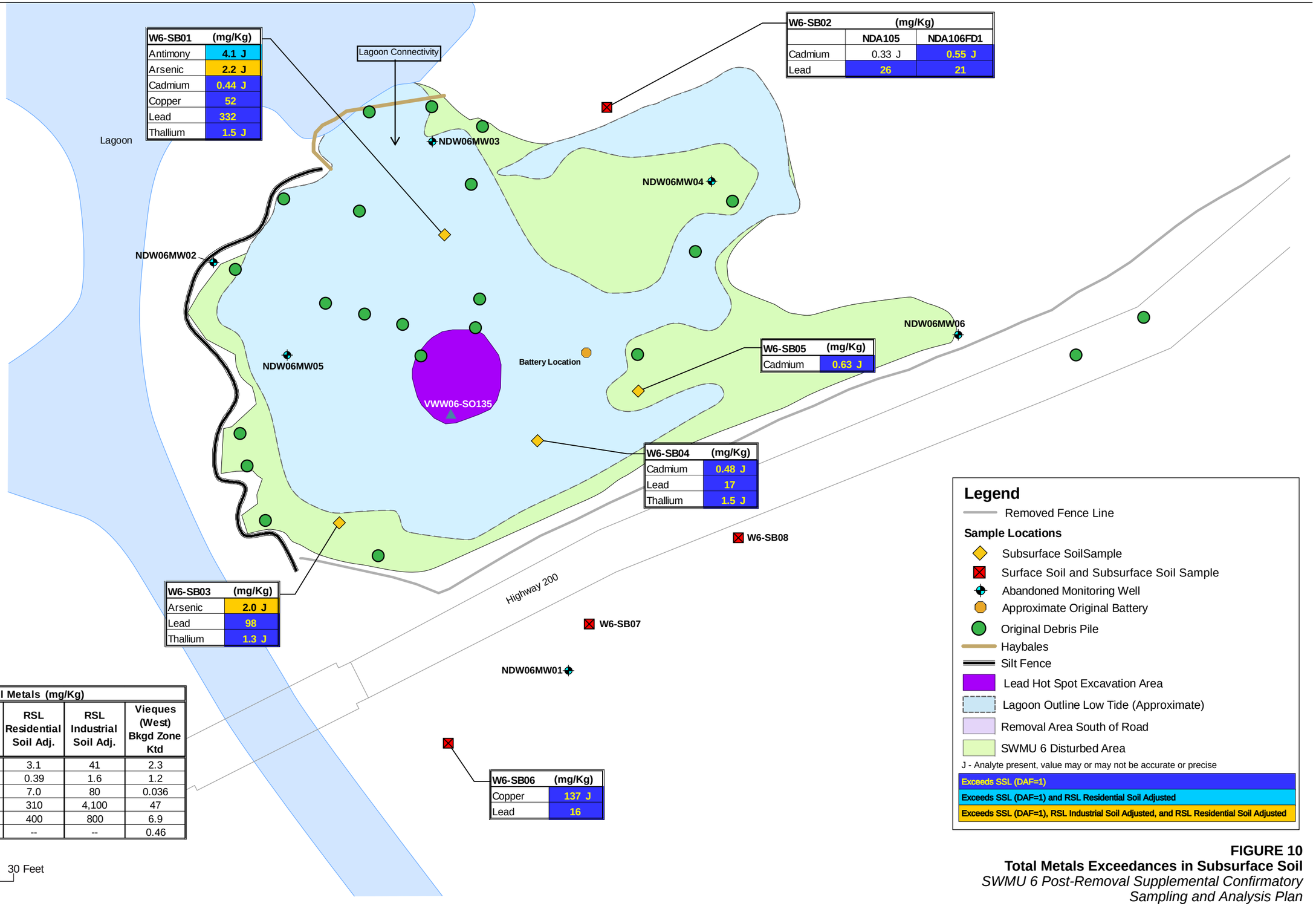
ES042110171949TPA F9-SWMU 6 Total Metals in Surface Soil-rev1.ai mstuart



Total Metals (mg/Kg)				
Screening Criteria	SSL (DAF= 1)	RSL Residential Soil Adj.	RSL Industrial Soil Adj.	Vieques (West) Bkgd Zone Ktd
Antimony	0.66	3.1	41	2.3
Arsenic	0.29	0.39	1.6	1.2
Cadmium	0.38	7.0	80	0.036
Copper	46	310	4,100	47
Lead	14	400	800	6.9
Thallium	0.14	--	--	0.46

FIGURE 10
Total Metals Exceedances in Subsurface Soil
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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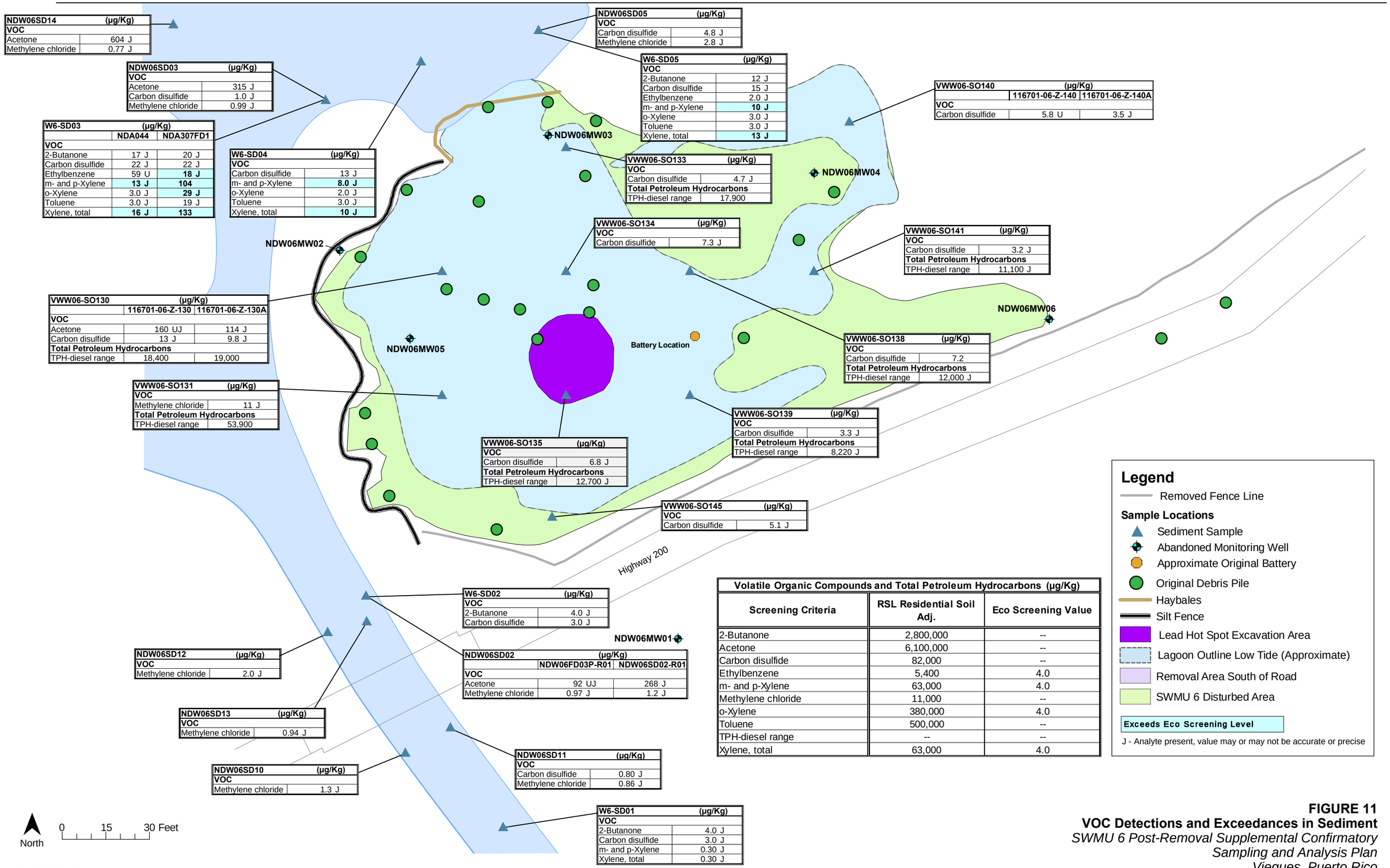
ES042110171949TPA F10-SWMU 6 Total Metals in Subsurface Soil-rev1.ai mstuart



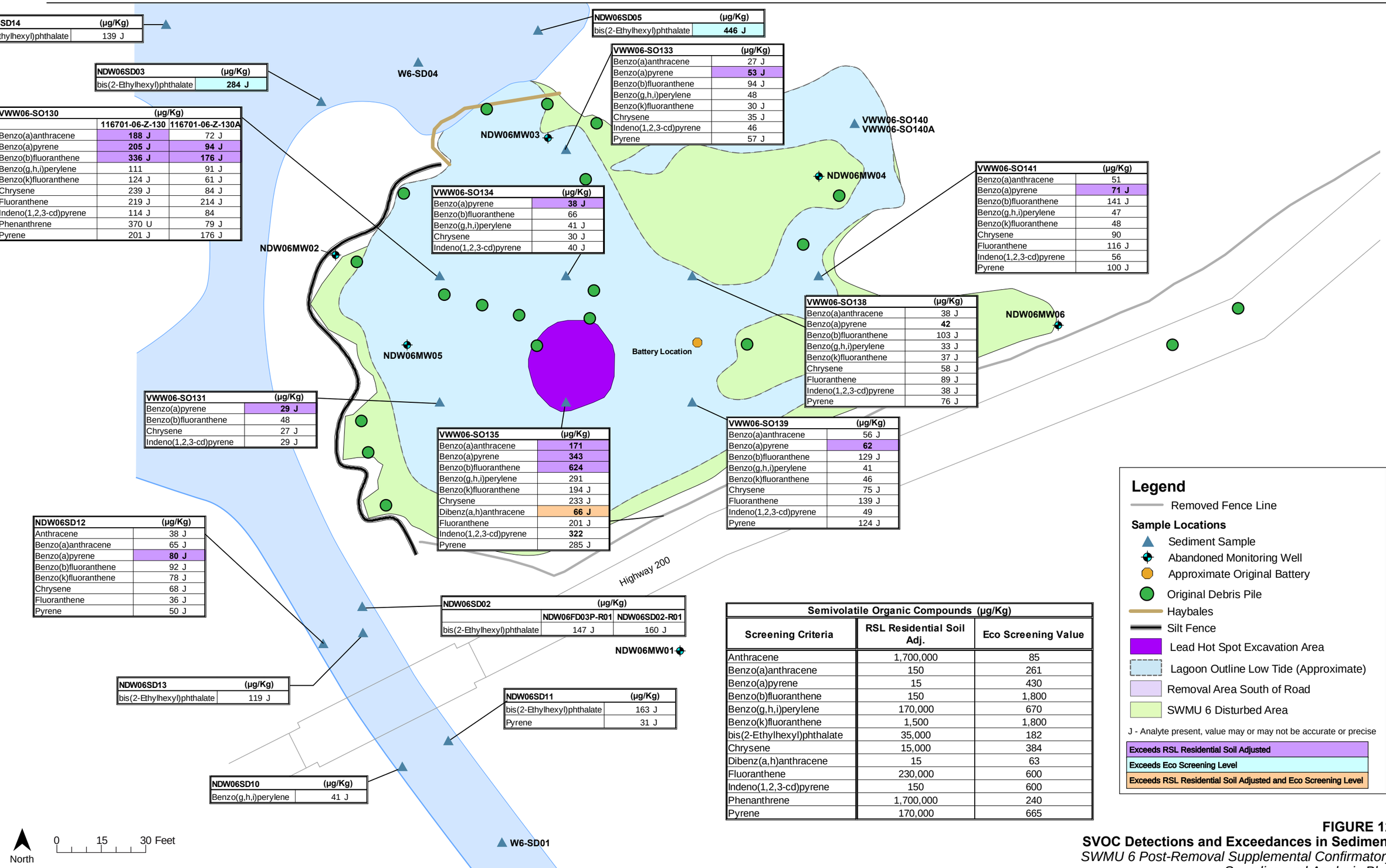
Volatile Organic Compounds and Total Petroleum Hydrocarbons (µg/Kg)

Screening Criteria	RSL Residential Soil Adj.	Eco Screening Value
2-Butanone	2,800,000	--
Acetone	6,100,000	--
Carbon disulfide	82,000	--
Ethylbenzene	5,400	4.0
m- and p-Xylene	63,000	4.0
Methylene chloride	11,000	--
o-Xylene	380,000	4.0
Toluene	500,000	--
TPH-diesel range	--	--
Xylene, total	63,000	4.0

FIGURE 11
VOC Detections and Exceedances in Sediment
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F11-SWMU 6 VOC in Sediment-rev1.ai mstuart



NDW06SD14	(µg/Kg)
bis(2-Ethylhexyl)phthalate	139 J

NDW06SD05	(µg/Kg)
bis(2-Ethylhexyl)phthalate	**446 J**

NDW06SD03	(µg/Kg)
bis(2-Ethylhexyl)phthalate	**284 J**

VWW06-SO133	(µg/Kg)
Benzo(a)anthracene	27 J
Benzo(a)pyrene	**53 J**
Benzo(b)fluoranthene	94 J
Benzo(g,h,i)perylene	48
Benzo(k)fluoranthene	30 J
Chrysene	35 J
Indeno(1,2,3-cd)pyrene	46
Pyrene	57 J

VWW06-SO130	(µg/Kg)	
	116701-06-Z-130	116701-06-Z-130A
Benzo(a)anthracene	**188 J**	72 J
Benzo(a)pyrene	**205 J**	**94 J**
Benzo(b)fluoranthene	**336 J**	**176 J**
Benzo(g,h,i)perylene	111	91 J
Benzo(k)fluoranthene	124 J	61 J
Chrysene	239 J	84 J
Fluoranthene	219 J	214 J
Indeno(1,2,3-cd)pyrene	114 J	84
Phenanthrene	370 U	79 J
Pyrene	201 J	176 J

VWW06-SO134	(µg/Kg)
Benzo(a)pyrene	**38 J**
Benzo(b)fluoranthene	66
Benzo(g,h,i)perylene	41 J
Chrysene	30 J
Indeno(1,2,3-cd)pyrene	40 J

VWW06-SO141	(µg/Kg)
Benzo(a)anthracene	51
Benzo(a)pyrene	**71 J**
Benzo(b)fluoranthene	141 J
Benzo(g,h,i)perylene	47
Benzo(k)fluoranthene	48
Chrysene	90
Fluoranthene	116 J
Indeno(1,2,3-cd)pyrene	56
Pyrene	100 J

VWW06-SO138	(µg/Kg)
Benzo(a)anthracene	38 J
Benzo(a)pyrene	**42**
Benzo(b)fluoranthene	103 J
Benzo(g,h,i)perylene	33 J
Benzo(k)fluoranthene	37 J
Chrysene	58 J
Fluoranthene	89 J
Indeno(1,2,3-cd)pyrene	38 J
Pyrene	76 J

VWW06-SO131	(µg/Kg)
Benzo(a)pyrene	**29 J**
Benzo(b)fluoranthene	48
Chrysene	27 J
Indeno(1,2,3-cd)pyrene	29 J

VWW06-SO135	(µg/Kg)
Benzo(a)anthracene	**171**
Benzo(a)pyrene	**343**
Benzo(b)fluoranthene	**624**
Benzo(g,h,i)perylene	291
Benzo(k)fluoranthene	194 J
Chrysene	233 J
Dibenz(a,h)anthracene	**66 J**
Fluoranthene	201 J
Indeno(1,2,3-cd)pyrene	**322**
Pyrene	285 J

VWW06-SO139	(µg/Kg)
Benzo(a)anthracene	56 J
Benzo(a)pyrene	**62**
Benzo(b)fluoranthene	129 J
Benzo(g,h,i)perylene	41
Benzo(k)fluoranthene	46
Chrysene	75 J
Fluoranthene	139 J
Indeno(1,2,3-cd)pyrene	49
Pyrene	124 J

NDW06SD12	(µg/Kg)
Anthracene	38 J
Benzo(a)anthracene	65 J
Benzo(a)pyrene	**80 J**
Benzo(b)fluoranthene	92 J
Benzo(k)fluoranthene	78 J
Chrysene	68 J
Fluoranthene	36 J
Pyrene	50 J

NDW06SD02	(µg/Kg)	
	NDW06FD03P-R01	NDW06SD02-R01
bis(2-Ethylhexyl)phthalate	147 J	160 J

NDW06SD13	(µg/Kg)
bis(2-Ethylhexyl)phthalate	119 J

NDW06SD11	(µg/Kg)
bis(2-Ethylhexyl)phthalate	163 J
Pyrene	31 J

NDW06SD10	(µg/Kg)
Benzo(g,h,i)perylene	41 J

Semivolatile Organic Compounds (µg/Kg)		
Screening Criteria	**RSL Residential Soil Adj.**	**Eco Screening Value**
Anthracene	1,700,000	85
Benzo(a)anthracene	150	261
Benzo(a)pyrene	15	430
Benzo(b)fluoranthene	150	1,800
Benzo(g,h,i)perylene	170,000	670
Benzo(k)fluoranthene	1,500	1,800
bis(2-Ethylhexyl)phthalate	35,000	182
Chrysene	15,000	384
Dibenz(a,h)anthracene	15	63
Fluoranthene	230,000	600
Indeno(1,2,3-cd)pyrene	150	600
Phenanthrene	1,700,000	240
Pyrene	170,000	665

Legend

Removed Fence Line

Sample Locations

- Sediment Sample
- Abandoned Monitoring Well
- Approximate Original Battery
- Original Debris Pile
- Haybales
- Silt Fence
- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

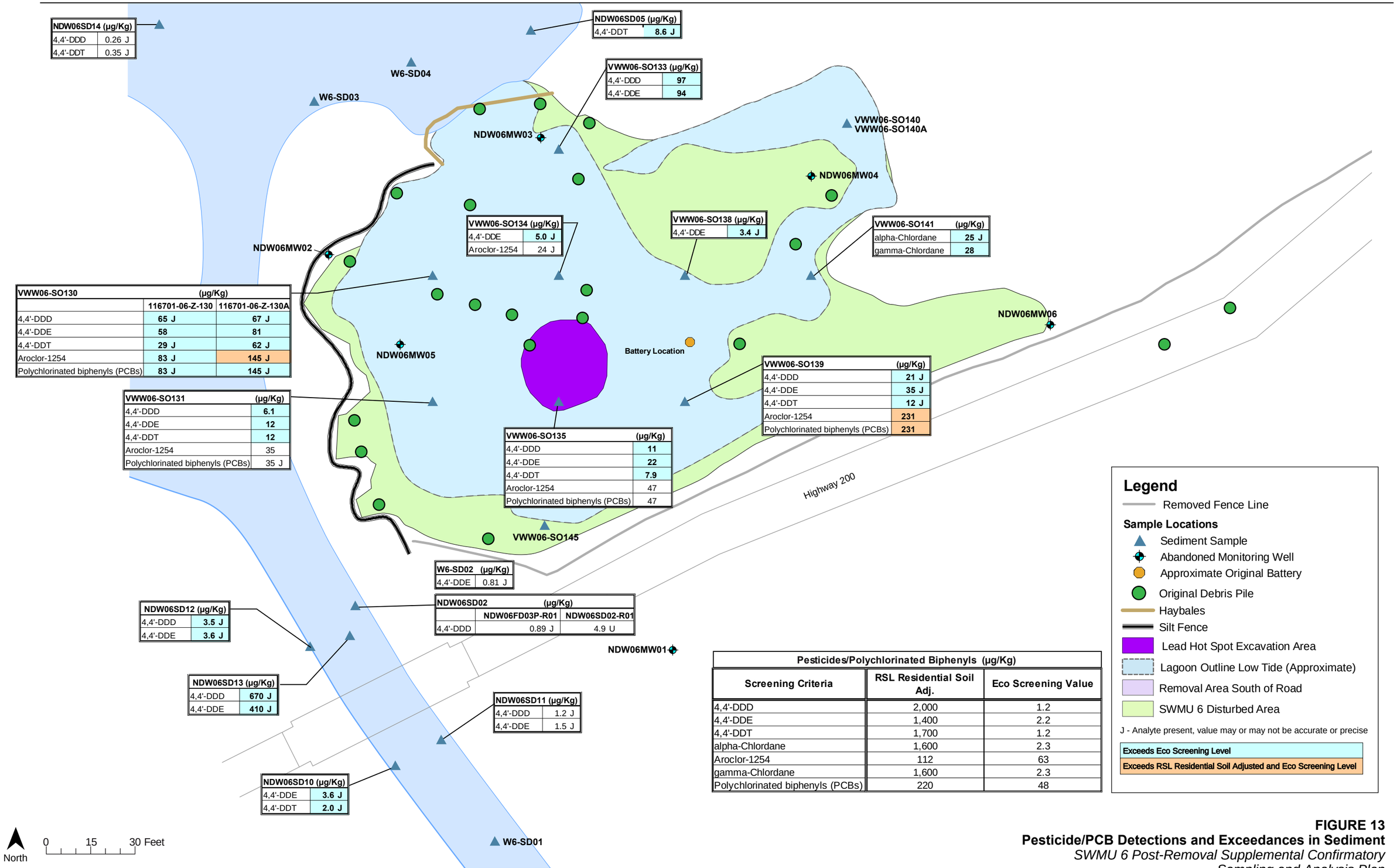
J - Analyte present, value may or may not be accurate or precise

- Exceeds RSL Residential Soil Adjusted
- Exceeds Eco Screening Level
- Exceeds RSL Residential Soil Adjusted and Eco Screening Level

FIGURE 12
SVOC Detections and Exceedances in Sediment
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

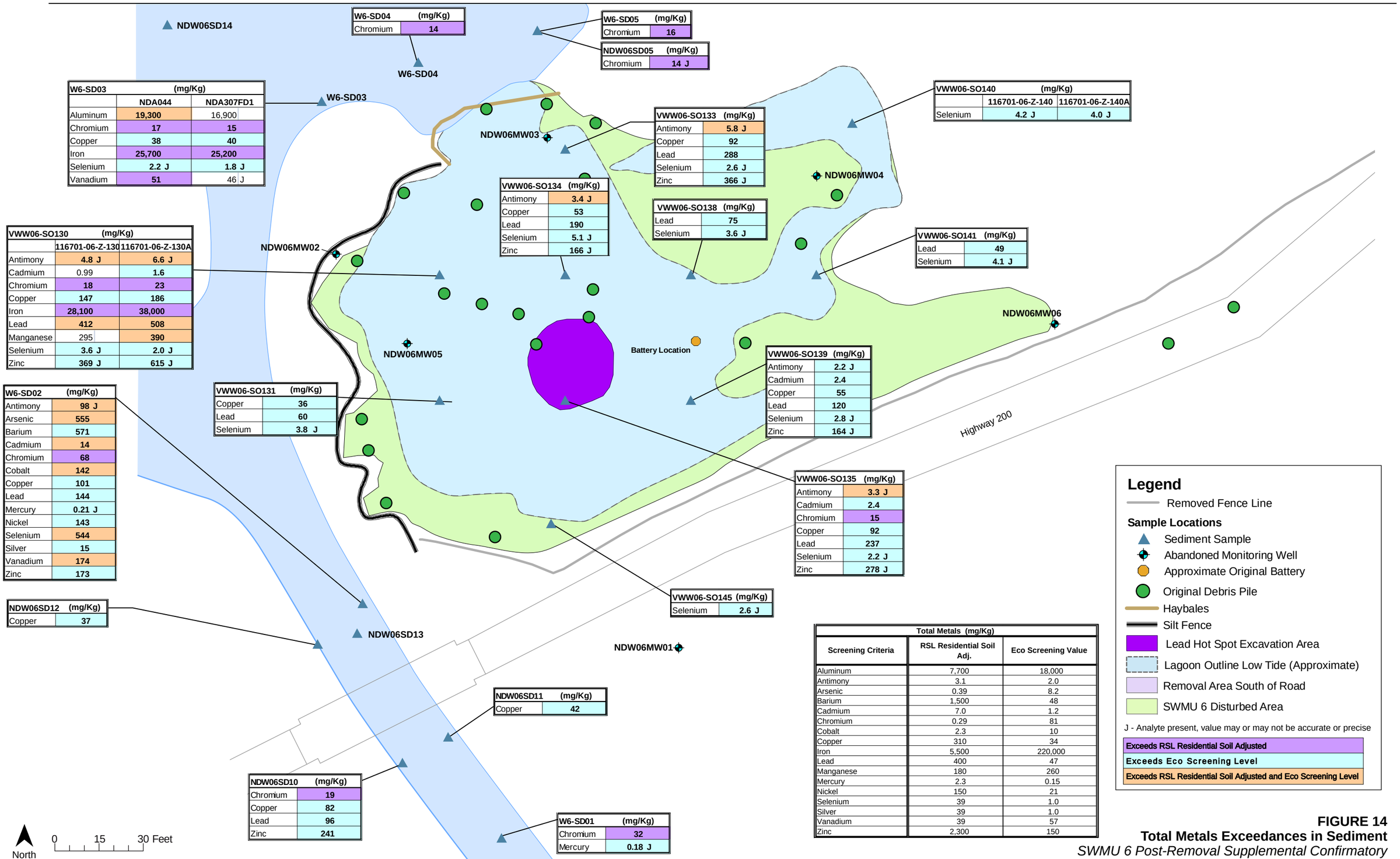
ES042110171949TPA F12-SWMU 6 SVOC in Sediment-rev1.ai mstuart



Pesticides/Polychlorinated Biphenyls (µg/Kg)		
Screening Criteria	RSL Residential Soil Adj.	Eco Screening Value
4,4'-DDD	2,000	1.2
4,4'-DDE	1,400	2.2
4,4'-DDT	1,700	1.2
alpha-Chlordane	1,600	2.3
Aroclor-1254	112	63
gamma-Chlordane	1,600	2.3
Polychlorinated biphenyls (PCBs)	220	48

FIGURE 13
Pesticide/PCB Detections and Exceedances in Sediment
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL
ES042110171949TPA F13-SWMU 6 Pesticides in Sediment-rev2.ai mstuart



W6-SD04	(mg/Kg)
Chromium	14

W6-SD05	(mg/Kg)
Chromium	16

NDW06SD05	(mg/Kg)
Chromium	14 J

W6-SD03	(mg/Kg)	
	NDA044	NDA307FD1
Aluminum	19,300	16,900
Chromium	17	15
Copper	38	40
Iron	25,700	25,200
Selenium	2.2 J	1.8 J
Vanadium	51	46 J

VWW06-SO140	(mg/Kg)	
	116701-06-Z-140	116701-06-Z-140A
Selenium	4.2 J	4.0 J

VWW06-SO133	(mg/Kg)
Antimony	5.8 J
Copper	92
Lead	288
Selenium	2.6 J
Zinc	366 J

VWW06-SO134	(mg/Kg)
Antimony	3.4 J
Copper	53
Lead	190
Selenium	5.1 J
Zinc	166 J

VWW06-SO138	(mg/Kg)
Lead	75
Selenium	3.6 J

VWW06-SO141	(mg/Kg)
Lead	49
Selenium	4.1 J

VWW06-SO130	(mg/Kg)	
	116701-06-Z-130	116701-06-Z-130A
Antimony	4.8 J	6.6 J
Cadmium	0.99	1.6
Chromium	18	23
Copper	147	186
Iron	28,100	38,000
Lead	412	508
Manganese	295	390
Selenium	3.6 J	2.0 J
Zinc	369 J	615 J

VWW06-SO139	(mg/Kg)
Antimony	2.2 J
Cadmium	2.4
Copper	55
Lead	120
Selenium	2.8 J
Zinc	164 J

VWW06-SO131	(mg/Kg)
Copper	36
Lead	60
Selenium	3.8 J

W6-SD02	(mg/Kg)
Antimony	98 J
Arsenic	555
Barium	571
Cadmium	14
Chromium	68
Cobalt	142
Copper	101
Lead	144
Mercury	0.21 J
Nickel	143
Selenium	544
Silver	15
Vanadium	174
Zinc	173

VWW06-SO135	(mg/Kg)
Antimony	3.3 J
Cadmium	2.4
Chromium	15
Copper	92
Lead	237
Selenium	2.2 J
Zinc	278 J

NDW06SD12	(mg/Kg)
Copper	37

VWW06-SO145	(mg/Kg)
Selenium	2.6 J

NDW06SD11	(mg/Kg)
Copper	42

NDW06SD10	(mg/Kg)
Chromium	19
Copper	82
Lead	96
Zinc	241

W6-SD01	(mg/Kg)
Chromium	32
Mercury	0.18 J

Total Metals (mg/Kg)		
Screening Criteria	RSL Residential Soil Adj.	Eco Screening Value
Aluminum	7,700	18,000
Antimony	3.1	2.0
Arsenic	0.39	8.2
Barium	1,500	48
Cadmium	7.0	1.2
Chromium	0.29	81
Cobalt	2.3	10
Copper	310	34
Iron	5,500	220,000
Lead	400	47
Manganese	180	260
Mercury	2.3	0.15
Nickel	150	21
Selenium	39	1.0
Silver	39	1.0
Vanadium	39	57
Zinc	2,300	150

Legend

Removed Fence Line

Sample Locations

- Sediment Sample
- Abandoned Monitoring Well
- Approximate Original Battery
- Original Debris Pile
- Haybales
- Silt Fence
- Lead Hot Spot Excavation Area
- Lagoon Outline Low Tide (Approximate)
- Removal Area South of Road
- SWMU 6 Disturbed Area

J - Analyte present, value may or may not be accurate or precise

- Exceeds RSL Residential Soil Adjusted
- Exceeds Eco Screening Level
- Exceeds RSL Residential Soil Adjusted and Eco Screening Level

FIGURE 14
Total Metals Exceedances in Sediment
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

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ES042110171949TPA F14-SWMU 6 Total Metals in Sediment-rev1.ai mstuart

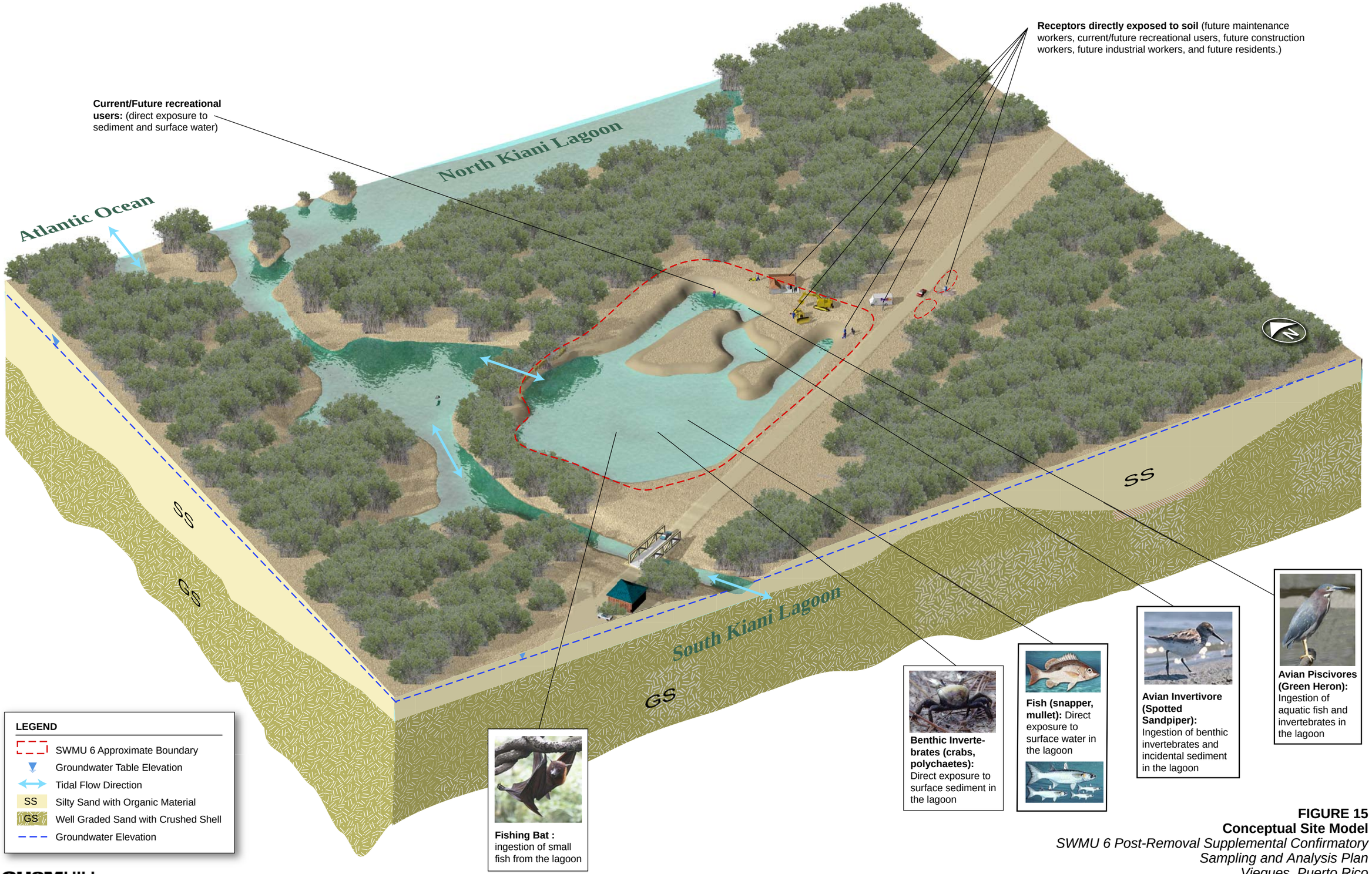


FIGURE 15
Conceptual Site Model
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F15-SWMU6_CSM_ver6.ai

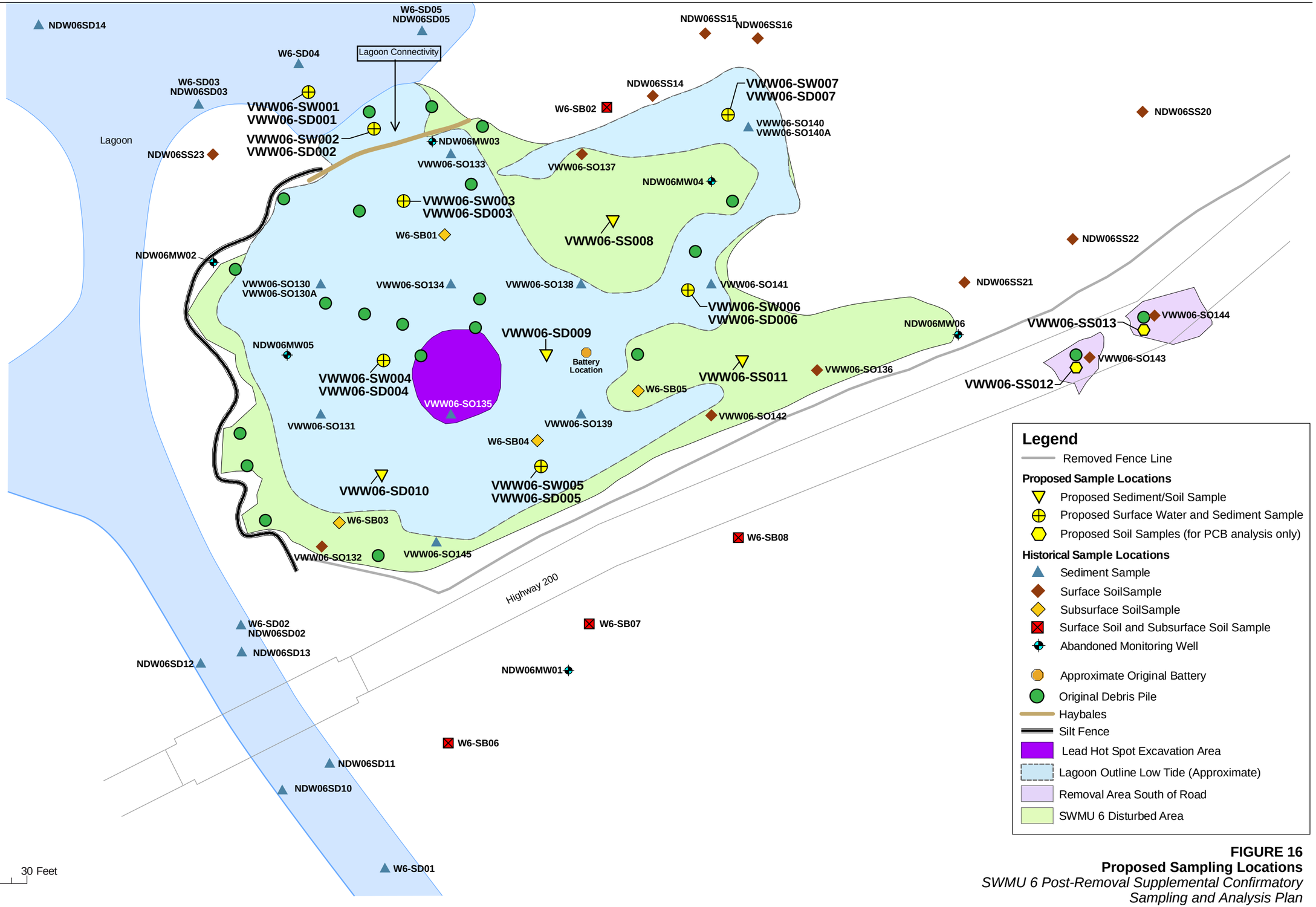
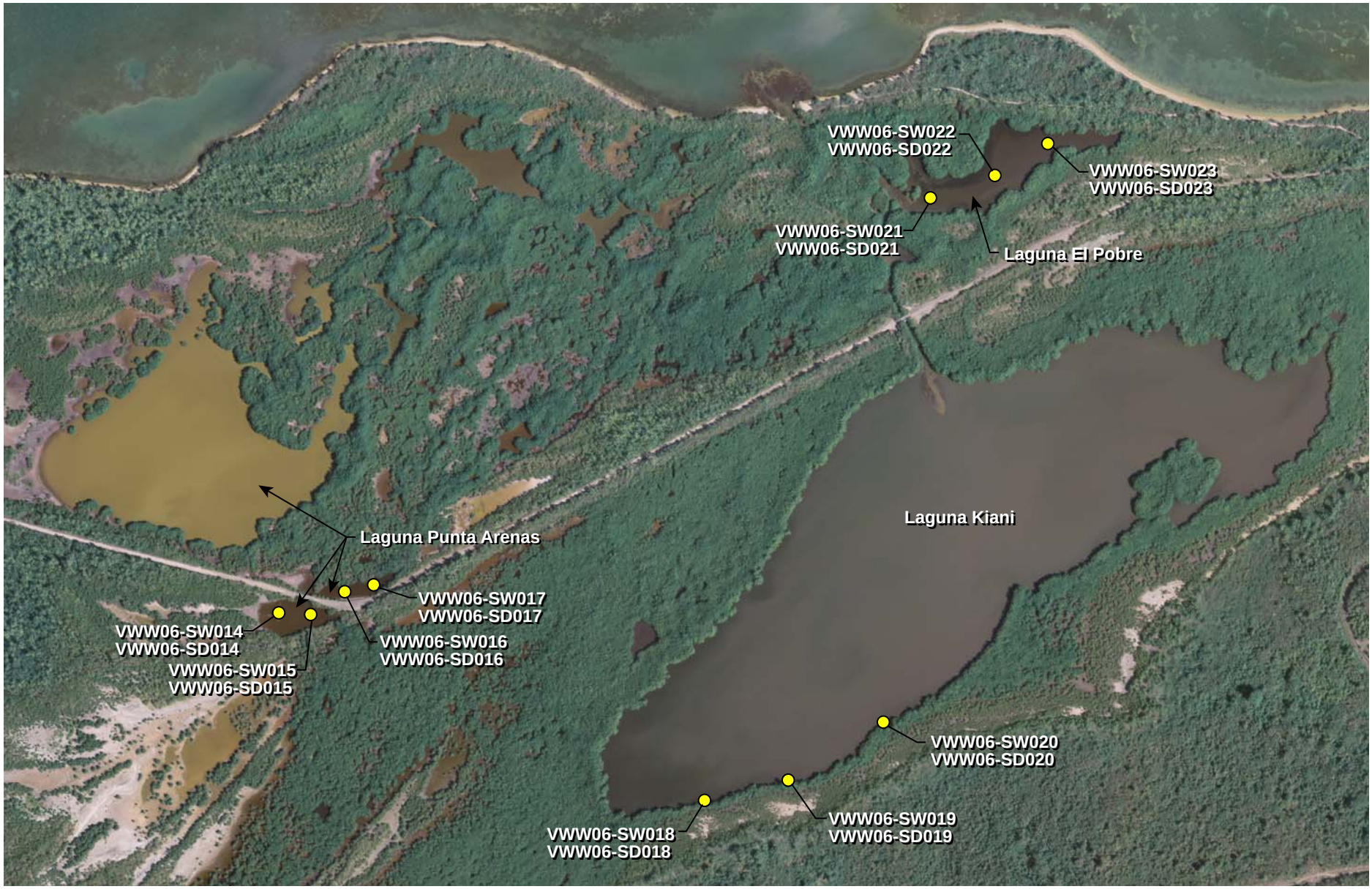


FIGURE 16
Proposed Sampling Locations
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL
ES042110171949TPA F16-SWMU 6 Proposed Sampling Locations-rev1.ai mstuart



North

0 300 600 Feet

LEGEND

- Background surface water and sediment sampling location

FIGURE 17
Background Sampling Locations
SWMU 6 Post-Removal Supplemental Confirmatory Sampling and Analysis Plan
Vieques, Puerto Rico

CH2MHILL

ES042110171949TPA F17-SWMU 6 Background Sampling Locations-rev1.ai

ATTACHMENT B
LABORATORY STANDARD OPERATING PROCEDURES

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Due to their proprietary and confidential nature, analytical laboratory SOPs are removed from this document and not available to the general public.

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ATTACHMENT C
FINAL RESPONSE TO EPA AND EQB COMMENTS

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Final Responses to

EPA Comments on the

Draft Post-Removal Supplemental Confirmatory Sampling and Analysis Plan Solid Waste Management Unit (SWMU) 6 Former Naval Ammunition Support Detachment Vieques, Puerto Rico

May 2010

1. Worksheet #9a, page 19 – Project Scoping Session Participants Sheet: Under "Project Role" for Mindy Pensak please include review of ecological risk assessments.

   Navy Response:

   Worksheet #9A, page 19 has been edited as indicated above.

2. Worksheet #9d, page 28 - Project Scoping Session Participants Sheet: Please include Stan Pauwels, Technical Support Contractor to EPA; ecological risk assessor.

   Navy Response:

   Worksheet #9d, page 28 has been edited as indicated above.

3. Worksheet #9d, page 30 - Project Scoping Session Sheet: Under SWMU-6 Sampling Approach, the second paragraph under the third Consensus bullet indicates that "historic surface water and sediment data will not be used in the future HHRA …" Please indicate whether the statement should refer to the ecological risk assessment, rather than the HHRA.

   Navy Response:

   This statement was intended to refer to both the HHRA and the ERA. Though the consensus statement cannot be changed because it is an excerpt from meeting minutes, clarification of the samples to be evaluated in the HHRA and ERA has been added to Worksheet #10, page 36, question #3; modifications are underlined:

   "Surface water, sediment, and soil results from the supplemental confirmatory sampling event, soil from the pre-removal characterization sampling events (in areas not excavated and outside of the canal adjacent to the site), and soil from post-removal confirmatory sampling (not including VOCs) will be evaluated in post-removal human health and ecological risk assessments. Sediment data from areas with greater than 3 feet of water will not be evaluated in the human health risk assessment because exposure in these areas is unlikely. For the ecological risk assessment, the solid media samples from the three sampling events described above will be evaluated as marine sediment since

they all represent an aquatic lagoon/mangrove habitat. As a result, sediment samples from the pre-removal characterization (undisturbed locations), post removal confirmatory sampling, and supplemental confirmatory sampling will be combined for the assessment of ecological risk. The results of the post-removal risk assessments will be presented in a post-removal risk assessment report."

4. Worksheet # 10, pages 35 and 36 – Problem Definition, Environmental Questions to be Answered by the Supplemental Confirmatory Sampling: The response to the first question indicates that background surface water and sediment data set will be collected and analyzed for inorganic constituents to compare to site concentrations. As elevated concentrations (greater than ecological screening values) of pesticides have been identified in the sediments (Figure 13, Pesticide/PCB Detections and Exceedances in Sediment), it may make sense to include pesticide analysis for background sediment collection, similar to what was conducted for the background soil collection.

Navy Response:

Pesticide analysis has been added to the background sample locations; all associated worksheets have been updated accordingly.

5. Worksheet # 11, page 37 – If the Method Detection Limit (MDL) will be used for comparisons to the action levels, the Navy should request that its laboratory report their results to the (MDL). It should be noted that results near the MDL (to around 5-10 times the MDL) should be used with caution.

Navy Response:

Although all nondetect results (U-Values) are reported at the QL, the laboratory reports all detected results that are at or greater than the MDL. This is a standard approach. All detected results less than the QL (but greater than the MDL) are qualified by both the laboratory and the data validator.

6. Worksheet # 12, pages 41 - 48 – In order to avoid confusion, the actual measurement performance criteria should be listed, not a reference to another worksheet.

Navy Response:

All field blank (equipment rinseate blank, trip blank, etc.) MPCs must be identical to the corresponding method blanks. Therefore, to prevent redundancy and possible discrepancies, MPCs for field blanks refer to the corresponding method blank MPCs. MS/MSDs are considered both laboratory and field QC. Therefore, MPCs for MS/MSDs are provided on the corresponding Worksheet 28s.

7. Worksheet # 13, page 53 – Secondary Data Criteria and Limitations Table: The third row includes 7 surface water samples and 12 sediment samples, which were collected during the RI in 2003. In the fourth column, "How Data Will Be Used" for the same row it is noted that "sampling results in areas not excavated will be used in the post-removal risk assessment." Worksheet # 9d indicate that previously collected surface water and sediment data will not be used in the post-removal risk assessment. Please clarify.

   Navy Response:

   Worksheet #13, row 3, column 4, first sentence has been revised to read "Soil sampling results in areas not excavated will be used in the post-removal risk assessment. Sediment and surface water samples will not be used."

8. Worksheet #15-8, page 70 – Reference Limits and Evaluation Table: The RSL Residential Soil Adjusted for Chromium is 290 ug/kg, which is the value for hexavalent chromium; hexavalent chromium is also included in this table. It is recommended that any samples for chromium be speciated and analyzed for both total chromium and hexavalent chromium. These results are used to determine the concentration of trivalent chromium. Due to the significant toxicity of hexavalent chromium and it's identification by EPA as an oral carcinogen, the toxicity of hexavalent chromium is significantly higher than trivalent chromium, which is likely to be present in higher concentrations. Unless speciated data are available, all chromium results should be evaluated in the HHRA as hexavalent. Therefore, it is recommended that all chromium samples be speciated.

   Navy Response:

   All samples are going to be analyzed for total and hexavalent chromium.

9. Worksheet # 15-11, page 73 – Reference Limits and Evaluation Table (AVS/SEM Analysis): Please provide information regarding how AVS/SEM data will be interpreted. It should be noted that regardless of the results of the AVS/SEM analysis, in the event that inorganic contaminants are identified at the site at concentrations greater than screening and background values, biological studies may be warranted.

   Navy Response:

   The SEM concentrations are summed and the sum is divided by the AVS concentration. A ratio less than 1 suggests that the metals concentrations are not bioavailable and thus the sediment is not toxic from this respect. A footnote has been added to Worksheet 15-11.

10. Worksheet #17, page 77 – Sampling Design and Rationale: Indicates that 2 soil samples will be collected and analyzed for PCBs in the former debris removal areas on the south side of Highway 200. SAP Worksheet #18 (Sampling Locations and Methods/SOP Requirements

Table) indicates that 3 sediment and/or soil samples will be analyzed for PCBs. Please confirm the number of samples analyzed for PCBs.

Navy Response:

Two soil samples will be collected and analyzed for PCBs in the former debris removal areas on the south side of Highway 200. Worksheet #18 also includes the number of duplicate samples, where one duplicate sample will be associated with these two soil samples, for a total of three soil samples for PCB analysis.

11. Worksheet # 17, page 77 – Sampling Design and Rationale: Please indicate whether SS009 and SS010 will be evaluated as marine sediment for ecological receptor exposures and surface soil for human health exposures.

Navy Response:

These locations will be evaluated as sediment for both the HHRA and the ERA. The following sentence has been added to the end of the first bullet in Worksheet #17: "These samples will be evaluated as sediment for human health exposure and as marine sediment for ecological receptor exposure."

12. Worksheet # 18, page 79 – Sampling Locations and Methods/SOP Requirements Table: The sampling SOP number should be provided for each type of sample collected.

Navy Response:

Worksheet #18, Sampling Locations and Methods/SOP Requirements Table, Sampling SOP Reference column, a line has been placed in the column separating "surface water" from "sediment and/or soil samples." In the surface water section, SOPs C-1, E-1, G-1, H-1, H-4, H-5, and H-6 have been referenced. In the Sediment and/or soil section, SOPs A-2, A-4, C-1, E-1, G-1, G-2, H-1, H-4, H-5, and H-6 have been referenced.

13. Worksheet # 18, page 79 – Sampling Locations and Methods/SOP Requirements Table: It may be useful to clearly indicate in the "Analytical Group" column which samples are for the background investigation. In the "Number of Samples" column please indicate the number of site or background-specific samples and the number of duplicates for each group to be sampled.

Navy Response:

Background investigation samples have been added beside inorganic constituents and pesticides in the analytical group for samples SD014 through SD023 and SW14 through SW23. In addition, the number of native samples and number of duplicates have been noted in the "Number of Samples" column.

14. Worksheet # 19, page 81 – Analytical SOP Requirement Table: It is difficult to distinguish which sampling requirements are applicable to which analytical method for metals. This information should be provided separately for each analytical method.

Navy Response:

Because analyses can sometimes share containers at the laboratory, the table is grouped by matrix and analytical group (and not separated by analytical method). All SW samples will be submitted for the same analyses. Therefore, all METALs samples will be analyzed for TAL Metals (6010 and 6020), Hg, and hexavalent chromium. Two bottles are needed due to the different preservation requirements.

15. Worksheet # 20, page 83 – Field Quality Control Sample Summary Table: Please explain why the total number of samples to be sent to the laboratory is overstated by one sample. Also, EPA does not normally require Trip Blanks for solid samples submitted for VOA analysis.

Navy Response:

"MS/MSDs" are pairs. Therefore, one MS/MSD pair is two samples submitted to the laboratory. This project will use trip blanks to assess potential sample contamination due to bottleware storage and transport of containers for solid and aqueous VOCs samples, which is a common practice.

16. Worksheet # 28 – Field QC and corrective action information should be added to this worksheet. In addition, the measurement performance criteria should be provided, since this information is more closely related to the rest of the information in this Worksheet than to that in Worksheet # 15.

Navy Response:

Worksheet 28 is for laboratory QC; field QC is listed separately on Worksheet 12. In that field QC samples undergo laboratory analysis with other field samples, the laboratory corrective actions listed in Worksheet #28 apply to field QC samples (based on sample type). Post-analysis corrective action based on field QC samples is typically initiated by the data validator as described on Worksheet 35 and as required by the procedures listed in Worksheet 36. Accuracy and Precision (A/P) limits (i.e. for LCS, MS/MSD, etc.) are analyte-specific and it is impractical to re-list all analytes within a cell on Worksheet 28. Because the analytes are already listed on Worksheet 15, the A/P information was added to Worksheet 15 and was then referenced by Worksheet 28. A note has been added to the bottom of each Worksheet #28 that states: "Refer to Worksheet #12 for Field QC samples. In the laboratory, field QC samples undergo the corrective actions (as applicable) listed in Worksheet #28. Post-analysis corrective action based on field QC samples is initiated by the data validator, as described on Worksheet #35, and as required by the procedures listed in Worksheet #36."

17. Attachment A, Figure 13, Pesticide/PCB Detections and Exceedances in Sediment: Please include units in site figure.

Navy Response:

The units (µg/Kg) have been added to the figure, as well as the other detections and exceedance figures.

Final Responses to

PREQB Technical Review of the

Draft Post-Removal Supplemental Confirmatory Sampling and Analysis Plan, Solid Waste Management Unit (SWMU) 6, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico

Dated May 2010

1. SAP Worksheet #3, Distribution List: Several project personnel listed on Worksheets #4 and 5 also need to be included on the SAP distribution list and therefore need to be added to this worksheet. Please revise Worksheet #3 to include the following personnel: Anita Dodson, Mark Orman, Juan Acaron, John Heyman, Jason Brenneman, Bhavana Reddy, Dia Whitaker, Jan Nielsen, and Paul Favara.

   Navy Response:

   The names listed above have been added to Worksheet #3.

2. SAP Worksheet #6, Communication Pathways: Please revise the worksheet to include PEL Laboratories in addition to Mitkem Laboratories.

   Navy Response:

   PEL Laboratories has been added to Worksheet #6.

3. SAP Worksheet #7, Personnel Responsibilities: Please revise the worksheet to include Jan Nielsen as the Navy QAO instead of Ken Bowers. This would be consistent with Worksheet #5.

   Navy Response:

   Worksheet #7, Personnel Responsibilities, 2nd person listed in 1st column has been changed to "Jan Nielson".

4. SAP Worksheet #9d, Project Scoping Session Sheet, Page 30: The worksheet states that one sediment sampling location will be added at the southeast area of SWMU 6 near the road for better coverage in the area that was disturbed by the removal action. Please clarify if surface soil sample VWW06-SS011 on Figure 16 is the sample being used to represent this location.

   Navy Response:

   Correct, SSO11 is the appropriate sample location.

5. Worksheet #10, Conceptual Site Model, Receptors, Human, Page 33:
   a. Please clarify why the residential exposure scenario only includes soil as environmental media as residents would be exposed to surface water and sediments as well as soil.

      <u>Navy Response:</u>

      The following text has been added following the bullet list on page 33:

      "Potential residential exposures to surface water and continuously inundated sediment will not be quantified separately in the HHRA. However, as a conservative approach, risk estimates for future recreational users can be used to represent potential surface water and sediment risks for residents since recreational users would likely be exposed at similar exposure frequencies and durations as residents. Intermittently-inundated sediment will be treated as surface soil for human health exposures since this type of sediment is available for direct contact when not covered by water."

   b. Please add a brief discussion of why groundwater is not being evaluated for this site. It is mentioned that surface water will not be evaluated as a potable water supply as it is salt water. Please add text addressing groundwater.

      <u>Navy Response:</u>

      The following statement has been added as a new paragraph after the paragraph listed above in comment 5a:

      "The removal action at the site was conducted within the area containing debris, including the area containing contamination potentially posing human and ecological risks. This removal action resulted in the study area becoming a shallow marine setting. In this area, human receptors would not be exposed to groundwater since it is now covered by saline surface water. Therefore, groundwater is not a potential exposure medium and is therefore not included in the human health risk assessment."

   c. Please clarify whether other species of crab are expected to be present that are considered edible crab species. If so, then please consider evaluating ingestion of crab tissue quantitatively.

      <u>Navy Response:</u>

      In addition to fish, blue crabs are an edible species that may be present at SWMU 6. Worksheet #10, page 33, last paragraph, second to last sentence has been modified as follows:

      "In addition, fish or shellfish (crab) ingestion is not expected, but a qualitative discussion will be prepared. Based on discussions held with EPA and PREQB on January 26, 2010, initially sediment data will be evaluated by the ecological risk assessors to determine whether sediment concentrations may be a concern for bioaccumulation in fish and shellfish. If there may be bioaccumulation at levels of concern, a conversation will be held between EPA, PREQB, and the Navy to develop the path forward. Considerations may include the following:

- Fish or crab home range size
- Modeled concentrations in edible-size fish or crab
- Percentage of fish or crab that a person could obtain from the onsite lagoon
- Percentage of fish or crab in a person's diet
- Where the chemical may partition into fish or crab tissues
- Cooking and preparation methods for fish and crab"

d. 3rd Question, Page 36: The results from samples collected during the pre-removal characterization sampling events in areas not disturbed (i.e., excavated) are proposed to be evaluated in the post-removal ecological risk assessment. Please clarify whether these samples represent sediment samples representative of an aquatic habitat (similar to the lagoon) and/or are representative of surface soil samples associated with a terrestrial environment. In addition, please provide the general approach for evaluating these samples in the post-removal ecological risk assessment (e.g., combined with sediment samples collected during post-removal and supplemental confirmation sampling).

Navy Response:

In Worksheet #10, page 36, question #3, the following modifications (as underlined) have been made:

> "Surface water, sediment, and soil results from the supplemental confirmatory sampling event, soil from the pre-removal characterization sampling events (in areas not excavated and outside of the canal adjacent to the site), and soil from post-removal confirmatory sampling (not including VOCs) will be evaluated in post-removal human health and ecological risk assessments. Sediment data from areas with greater than 3 feet of water will not be evaluated in the human health risk assessment because exposure in these areas is unlikely. For the ecological risk assessment, the solid media samples from the three sampling events described above will be evaluated as marine sediment since they all represent an aquatic lagoon/mangrove habitat. The sediment samples from the pre-removal characterization (undisturbed locations), post removal confirmatory sampling, and supplemental confirmatory sampling will be combined for the assessment of ecological risk. The results of the post-removal risk assessments will be presented in a post-removal risk assessment report."

6. SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements:

a. The bottom of page 37 discusses the analytes where the quantitation limits (QLs) exceed the project action limits (PALs). The QL exceedances for PCBs in surface water are justified by stating that PCBs are generally not observed in surface water due to the fate and transport of PCBs. However, PCBs are of concern at this site as a PCB release has been identified. Since the PCB marine water quality criterion is based on total PCBs and can be the sum of all Aroclors, homologs, or congeners, please consider using EPA method 680 for PCB homologues in order to achieve the PALs.

Navy Response:

As the comment indicates, QL exceedances of the surface water PALs are justified because PCBs are generally not observed in surface water. This statement is supported by the fact that PCBs were not detected in any of the historical surface water samples collected at SWMU 6. As shown in Worksheet #15-7, the QLs for PCBs in sediment, in which historic data identified the presence of PCBs, are all below the PALs. Therefore, no modification to the proposed PCB analytical method is warranted. For aqueous 8082, PEL will provide a method modification by bringing the final volume to 2mL instead of 10mL and adjusting the spike concentrations. Worksheets 15-3 and 23 have been updated to reflect this. This modification allowed them to lower their QLs from 0.5ug/L to 0.1ug/L for all Aroclors.

On the Vieques Technical Subcommittee conference call held on October 21, 2010, representatives from the Navy, EPA, PREQB, FWS, NOAA (and associated contractors) discussed this topic to determine if special methods for PCB analysis in surface water are warranted. CH2M HILL restated that PCBs are not commonly found in the water column (except if sediment containing PCBs is disturbed). Noting that PALs are based on the lower of the human health and ecological screening criteria, CH2M HILL stated that the human health screening criteria used were the tapwater RSLs, which are not realistic for this site, since it is a marine environment. In addition, CH2M HILL noted that there is likely a more appropriate ecological screening value (FCV or SCV) that could be used to put PALs based on ecological screening values into better perspective.

EPA also noted that the site is not a PCB site in that PCBs were not detected throughout the site. In fact, PCBs were detected in a small, isolated, terrestrial area adjacent to the road, not where the shallow marine setting now exists. EPA also noted that PCBs are generally not observed in the water column unless they have been mobilized by solvents, and solvents are not contaminants at SWMU 6. Further, PCBs were not observed in sediments at this site, so they would not be expected in surface water at this site. In addition, we will be analyzing PCBs in sediment, which will help determine if there is a potential source to the surface water.

Based on the above information, EPA concurred with the use of the PCB analytical methods proposed in the Draft SAP and that special methods are not warranted. PREQB stated that although its preference is to use methods that have quantitation limits that are lower than the PALs, it would defer to EPA's position on this comment.

b. The following statement is made in the first bullet item at the bottom of this page: "Detections of other constituents within that analytical group would aid in determining if residual contamination is present at the site (e.g., PAHs commonly occur together)." Although detections of other constituents within the analytical group would aid in determining if residual contamination is present, not meeting the PALs may result in

underestimating risks. Please discuss how risks associated with elevated nondetects for these chemicals will be addressed in the risk assessments.

Navy Response:

The following text has been added as the final bullet on page 37:

> "Sample-specific detection limits will be compared to risk-based screening levels in the HHRA. Chemicals with elevated detection limits that are nondetect in all samples within an environmental medium will not be selected as chemicals of potential concern in that medium and human health risks will not be estimated for these chemicals. However, the potential for elevated detection limits to underestimate risks will be addressed in the uncertainty section of the HHRA. Similarly, in the ecological risk assessment, the potential risks associated with non-detected chemicals having detection limits above ecological screening values will be discussed in the uncertainty section, though they will not be carried forward as contaminants of potential concern."

c. Page 38 discusses the potential issues with the metals analyses for surface water samples with high salinity conditions. In general, the discussion states that samples will require dilutions (20-fold for 6020 analyses and 5-fold for 6010B analyses) to overcome interferences. The dilutions will result in QLs that exceed the PALs for both the 6020 and 6010B analyses for the majority of metals. There are other steps that can be taken by the laboratories to deal with saltwater interference besides dilution. Hydride ICP/MS analyses have been used successfully for arsenic and selenium. Chelate extraction with ICP/MS has been used successfully for cadmium, lead, nickel, silver, zinc, and vanadium. Please investigate other techniques (and possibly other laboratories) to deal with the saltwater interference. Otherwise, the QLs will exceed the PALs for all metals except aluminum, barium, calcium, magnesium, manganese, potassium, and sodium and the usability of the data for the achievement of project objectives will be limited.

Navy Response:

Based on anticipated high-salinity conditions and the laboratory's experience, analytes were assigned to SW-846 methods 6010 and 6020 based on potential dilution factors to overcome interference. It is difficult to predict the actual interference that will result from site conditions. However, it is safe to say that background locations will have similar salinity-related effects since they will be collected from locations of similar salinity. Chelation and hydride generation combined with ICP-MS, such as EPA method 1638, is a specialty and expensive approach that is often used one metal at a time for research-type projects. This is not necessary or appropriate for generating defensible data when the current 6010B/6020 strategy is sufficient for the planned data use. Uncertainty as a result of QL v. PAL exceedances is a common occurrence and such uncertainty is discussed in the report, as indicated in Worksheet 11.

On the Vieques Technical Subcommittee conference call held on October 21, 2010, representatives from the Navy, EPA, PREQB, FWS, NOAA (and associated

contractors) discussed this topic to determine if special methods for metals analysis in surface water are warranted. CH2M HILL noted that, like the PCB PALs, the human health screening values used to help establish the PALs were based on tap water RSLs, which are not appropriate for this marine site. In addition, when considering only the ecological screening criteria, even at a 5x or 20x dilution (depending on the analytical method), only two metals (copper and thallium) did not have a QL or MDL below the PAL, but the PALs were similar to the MDLs for these two metals. In addition, thallium has never been observed to be released at any of the sites investigated to date. EPA also noted that the potential contaminant sources at the site were not copper only, so one would expect to see other metals if there is metal contamination at the site.

Based on the above information, EPA concurred with the use of the metals analytical methods proposed in the Draft SAP and that special methods are not warranted based on existing information. PREQB stated that although its preference is to use methods that have quantitation limits that are lower than the PALs, it would defer to EPA's position on this comment.

In addition to above, CH2M HILL noted that it will update the PALs to be consistent with any screening value that has changed since the Draft SAP was issued.

d. Page 38 states that all samples will be submitted to Mitkem Laboratories. However, according to subsequent worksheets, samples will be submitted to PEL Laboratories and Faulkner Engineering as well. Please revise accordingly.

Navy Response:

All analytical fractions will be shipped to PEL Laboratories. PEL will then ship to Mitkem and Faulkner Engineer, as necessary. Worksheet 11 (Page 38) has been updated to clarify that all three laboratories are used.

e. Page 39 states the field measurements that will be conducted on the background surface water samples. Revise this list to also include salinity.

Navy Response:

Salinity was added to the list of field measurements that will be conducted on the background surface water samples.

f. Page 39 states that samples will be collected in winter 2010. Please revise as this date has already past.

Navy Response:

Worksheet #11 page 39, 3rd bullet first tick mark has been edited to read: "Samples will be collected during one field mobilization planned to occur in early 2011."

7. SAP Worksheet #14, Summary of Project Tasks: Page 56, Sample Analysis: This section states that soil and groundwater samples will be analyzed by the laboratory. Please revise to state soil, sediment, and surface water samples will be analyzed by the laboratory.

Navy Response:

Worksheet #14, Summary of Project Tasks: Page 56, Sample Analysis, the 2nd sentence has been edited to read: "The laboratory will analyze soil, sediment, and surface water samples for various groups of parameters, as shown on Worksheet #15 and #18."

8. SAP Worksheet #15, Reference Limits and Evaluation Tables:
   a. Worksheet #15-1:
      i. The list of VOCs does not represent the most current TCL list (http://www.epa.gov/superfund/programs/clp/som-vtarget.htm). Please revise to include bromochloromethane, 1,4-dioxane, and 1,2,3-trichlorobenzene.

Navy Response:

The TCL referenced in the SAP is EPA CLP OLM04.3 as opposed to EPA CLP SOM01.2 to be consistent with the past analytical protocol. However, bromochloromethane and 1,2,3-trichlorobenzene will be added to the OLM04.3 TCL. SW-846 8260B is not acceptable for determination of 1,4-dioxane because it is a poor purger. Please also note that 1,4-dioxane was removed from the "Trace Water by SIM" and "Trace Water" lists at http://www.epa.gov/superfund/programs/clp/som-vtarget.htm. and that the "Low Water" QL for 1,4-dioxane is elevated compared to the rest of the "Low Water" QLs. In addition, 1,4-dioxane is commonly associated with TCE (as a stabilizer), which was not detected in site media (see Figures 3, 4, and 11 of the SAP). Based on the above information, 1,4-dioxane will not be added to the TCL.

   b. Worksheet #15-2:
      i Include the in-house laboratory limits for 1-methylnaphthalene.

Navy Response:

The aqueous in-house laboratory limits for 1-methylnaphthalene, 53-125%, have been added to worksheet 15-2.

      ii The QLs are listed as 0.05 µg/L. However, the laboratory SOP states that the low calibration standard is 0.02 µg/L. Please revise QLs to reflect the lowest calibration standard. This would also ensure the achievement of the PALs for benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene.

Navy Response:

It is the laboratory's decision as to where to set their QL. In this instance, the QL is set at greater than the lowest calibration standard, which is acceptable. There is a calibration standard at the QL and this is necessary such that the QL is sufficiently greater than the MDL.

c. Worksheet #15-3:
   i. The PCB marine water quality criterion is based on total PCBs and can be the sum of all Aroclors, homologs, or congeners. Therefore, please use EPA Method 680 for PCB homologues in surface water in order to obtain lower QLs and achieve the PALs instead of analyzing for PCB Aroclors.

      Navy Response:

      Please refer to response to comment 6a, above.

d. Worksheet #15-4:
   i. Please clarify why cyanide and hexavalent chromium are included on this worksheet. These contaminants were not cited as contaminants of concern in previous sections (Page 25 of Worksheet #9b).

      Navy Response:

      Hexavalent chromium is likely not a contaminant of concern. However, past regulatory comments have suggested total chromium concentrations should be assumed to be 100 percent hexavalent chromium when performing risk screening. Since the actual concentrations of hexavalent chromium are likely to be a tiny fraction of the total chromium concentrations, this assumption is overly conservative. To avoid having to make the assumption (or justify why it is overly conservative) for this study, hexavalent chromium analysis has been added. All solid samples analyzed for hexavalent chromium will also be analyzed for pH and ORP to help determine the reducing nature of the sample and to help interpret the hexavalent chromium data, especially if matrix spike recoveries are low. This information has been added to the appropriate worksheets. Cyanide is not a contaminant of concern, based on historical data, and has therefore been removed from the analytical protocol.

   ii. The footnote of the worksheet states that the standard protocol for diluting samples of marine and brackish waters are contained within the laboratory SOPs. Please provide the locations within the PEL and Mitkem SOPs where this protocol is provided.

      Navy Response:

      The footnote has been updated to read "The potential for dilution to overcome interference during analysis of marine and brackish water samples as a result of high dissolved salts concentrations is discussed in Section 5.4 and the 'interference' section of analytical laboratory SOPs 100.0110 and SOP00012, respectively."

   iii. Refer to comment #5b about potential other ways to deal with the saltwater interferences. Please consider the use of 6020 for the majority of metals in conjunction with hydride analyses and/or chelate extractions. This would also eliminate the need to split samples between two laboratories, Mitkem for 6020 and PEL for 6010B.

Navy Response:

Please refer to response to comment 6c, above.

e. Worksheet #15-5: Please update the list of VOCs to the most current TCL list (http://www.epa.gov/superfund/programs/clp/som-vtarget.htm). Note that bromochloromethane, 1,4-dioxane, and 1,2,3-trichlorobenzene need to be included.

Navy Response:

Please refer to response to comment 8a, above.

f. Worksheet #15-6: Please Include the in-house laboratory limits for 1-methylnaphthalene.

Navy Response:

The solid in-house laboratory limits for 1-methylnaphthalene, 77-140%, have been added to Worksheet 15-6.

g. Worksheet #15-8:
   i. Please clarify why cyanide and hexavalent chromium are included on this worksheet. These contaminants were not cited as contaminants of concern in previous sections (Page 25 of Worksheet #9b).

   Navy Response:

   Please refer to response to comment 8di, above.

   ii. The QL listed for chromium as 1000 µg/kg via method 6020 appears high. Laboratories are able to report down to 200 µg/kg for this metal. Please revisit with the laboratory in order to be able to achieve the PAL.

   Navy Response:

   The QL listed for chromium, 1000ug/kg, via method SW-846 6020 was confirmed with the laboratory.

h. Worksheet #15-9: The lower and upper control limits provided for the LCS, MS, and MSD for sulfide and ammonia reflect the LCS limits only. As per the laboratory SOPs, the MS limits are different than the LCS limits (75-125 for sulfide and 80-120 for ammonia). Please revise the worksheet accordingly.

Navy Response:

For strict DoD QSM compliance, the laboratory will be using the same accuracy limits for LCS, MS, and MSD. For this project, the limits were set at the more-stringent between the LCS and MS, which are the LCS limits in the laboratory SOP.

9. SAP Worksheet #18, Sampling Locations and Methods/SOP Requirements Table:
   a. Samples VWW06-SD08 and VWW06-SD011: These samples are labeled as SS-08 and SS-11, respectively, on Figure 16 and Worksheet #17. Please clarify and be consistent throughout the SAP.

Navy Response:

The worksheet has been revised to match the nomenclature in the figures.

b. Footnote #2: Please include salinity in the list of field parameters to be measured. Include a note that field measurements will be performed at both low tide and high tide and at 1-foot depth profiles, as discussed in Worksheet #14.

Navy Response:

Salinity and timing of field measurements has been added to the footnote in Worksheet #18, in accordance with Worksheet #14.

c. Footnote #3: This footnote should refer to Worksheet #12 instead of Worksheet #28 since Worksheet #12 discusses the field QC samples.

Navy Response:

Footnote #3 has been edited as indicated above.

10. SAP Worksheet #19, Analytical SOP Requirements Table:
    a. SVOCs in Surface Water:
        i. The Containers should be listed as "2" of 1 L Amber. An extra bottle is needed in case of potential reextraction, breakage, etc.

Navy Response:

The bottleware requirement has been updated as noted in the comment.

        ii. The preparation method should reference 3510C instead of 3510.

Navy Response:

The preparation method has been updated as noted in the comment.

    b. PEST/PCB in Surface Water:
        i. The Containers should be listed as "4" of 1 L Amber. An extra bottle is needed in case of potential reextraction, breakage, etc.

Navy Response:

One additional amber should be sufficient for PEST/PCB; note that one additional amber is also being added as per response to comment 10ai, above. The bottleware requirements have been updated to three bottles for PEST/PCB.

        ii. The preparation method should reference 3510C instead of 3510.

Navy Response:

The preparation method has been updated as noted in the comment.

    c. METALS in Surface Water:

i. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

Navy Response:

Please refer to response to comment 8di, above.

ii. Please add the Mitkem preparation SOP, 100.0003 and the PEL preparation SOP, SOP00011.

Navy Response:

The two preparation SOPs have been added.

iii. The Containers should be listed as "2" of 250 mL HDPE since two laboratories are currently being used for the preparation and analysis of aqueous samples for metals. Therefore, separate bottles will be required.

Navy Response:

The number of containers has been changed to "2."

d. SVOCs in Sediment and Surface Soil: Please include the preparation method and SOP which will be used. Currently, Worksheet #23 lists two different preparation methods (SOP00025 and SOP00026). Please clarify which one will be utilized for the extraction of SVOCs.

Navy Response:

For SVOCs and PEST/PCBs in sediment and surface soil, SOP00026 (automated solvent extraction (ASE) and SW-846 3545A) is used by default. SOP00025 (sonication and SW-846 3550B) may be used if there are instrumental issues with the ASE or if the sample has a high percent moisture. The two preparation methods have been added to Worksheet 19 and a footnote has been added to clarify when each is used.

e. PEST/PCB in Sediment and Surface Soil: Please include the preparation method and SOP which will be used. Currently, Worksheet #23 lists two different preparation methods (SOP00025 and SOP00026). Please clarify which one will be utilized for the extraction of pesticides and PCBs.

Navy Response:

Please refer to response to comment 10d, above.

f. METALS in Sediment and Surface Soil:

i. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

Navy Response:

Please refer to response to comment 8di, above.

ii. Please add the Mitkem preparation SOP, 100.0100 and the PEL preparation SOP, SOP00011.

Navy Response:

The two preparation SOPs have been added.

g. WCHEM in Sediment and Surface Soil:
   i. The Analytical method column cites the Lloyd Kahn method for TOC. Therefore, please change the holding time to 14 days instead of 28 days.

   Navy Response:

   The holding time has been updated to 14 days for TOC.

   ii. Please revise the preservation requirements for sulfide to state 2N Zinc Acetate and no headspace, as per the method.

   Navy Response:

   The preservation requirement has been updated to 2N ZnAce, no headspace, Cool to 4°C.

h. AVSSEM in Sediment:
   i. Please revise the preservation requirements to include a requirement for no headspace, as per the method.

   Navy Response:

   The preservation requirement has been updated to no headspace, Cool to 4°C.

   ii. Please revise the holding time to be 14 days instead of 28 days, as per the method and the laboratory's SOP.

   Navy Response:

   The holding time has been updated to 14 days to match the laboratory SOP.

11. SAP Worksheet #20, Field Quality Control Sample Summary Table:
    a. Surface Water:
       i. The number of Sampling Locations needs to be 17, not 20, per Worksheet #18.

       Navy Response:

       The number of surface water sampling locations has been revised to 7 for VOC and SVOC analysis, and 17 for the other analyses.

       ii. Please revise the MS/MSDs to 2 for each parameter, as it is recommended that there be 1 MS/MSD from the site and 1 MS/MSD from the background locations due to the potential for different matrix issues.

       Navy Response:

       Footnote #1 has been updated to read "1 MS/MSD will be collected from the site and 1 MS/MSD will be collected from the background locations to due to the

potential for different matrix issues." The number of MS/MSD pairs column has been updated and the total number of samples has been updated accordingly.

iii. The number of equipment blanks is listed as one. However, the footnote states that one equipment blank will be collected per day and there will be eight days of sampling. Please clarify.

Navy Response:

The footnote indicates that one equipment blank is collected per event when equipment is disposable. At this point, it is assumed that all disposable equipment will be used. In the event that equipment is decontaminated, one equipment blank will be collected per day, as indicated by the footnote.

b. Surface Soil: Please revise the analytical group to state PCB only.
Navy Response:

The change has been made as noted in the comment.

c. Sediment:
i. For all parameters except Metals, the number of Sampling Locations needs to be 11, not 20, per Worksheet #18. For metals, the number of Sampling Locations needs to be 21.

Navy Response:

The number of samples has been revised to 11.

ii. Please revise the MS/MSDs to 2 for metals, as it is recommended that there be 1 MS/MSD from the site and 1 MS/MSD from the background locations due to the potential for different matrix issues.

Navy Response:

Please see response to comment 11aii, above.

iii. Please delete the row for filtered metals as this does not apply to sediment samples.

Navy Response:

Worksheet #20, Matrix SD, Analytical Group FMETAL, this row has been deleted.

12. SAP Worksheet #21, Project Sampling SOP References Table: Please remove SOP A-4, Soil Sampling for VOCs Using the EnCore Sampler. As per Worksheet #9a, page 21, EnCore samplers will not be used.

Navy Response:

The EnCore Sampler SOP has been removed.

13. SAP Worksheet #22, Field Equipment Calibration, Maintenance, Testing and Inspection Table: Please include the requirements for the salinity probe.

Navy Response:

The salinity probe is the conductivity probe. Conductivity is mathematically converted to salinity.

14. SAP Worksheet #23, Analytical SOP References Table:
    a. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

    Navy Response:

    Please refer to response to comment 8di, above.

    b. Please clarify which of the solid preparation methods will be used for SVOCs, pesticides, and PCBs: SW-846 3550B or SW-846 3545A. Both are included on this worksheet.

    Navy Response:

    Please refer to response to comment 10d, above. It is not necessary to add a footnote to Worksheet 23 because it is just a list of SOPs.

15. SAP Worksheet #24, Analytical Instrument Calibration Table:
    a. GC/MS:
        i. The acceptance criteria for the second source calibration verification are listed as ±20% of the true value. However, the VOC and SVOC SOPs both list the acceptance criteria as ±25%. Please clarify.

        Navy Response:

        For strict DoD QSM compliance, the acceptance criteria for second source calibration verification are ±20% of the true value.

        ii. The breakdown check for the SVOC method is not included in the SVOC-SIM SOP. Please clarify if this is utilized for the SIM analysis.

        Navy Response:

        For strict DoD QSM compliance, the breakdown check is performed for the SIM PAHs as part of SW-846 method 8270.

    b. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

    Navy Response:

    Please refer to response to comment 8di, above.

c. Spectrophotometer/Sulfide: The acceptance criteria for the continuing calibration are listed as ±15% of the true value. However, the SOP lists the acceptance criteria as ±10%. Please clarify.

Navy Response:

The acceptance criteria have been updated to ±10.

16. SAP Worksheet #25, Analytical Instrument and Equipment Maintenance, testing, and Inspection Table:
    a. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

Navy Response:

Please refer to response to comment 8di, above.

b. Please add the SOP 100.0110 to the SOP Reference column for metals analyses.

Navy Response:

SOP 100.0110 has been added.

17. SAP Worksheet #28, Laboratory QC Samples Table:
    a. Worksheets #28-4 and 28-8:
        i. Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

Navy Response:

Please refer to response to comment 8di, above.

ii. 6010 and 6020: The acceptance criteria for the calibration blank states that the analytes must not be detected above the LOD. However, the 6010 SOP states that analytes should be not detected above 2x MDL and the 6020 SOP states that the analytes should not be detected above the PQL. Please clarify.

Navy Response:

For strict DoD QSM compliance, analytes must not be detected at greater than the LOD.

iii. 6010 and 6020: The acceptance criteria for the ICS-A states that the absolute value of the concentration for non-spiked analytes must be <LOD. However, both SOPs state that these concentrations should be <2x MDL. Please clarify.

Navy Response:

For strict DoD QSM compliance, the absolute value of concentration for all non-spiked analytes must be < LOD.

iv. 6010 and 6020: The acceptance criteria for the serial dilution states that the evaluation criteria are only applicable to concentrations >50x LOQ. However, the 6010 SOP states that the evaluation criteria are applicable to concentrations >50x the MDL and the 6020 SOP states that the evaluation criteria are applicable to concentrations >10x the PQL. Please clarify.

Navy Response:

For strict DoD QSM compliance, the serial dilution is only applicable for samples with concentrations > 50X LOQ.

v. 6020: Add criteria for the internal standards.

Navy Response:

Criteria for internal standards were added to Worksheets 28-4 and 28-8 as per DoD QSM v. 4.1.

b. Worksheet #28-9:

i. SOP 100.0112 is listed under the SOP References. This SOP was not included on Worksheet #23. Please clarify if it is being used.

Navy Response:

The correct reference is SOP00083. Worksheet 28-9 has been updated.

ii. Add SOP 00083 for the analysis of pH to the list of SOP References.

Navy Response:

Please see response to comment 17aii, immediately above.

iii. pH: SOP also includes requirements for an LCS and LCS Duplicate. Please add to the Worksheet.

Navy Response:

Requirements for LCS and LCSD have been added to Worksheet 28-9.

iv. Sulfide: The acceptance criteria for the MS and MSD are listed as being the same as the LCS. However, as per the SOP, the criteria are 75-125% and not 80-120% like the LCS.

Navy Response:

Please see response to comment 8h, above.

v. Ammonia: The acceptance criteria for the MS and MSD are listed as being the same as the LCS. However, as per the SOP, the criteria are 80-120% and not 90-110% like the LCS.

Navy Response:

Please see response to comment 8h, above.

18. SAP Worksheet #29, Project Documents and Records Table: Please revise row 7 to state surface water instead of groundwater.

    Navy Response:

    Worksheet #29, Project Documents and Records Table, row 7 has been edited as follows: "Water quality field parameters collected during surface water sampling."

19. SAP Worksheet #30, Analytical Services Table: Please remove the reference to cyanide and hexavalent chromium if these analyses will not be performed for this investigation.

    Navy Response:

    Please refer to response to comment 8di, above.

20. SAP Worksheet #31, Planned Project Assessments Table: Please revise the CH2M Hill H&S Officer to be Mark Orman instead of Steve Beck, to be consistent with Worksheet #4.

    Navy Response:

    Worksheet #31, Planned Project Assessments Table, 7th Column and last row cell has been edited as follows: "Mark Orman
    H&S Officer
    CH2M HILL"

21. SAP Worksheet #33, QA Management Reports Table:
    a. This worksheet lists the Data Validation Subcontractor as DataQual. However, all previous worksheets list "TBD" for the data validation subcontractor. Please clarify and revise all worksheets to be consistent.

       Navy Response:

       The worksheet has been updated to reflect "Data Validation Subcontractor/TBD."

    b. Revise the Project EIS to be Juan Acaron instead of Emma Brewer, to be consistent with Worksheet #4.

       Navy Response:

       Worksheet #33, QA Management Reports Table, 3rd Column and 2nd Row, Project EIS has been edited as follows: "Project EIS: Juan Acaron/CH2M HILL"

    c. Revise the Project Manager to be Bill Hannah instead of John Swenfurth, to be consistent with Worksheet #4.

Navy Response:

Worksheet #33, QA Management Reports Table, 3rd Column and 2nd Row, Project Manager has been edited as follows: "Project Manager: Bill Hannah/CH2M HILL"

22. QAPP Worksheet #36, Validation:
    a. VOA: Please revise the validation criteria to reflect the latest version, August 2008.

    Navy Response:

    Worksheet 36 was updated to reflect Revision 2, August, 2008.

    b. SVOA: Please revise the validation criteria to reflect the latest version, Revision 4, August 2008.

    Navy Response:

    Worksheet 36 was updated to reflect Revision 4, August, 2008.

23. Figure 17: This figure depicts the 10 proposed surface water and sediment background sampling locations. Please clarify the figure by identifying the individual lagoons on the figure. On page 36 and page 77 of the SAP, the text refers to an unnamed lagoon located to the west and adjacent to Route 200 as a background location while page 55 of the SAP text states that background samples will be collected from Laguna El Pobre, Laguna Kiani and Laguna Arenas. Please clarify and depict the names of the background sampling lagoons on Figure 17.

    Navy Response:

    Figure 17 has been edited to include the names of the three lagoons mentioned. Page 36, first paragraph, 5th sentence has been edited to read: "The background data set collected from Lagoona Punta Arenas, located to the west and adjacent to Highway 200, will initially…..". Page 77, second to last paragraph, 1st sentence has been edited to read: "……, and four from Laguna Punta Arenas located further west adjacent to Highway 200 (…….".