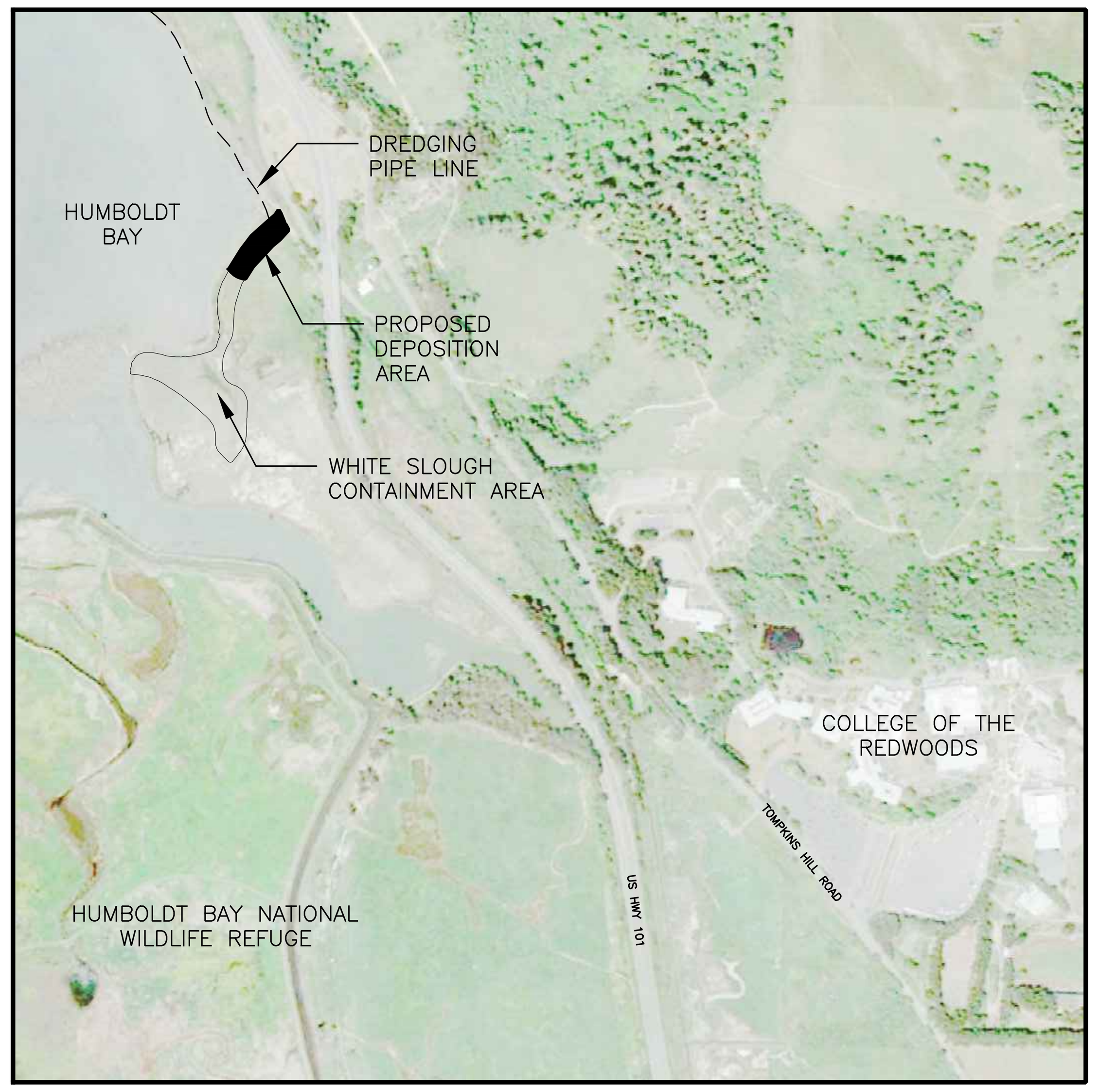
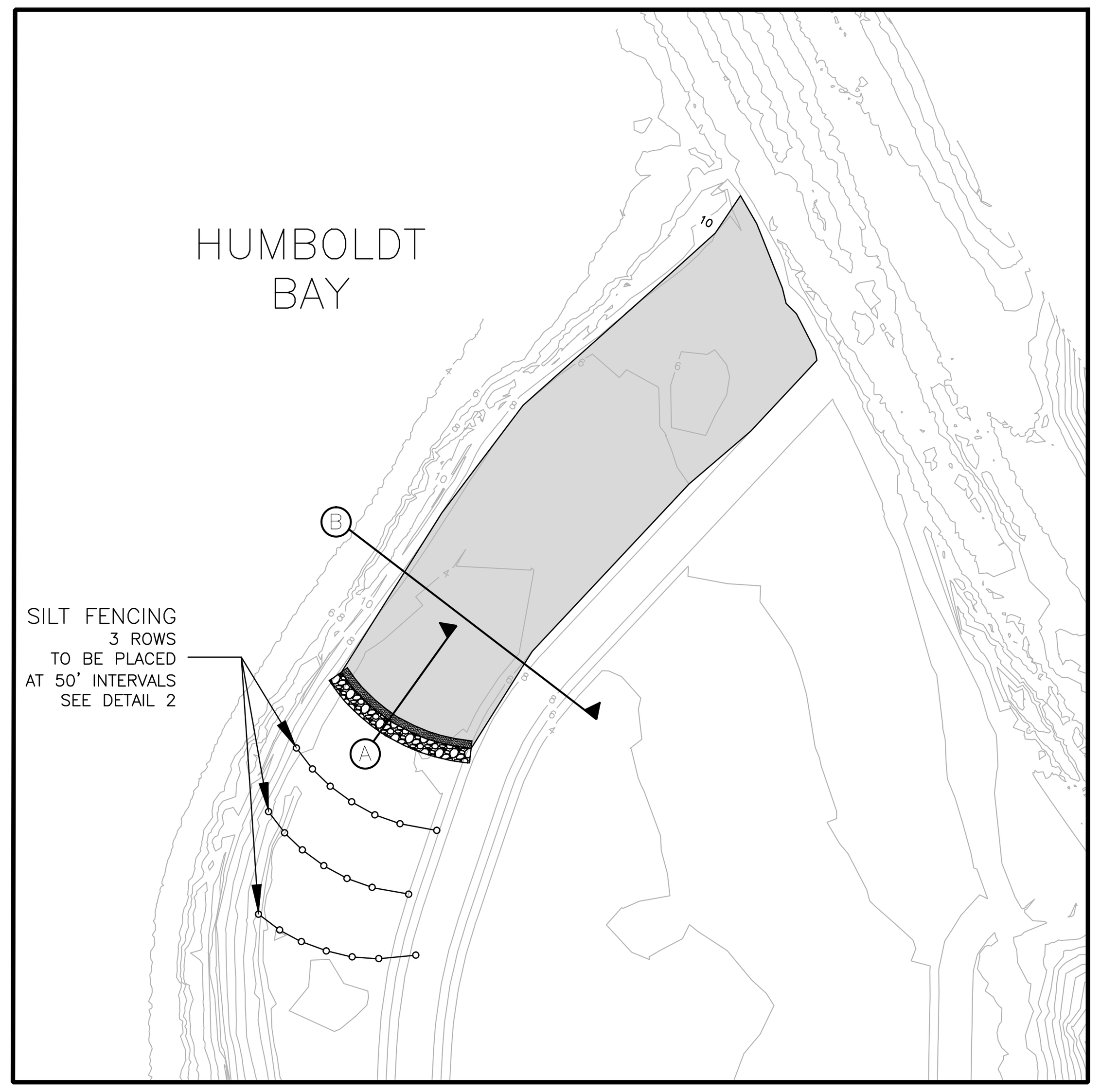
Appendix A
White Slough Beneficial Reuse Plan Drawings



SITE LOCATION
SCALE: 1" = 500'

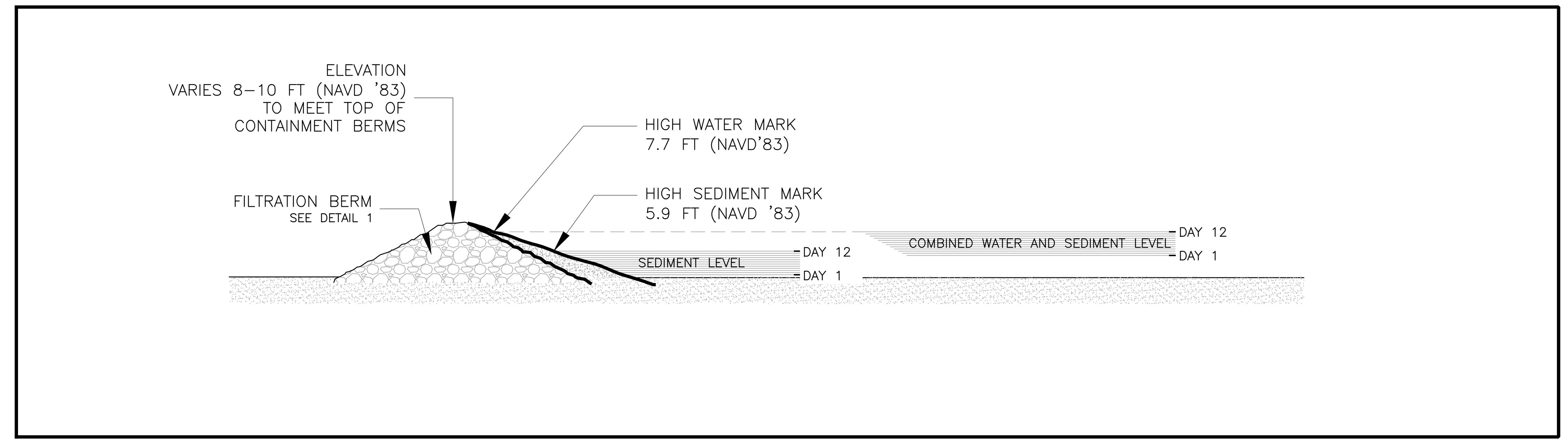


SITE PLAN – ALTERNATIVE A
SCALE: 1" = 100'

ALTERNATIVE A: FILTRATION BERM DEWATERING

SCOPE OF WORK

THE GOAL OF THIS PROJECT IS TO DEVELOP A DEPOSITION AREA AT WHITE SLOUGH TO RECEIVE AND DEWATER DREDGING MATERIAL FROM THE FISHERMAN'S CHANNEL DREDGING PROJECT. THE ALTERNATIVE DESIGN SOLUTION PRESENTED HEREIN EMPLOYS A FILTRATION BERM TO DEWATER THE DREDGING MATERIAL AND USES A SERIES OF SILT FENCES FOR THE EFFLUENT TO PASS THROUGH AS SECONDARY TREATMENT BEFORE IT IS DISCHARGED INTO THE SURROUNDING ENVIRONMENT.



A FILTRATION BERM PROFILE
SCALE: 1"=10'

LOCATION

WHITE SLOUGH
APPROXIMATELY 1.13 MILES NORTHWEST OF COLLEGE OF THE REDWOODS
APN: 307–052–001

ESTIMATED DEPOSITION AREA AVAILABLE

AERIAL FOOTPRINT	43560 SQ FT
AVAILABLE DEPTH	4.5 FT
AVAILABLE VOLUME	196020 CU FT = 7260 CY

ESTIMATED DREDGING MATERIAL QUANTITIES

SEDIMENT	3900 CY
WATER	35100 CY
TOTAL	39000 CY

FINAL SEDIMENT LEVEL WITHIN DEPOSITION AREA:
2.4 FT ABOVE EXISTING GRADE

ESTIMATED DEPOSITION RATE

VOLUMETRIC RATES:

PER HOUR	400 CY
PER DAY (8 HRS)	3200 CY
PER WEEK (40 HRS)	16000 CY

TIME TO COMPLETE MATERIAL DEPOSITION:
97.5 HRS = 12.2 WORK DAYS

ESTIMATED SAND FILTER FLOW PARAMETERS

HYDRAULIC CONDUCTIVITY	0.02 FT/S
BERM HEIGHT	4.5 FT
BERM SPAN	100 FT
BERM WIDTH	4.5 FT MAX
BERM SLOPE	3:1 (18.43° ANGLE OF INCLINATION)
MAX HEAD	2 FT MAX
MAX OUTFLOW RATE	6 CFS

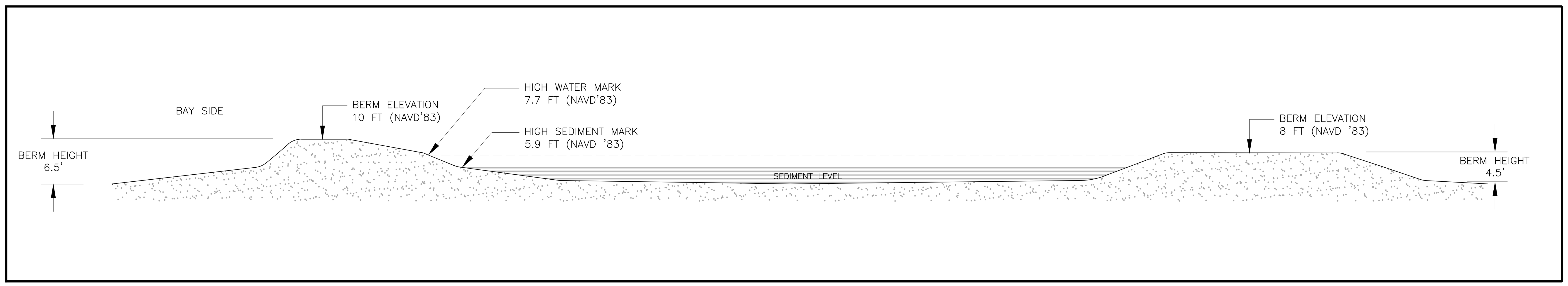
TIME TO DEWATER DAILY SPOILS THROUGH SAND BERM
4 HRS

ESTIMATED BILL OF MATERIALS

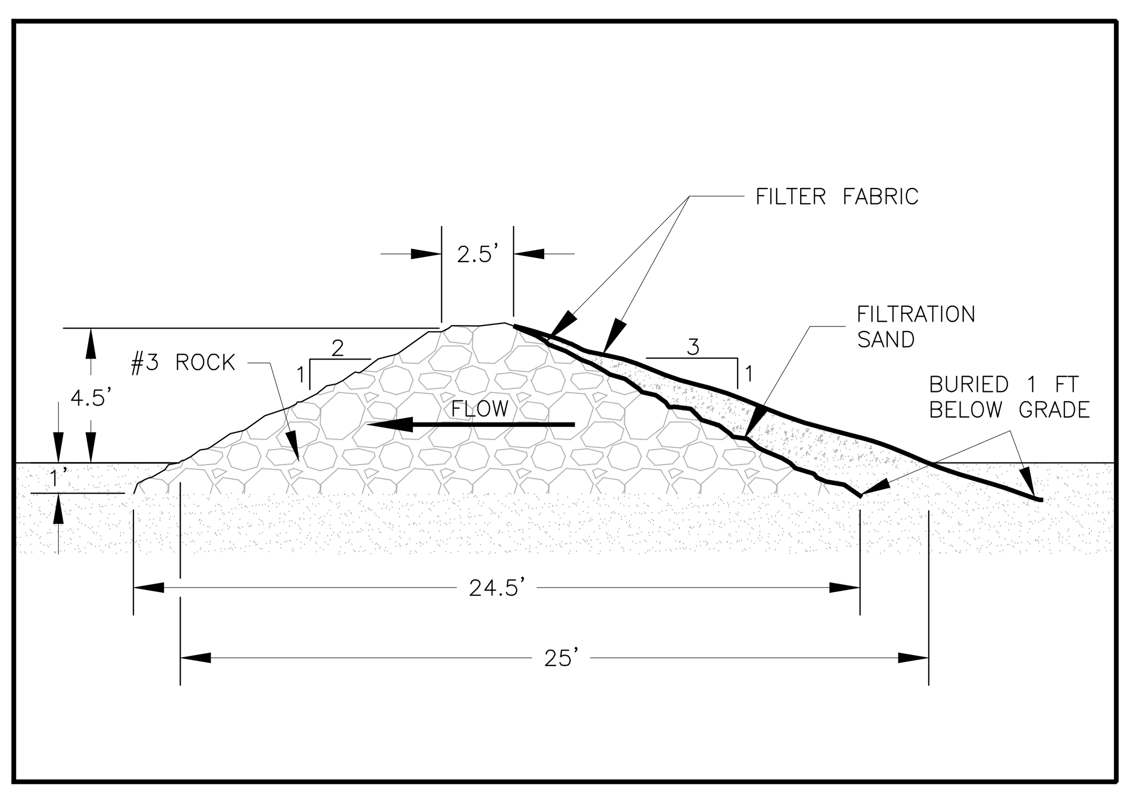
FILTRATION SAND	40 CY
#3 DRAINAGE ROCK	235 CY
SILT FENCE MATERIAL WITH WIRE MESH (36 IN)	350 FT
NON–WOVEN 4.5 OZ DRAINAGE AND FILTRATION FABRIC (15 FT)	120 FT

DATUMN

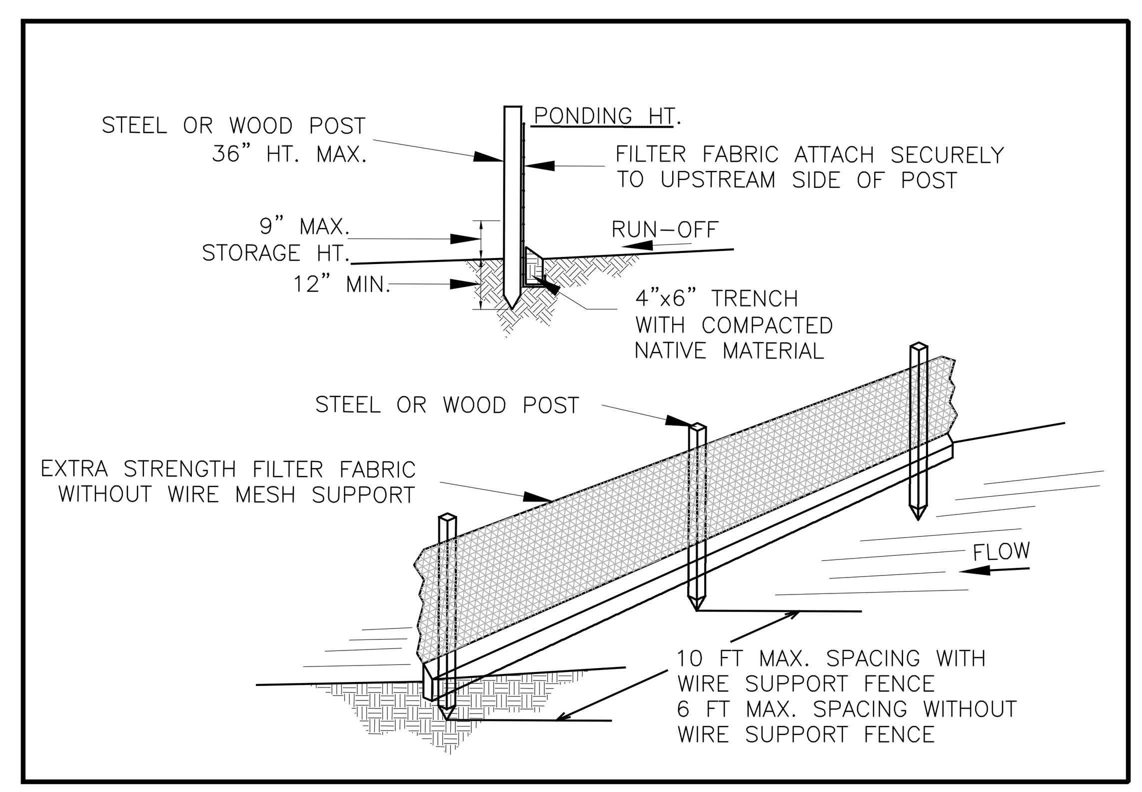
HORIZONTAL: CALIFORNIA COORDINATE SYSTEM ZONE 1 NAD '83
VERTICAL: NAVD '83



B CONTAINMENT BERMS PROFILE
SCALE: 1"=10'



1 FILTRATION BERM DETAIL
NOT TO SCALE



2 SILT FENCE DETAIL
NOT TO SCALE

NOTES:

1. THE CONTRACTOR SHALL INSPECT AND REPAIR FENCE AFTER EACH DAY OF SEDIMENT DEPOSITION AND REMOVE SEDIMENT WHEN NECESSARY.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF–SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMUM PONDING EFFICIENCY.
4. WOOD STAKES SHOULD BE COMMERCIAL QUALITY LUMBER OF THE SIZE AND SHAPE SHOWN ON THE PLANS. EACH STAKE SHOULD BE FREE FROM DECAY, SPLITS OR CRACKS LONGER THAN THE THICKNESS OF THE STAKE OR OTHER DEFECTS THAT WOULD WEAKEN THE STAKES AND CAUSE THE STAKES TO BE STRUCTURALLY UNSUITABLE.
5. SILT FENCE SHALL BE LEFT IN PLACE, INSPECTED, AND MAINTAINED UNTIL THE UPSTREAM AREA IS PERMANENTLY STABILIZED.
6. SEDIMENT THAT ACCUMULATES IN THE SILT FENCE MUST BE PERIODICALLY REMOVED IN ORDER TO MAINTAIN EFFECTIVENESS. SEDIMENT SHOULD BE REMOVED WHEN SEDIMENT ACCUMULATION REACHED ON THIRD OF THE BARRIER HEIGHT. SEDIMENT REMOVED DURING MAINTENANCE MAY BE STOCKPILED AND PLACED WITHIN THE DEPOSITION AREA.
7. SILT FENCE FABRIC SHOULD BE WOVEN POLYPROPYLENE WITH A MINIMUM WIDTH OF 36" AND A MINIMUM TENSILE STRENGTH OF 100 LB FORCE. THE FABRIC SHOULD CONFORM TO THE REQUIREMENTS IN ASTM DESIGNATION D4632 AND SHOULD HAVE AN INTEGRAL REINFORCEMENT LAYER. THE REINFORCEMENT LAYER SHOULD BE POLYPROPYLENE, OR EQUIVALENT, NET PROVIDED BY THE MANUFACTURER. THE PERMITTIVITY OF THE FABRIC SHOULD BE BETWEEN 0.1 SEC AND 0.15 SEC IN CONFORMANCE WITH THE REQUIREMENTS IN THE ASTM DESIGNATION D4491.

PRELIMINARY DRAWING - NOT FOR CONSTRUCTION

This drawing or drawing set shall not be used for construction unless a jurisdictional stamp (County, City, State, Federal) has been issued on the drawing, stating "FOR PERMIT" or similar verbiage, a wet signed professional engineer's stamp, and permit documents have been issued for the project.

1 INCH

THESE PLANS ARE ORIGINALLY PRINTED ON 24"x36" PAPER.

REVISIONS	BY

WHITCHURCH ENGINEERING, INC.
610 9th Street Fortuna, California 95540 Phone (707) 725–6926

FISHERMEN'S CHANNEL DREDGING PROJECT
APN: 307–052–001
WHITE SLOUGH DEPOSITION AREA PROJECT, SITE PLAN, FILTRATION BERM DEWATERING
For: PACIFIC GAS AND ELECTRIC COMPANY

Date	AUG 31 '15
Scale	AS NOTED
Design	CPL
Drawn	CPL
Job	LOE12
Sheet	1A

Appendix B
Eelgrass Mitigation Plan

JANUARY 2016 DRAFT

Eelgrass Mitigation Plan for the Fisherman's Channel Dredging Project

PREPARED FOR

Humboldt Bay Harbor, Recreation, and Conservation District
601 Startare Drive
Eureka, CA 95501

PREPARED BY

Stillwater Sciences
850 G Street, Suite K
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Stillwater Sciences

Suggested citation:
Stillwater Sciences. 2016. DRAFT Eelgrass Mitigation Plan for the Fisherman's Channel Dredging Project. Humboldt County, California. Prepared by Stillwater Sciences, Arcata, California for the Humboldt Bay Harbor, Recreation, and Conservation District, Eureka, California.

Cover photos: Photos taken by Stillwater Sciences 2014–2015. Eelgrass at mouth of Fisherman's Channel (top left), Fields Landing Mitigation area (top right, bottom right, and bottom left).

Table of Contents

Tables

Figures

1 INTRODUCTION AND BACKGROUND

1.1 Project Description

The Humboldt Bay Harbor, Recreation, and Conservation District (Harbor District) is proposing to conduct maintenance dredging of Fisherman's Channel as part of a beneficial reuse dredging pilot project (Project) to facilitate improved navigation in the channel via dredging and subsequent beneficial reuse of the dredged sediments for salt marsh restoration at the White Sough Unit of the Humboldt Bay National Wildlife Refuge (Refuge). Fisherman's Channel is located in King Salmon, California, approximately 2.5 miles south of the City of Eureka along Humboldt Bay (Figure 1). Currently, Fisherman's Channel is inaccessible to larger vessels at a lower low tide due to a bar that has formed at the channel entrance. Dredging of the mouth of Fisherman's Channel and main channel is proposed to take place in summer or fall 2016. The areas to be dredged are shown in Figure 2. Dredging activities for the King Salmon residential canals that connect with the Fisherman's Channel are not part of this Project because the feasibility, funding, and timeline for dredging those canals are unknown at this time.

The Project objectives are described in the project description of the California Environmental Quality Act (CEQA) Initial Study and summarized below:

- Dredge the channel in the Fisherman's Channel to restore safe and consistent boat navigation at all tidal heights
- Provide dredged material to the White Sough Unit of the Refuge for beneficial reuse by the United States Fish and Wildlife Service (USFWS) for salt marsh restoration
- Carry out the Project to provide agencies with operations data that will facilitate future dredge and beneficial reuse design, permitting, and implementation elsewhere in Humboldt Bay
- Conduct water quality monitoring that will guide future dredging operations elsewhere within Humboldt Bay
- Implement and monitor success of eelgrass (*Zostera marina*) and longfin smelt (*Spirinchus thaleichthys*) mitigation
- Establish an acceptable standard protocol for sediment sampling methods and analysis for future dredging to focus on Constituents of Concern (COC) and possibly reduce redundancy in the sampling suite
- Provide Harbor District staff with dredging and beneficial reuse experience, particularly to address boat navigation, habitat restoration, and sea level rise issues within Humboldt Bay
- Inform a Humboldt Bay Sediment Master Plan

Portions of this Project have the potential to impact eelgrass and longfin smelt, requiring mitigation. The very low risk of take of longfin smelt associated with the Project will be fully mitigated through implementation of this eelgrass mitigation plan. The purpose of this mitigation and monitoring plan is to identify the amount of eelgrass habitat that requires mitigation, identify the location for completing the mitigation requirement, outline mitigation conceptual design and implementation steps, define performance criteria, describe the monitoring and reporting protocols, and describe the maintenance and remedial action plans.

Figure 1. Project area.

Figure 2. Fisherman's Channel Dredging Area.

1.2 Impacts on Existing Eelgrass Beds

Eelgrass is present and widely distributed in Fisherman's Channel and will be affected by dredging activities. There are a total of 3.03 acres (ac) of eelgrass in the main portion of the Fisherman's Channel and an additional 1.9 ac in the Residential Canals (Stillwater Sciences 2012).

The Project has been modified from the original design to substantially reduce the amount of eelgrass impacted. The dredging footprint was greatly reduced within the entire main channel to include only those specific locations where sediment accumulations are posing a navigation hazard. In addition, the dredging depth was decreased in most of the channel to allow for eelgrass to recolonize the channel following dredging. This change in dredging depth and width has resulted in a reduction of the eelgrass impact area from 2.8 ac to 1.2 ac.

The entrance of Fisherman's Channel will be dredged to a depth of -8 ft mean lower low water (MLLW) and will experience relatively frequent maintenance dredging (i.e., every 10 years) in the future to maintain boat access into Fisherman's Channel during low tides (Figure 2). The remainder of the dredging area farther up the channel will be dredged to a depth of -6 ft MLLW and is not expected to be subject to dredging more frequently than every 25 years.

A total of 1.2 ac of eelgrass will be directly affected by dredging activities; 0.23 ac in the entrance of the channel and 0.97 ac farther up the channel (Figure 3). An additional 0.37 ac of eelgrass, located within a 5-ft buffer surrounding the dredging footprint, may be indirectly impacted by increased turbidity during dredging activities, but the impact is expected to be minimal and temporary. This area is not included in the 1.2 ac of eelgrass that will be impacted by dredging.

All of the direct and indirect impacts on the eelgrass in Fisherman's Channel are considered to be temporary. Eelgrass is abundant in the channel at elevations of -7 ft MLLW and higher. The -8 ft MLLW dredging depth at the channel entrance will allow eelgrass to grow back once the channel has silted in about one foot (i.e., to -7 ft MLLW). The remainder of Fisherman's Channel, which will be dredged to -6 ft MLLW, will recolonize rapidly due to the large amount of eelgrass outside the dredging footprint and in the adjacent residential canals. No dredging will occur along the side slopes outside of the designated dredge footprint, which will provide a source for recolonization immediately adjacent to the dredged area.

Figure 3. Existing eelgrass coverage in Fisherman's Channel overlaid with dredging footprint and eelgrass impact interval.

1.3 Regulatory Setting and Compliance Requirements

Authorization to dredge and subsequently place dredged material in upland sites for beneficial reuse is provided through a variety of federal and state permitting processes. Humboldt Bay, along with its tributary rivers, streams, adjacent wetlands, and the Pacific Ocean out to the 3-mile limit, are "waters of the United States" pursuant to the Clean Water Act (CWA) Section 404 jurisdiction. The United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA) and the North Coast Regional Water Quality Control Board (NCRWQCB) regulate placement of dredged material in Humboldt Bay. The USACE implements Section 10 of the Rivers and Harbors Act and Section 404 of the CWA, and the USEPA has oversight authority. Under CWA Section 401, the NCRWQCB must certify that beneficial reuse of the dredged material will not violate state water quality standards and other applicable requirements.

The Project requires a permit under Section 10 of the Rivers and Harbors Act from the USACE, Section 401 Water Quality Certification from the NCRWQCB, a Coastal Development Permit (CDP) from the North Coast Division of the California Coastal Commission (CCC), a development permit from the Harbor District, an California Endangered Species Act (CESA) Incidental Take Permit (ITP) from the California Department of Fish and Wildlife (CDFW), and a Conditional Use Permit from the County of Humboldt. The Project is also subject to review under CEQA, the National Environmental Policy Act (NEPA), and regulation under the state and federal Endangered Species Acts. The Harbor District will act as lead agency for CEQA and the USACE is lead agency for NEPA.

In addition to those listed above, the following agencies may have permit authority and/or will be consulted:

- US Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)
- Humboldt Bay National Wildlife Refuge
- North Coast Railroad Authority

Permit applications will be filed in January 2016 and all necessary permits and approvals obtained prior to July 31, 2016.

1.4 Proposed mitigation ratios

As described above, all impacts to eelgrass will be temporary. The eelgrass restoration project (described below) is expected to be very successful because it involves creating eelgrass habitat adjacent to an existing eelgrass bed rather than transplanting eelgrass into potentially unsuitable habitat. Direct impacts on eelgrass (1.2 ac) will be mitigated at a 1.2:1 ratio, which will require 1.44 ac of mitigation area. The 1.2:1 ratio is warranted because (1) the eelgrass impacts are temporary, (2) the eelgrass mitigation is permanent, and (3) eelgrass mitigation has a high likelihood of success. All direct impacts on eelgrass will be mitigated for with permanent conservation of eelgrass habitat at the Fields Landing mitigation area. This, combined with the regrowth of eelgrass in Fisherman's Channel, will result in a net increase of eelgrass in south Humboldt Bay. Eelgrass restoration will occur during the same season as the dredging.

1.5 Mitigation Approach

Impacts on the eelgrass habitat affected by Project activities will be mitigated for by removing approximately 500 dilapidated pilings, excavating remnant gravel/cobble fill that currently limits eelgrass growth, and lowering shoreline elevations, to create a total of 1.44 ac of suitable eelgrass habitat at the Harbor District's Fields Landing Boat Yard property (Figure 4). The newly created eelgrass habitat is expected to be rapidly colonized by adjacent eelgrass, but will also be seeded to further ensure success. Appropriately, the mitigation site is only one mile from the dredging site.

The proposed eelgrass mitigation is intended, in part, to increase the quality and quantity of rearing habitat for listed estuarine species, including longfin smelt. The proposed habitat improvements would result in higher quality rearing conditions, greater amount of cover from predators, and ultimately increased survival rates over the current condition. Increased survival rates will help with the recovery of populations of longfin smelt and anadromous salmonids. The increased habitat area and survival rates will fully mitigate for the very low risk of take of longfin smelt associated with the Project.

Figure 4. Fields Landing mitigation area.

The Harbor District will be responsible for implementing this mitigation plan including the monitoring and reporting program, maintenance during the monitoring period, and any remedial action(s) determined necessary to achieve performance criteria.

1.6 Sea Level Rise

The Humboldt Bay area is and will continue to be affected by sea level rise. The CCC has taken steps to incorporate considerations of sea level rise into its CDP process and has recently issued guidance on doing so (CCC 2013). In California north of Cape Mendocino, the rate of sea level rise over the next 100 years is expected to range from 10 to 143 cm (0.3 to 4.69 feet [ft]) (National Research Council 2012). Locally in the Humboldt Bay/Eel River estuary area, however, subsidence counteracts the effects of tectonic uplift that are occurring elsewhere north of Cape Mendocino. The CCC's guidance document recommends replacing the estimates of tectonic uplift that apply in this region with a local sea level rise factor for the Humboldt Bay area of 4.14 mm/year.

The CCC draft sea level rise policy guidance document (CCC 2013) was used to estimate the amount of sea level rise that may occur in the Project area so that the effects could be evaluated for the proposed mitigation areas. The projected sea level rise in Humboldt Bay by 2030 and 2050 was calculated using the sea level rise rates and formulas in the guidance document (CCC 2013) for north of Cape Mendocino and then adjusting for Humboldt Bay subsidence per CCC (2013) by subtracting the North of Cape Mendocino factor and then adding the Humboldt Bay subsidence-per-year factor times the number of years (Table 1). The eelgrass mitigation area has been designed with sea level rise in mind and is expected to be able to withstand the predicted changes. The impact of sea level rise on the eelgrass mitigation area is described in Section 2.3.4 below.

Table 1. Projected sea level rise[1] in Humboldt Bay, per CCC (2013)

Projection	2030		2050	
	cm	in	cm	in
Low range	5.6	2.2	12.7	5.0
Projected	9.9	3.9	21.8	8.6
High range[2]	31.8	12.5	63.0	24.8

[1] Adjusted for Humboldt Bay subsidence per CCC (2013) by subtracting the North of Cape Mendocino factor and then adding the Humboldt Bay subsidence-per-year factor times the number of years.

[2] The high range was used for evaluating the impact of sea level rise on the mitigation area.

2 PROPOSED EELGRASS MITIGATION

The Harbor District will mitigate for direct impacts on eelgrass by removing approximately 500 dilapidated pilings and excavating approximately 4,600 yd^3 of gravel/cobble fill in a 1.44-ac area in the vicinity of the Fields Landing Boat Yard (Figure 4). The pilings and gravel/cobble fill on the site limit the available growing space for eelgrass; the pilings also limit sunlight to the eelgrass that is currently growing at the edge of the mitigation area (Figure 5). Removing the closely-spaced pilings and gravel/cobble fill will increase the available habitat for eelgrass and improve growing conditions for the existing eelgrass. Removing the pilings, which are likely treated with creosote, will also remove a source of potential water quality contamination from Humboldt Bay.

Figure 5. Remnant pilings and gravel/cobble fill in the mitigation area.

2.1 Existing Ecological Conditions

The eelgrass mitigation area is the site of a former dock that was part of a saw mill located on the Harbor District's Fields Landing property. The saw mill and most of the top deck of the dock have been removed, leaving the pilings in the bay and approximately 2–3 ft of gravel/cobble fill on top of the native clay soil layer. Wave action has caused erosion of the bank and redistributed some of the gravel/cobble fill from the adjacent road prism onto the bay substrate (Figure 6). Eelgrass is present in the deeper portions of the mitigation area along the outer edge of the pilings. The exact extent of the current eelgrass population is unknown; surveys will be conducted during the eelgrass growing season within 30 days of the start of excavation to determine the size of the existing eelgrass bed.

Figure 6. Eroding shoreline, remnant pilings, and gravel/cobble fill in the mitigation area.

2.2 Mitigation Implementation

2.2.1 Piling removal

The Harbor District will follow the U.S. Environmental Protection Agency (USEPA) best management practices (BMPs) for piling removal and disposal (USEPA 2007). This entails using a vibratory pile driver hammer to remove the pilings. The vibratory hammer would be mounted on a land-based crane that would operate from the shoreline.

The operation requires the vibratory hammer "wake up" the piling to break up its skin friction bond with sediment. Bond-breaking avoids pulling out a large block of sediment—possibly breaking off the piling in the process. Usually there is little to no sediment attached to the piling during withdrawal (USEPA 2007). In some cases material may be attached to the piling tip, in line with the piling. Once the piling is pulled, it will be placed in a contained storage site on the Fields Landing property prior to disposal at a landfill that is licensed to handle such material. Piling removal will take place at low tide and a turbidity curtain will be placed outside the pilings, both of which will minimize the production and dispersal of turbid water.

If the entire piling cannot be removed with the vibratory hammer (i.e., the piling breaks off or is already broken), then it would be cut below the mudline using a pneumatic underwater chainsaw or shears. Pilings that are exposed at low tide and not within eelgrass beds may be excavated 1 to 2 ft below the sediment surface and cutoff with a hydraulic saw or shears. Project-specific requirements for cutoff would be set by the project engineer considering the mudline elevation. The USEPA (2007) recommends that in general, pilings should be cut off at the mudline if the mudline is subtidal, to minimize disturbance of the sediment and pilings in intertidal areas should be cut off at least 1 ft below the mudline where the work can be accomplished during periods of low tide.

2.2.2 Gravel/cobble fill excavation

The Harbor District proposes to excavate approximately 1,400 linear feet of gravel/cobble fill along the shoreline within the 1.44-ac Fields Landing mitigation area to create conditions suitable for eelgrass colonization (Figure 4). The area proposed for excavation is located shoreward of the pilings that will be removed. This area is currently covered with gravel/cobble fill that has eroded from the shoreline and covered the original clay and bay mud layers. This fill material was originally used to create the base for a former sawmill operation. The excavation area will be lowered in a two-step process to reach an elevation of -1.0 to 0 ft MLLW to create the conditions suitable for natural eelgrass recolonization. It is currently estimated that approximately 4,600 cubic yards of material will be excavated. Excavation will occur during low tidal cycles to eliminate potential excavation-related direct impacts on longfin smelt and other bay species.

The first step in the excavation will be to remove the gravel/cobble fill layer. This material will be removed using an excavator positioned on the top of the bank. The sediment will be placed in a truck and moved to a different part of the Fields Landing Harbor District Property for storage or some other use on site. Potential uses may include improvements to the existing road, shoreline stabilization, and/or leveling of non-wetland areas on the property. Erosion control BMPs will be implemented to minimize movement of sediment and/or water into wetlands and waters of the state.

The second step in the excavation will be to remove the bay mud/clay to the elevations conducive for eelgrass recolonization beginning at the edge of the existing eelgrass and moving toward the shoreline. Sediment removed during this step will be stockpiled on the Fields Landing site while waiting final disposition. Potential future uses may include beneficial reuse at the White Slough Unit of the Refuge. Erosion control BMPs will be installed at the site to minimize movement of sediment and/or water into wetlands and waters of the state.

The shoreline in this area will require stabilization following excavation of the sediment to reduce wave-induced erosion that may increase due to lowering of the current wave slope. Stabilization could be accomplished using one or more of the following options; all of which will require further engineering and biological analyses:

- Installation of riprap along the exposed shoreline
- Placement of a plastic sheet pile wall along the shoreline
- Creating a new shoreline edge by excavating the existing shoreline back from the bay and gradually sloping up to the current road elevation

2.2.3 Eelgrass establishment

Eelgrass will not be initially planted in the mitigation area. It is anticipated that the existing eelgrass at the edge of the mitigation area will rapidly spread to colonize the mitigation area once the pilings and gravel/cobble fill are removed and the elevation is lowered to a depth conducive to eelgrass growth. Four seed buoys (mesh bags attached to buoys containing flowering shoots of eelgrass) will be deployed in the mitigation area during the first growing season following implementation to drop ripe seeds onto the substrate below and further facilitate colonization of eelgrass in the mitigation area.

2.2.4 Best management practices

All mitigation activities will conform to standard BMPs (e.g., hazardous material handling) to protect adjacent wetlands and waterways. Some of the BMPs that will be implemented for this Project include:

- Stockpiling of construction materials, including portable equipment and supplies, will be restricted to a designated staging area.
- All erosion control materials will be made of natural fibers and will not contain plastic or synthetic mono-filament.
- Extreme caution will be used when handling chemicals (fuel, hydraulic fluid, etc.) near waterways. The crew will abide by any and all laws and regulations and follow all applicable hazardous waste BMPs. Appropriate materials will be on site to prevent and manage spills.
- The Harbor District will implement a hydrocarbon spill prevention and clean-up plan to minimize the potential for Project-related hydrocarbon contamination of bay waters. The dredge and support facilities will contain spill kits.
- Dredging and eelgrass mitigation is scheduled to occur between July 1 and October 1 when no salmonids are expected to be present within Fisherman's Channel or at the Fields Landing Mitigation Area.
- An infiltration berm and silt fences will be constructed/deployed in the White Slough Unit beneficial reuse area to contain and filter turbid water that may eventually be delivered to the bay during dredge spoils dewatering.
- Silt fences, straw wattles, and other appropriate erosion control BMPs will be constructed/deployed around the sediment storage and placement locations at the Fields Landing mitigation area.

2.3 Mitigation Goals and Performance Criteria

The goal for the mitigation area is to create a self-sustaining eelgrass bed by the end of the five-year monitoring period. The final performance standard to determine success of the eelgrass mitigation area is 100% coverage of eelgrass and 85% density of the reference area.

The reference area will be selected in an undisturbed eelgrass bed in the vicinity of the mitigation area. This reference area will be monitored annually at the same time as the mitigation area to determine performance success and account for any seasonal changes that may be affecting eelgrass densities throughout the region. Monitoring methods for the reference area will be the same as described below for the mitigation area. Photopoints will also be established with the reference area for comparison with the mitigation area.

Milestones have been developed to track progress towards the final performance standard:

- One year following the mitigation implementation, the mitigation area will achieve at least 40% cover and 20% density of the reference area.
- Two years following the mitigation implementation, the mitigation area will achieve at least 85% cover and 70% density of the reference area.
- Three and four years following the mitigation implementation, the mitigation area will achieve at least 100% cover and 85% density of the reference area.

No performance standards are proposed for recolonization of the eelgrass in Fisherman's Channel.

2.4 Monitoring

2.4.1 Fields Landing mitigation area

The eelgrass mitigation area will be initially surveyed during the first growing season following mitigation implementation. Thereafter, the eelgrass mitigation area will be monitored annually for five years following implementation. Monitoring will be halted if the revegetation goals are met prior to year five. Monitoring will be conducted at the same time each year during the eelgrass growing season (May–August). The mitigation area will be surveyed to determine the spatial distribution and areal extent of vegetated cover, percent vegetated cover, and density of eelgrass as described in the California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA 2014). Spatial distribution and areal extent will be determined by mapping the extent of eelgrass vegetated cover and extending outward a distance of 16 ft using a handheld GPS receiver. Gaps within the vegetated cover that have individual plants greater than 33 ft from neighboring plants will be excluded and considered unvegetated habitat. Eelgrass percent cover will be visually estimated in quadrats placed randomly throughout the mitigation area using the seagrass percentage cover photo guide from the Manual for Scientific Monitoring of Seagrass Habitat (Short et al. 2006). Plant density will then be estimated by counting the number of eelgrass turions (shoots) in a sample area (i.e., quadrats). Photopoints will be established throughout the mitigation area at fixed locations to monitor site changes over time. Photographs will be taken during annual monitoring efforts at all photopoint locations. To ensure consistency, photopoint locations will be recorded using a handheld GPS receiver, all photos will be taken at a standing position, and a compass bearing of the direction the camera is facing will be taken (or the compass bearing for the start and end of a panoramic series of photographs).

2.4.2 Fisherman's Channel dredging area

It is anticipated that most of the dredged areas in the Fisherman's Channel will rapidly recolonize with eelgrass, though the amount of time it will take for the eelgrass to grow back is unknown. One aspect of this beneficial reuse pilot project is to inform future dredging projects in Humboldt Bay. Fisherman's Channel will be monitored annually during the eelgrass growing season for three years to determine the rate of eelgrass colonization of the dredged area. The dredged area will be surveyed to determine the spatial distribution and areal extent of vegetated cover, percent vegetated cover, and density of eelgrass as described above in Section 2.4.1. The undisturbed portions of Fisherman's Channel will be surveyed as a reference area to compare with the eelgrass growth in the dredged area. The depth and relatively high boat traffic in the main portion of Fisherman's Channel preclude a standard eelgrass survey. Therefore, the dredging area will be surveyed using underwater video camera and weighted quadrats.

2.5 Expectation of Success

Eelgrass is currently present along the edge of the mitigation area; therefore, the current and wave action are not limiting eelgrass growth. If the correct elevations are created in the mitigation area and the gravel/cobble fill is removed to expose the bay floor, then the likelihood of eelgrass successfully becoming establishing and surviving is high. The large eelgrass beds in the vicinity of the mitigation area will provide a source for recolonization.

As previously stated in Section 1.2, the eelgrass in Fisherman's Channel is expected to rapidly recolonize following dredging. Both Fisherman's Channel and the Residential Canals have large populations of eelgrass adjacent to the dredging area and will provide a large seed source for the dredged area. No dredging will occur along the side slopes outside of the designated dredge footprint; eelgrass outside the dredging footprint will spread into the dredged area.

2.6 Sea Level Rise

The eelgrass mitigation area will be designed to be 0 ft to -1 ft MLLW and then will slope up to areas of bare mudflat. Eelgrass in Humboldt Bay typically grows from +0.3 ft to -6.9 ft MLLW (Gilkerson 2008), so eelgrass in the mitigation area is expected to be able to withstand an increase in sea level. An increase in sea level would either cause a shift of the eelgrass beds towards the higher elevation mudflat areas or an increase in the size of the eelgrass beds. This would be the case for both the 2030 projected high-range increase in sea level of 12.5 inches (in) and the 2050 projected increase of 24.8 in. It is anticipated that there would be no loss of eelgrass habitat in the mitigation area as a result of the projected increases in sea level.

3 REPORTING

Results of the annual monitoring of the Fields Landing mitigation area will be summarized in a report and distributed to the appropriate regulatory agencies. These reports will present a summary of the data collected and present conclusions regarding whether the annual performance objectives are being met and, if needed, provide recommendations for remedial action (e.g., eelgrass transplanting). Reports will include the following sections:

- Introduction
- Maintenance activities performed
- Monitoring methods
- Monitoring results (e.g., qualitative and quantitative results compared with baseline data from the initial planting, comparisons with previous years' data, etc.)
- Time series photographs of the mitigation and reference area
- Achievement of performance criteria and milestones in the mitigation area
- Recommendations for remedial action, if needed

Annual monitoring of the mitigation area will occur up to five years or until success criteria are met, whichever comes first. Once the success criteria are met, then the annual monitoring and maintenance will cease and a final report demonstrating success of the mitigation will be prepared and submitted to the appropriate agencies.

4 REMEDIAL ACTION PLAN

If results from the annual monitoring indicate that eelgrass is not colonizing the area quickly enough to meet the performance objectives, eelgrass will be transplanted from nearby donor beds into the mitigation area. Any remedial action determined to be necessary will be initiated as soon as feasible to increase the likelihood of success. Eelgrass would be planted during extreme low-tide events at densities similar to those found in adjacent areas. Eelgrass will be collected from donor beds in the form of one-gallon plugs with 2–4 clumps of turions per plug and will be transplanted in plots distributed throughout the planting area. Turions will be collected from approximately the same tidal elevation as the area into which they will be transplanted. Collections from donor beds will be spaced well apart to minimize impacts on the donor beds. No more than 10% of any eelgrass bed will be used for transplanting purposes. A letter of permission to harvest and transplant eelgrass will be obtained from CDFW.

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Appendix C
Biological Resources Evaluation

DRAFT REPORT ◦ JANUARY 2016

Fisherman's Channel Dredging Biological Resources Evaluation

PREPARED FOR

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Suggested citation:
Stillwater Sciences. 2016. Fisherman's Channel dredging biological resources evaluation. Prepared by Stillwater Sciences, Arcata, California for the Humboldt Bay Harbor, Recreation, and Conservation District, Eureka, California.

Cover photo: Residential Finger Channel A, King Salmon (top left), horned grebe foraging within open water habitats in Fisherman's Channel, King Salmon (top right), Humboldt Bay shoreline, Fields Landing (bottom left), and Residential Finger Channel B, King Salmon (bottom right).

Table of Contents

Tables

Figures

Appendices

1 PROJECT BACKGROUND

The Humboldt Bay Harbor, Recreation, and Conservation District (Harbor District), with assistance from the Pacific Gas and Electric Company (PG&E), is planning a dredging project in a waterway called Fisherman's Channel to allow for unimpeded navigation at low tide (project).

Fisherman's Channel is located in King Salmon, approximately 2.5 miles (mi) south of Eureka in Humboldt County, California. The community of King Salmon was developed in 1947 after Fisherman's Channel and Residential Canals were created by dredging a large sand and dune area extending south of Buhne Hill and lots were sold for recreational fishing sites and homes (Tuttle 2007; Figure 2). In 1952, PG&E purchased the property that is now the Humboldt Bay Power Plant (HBPP) (Tuttle 2007) and constructed the Intake Canal in 1955 to provide once-through cooling water to the HBPP from Fisherman's Channel. PG&E also took ownership of Fisherman's Channel at this time. The Intake Canal is no longer used by PG&E since the construction of the new Humboldt Bay Generating Station, which uses radiators for cooling. PG&E is transferring Fisherman's Channel property (approximately 30 acres) to the Harbor District.

The main channel (Fisherman's Channel) is approximately 2,625 feet (ft) long. There are numerous private dock facilities along the northwestern side of the channel. The southeastern bank is a narrow vegetated levee/breakwater. A number of residents of the unincorporated community of King Salmon own property located on and including portions of side channels to Fisherman's Channel, called Residential Canals A–D, and maintain docks and watercraft there (Figure 3). The residents use Fisherman's Channel for access between the Residential Canals and Humboldt Bay (Figure 1). The Harbor District proposes to dredge Fisherman's Channel. The Project does not include dredging the Residential Canals.

In 1982, approximately 21,000 cubic yards (yd^3) of sediment were dredged from Fisherman's Channel. This was done as an emergency action due to a sudden accumulation of sand that appeared, for unknown reasons, to have shifted from the dune area to the west of King Salmon (Getty 1983). A dragline crane and a floating dredge were used to remove the material. After the material at the entrance was removed, the first 150 ft of channel were dredged to -12 ft (mean lower low water [MLLW]) to create a sand trap for potential future build-up. Dredging spoils were used to bolster on-site dikes as well as for filling in the Caltrans Elk River overpass project a few miles north of King Salmon. Since then, Fisherman's Channel has gradually silted in, and it is no longer navigable by large boats during low-low tide. This has resulted in an increased risk of a navigational hazard resulting in vessel groundings, allisions (a vessel striking against a fixed object such as the breakwater), or collisions. Such incidents have the potential for spill that could adversely impact water quality and human safety.

Therefore, the Harbor District is proposing to dredge specific areas within Fisherman's Channel to improve navigation and public safety. The Harbor District will pump the dredge spoils along the eastern shore of the bay and dispose of the dredged sediment at the White Slough Unit of the Humboldt Bay National Wildlife Refuge (Refuge) where it will be utilized for beneficial reuse as part of the U.S. Fish and Wildlife Services' White Slough Tidal Wetlands Restoration Project (Figure 1). The Refuge needs the material to create a mosaic of tidal marsh plains with salinities ranging from salt to fresh as well as a network of tidal channels and two wetlands/ponds.

The Project Area consists of Fisherman's Channel dredging area, pipeline route, Fields Landing mitigation area, and the White Slough sediment beneficial reuse area (Figures 1, 3, 4, and 5).

The purpose of this document is to identify potential impacts of the Project on biological resources, describe mitigation measures to reduce impacts to a less than significant level, and support the application and acquisition of the necessary local and state permits.

Figure 1. Project area.

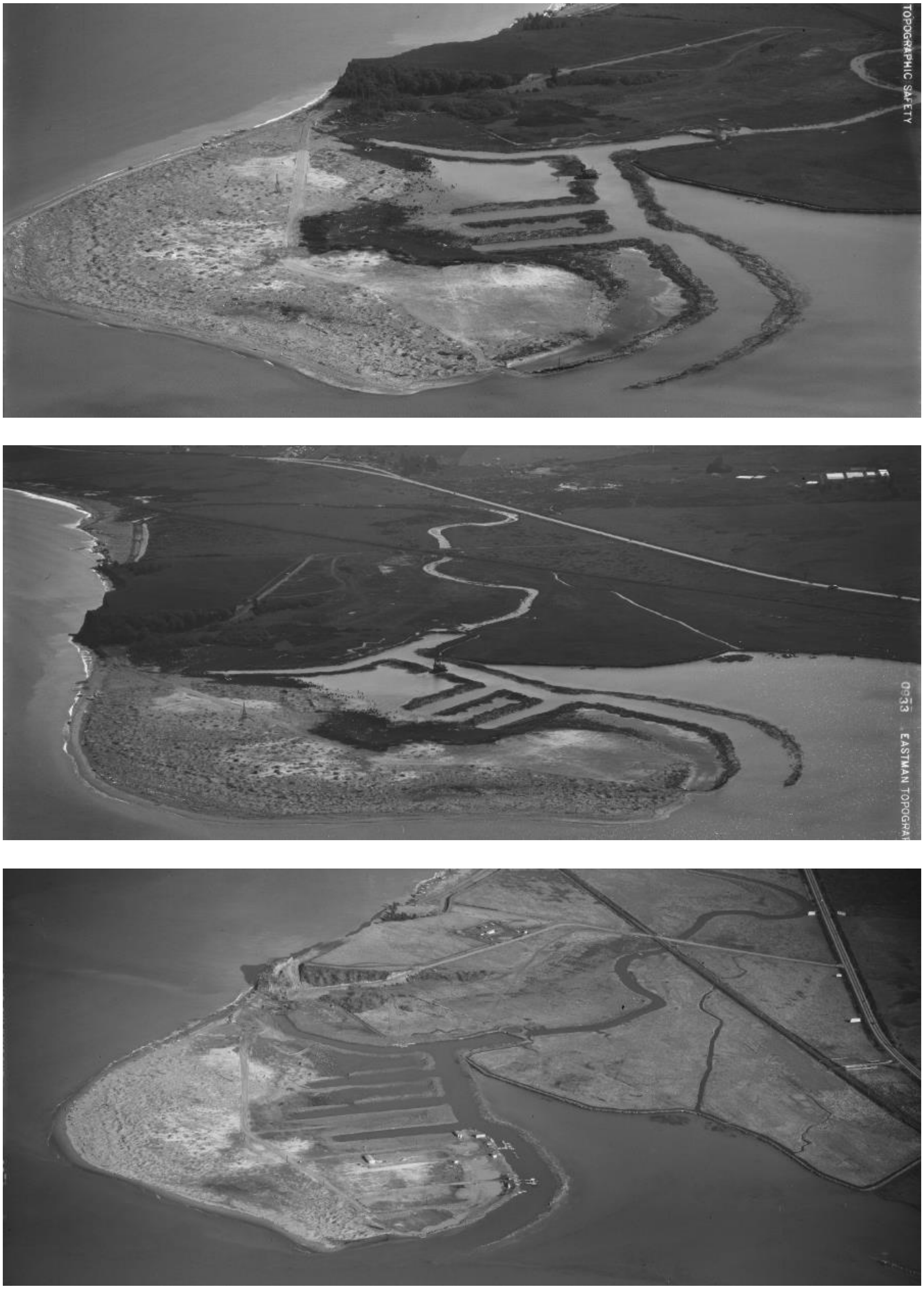

Figure 2. Community of King Salmon. Top: Construction of canals (17 April 1948); Middle: The dredge "Jupiter" is visible working (20 May 1948); and Bottom: First docks and building appearing (30 December 1948) (Source: Shuster Collection-HSU).

Figure 3. Fisherman's Channel dredging area and pipeline route.

Figure 4. Fields Landing eelgrass mitigation area and pipeline route.

Figure 5. White Slough beneficial reuse area and pipeline route.

2 PROJECT DESCRIPTION

The Harbor District proposes to dredge sediment from Fisherman's Channel with a cutter-head suction dredge (Figure 6) and transport the material via temporary pipeline to the White Slough Unit on the Refuge where it will be beneficially reused in a restoration project. The dredging portion of the Project will encompass about 1.6 acres (ac) by removing approximately 4,150 yd^3 of sediment from Fisherman's Channel (Figures 1 and 3). The dredged sediment will be transported 0.2 mi via pipeline over a portion of Humboldt Bay to a nearby dock facility where it will make landfall (Figures 1 and 3). The pipeline will continue past the Fields Landing mitigation area (Figures 1 and 4) and thence along an unused railroad track to the White Slough beneficial reuse site on the Refuge (Figures 1 and 5). The pipeline land route will extend approximately 11,600 ft, and with a 5-ft buffer on either side of the pipe, will encompass approximately 2.7 ac.

In general, the Project will require:

- Mobilization of the dredge
- Pipeline installation
- Dredging of Fisherman's Channel site
- Placement of dredge spoils at the White Slough Unit for beneficial reuse
- Demobilization of the dredge and associated equipment
- Eelgrass mitigation

Project activities are anticipated to be completed between July 1 and October 1, 2016.

2.1 Mobilization of Dredge

The Harbor District's dredge (Figure 6) and support equipment will be moved into position from their location at the Fields Landing Boat Yard. The dredging equipment consists of:

- The dredge (*Nehalem*) with a 750 hp main engine
- Work boat capable of moving the dredge and pipe
- 13,000 ft of 12-inch dredge pipe (made of durable plastic material [styrene-rubber 17])
- Pontoon floats to support the dredge pipe
- Booster pump, portable barge, and generator
- Spud and ladder extensions to enable dredging
- Concrete weights and steel anchors

The dredge will be anchored near the channel entrance. The pipeline will be attached to the dredge prior to the start of dredging.

Figure 6. Cutterhead suction dredge, workboat, and floating pipeline (behind dredge) to be used for the Project.

2.2 Pipeline Installation

Dredged material will be transported from the *Nehalem* through a 12-inch-diameter pipe, which is made of durable plastic material (styrene-rubber (SR) 17). Placement of the pipeline will involve fusing approximately 13,000 ft of 40-ft pipe sections together at the Harbor District's Fields Landing property. The pipe will be installed by boat and floated from the dredge for approximately 0.2 mi (Figure 6) to where it will make landfall at an existing dock (Figure 3). At no time will the pipeline come into contact with the bottom of the bay at low tide. Approximately 10 floats (64 cubic foot [ft^3] plywood boxes with Styrofoam interiors) will be attached to the pipeline and anchored in the bay using five anchors (two floats per anchor). The pipeline will then extend 0.75 mi from the dock, along the side of an existing private roadway, and cross Railroad Avenue before reaching the Fields Landing Boat Yard (Figures 3 and 4). At the Boat Yard, a booster pump will be placed in line. From the Boat Yard, the pipe will extend 1.3 mi along the length of the Harbor District property, continue on a railroad track, cross a narrow slough entrance on a temporary bridge, and end at the White Slough Unit receiving site (Figures 4 and 5). Vegetation removal along the railroad right-of-way will be necessary to allow for pipeline installation. A 5-ft buffer on either side of the land-based portion of the pipeline will provide access for installation and maintenance during dredging activities. Mobilization of the dredge and pipeline will take approximately seven to ten days.

2.3 Dredging Fisherman's Channel

Cutterhead-pipeline dredges are hydraulic dredges that use a cutterhead at the intake end of a pipeline to carve away at accumulated sediment. A cutterhead is a mechanical device that has rotating blades or teeth to break up or loosen the bottom material so that it can be suctioned, using onboard pumps, into the intake pipe (Figure 7). The sediment and water slurry is then transported through the pipeline and discharged directly onto the receiving site. Because cutterhead-pipeline dredges pump directly to the receiving site, they operate continuously and can be more cost- and time-efficient than other types of dredges.

Once the dredge is anchored in Fisherman's Channel and the pipeline is in place, the cutterhead will be lowered into position on the channel bottom, the pump will be primed, and dredging will begin. The cutterhead swings in an arc from side to side as the dredge is stepped forward on pivoting spuds at the stern of the vessel. The Project will dredge approximately 0.23 ac of sediment at the mouth of Fisherman's Channel down to approximately -8 ft MLLW (Figure 3). The remainder of Fisherman's Channel will be dredged in three locations totaling 1.39 ac to -6 ft MLLW. A total of 4,150 yd^3 of sediment are planned for removal. This process is relatively continuous and is expected to take approximately two weeks (14 days).

Figure 7. Generalized cutterhead in operation. Red arrows indicate water flow paths (Clausner 2005).

2.4 Sediment Placement at White Slough

Sediment from dredging operations in Fisherman's Channel will be deposited for beneficial reuse in the White Slough Unit of the Refuge in southeastern Humboldt Bay (Figures 5 and 8). The dredged material will be used as part of the White Slough Tidal Wetlands Restoration Project, which will restore salt marsh in an area of tidelands that are separated from the bay by failing dikes. The restoration plan involves the placement of fill to raise the elevation of currently diked tidelands by more than 3 ft, allowing for the establishment of higher-elevation mixed marsh type wetlands. Tidal channels would be created within the restoration area. The Refuge permits for the White Slough Restoration Project specifically refer to beneficially reusing suitable dredged materials for its restoration purposes (USACE 2015). The restoration would provide benefits for fish and wildlife habitat, flood protection, and sea level rise adaptation, as well as allowing for increased carbon sequestration in restored salt marshes.

The dredged material will exit the pipeline and flow over a bar rack screening system at the receiving site to remove trash and debris. These screens are typically made of inclined metal bars that, in this case, would be spaced approximately 2 in apart. The trash will be collected by hand and placed in a bin for proper disposal.

The Harbor District's dredge will excavate an estimated 840 yd^3 of sediment per six-hour day. The dredged slurry will occupy several times its original volume because of the high water-to-sediment ratio (approximately 9:1). Therefore, approximately 8,400 yd^3 of slurry will be discharged at the 2.5-ac receiving site on a daily basis during operations. The sediment slurry will distribute fairly evenly across the receiving site and be contained within a bermed area where the settling and dewatering process will occur. Water from the dredged material will flow south through a 4-ft high porous gravel containment berm that is designed to keep the vast majority of the sediment in the reuse area. Once through the berm, the remaining turbid water will then be filtered through a series of six silt fences and vegetation before it drains west through a tidegate into the bay. The sediment will eventually dry and consolidate as the remaining water is evaporated. The Refuge will then grade the dried sediment as necessary to conform to the restoration plan specifications.

The sediment reuse containment area will be properly sized to contain both the volume of dredged sediment and water transported during the project. Temporary fencing will be placed around the receiving site for safety purposes. Turbidity will be monitored throughout implementation to ensure sufficient sediment removal. If necessary, additional silt fences may be installed.

2.5 Dredge Demobilization

Once the dredging is completed, the pipes will be flushed with bay water to clear any debris or sediment remaining in the pipes. The flushed water will be deposited at the White Slough Unit receiving area. Demobilization and cleanup will include collecting the floats, de-coupling the pipe sections, and moving the dredge and piping back to the Fields Landing Boat Yard. Demobilization will take approximately seven days.

The rock infiltration berm at the White Slough receiving site will be dismantled and the rock buried, spread out, or used onsite by the Refuge. Rock will not be hauled offsite.

2.6 Eelgrass Mitigation Program

Approximately 1.2 ac (0.23 ac in the -8 ft MLLW area and 0.97 ac in the -6 ft MLLW main channel area) of eelgrass are expected to be directly impacted by the Project (Figure 8). Another 0.37 ac in the 5-ft buffer surrounding the dredging footprint will be indirectly impacted by turbidity. Direct impacts on eelgrass will be mitigated at a 1.2:1 ratio, which will require an estimated 1.44 ac of mitigation area. The indirect impacts will not be mitigated due tidal flushing limiting any turbidity-related effects to a very short time period.

All of the direct and indirect impacts on eelgrass within the dredging footprint are considered to be temporary. The -8 ft MLLW dredging depth at the channel entrance will allow eelgrass to grow back once that portion of the channel has silted in about one foot. The remainder of

Fisherman's Channel, which will be dredged to -6 ft MLLW, will recolonize rapidly due to the large amount of eelgrass outside the dredging footprint and in the adjacent residential canals. No dredging will occur along the side slopes outside of the designated dredge footprint, which will provide a source for recolonization immediately adjacent to the dredged area.

The Harbor District will mitigate for direct impacts on eelgrass by removing approximately 500 dilapidated pilings and excavating approximately 4,600 yd^3 of gravel/cobble fill in a 1.44ac area in the vicinity of the Fields Landing Boat Yard (Figure 4). The pilings and gravel/cobble on the site limit the available growing space for eelgrass; the pilings also limit sunlight to the eelgrass that is currently growing at the edge of the mitigation area (Figure 9). Removing the closely-spaced pilings and gravel/cobble will increase the available habitat for eelgrass and improve growing conditions for the existing eelgrass. Removing the pilings, which are likely treated with creosote, will also remove a source of potential water quality contamination from Humboldt Bay. See the Eelgrass Mitigation Plan (Appendix A) for more details.

2.6.1 Piling removal

The Harbor District will follow the U.S. Environmental Protection Agency (USEPA) best management practices (BMPs) for piling removal and disposal (USEPA 2007). This entails using a vibratory pile driver hammer to remove the pilings. The vibratory hammer would be mounted on a land-based crane that would operate from the shoreline.

The operation requires the vibratory hammer "wake up" the piling to break up its skin friction bond with sediment. Bond-breaking avoids pulling out a large block of sediment—possibly breaking off the piling in the process. Usually there is little to no sediment attached to the piling during withdrawal (USEPA 2007). In some cases material may be attached to the piling tip, in line with the piling. Once the piling is pulled, it will be placed in a contained storage site on the Fields Landing property prior to disposal at a landfill that is licensed to handle such material. Piling removal will take place at low tide and a turbidity curtain will be placed outside the pilings, both of which will minimize the production and dispersal of turbid water.

If the entire piling cannot be removed with the vibratory hammer (i.e. the piling breaks off or is already broken), then it would be cut below the mudline using a pneumatic underwater chainsaw or shears. Pilings that are exposed at low tide and not within eelgrass beds may be excavated 0.3 to 0.6 m (1 to 2 ft) below the sediment surface and cutoff with a hydraulic saw or shears. Project-specific requirements for cutoff would be set by the project engineer considering the mudline elevation. The USEPA (2007) recommends that in general, pilings should be cut off at the mudline if the mudline is subtidal, to minimize disturbance of the sediment and that pilings in intertidal areas should be cut off at least 1 ft below the mudline where the work can be accomplished during periods of low tide. See the Eelgrass Mitigation Plan (Stillwater Sciences 2016a) for detailed information.

2.6.2 Shoreline excavation

The Harbor District will excavate gravel and cobble fill along approximately 1,400 linear feet of shoreline along their Fields Landing property to create conditions suitable for eelgrass colonization (Figure 10). The area that will be excavated is located shoreward of the pilings that are scheduled for removal. This area is currently covered with gravel/cobble fill that has eroded from the shoreline and covered the original clay and bay mud layers. This fill material was originally used to create the base for a former sawmill operation. The excavation area will be lowered in a two-step process to reach an elevation of -1.0 to 0 ft MLLW that will create the conditions suitable for natural eelgrass recolonization. Excavation will occur during low tidal cycles to eliminate potential excavation-related direct impacts on coho salmon and longfin smelt.

The first step in the excavation will be to remove the gravel/cobble layer along the shoreline. This material will be removed using an excavator positioned on the top of the bank. The sediment will be placed in a truck and moved to a different part of the Fields Landing site for storage or some other use on site. Potential uses may include improvements to the existing road, shoreline stabilization, and/or leveling of non-wetland areas on the property. Erosion control BMPs will be implemented to minimize movement of sediment and/or water into wetlands and waters of the state.

The second step in the excavation will be to remove the bay mud/clay to the elevations conducive for eelgrass recolonization beginning at the edge of the existing eelgrass and moving toward the shoreline. Sediment removed during this step will be stockpiled on the Fields Landing site while waiting final disposition. Potential future uses may include beneficial reuse at the White Slough Unit. Erosion control BMPs will be installed at the site to minimize movement of sediment and/or water into wetlands and waters of the state.

The shoreline in this area will require stabilization following excavation of the sediment to reduce wave-induced erosion that may increase due to lowering of the current wave slope. Stabilization could be accomplished using one or more of the following options; all of which will require further engineering and biological analyses:

- Installation of riprap along the exposed shoreline
- Placement of a composite material sheet pile wall along the shoreline
- Set back, and excavate to clay layer, the existing shoreline approximately 15–20 ft to create new shoreline edge

Will provide more detail once the stabilization design is developed

As stated above, excavation activities will occur during low tide when the area is exposed to air and within the July 1 and October 1 work window. Therefore, no impacts on special-status fish species are expected from this activity.

2.6.3 Expectation of success

As previously stated in Section 2.6, the eelgrass in main portion of Fisherman's Channel is expected to rapidly recolonize following dredging since it will be shallower than the -6.9 ft MLLW depth limit for eelgrass in Humboldt Bay (Schlosser and Eicher 2012). Both Fisherman's Channel and the Residential Canals have large populations of eelgrass adjacent to the dredging area and will provide a large seed source for the dredged area. No dredging will occur along the side slopes outside of the designated dredge footprint; eelgrass outside the dredging footprint will spread into the dredged area.

Eelgrass is currently present along the edge of the Fields Landing mitigation area, therefore, the current and wave action are not limiting eelgrass growth. If the correct elevations are created in the mitigation area and the gravel/cobble fill is removed to expose the bay floor, then the likelihood of eelgrass successfully becoming establishing and surviving is high. The large eelgrass beds in the vicinity of the mitigation area will provide a source for recolonization. In addition, four seed buoys (mesh bags attached to buoys containing flowering shoots of eelgrass) will be deployed in the mitigation area during the first growing season following implementation of the mitigation plan. The purpose of the seed buoys is to drop ripe seeds onto the newly exposed substrate below to facilitate more rapid colonization of eelgrass in the mitigation area.

2.7 Best Management Practices

All activities will conform to standard Best Management Practices (BMPs) (e.g., hazardous material handling) and the species- and habitat-specific minimization measures identified in Section 4. Some of the BMPs that will be implemented for this project include:

- Stockpiling of construction materials, including portable equipment and supplies, will be restricted to a designated staging area.
- All erosion control materials will be made of natural fibers and will not contain plastic or synthetic mono-filament.
- Extreme caution will be used when handling chemicals (fuel, hydraulic fluid, etc.) near waterways. The crew will abide by any and all laws and regulations and follow all applicable hazardous waste BMPs. Appropriate materials will be on site to prevent and manage spills.
- The Harbor District will implement a hydrocarbon spill prevention and clean-up plan to minimize the potential for project-related hydrocarbon contamination of bay waters. The dredge and support facilities will contain spill kits.
- Dredging and eelgrass mitigation is scheduled to occur between July 1 and October 1 when no salmonids are expected to be present within Fisherman's Channel.
- The dredging elevation will not extend below -8 ft MLLW at the channel entrance and -6 ft MLLW in the main portion of Fisherman's Channel, which will allow for eelgrass recolonization.
- No dredging will occur along the side slopes outside of the designated dredge footprint, which will facilitate the retention of eelgrass in Fisherman's Channel, thereby providing a source for recolonization of the dredged area.
- An infiltration berm and silt fences will be constructed/deployed in the White Slough beneficial reuse area to contain and filter turbid water that may eventually be delivered to the bay during dredge spoils dewatering.

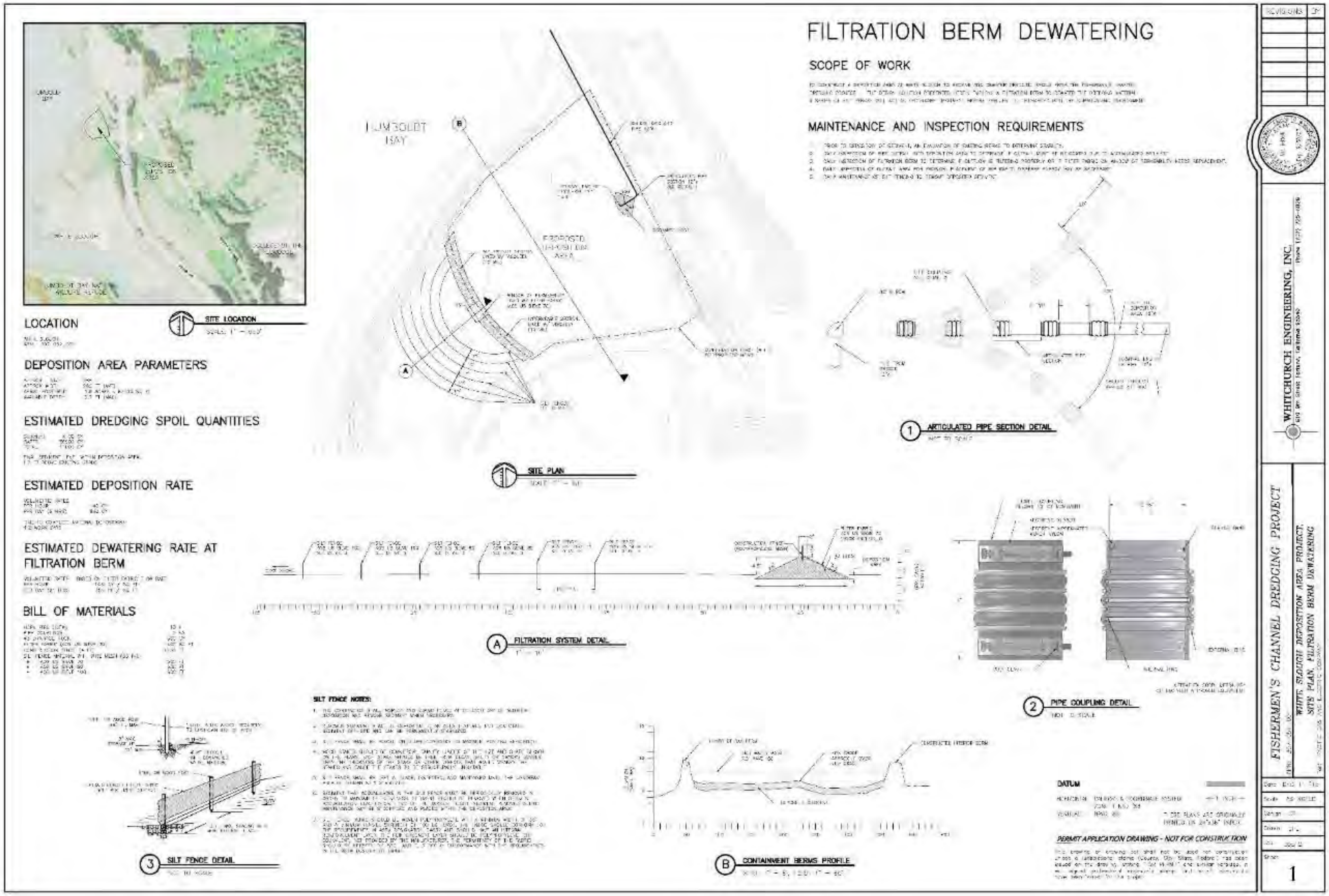

Figure 8. White Slough beneficial reuse design.

Figure 9. Existing eelgrass coverage in Fisherman's Channel overlaid with dredging footprint and impact recurrence interval.

Figure 10. Dilapidated pilings and cobble/gravel fill at the Fields Landing eelgrass mitigation site.

2.8 Project Timing

Dredging is planned to occur as soon as permits have been obtained, possibly in July 2016. It is expected that all permits will be in place by July 31. An estimated project schedule is in Table 1.

Table 1. Estimated project schedule, 2016.

Activity	Approximate start	Approximate finish/time to finish
Mobilization of dredge	August 1	August 10
Dredging of Fisherman's Channel	August 11	August 25
Demobilization of dredge	September 1	September 5
Implementation of eelgrass mitigation program	August 1	October 1

3 HABITAT ASSESSMENT

3.1 Methods

3.1.1 Sediment characterization

In preparation for planned maintenance dredging of Fisherman's Channel, the sediment proposed for dredging was sampled and analytically tested, according to a final approved *Workplan for Sediment Sampling and Analysis (SAP) Prior to Dredging* (GHD 2012). The sampling and analysis methods originally proposed and submitted for regulatory agency approval are detailed in the 2012 Workplan. The sediment sampling results were summarized and discussed in the Report of Findings for Sediment Sampling and Analysis Fisherman's Channel (GHD 2013). To allow comparison with existing baseline conditions documented at the White Slough Unit receiving area, additional sediment sampling and analysis using Incremental Sampling Methodology (ISM) was performed in 2015.

The use of the White Slough receiving site for beneficial reuse is dependent on compatibility of the dredged sediments from Fishermen's Channel with those of the White Slough Unit. As such, sediment quality and composition results from Fisherman's Channel were compared with baseline conditions documented utilizing ISM at the White Slough site. Per consultation with the North Coast Regional Water Quality Control Board (NCRWQCB), a *Workplan for Fisherman's Channel Dredge Sediment Sampling for Beneficial Reuse* was prepared (GHD 2015). Thirty (30) soil samples were collected from the dredge area with three replicates per the ISM protocol being analyzed for total constituents listed in the Workplan. A subsample of sediment collected from ISM was submitted for benthic testing lab analysis.

The Report of Findings (GHD 2015) (Appendix B) presents laboratory results and statistical analysis. Soil sediment results were compared with White Slough ISM baseline conditions as well as with USEPA Maximum Contaminant Levels (MCLs), or USEPA residential Regional Screening Levels (RSLs). Results were also compared with National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) for marine sediments to document evaluation of potential risks from contaminated sediment and the basis for whether to conduct benthic organism testing.

3.1.2 Habitat and species evaluation

3.1.2.1 Desktop review

A desktop literature review was conducted for known occurrences of sensitive natural communities, critical habitat, and special-status plant and wildlife species within the following eight USGS quadrangles that surround the project: Fields Landing (main), Cannibal Island, Eureka, Arcata South, McWhinney Creek, Ferndale, Fortuna, and Hydesville. The following sources were queried:

- The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (CDFW 2015)
- The California Native Plant Society (CNPS) List of Rare and Endangered Plants (CNPS 2015)
- The United States Fish and Wildlife Service (USFWS) online database, which includes USFWS and National Marine Fisheries Service (NMFS) species and critical habitat designations (USFWS 2015a)

The results of the special-status wildlife and plant species queries were synthesized into a single preliminary list for review during the field habitat assessment. This list includes those species that have been documented to occur and/or have a protected status within the eight quadrangles listed above and have the following status designations:

- State or federally threatened, endangered, candidate, proposed threatened, or proposed endangered
- State species of concern
- Plant species with a California Rare Plant Rank (CRPR) of 1B, 2B, 3, and 4 by the CNPS

In addition to the USFWS, NMFS, and CDFW special-status species identified during the queries above, the following species and habitat protected under other federal and state regulations were considered:

- Essential Fish Habitat (EFH) is a category of fish habitat protected under a provision of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). EFH includes spawning, rearing, nursery, and migration habitat for Chinook and coho salmon, groundfish (flatfishes, sharks, skates, rockfishes), and coastal pelagic fish (northern anchovy and Pacific sardine). Eelgrass (*Zostera marina*) habitat has been identified as a "Habitat Area of Particular Concern" as a subset of EFH pursuant to the MSA. This designation is due to eelgrass' importance as a nursery area for groundfish species.
- Eelgrass has been identified by the California Coastal Commission (CCC) as a "species of special biological significance," and therefore requires special protection pursuant to the California Coastal Act (HBHRCD 2006). Eelgrass provides a variety of essential ecosystem functions, including primary production, predation refuge, nursery functions, physical structure, and nutrient cycling.
- Species protected under the Marine Mammal Protection Act (MMPA) overlap with mammals addressed in this document. Species protected under this act that could occur within or adjacent to the project area include harbor seals and California sea lions.
- Many bird species are protected under the under the Migratory Bird Treaty Act (MBTA), in addition to those federally and state-listed.

3.1.2.2 Field habitat evaluation

Following the desktop analysis, field habitat assessments were conducted on 1 March 2013, 12–19 August 2014, 22 January 2015, 10 February 2015, and 13 November 2015. The purpose of the assessments was to evaluate habitat conditions (e.g., disturbance, elevation, landscape position) and vegetation within the project area and determine the likelihood of presence for special-status plants and wildlife species identified during the desktop analysis. During the field habitat assessment, sensitive natural communities were evaluated. The assessment area included: (1) Fisherman's Channel Dredging Area, (2) land within 1-mile radius of Fisherman's Channel Dredging Area (for wildlife only), (3) the District's Fields Landing property and Mitigation Area, and (4) the pipeline route between Fields Landing and White Slough. Private property was not accessed during the survey, except where permission to access was approved (e.g., boat dock at Johnny's Marina). No species-specific surveys were conducted as part of the habitat assessment.

3.1.2.3 Special-status plant survey

A list of special-status plants with the potential to occur in the survey areas was developed using the CNDDB, CNPS, and USFWS queries. Habitat associations for each species were compared with the vegetation types documented in the project area during the general habitat assessment. If a species' required habitat was lacking (e.g., coastal dunes) or if the project area was outside the species' known distribution or elevation range, the species was considered not likely to occur. The life histories of plants with potential to occur in the project area were reviewed to select survey dates that would coincide with the phenological stage (e.g., flowering or fruiting) during which the species were most easily identified in the field. Surveys for special-status plant species were conducted in accordance with the *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996), and *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities* (CDFG 2009).

On 21 May and 4 June 2015, the project area was traversed on foot by a two-person team, using the intuitive-controlled method (i.e., a complete survey of habitats with the highest potential for supporting rare plant populations and a less intense survey of all other habitats present). The team consisted of a botanist and ecologist with: (1) experience conducting floristic surveys, (2) knowledge of plant taxonomy and plant community ecology and classification, (3) familiarity with the plant species of the area, (4) familiarity with appropriate state and federal statutes related to plants and plant collecting, and (5) experience with analyzing effects of a project on native plant communities. Surveys were comprehensive for vascular plants such that "every plant taxon that occurs on site is identified to the taxonomic level necessary to determine rarity and listing status" (CDFG 2009); therefore the surveys identified vascular plants to species, subspecies, or variety, as necessary to verify the special-status taxon, using taxonomic keys for the region (Baldwin et al. 2012). If identification was not possible in the field, the plants were collected for identification in the laboratory using the "1 in 20" rule[1] (Wagner 1991).

If a special-status plant was identified, the location was recorded with a Global Positioning System (GPS) and a CNDDB form was completed. Information on the forms included the following:

- numbers of individuals
- phenology
- habitat description (e.g., plant communities, dominant species, associated species, substrates/soils, aspects/slopes)
- relative condition of the population (i.e., a qualitative assessment of site quality based upon evident threats [excellent, good, fair, or poor])
- recognizable risk factors

In addition, photographs were taken to document diagnostic floral characteristics, growth forms, and habitat characteristics of special-status species. Per the survey protocols referenced earlier in this section, completed CNDDB forms will be submitted to the CNDDB.

[1] Wagner's (1991) 1 in 20 rule is that no more than 5% of a population should be collected. If a population is less than 20 plants, no samples are to be collected.

3.1.3 Wetland delineation

A delineation of potential jurisdictional waters and wetlands within the Fields Landing Mitigation Area was conducted in accordance with the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (WMVC Supplement; USACE 2010). The delineation included any feature that could potentially meet the definition of a water protected under the Clean Water Act (and thus subject to U.S. Army Corps of Engineers (USACE) jurisdiction), as defined by both the previous definition of waters of the U.S. from the *Corps of Engineers Wetland Delineation Manual* and WMVC Supplement (USACE 1987, USACE 2010), as well as the June 2015 Clean Water Rule (33 CFR Part 328), which revised the definition. The delineation of the Fields Landing Mitigation Area was conducted on 10 February 2015 by qualified personnel. In addition, wetlands mapped in the USFWS National Wetlands Inventory (NWI) online application, *Wetlands Mapper* (USFWS 2015) immediately surrounding the survey area and along Project's proposed pipeline alignment were reviewed and a field site visit was conducted on 21 May 2015 and 20 November 2015 to assess wetland conditions and potential impacts to wetland resources by the Project. Results of that delineation will be reported in the *Preliminary Delineation of Waters and Wetlands for the PG&E Fisherman's Channel Dredging Project, Humboldt County, California.* The Fisherman's Channel Dredging Area waters boundary was determined using the bathymetry data and recent wetland information conducted along King Salmon Avenue for the Humboldt Bay Power Plant Final Site Restoration Project (Stillwater Sciences 2016, in progress).

3.1.4 Eelgrass survey

Eelgrass habitat has been identified as a "Habitat Area of Particular Concern" as a subset of Essential Fish Habitat pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. This designation is due to eelgrass' importance as a nursery area for groundfish species. Eelgrass has also been identified by CCC as a "species of special biological significance" and, therefore, requires special protection pursuant to the California Coastal Act. Eelgrass provides a variety of essential ecosystem functions, including primary production, predation refuge, nursery functions, physical structure, and nutrient cycling.

Eelgrass surveys were conducted in Fisherman's Channel and Residential Canals on 26–29 August 2011, during low tide at the end of the primary eelgrass growing season (May through August). Detailed survey methods are described in *Fisherman's Channel Eelgrass Survey—Final Report* (Stillwater Sciences 2012). A second eelgrass survey targeting the dredging area at the mouth of Fisherman's Channel was conducted on 12 August 2014 during low tide.

Eelgrass is also present in the deeper portions of the Fields Landing Mitigation Area. Surveys have not been conducted to determine the extent of the Fields Landing eelgrass beds. Surveys will be conducted during the 2016 growing season no later than 30 days prior to initiation of dredging and mitigation implementation.

3.2 Results

3.2.1 Sediment characterization

Lithology of the sediments from Fisherman's Channel is relatively homogeneous. From the sediment surface to total depth of sampling (approximately -8 to -10 feet MLLW), sand and silt/clay were encountered, with the main channel consisting almost entirely of silt/clay, and the channel mouth area consisting of more sandy material interlaid with portions of silt/clay (GHD 2015). The sediments encountered were generally gray to dark gray with varying amounts of organic matter. Organic material was encountered at various depths throughout Fisherman's Channel and included non-rooted remnant eelgrass, shells, worms, and roots. In some locations, a hydrogen sulfide odor was noted on the sediment core log sheets.

Statistical analysis of White Slough and Fisherman's Channel concentrations identified one constituent (cobalt) where Fisherman's Channel concentrations were higher than White Slough concentrations, and the 95UCL results indicated that the Fisherman's Channel data were above the applicable water quality standard. For each of the other constituents, concentrations reported in White Slough replicates were either higher than, or no different from, those observed in Fisherman's Channel replicates, or were below the water quality standards considered. The Fisherman's Channel value of 11 ppm for cobalt is slightly higher than the values ranging between 7.8 ppm and 8.6 ppm reported for White Slough (GHD 2015). A follow-up benthic analysis of the sediment samples indicate that Fisherman's Channel's sediments are not acutely toxic to amphipods or polychaetes (GHD 2015).

Based on statistical comparison of White Slough baseline concentrations with Fisherman's Channel ISM analytical and benthic results, GHD (2015) concluded that beneficial reuse of Fisherman's Channel's dredge sediments within the White Slough restoration area should be acceptable to the regulatory agencies. The NCRWQCB (2015) also concluded that Fisherman's Channel's sediments were suitable for beneficial reuse at White Slough.

See Appendix B for the full sediment characterization report.

3.2.2 Habitat and species evaluation

General habitat associations and vegetation were documented during the field habitat assessment to evaluate the likelihood of occurrence for special-status plants and wildlife identified during the desktop review. During the assessment, presence of special-status natural communities was determined.

3.2.2.1 General habitat

The Fisherman's Channel Dredging Area is located within an active residential area of King Salmon. The areas surrounding Fisherman's Channel and Residential Canals range from disturbed or highly managed and landscaped private properties to native coastal habitats. Native vegetation bordering the channels is limited and typically occurs in small, narrow bands when present. Fisherman's Channel contains intertidal and subtidal habitat. The intertidal habitat is dominated by soft-bottom mud and eelgrass beds with rocky areas along the breakwater and residential shoreline. The subtidal habitat similarly consists of soft-bottom mud and eelgrass beds. The Fields Landing Mitigation Area is a former sawmill site and is composed of disturbed and coastal habitats, a graveled access road and parking area, Humboldt Bay shoreline, dilapidated pilings, and eelgrass beds. The White Slough Unit beneficial reuse area is composed of a mix of upland grasses at higher elevation (7–8 ft) transitioning to saltmarsh adjacent to the low-elevation (-1 ft) channel.

3.2.2.2 Vegetation

Vegetation assessed at each project area was classified to the native alliance or group (e.g., annual grassland) according to *A Manual of California Vegetation*, second edition (Sawyer et al. 2009).

These alliances were used to assess the likelihood of occurrence for special-status plants identified during the desktop review (Section 3.2.2.3). Results from the evaluation of sensitive natural communities in the project area are provided in Table 2.

Table 2. Sensitive natural communities evaluated in the project area.

Natural community	Status[1] (Global Rank/State Rank)	Distribution[2]	Habitat description[2]	Documented in the project area
Coastal Terrace Prairie	G2/S2.1	Found on sandy loams on marine terraces near the coast (below ~700–1,000 ft) within the zone of coastal fog incursion. There is a single patch of coastal terrace prairie located at Table Bluff, CA, approximately 7.5 km (4.7 mi) south of the project area. It primarily consists of *Danthonia* sp. (60–70% cover) with a high diversity of native and non-native herbaceous species[3].	Dense, tall (up to 3 ft) grassland dominated by both sod and tussock-forming perennial grasses. Most stands are patchy and variable in composition, reflecting local differences in available soil moisture capacity.	No
Sitka Spruce Forest	G1/S1.1	Found on moist, well-drained soils of seaward slopes and coastal headlands, with strong sea winds, frequent fogs, and small annual temperature fluctuation. Occurs in the immediate coastal strip from southern Del Norte County to Cape Mendocino, Humboldt County; and along the coast of central Mendocino County, especially in the vicinity of Pt. Cabrillo.	Dense forest dominated by coniferous evergreen trees up to 115 ft tall, but shorter and wind-pruned on exposed headlands. Dense understory of broadleaved trees, shrubs and perennial herbs, including several species of ferns. The growing season is nearly year-round, but reaches a maximum from late spring to early summer. Some plants are dormant during the relatively dry late summer or during the winter.	Yes, see *Picea sitchensis* forest alliance
Northern Coastal Salt Marsh	G3/S3.2	Found along sheltered inland margins of bays, lagoons, and estuaries where hydric soils are subject to regular tidal inundation by salt water for at least part of each year. Occurs along the coast from the Oregon border south to about Pt. Conception.	Highly productive, herbaceous and suffrutescens, salt-tolerant hydrophytes forming moderate to dense cover. Usually segregated horizontally with cord grass (*Spartina* spp.) nearer the open water, pickleweed (*Salicornia* spp.) at mid-littoral elevations, and a richer mixture closer to high ground.	Yes, see *Salicornia pacifica* herbaceous alliance
Eelgrass beds				Yes, see Section 3.2.5

[1] Status:

Global Rank		State Rank		Global and State Threat Ranks	
G1	Critically Imperiled	S1	Critically Imperiled	0.1	Very threatened
G2	Imperiled	S2	Imperiled	0.2	Threatened
G3	Vulnerable	S3	Vulnerable		

[2] Based on Holland (1986) unless otherwise noted.

[3] Occurrence data from CNDDB database (CDFW 2015).

Salicornia pacifica herbaceous alliance (pickleweed mats)

Salicornia pacifica (Pacific pickleweed) is a native perennial herb in the Chenopodiacae family. This alliance consists of the northern coastal salt marsh, a CNDDB-listed sensitive natural community. It is categorized by highly productive, herbaceous, salt-tolerant hydrophytes that form a low-lying, moderate to dense ground cover (Holland 1986). This alliance has an intermittent to continuous herbaceous layer predominantly composed of Pacific pickleweed with moderate cover by *Distichlis spicata* (salt grass), *Juncus* spp. (various rushes), and *Atriplex prostrata* (fat-hen). Additional herbaceous species with low cover include *Spergularia macrotheca* (sticky sandspurry), *Triglochin maritima* (seaside arrowgrass), and *Deschampsia cespitosa* (tufted hair grass). Shrubs of *Baccharis pilularis* (coyote brush) and *Morella californica* (wax myrtle) are occasionally scattered throughout this alliance. Nonnative invasive *Spartina densiflora* (dense-flowered cordgrass) has been observed with moderate to high presence in this alliance. The pickleweed mats alliance occurs along the edges of Fisherman's Channel, portions of the Residential Canals, as well as around the Humboldt Bay high tide line, along tidally-influenced drainages in the Fields Landing Mitigation Area, and adjacent to the railroad right-of-way along the pipeline route.

Bolboschoenus maritimus herbaceous alliance (saltmarsh bulrush marsh)

Bolboschoenus maritimus (saltmarsh bulrush) is a perennial rhizomatous herb in the Cyperaceae family. The alliance occurs in tidal marshes with seasonal flooding at intermediate tidal elevations and relatively high salinity (Pickart 2006). Stands on the northern California coast occur where saltmarsh bulrush colonizes banks of former tidal sloughs that periodically receive saline water from leaky tide gates or in other areas where saltwater enters (Pickart 2006). Saltmarsh bulrush is dominant in the herbaceous layer with low to moderate cover of *Typha latifolia* (broad-leaved cattail), *Holcus lanatus* (common velvet grass), *Potentilla anserina* ssp. *pacifica* (Pacific silverweed), *Oenanthe sarmentosa* (water parsley), and *Agrostis stolonifera* (creeping bentgrass). Scattered throughout this alliance are pockets with high concentrations of saltmarsh species including Pacific pickleweed, salt grass, and fat-hen. This alliance is present within the tidally-influenced drainages throughout the Fields Landing Mitigation Area and adjacent to the railroad right-of-way along the pipeline route.

Deschampsia cespitosa herbaceous alliance (tufted hair grass meadows)

Deschampsia cespitosa (tufted hair grass) is a native perennial bunchgrass in the Poaceae family. In coastal regions it occurs in coastal bluffs, terraces, sand dunes, and seasonally flooded areas of moderate salinity. In addition to the dominant tufted hair grass, the herbaceous layer includes *Festuca rubra* (red fescue), *Juncus lescurii* (San Francisco rush), *Juncus breweri* (Brewer's rush), *Juncus effusus* (soft rush), *Symphyotrichum chilensis* (Pacific aster), *Parentucellia villosa* (yellow glandweed), and *Rubus ursinus* (California blackberry). This alliance is present along the margins of the pickleweed mats alliance in the Fields Landing Mitigation Area.

Distichlis spicata herbaceous alliance (salt grass flats)

Distichlis spicata (salt grass) is a native perennial grass in the Poaceae family. In the northern California coast region, stands occur in salt marshes around Humboldt Bay. Salt grass is dominant or codominant in the herbaceous layer and includes the following plant associates: Pacific pickleweed, fat-hen, seaside arrowgrass, *Hordeum brachyantherum* (meadow barley), and San Francisco rush. Salt grass flats are located throughout the project area near the pickleweed mats alliance and tidally-influenced waters.

Eleocharis macrostachya herbaceous alliance (Pale spike rush marshes)

Eleocharis macrostachya (pale spikerush) is a native perennial grasslike herb in the Cyperaceae family. It commonly occurs in seasonally flooded habitats including brackish marshes, ponds, vernal pools, shallow lakes, streamsides, and wet meadows (Sawyer et al. 2009). This alliance occurs in seasonally flooded brackish marshes in nearby Humboldt Bay Wildlife Refuge (Pickart 2006). Plant associates in the project area include Brewer's rush, San Francisco rush, *Cyperus eragrostis* (tall flatsedge), and *Mentha pulegium* (pennyroyal). Additional plant species include meadow barley, common velvet grass, *Medicago polymorpha* (bur clover), bird's-foot trefoil, brome fescue, and Italian ryegrass. This alliance is primarily associated with the seasonally wet depressions on the graveled areas of the Fields Landing Mitigation Area. These areas were delineated during the wetland delineation survey and are discussed in Section 3.2.3.

Juncus lescurii herbaceous alliance (salt rush swale)

Juncus lescurii (San Francisco rush) is a native perennial herb in the Juncaceae family. Salt rush swales are found in seasonally wet, slightly brackish marshes at the upper edges of salt marshes or behind dikes in former salt marsh at intermediate elevations (Sawyer et al. 2009). San Francisco rush is dominant in a continuous herbaceous layer with common velvet grass, fat-hen, sea-watch, Pacific aster, *Rumex* spp. (various dock), and *Galium* spp. (various bedstraw) scattered throughout. This alliance is present along low depressed areas near the base of levee berms and bordering the pickleweed mats alliance in the Fields Landing Mitigation Area.

Zostera marina beds (Eelgrass beds)

Eelgrass species (*Zostera marina* L. and *Z. pacifica*) are seagrasses that occur in the temperate unconsolidated substrate of shallow coastal environments, enclosed bays, and estuaries. Eelgrass is a highly productive species and is considered to be a "foundation" or habitat forming species (NOAA 2014). *Zostera marina* (eelgrass) beds, which are present in Humboldt Bay, are a sensitive natural community and eelgrass habitat has been identified as a "Habitat Area of Particular Concern" as a subset of Essential Fish Habitat pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. This designation is due to eelgrass' importance as a nursery area for a variety of commercial fish and shellfish species. Eelgrass has also been identified by CCC as a "species of special biological significance," and therefore requires special protection pursuant to the California Coastal Act. Eelgrass provides a variety of essential ecosystem functions, including primary production, predation refuge, nursery functions, physical structure, and nutrient cycling. Eelgrass presence in the project area are described in detail in Section 3.2.4.

Baccharis pilularis shrubland alliance (coyote brush scrub)

Baccharis pilularis (coyote brush) is a native shrub in the Asteraceae family. In the northern California coast region, stands of coyote brush exist under humid and salt-laden conditions and are found on steep, rocky, dry areas exposed to salt spray; or when mixed with the *Rubus* (blackberry) alliance found on more shallower slopes (Sawyer et al. 2009). Stands can be transitory to forest and woodland types or persistent for a long time (Heady et al. 1977). Coyote brush is a co-dominant in the shrub canopy which also includes wax myrtle, California blackberry, *Lupinus rivularis* (riverbank lupine), and *Lonicera involucrata* (twinberry). The herbaceous layer is continuous and well-developed consisting of *Achillea millefolium* (common yarrow), *Polystichum munitum* (western sword fern), *Scrophularia californica* (California figwort), and Pacific aster. Coyote brush scrub is found above the fluctuating tide of Fisherman's Channel along the dry upland (i.e., above the high tide line) portions of the levees and undisturbed residential areas, along upland levee berms within the Fields Landing Mitigation Area, and on the railroad right-of-way portion of the pipeline route.

Salix hookeriana shrubland alliance (coastal dune willow thicket)

Salix hookeriana (coastal willow) is a California native shrub or tree in the Salicaceae family. This coastal species forms a moisture-loving disturbance-related alliance in areas near the ocean where there is periodic standing water and/or seasonal flooding (Sawyer et al. 2009). This shrubland alliance is the most common willow scrub found along the northwestern coastal belt of California (Sawyer et al. 2009). Coastal willow is a dominant tall shrub to low tree in this alliance with understory canopy dominated by California blackberry, *Sambucus racemosa* (red elderberry), *Ribes sanguineum* (red-flowering currant), Pacific aster, *Conium* *maculatum* (poison hemlock), and *Heracleum maximum* (common cow parsnip). Additional species with low to moderate cover include *Frangula purshiana* (cascara) and *Salix sitchensis* (Sitka willow). This alliance is located in the lower gradient riparian areas along the drainages found in the Fields Landing Mitigation Area. It blends with coyote brush scrub at some locations where the upland scrub meets the riparian area.

Picea sitchensis forest alliance (Sitka spruce forest)

Picea sitchensis (Sitka spruce) is a native evergreen conifer in the Pinaceae family. It occurs in coastal forests, is an early colonizer of disturbed soils, and is a late-seral species in coastal forests (Sawyer et al. 2009). Sitka spruce forest occurs on bottomlands, upland steep slopes, seaward bluffs, and ravines near the ocean (Sawyer et al. 2009) and is a CNDDB-listed sensitive natural community. Sitka spruce is dominant in the tree canopy of this alliance, which also includes red alder. The tree canopy is continuous with a sparse to moderate shrub layer of various blackberries, coastal willow, cascara, wax myrtle, twinberry, and *Garrya elliptica* (elliptic silk tassel). Herbaceous cover is abundant with various ferns, western sword fern and *Dryopteris expansa* (spreading wood fern), as well as tufted hair grass, common cow parsnip, California figwort, *Iris douglasiana* (Douglas iris), and various *Equisetum* spp. (various horsetail). This alliance occurs along the upland portions of levees in the Project Area.

Annual grassland

Annual grassland is primarily composed of naturalized, nonnative annual grasses *Hordeum marinum* subsp. *gussoneanum* (Mediterranean barley), *Cynosurus echinatus* (bristly dogtail grass), and *Briza maxima* (big quaking grass). All grasses are in the Poaceae family and have a limited or moderate weed rating from California Invasive Plant Council (Cal-IPC). Additional grass and forb species include common yarrow, *Festuca bromoides* (brome fescue), *Anagallis arvensis* (scarlet pimpernel), *Avena sativa* (common oat), *Bromus hordeaceus* (soft brome), common velvet grass, *Festuca perennis* (Italian ryegrass), meadow barley, *Helminthotheca echioides* (bristly ox-tongue), *Daucus carota* (Queen Anne's lace), *Plantago lanceolata* (English plantain), *Lotus corniculatus* (birds-foot trefoil), *Leontodon saxatilis* (lesser hawkbit), *Linum bienne* (pale flax), *Dactylis glomerata* (orchard grass), and *Madia sativa* (coast tarweed). Annual grassland occurs throughout large portions of the disturbed, graveled sections of the Fields Landing Mitigation Area.

3.2.2.3 Special-status plants

Based on the vegetation assessment, the likelihood of presence for special-status plants in the project area are provided in Table 3.

Table 3. Special-status plants evaluated for the likelihood to occur in the project area.

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
Abronia umbellata ssp. *breviflora* (pink sand-verbena)	–/–/1B.1[2]	Coastal dunes; 0–33 ft (June–October)	CNDDB, CNPS	**None**: No habitat present.
Angelica lucida (sea watch)	–/–/4.2	Coastal bluff scrub, coastal dunes, coastal scrub, and coastal salt marshes and swamps; 0–492 ft (May–September)	CNPS	**Moderate/High:** Suitable habitat present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, and coyote brush scrub vegetation alliances. Known occurrences of sea-watch were documented in these vegetation alliances in King Salmon, CA (Stillwater Sciences, unpublished data).
Anomobryum julaceum (slender silver moss)	–/–/4.2	Damp rock and soil on outcrops, usually on roadcuts in broad-leafed upland forest, lower montane coniferous forest, and North Coast coniferous forest; 328–3,281 ft (n/a—moss)	CNDDB, CNPS	**None**: Outside of elevation range.
Astragalus pycnostachyus var. *pycnostachyus* (coastal marsh milk-vetch)	–/–/1B.2[2]	Mesic coastal dunes, coastal scrub, coastal salt marshes and swamps, wetlands and streamsides; 0–98 ft (April–October)	CNDDB, CNPS	**Low:** Suitable habitat present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, pale spike rush marshes, and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Bryoria pseudocapillaris (false gray horsehair lichen)	–/–/3.2	Usually on conifers in coastal dunes and North Coast coniferous forest within the immediate coast; 0–295 ft (n/a—lichen)	CNPS	**Low:** Suitable habitat is present in the Sitka spruce forest vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Bryoria spiralifera (twisted horsehair lichen)	–/–/1B.1	North Coast coniferous forest within the immediate coast. Found on conifers in coastal dune forest; 0–98 ft (n/a—lichen)	CNDDB, CNPS	**Low:** Suitable habitat is present in in the Sitka spruce forest vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Cardamine angulata (seaside bittercress)	–/–/2B.1	Wet areas, streambanks in redwood forests and mixed evergreen forests; 213–3,002 ft (April–June)	CNDDB, CNPS	**None**: Outside of elevation range.

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
Carex arcta (northern clustered sedge)	–/–/2B.2	Bogs and fens, North Coast coniferous forest; 197–4,593 ft (June–September)	CNDDB, CNPS	**None**: Outside of elevation range.
Carex leptalea (bristle-stalked sedge)	–/–/2B.2	Bogs and fens, mesic meadows and seeps, marshes and swamps; 0–229 ft (March–July)	CNDDB, CNPS	**Low:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, pale spike rush marshes, and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Carex lyngbyei (Lyngbye's sedge)	–/–/2B.2	Brackish or freshwater marshes and swamps; 0–33 ft (April–August)	CNDDB, CNPS	**Low:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, and pale spike rush marshes vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Carex praticola (northern meadow sedge)	–/–/2B.2	Moist to wet meadows and seeps, coastal prairie, and North Coast coniferous forest; 0–10,499 ft (May–July)	CNDDB, CNPS	**Low**: Suitable habitat is present in the tufted hair grass meadows, salt grass flats, salt rush swale, pale spike rush marshes, and Sitka spruce forest vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Castilleja affinis ssp. *litoralis* (Oregon coast paintbrush)	–/–/2B.2	Coastal bluff scrub, coastal dunes, coastal scrub/sandy; 49–328 ft (June)	CNDDB, CNPS	**Low**: Suitable habitat is present in the coyote brush scrub vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Castilleja ambigua ssp. *humboldtiensis* (Humboldt Bay owl's-clover)	–/–/1B.2[2]	Marshes and swamps; 0–10 ft (April–August)	CNDDB, CNPS	**Moderate/High:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, pale spike rush marshes vegetation alliances. A CNDDB known occurrence is located adjacent to Fisherman's Channel Dredging Area.
Chloropyron maritimum ssp. palustre (Point Reyes bird's-beak)	–/–/1B.2[2]	Marshes and swamps; 0–33 ft (June–October)	CNDDB, CNPS	**Moderate/High:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, salt grass flats, salt rush swale, and pale spike rush marshes vegetation alliances. A CNDDB known occurrence is located adjacent to Fisherman's Channel Dredging Area.
Clarkia amoena ssp. *whitneyi* (Whitney's	–/–/1B.1	Coastal bluff scrub, coastal scrub; 33–328 ft (June-August)	CNDDB, CNPS	**Low:** Suitable habitat is present in the coyote brush scrub vegetation alliance, although there are no known occurrences

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
farewell-to-spring)				in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Collomia tracyi (Tracy's collomia)	–/–/4.3	Lower montane coniferous forest; 984–6,890 ft (June–July)	CNPS	**None**: Outside of elevation range.
Erysimum menziesii ssp. *eurekense* (Humboldt Bay wallflower)	FE/CE/1B.1	Coastal dunes; 0–33 ft (March–October)	CNDDB, CNPS	**None**: No suitable habitat present.
Erythronium revolutum (coast fawn lily)	–/–/2B.2	Bogs and fens, broad-leafed upland forest, mesic North Coast coniferous forest, streambanks; 0–5,249 ft (March–August)	CNDDB, CNPS	**Low:** Suitable habitat is present in the Sitka spruce forest and coastal dune willow thicket vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Fissidens pauperculus (minute pocket moss)	–/–/1B.2[3]	North Coast coniferous forest with damp soil; 33–3,360 ft (n/a—moss)	CNDDB, CNPS	**Low:** Suitable habitat is present in the Sitka spruce forest vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Gilia capitata ssp. *pacifica* (Pacific gilia)	–/–/1B.2	Coastal bluff scrub, chaparral, coastal prairie, valley and foothill grassland; 16–2,851 ft (April–August)	CNDDB, CNPS	**Low:** Suitable habitat is present in the tufted hair grass, annual grassland, and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Gilia millefoliata (dark-eyed gilia)	–/–/1B.2[2]	Coastal dunes; 7–66 ft (April–July)	CNDDB, CNPS	**None**: No suitable habitat present.
Glehnia littoralis ssp. *leiocarpa* (American glehnia)	–/–/4.2	Coastal dunes; 0–66 ft (May–August)	CNPS	**None**: No suitable habitat present.
Hesperevax sparsiflora var. *brevifolia* (short-leaved evax)	–/–/1B.2[2]	Coastal bluff scrub, coastal dunes; 0–705 ft (March–June)	CNDDB, CNPS	**Low**: Suitable habitat is present in the coyote brush scrub vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Hesperolinon adenophyllum (glandular western flax)	–/–/1B.2	Chaparral, valley grassland, foothill woodland, affinity to serpentine soil; 492–4,314 ft (May–August)	CNPS	**None**: Outside of elevation range.
Lathyrus japonicus (seaside pea)	–/–/2B.1	Coastal dunes; 3–98 ft (May–August)	CNDDB, CNPS	**None**: No suitable habitat present.
Lathyrus palustris (marsh pea)	–/–/2B.2	Bogs and fens, marshes and swamps, coastal prairies, coastal scrub; 3–328 ft (March–August)	CNDDB, CNPS	**Low:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, pale spike

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
				rush marshes, and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Layia carnosa (beach layia)	FE/CE/1B.1	Coastal dunes, coastal scrub (sandy); 0–197 ft (March–July)	CNDDB, CNPS	**Low**: Suitable habitat is present in the coyote brush scrub vegetation community, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Lilium kelloggii (Kellogg's lily)	–/–/4.3	Openings and roadsides in lower montane coniferous forest and North Coast coniferous forest; 10–4,265 ft (May–August)	CNPS	**Low:** Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Lilium occidentale (western lily)	FE/CE/1B.1	Marshes and swamps, bogs and fens, coastal scrub, and coastal prairie; edges of sphagnum bogs and forest openings along margins of ephemeral ponds and stream channels; 7–607 ft (June–July)	CNDDB, CNPS	**Low:** Suitable habitat is present in the saltmarsh bulrush marshes, tufted hair grass meadows, salt grass flats, salt rush swale, pale spike rush marshes, and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Lilium rubescens (redwood lily)	–/–/4.2	Sometimes serpentinite and roadsides broad-leafed upland forest, chaparral, lower montane coniferous forest, North Coast coniferous forest, and upper montane coniferous forest; 98–6,266 ft (April–September)	CNPS	**None**: Outside of elevation range.
Listera cordata var. *nephrophylla* (heart-leaved twayblade)	–/–/4.2	Bogs and fens, lower montane coniferous forest, North Coast coniferous forest; 16–4,495 ft (February–July)	CNPS	**Low:** Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
Lycopodium clavatum (running pine)	–/–/4.1	Openings, edges, and roadsides of mesic lower montane coniferous forest, marshes and swamps, and mesic North Coast coniferous forest; 148–4,019 ft (June–September)	CNDDB, CNPS	**None**: Outside of elevation range.
Mitellastra caulescens (leafy-stemmed miterwort)	–/–/4.2	Mesic, sometimes roadsides in broad-leafed upland forest, lower montane coniferous forest, meadows and seeps, and North Coast coniferous forest; 16–5,577 ft (March–October)	CNDDB, CNPS	**Low:** Suitable habitat is present in tufted hair grass meadows, coyote brush scrub, and Sitka spruce vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Monotropa uniflora (ghost-pipe)	–/–/2B.2	Broadleaf upland forest, North Coast coniferous forest; 33–1,804 ft (June–September)	CNDDB, CNPS	**Low:** Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area, and elevation is likely out of range.
Montia howellii (Howell's montia)	–/–/2B.2	Meadows and seeps, North Coast coniferous forest, mesic vernal pools, and roadsides; 0–2,395 ft (March–May)	CNDDB, CNPS	**Low:** Suitable habitat is present in the tufted hair grass meadows, pale spike rush marshes, coyote brush, and Sitka spruce vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Oenothera wolfii (Wolf's evening-primrose)	–/–/1B.1[2]	Coastal bluff scrub, coastal dunes, coastal prairie, lower montane coniferous forest (sandy), usually mesic; 10–2,625 ft (May–October)	CNDDB, CNPS	**Low:** Suitable habitat is present in the tufted hair grass meadows and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Packera bolanderi var. *bolanderi* (seacoast ragwort)	–/–/2B.2	Coastal scrub, North Coast Coniferous forest, sometimes along roadsides; 98–3,002 ft (April–May)	CNDDB, CNPS	**None**: Outside of elevation range.
Pityopus californica (California pinefoot)	–/–/4.2	Mesic broad-leafed upland forest, lower montane coniferous forest, North Coast coniferous forest, upper montane coniferous forest; 49–7,300 ft (March–August)	CNPS	**Low:** Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Pleuropogon refractus (nodding semaphore grass)	–/–/4.2	Mesic lower montane coniferous forest, meadows and seeps, North Coast coniferous forest, riparian forest; 0–5,249 ft (March–August)	CNPS	**Low:** Suitable habitat is present in the tufted hair grass meadows, coastal dune willow thicket, and Sitka spruce vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
				Landing Mitigation Area.
Polemonium carneum (Oregon polemonium)	–/–/2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest; 0–6,004 ft (April–September)	CNDDB, CNPS	**Low:** Suitable habitat is present in the tufted hair grass meadows and coyote brush scrub vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Puccinellia pumila (dwarf alkali grass)	–/–/2B.2	Coastal salt marshes and swamps; 3–33 ft (July)	CNDDB, CNPS	**Low:** Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, salt grass flats, salt rush swale, and pale spike rush marshes vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area..
Ribes laxiflorum (trailing black currant)	–/–/4.3	Sometimes roadsides in North Coast coniferous forest; 16–4,577 ft (March–August)	CNPS	**Low:** Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Sidalcea malachroides (maple-leaved checkerbloom)	–/–/4.2	Often in disturbed areas in broad-leafed upland forest, coastal prairie, coastal scrub, North Coast coniferous forest, and riparian woodland; 0–2,395 ft (March–August)	CNPS	**Low**: Suitable habitat is present in the tufted hair grass meadows, coyote brush scrub, coastal dune willow thicket, and Sitka spruce vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Sidalcea malviflora ssp. *patula* (Siskiyou checkerbloom)	–/–/1B.2	Coastal bluff scrub, coastal prairie, North Coast coniferous forest/often roadcuts; 49–2,881 ft (May–August)	CNDDB, CNPS	**Low**: Suitable habitat is present in the tufted hair grass meadows, coyote brush scrub, and Sitka spruce vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Sidalcea oregana ssp. *eximia* (coast checkerbloom)	–/–/1B.2	Meadows, wetland-riparian; 16–4,396 ft (June–August)	CNPS	**Low**: Suitable habitat is present in the tufted hair grass meadows, pale spike rush marshes, and coastal dune willow thicket vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Spergularia canadensis var. *occidentalis* (western sand-spurrey)	–/–/2B.1	Coastal salt marshes and swamps; 0–19 ft (June–August)	CNDDB, CNPS	**Low**: Suitable habitat is present in the pickleweed mats, saltmarsh bulrush marshes, salt grass flats, salt rush swale, and pale spike rush marshes vegetation alliances, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area..

Species name	Status[1] Federal/ State/ CRPR	Habitat associations (blooming period)	Source	Likelihood of occurrence (none, low, moderate, high)
Usnea longissima (Methuselah's beard lichen)	–/–/4.2	North Coast coniferous forest, broad-leafed upland forest; 0–2,000 ft (n/a—lichen)	CNDDB	**Low**: Suitable habitat is present in the Sitka spruce vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.
Viola palustris (alpine marsh violet)	–/–/2B.2	Coastal bogs and fens, coastal scrub; 0–492 ft (March–August)	CNDDB, CNPS	**Low**: Suitable habitat is present in the coyote brush scrub vegetation alliance, although there are no known occurrences in Fisherman's Channel Dredging Area and Fields Landing Mitigation Area.

[1] **Status:**

Federal
FE Endangered
– No federal status

State
CE Endangered
– No state status

California Rare Plant Rank
1B Plants rare, threatened, or endangered in California and elsewhere
2B Plants rare, threatened, or endangered in California, but more common elsewhere
3 Plants about which more information is needed - a review list
4 Plants of limited distribution - a watch list

Threat Ranks:
0.1 Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 Fairly threatened in California (20–80% occurrences threatened/moderate degree and immediacy of threat)
0.3 Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

[2] Based on Holland (1986) unless otherwise noted.
[3] Occurrence data from CNDDB database (CDFW 2013).

A comprehensive list of plant species identified within Fisherman's Channel Dredging Area and Fields Landing Mitigation Area are provided in Appendix C (Tables C-1 and C-2).

Two special-status plants, Point Reyes bird's-beak (*Chloropyron maritimum* ssp. *palustre*) and sea-watch were located during the targeted special-status surveys conducted in Fisherman's Channel and Fields Landing survey areas (Figures 11 and 12). Based on botanical surveys conducted in previous years, a population of Humboldt Bay owl's-clover (*Castilleja ambigua* var. *humboldtiensis*) is also known to exist at the Point Reyes bird's-beak population site (V. Dains, Botanist, pers. comm., 10 October 2012) (Figure 1).

Angelica lucida **(sea-watch)**

Sea-watch is a native perennial herb in the Apiaceae (carrot) family that has a California Rare Plant Rank (CRPR) of 4.2 (i.e., plants of limited distribution; moderately threated in California) (CNPS 2015). It is limited to the north coast of California in Humboldt, Mendocino, and Del Norte counties from 0 to 164 ft elevation (Baldwin et al. 2012). Sea-watch typically occurs in coastal bluff scrub, coastal dunes, coastal scrub, and coastal salt marshes and blooms from May to September (CNPS 2015). In the survey area, plants commonly associated with sea-watch include *Rubus ursinus* (California blackberry), *Baccharis pilularis* (coyote brush), *Symphyotrichum chilense* (seaside aster), *Anthoxanthum odoratum* (sweet vernal grass), *Achillea millefolium* (common yarrow), and *Juncus lescurii* (San Francisco rush). Overall, 130 individuals of sea-watch were observed in the Fields Landing and Fisherman's Channel survey areas (Figures 11 and 12).

Approximately 20 individuals of sea-watch were documented within the upland coyote brush scrub alliance in Fisherman's Channel Dredging Area (Figure 12). An estimated 110 individuals of sea-watch were documented in the Fields Landing Mitigation Area (Figure 11), the majority of which were noted along the high tide line of Humboldt Bay (~100 individuals). An additional 10 individuals were found nearby in a gated section at the base of a levee berm. Both occurrences were located at the south end of Frontage Road (Figure 11).

Chloropyron maritimum **subsp.** *palustre* **(Point Reyes bird's-beak)**

Point Reyes bird's-beak is a hemi-parasitic annual herb in the Orobanchaceae (broomrape) family that has a California Rare Plant Rank (CRPR) of 1B.2 (i.e., plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California). In California, it is limited to the north and central coast, in Humboldt, Marin, and Sonoma counties, from 0 to 33 ft elevation (Baldwin et al. 2012). Point Reyes bird's-beak occurs in coastal salt marshes and swamps and blooms from June through October (CNPS 2015). Plant associates in the survey area include *Distichlis spicata* (salt grass), *Salicornia pacifica* (Pacific pickleweed), *Cuscuta pacifica* var. *pacifica* (goldenthread dodder), and *Spartina densiflora* (dense-flowered cordgrass), a Cal-IPC listed high-alert weed (i.e., species that have severe ecological impacts on physical processes, plant and animal communities and vegetation structure; may have the potential to spread much further). Over 200 individuals of Point Reyes bird's-beak were documented within the salt marsh located between King Salmon Avenue and Fisherman's Channel, up channel from the dredging area (Figure 12).

Figure 11. Special-status plants documented in the Field Landing Mitigation Area.

Figure 12. Special-status plants, eelgrass, and jurisdictional waters and wetlands documented in Fisherman's Channel Dredging Area.

3.2.2.4 Special-status fish and wildlife

Special-status animals identified during the desktop analysis and their likelihood to be present in the project area are listed in Table 4. Suitable habitat is not present for many of the species listed in Table 4, such as whales or sea turtles (due to the inland and shallow nature of the bay and channels), black abalone, yellow-legged frogs, tailed frogs, southern torrent salamanders, western pond turtles, and short-tailed albatross (because the Project Area is out of these species' range of distribution or does not contain suitable habitat). Therefore, these species will not be discussed further in this document.

Invertebrates

No special-status invertebrate species were documented as occurring in the project vicinity.

Fish and habitat

A number of special-status fish species have a low to moderate potential to be in Fisherman's Channel and could potentially be present during dredging activities (Table 4). These species include North American green sturgeon (Southern DPS), tidewater goby, longfin smelt, southern Oregon/northern California coho salmon, northern California steelhead, and California coastal Chinook salmon.

Designated critical habitat is present in Fisherman's Channel for North American green sturgeon (Southern DPS), southern Oregon/northern California coho salmon, northern California steelhead, and California coastal Chinook salmon.

The waters within the project area contain EFH for a number of species subject to the MSA including northern anchovy, Pacific herring, Pacific sardine, coho and Chinook salmon, and flatfishes.

Eelgrass habitat is present in Fisherman's Channel. Eelgrass has been identified as a "Habitat Area of Particular Concern" as a subset of EFH pursuant to the MSA. This designation is due to eelgrass' importance as a nursery area for groundfish species. Eelgrass has also been identified by the CCC as a "species of special biological significance," and therefore requires special protection pursuant to the California Coastal Act (HBHRCD 2006). Fisherman's Channel contains 3.03 ac of eelgrass. It is expected that implementation of the project will temporarily affect a total of 1.2 ac of eelgrass, with another 0.36 ac being indirectly affected by turbidity. Approximately 1.5 acres of eelgrass in Fisherman's Channel is present along the sides of the channel where the water is shallow enough and out of the way of disturbance from boat traffic and will not be affected by the Project. Although no special-status fish species surveys have been conducted, it is assumed that a variety of fish use the eelgrass habitat, because Fisherman's Channel is in close proximity to the bay and ocean, is relatively deep, and protected from wind and waves.

Amphibians

The northern red-legged frog is documented as occurring within the Project Area. This species is known to occur on the adjacent HBPP property and at the Fields Landing eelgrass mitigation area.

Reptiles

No special-status reptile species are known to occur in the Project vicinity.

Birds

A number of bird species that have the potential to be in Fisherman's Channel are discussed below.

Marbled murrelets

Marbled murrelets may fly over the Project Area at twilight and just before dawn as they migrate from their nest location to forage in the open ocean. There is no suitable breeding habitat for marbled murrelets in the Project Area.

Bald eagles

Bald eagles may forage within the bay near Fisherman's Channel and Fields Landing eelgrass mitigation area. The closest documented nesting location is about 6 kilometers (4 miles) from the Project Area.

Western snowy plover

Although western snowy plover is not likely to be present in Fisherman's Channel, it is possible that individuals could be present nearby, and critical habitat is located along the ocean-side of the south spit, which is about 1 mi west of Fisherman's Channel.

Migratory birds

A number of birds protected by the MBTA have been documented within the area and include, but are not limited to: great egret, snowy egret, great blue heron, black-crowned night heron, Cooper's hawk, double-crested cormorant, osprey, sharp-shinned hawk, and bald eagle (CDFW 2015). Species protected under the MBTA may be present foraging and loafing in the waterway or on exposed tidal mudflats, nesting in nearby bushes, trees, or manmade structures (houses, docks), and flying over the channel during daily and seasonal migrations.

Mammals

A number of mammal species that have the potential to be in Fisherman's Channel are discussed below.

Marine Mammal Protection Act-listed species

Species that are protected under the MMPA (e.g., harbor seals, California sea lions) could occur within or adjacent to Fisherman's Channel. However, these species are highly mobile and would be able to avoid the dredging area of disturbance. These species have not been observed hauling out on the docks in King Salmon or using the Fields Landing or White Slough shorelines for hauling out. Therefore, marine mammals will not be discussed further in this document.

Townsend's big-eared bat

Townsend's big-eared bat migration and foraging habitat may be present over and around Fisherman's Channel. However, the nearest documented occurrence is over 5 miles from the Project Area. The Project will not affect migration, roosting, or foraging habitat; therefore, this species will not be discussed further in this document.

Pallid bat

Pallid bat migration habitat may be present over Fisherman's Channel and foraging habitat may be present in the adjacent upland areas. Furthermore, roosting habitat is present in nearby manmade structures (e.g., houses). However, the most recent documented occurrence is from 1924 and over 10 miles from the Project Area. The Project will not affect migration, roosting, or foraging habitat; therefore, this species will not be discussed further in this document.

Table 4. Special-status fish and wildlife species evaluated for the likelihood to occur in the project area.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Invertebrates					
Black abalone (*Haliotis cracherodii*)	FE/–	Point Arena in northern California to Bahia Tortugas and Isla Guadalupe, Mexico	Intertidal and shallow subtidal rocks, in areas of moderate to heavy surf action	USFWS	**None**: Outside of current distribution.
Fish					
North American green sturgeon—(Southern Distinct Population Segments [DPS]) (*Acipenser medirostris*)	FT/SSC critical habitat	San Francisco, San Pablo, Suisun, and Humboldt bays; Sacramento-San Joaquin Delta, Sacramento and Klamath rivers	Large mainstem rivers with cool water and cobble, clean sand, or bedrock for spawning	CNDDB NMFS[2]	**Low**: Known to occur in the North Humboldt Bay (area of the bay north of the harbor entrance). Unlikely to occur in Fisherman's Channel. Critical habitat, which includes all tidally influenced areas of Humboldt Bay (including tributaries) up to the elevation of mean higher high water, is present.
Tidewater goby (*Eucyclogobius newberryi*)	FE/SSC critical habitat	Tillas Slough (mouth of the Smith River, Del Norte County) to Agua Hedionda Lagoon (northern San Diego County)	Coastal lagoons and the uppermost zone of brackish large estuaries; prefer sandy substrate for spawning, but can be found on silt and rocky mud substrates; can occur in water up to 15 ft in lagoons and within a wide range of salinity (0–42 ppt)	CNDDB USFWS	**Low**: Habitat not present in Fisherman's Channel, along the pipeline route, or at White Slough beneficial reuse area. Three individuals were documented in the White Slough area, outside of the beneficial reuse area (Ojerholm and Wallace 2015). Surveys conducted in 2007 within Buhne Slough, near the project area, did not identify presence (Stillwater Sciences 2007). Survey in neighboring unnamed slough did not identify presence (USFWS 2014). Individuals were documented in 2006 in the vicinity of Swain Slough and Elk River, about 1.5 mi from the project area (CDFW 2015). Designated critical habitat is located in slough habitat about 1 mi north and on the Refuge south of the White Slough beneficial reuse site.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Eulachon (Southern DPS) (*Thaleichthys pacificus*)	FT/SSC critical habitat	Skeena River in British Columbia (inclusive) south to the Mad River in Northern California (inclusive)	An anadromous fish that historically used the Klamath River estuary and lowest portions of the river to spawn. Few to no individuals currently use the estuary. Most of their life is spent in the ocean.	NMFS[2]	**None**: Outside of current distribution. Last observed in the Mad River in 1977 (CDFW 2015), more than 14 mi north of the project area. Critical habitat is located about 14 mi north on the Mad River.
Longfin smelt (*Spirnichus thaleichthys*)	FC/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults in large bays, estuaries, and nearshore coastal areas; migrate into freshwater rivers to spawn; salinities of 15–30 ppt	CNDDB	**Moderate**: Rearing habitat for juveniles is present year-round in Humboldt Bay and sloughs. Larvae prefer areas where fresh and saltwater mix for rearing, which does not occur in the project area. Adults begin moving into freshwater in the fall and spawn in the winter. Spawning habitat is not present, since this species spawns in freshwater streams. Documented throughout Humboldt Bay (CDFW 2015).
Coastal cutthroat trout (*Oncorhynchus clarki clarki*)	–/SSC	Small, low-gradient coastal streams and estuaries. Shaded streams with water temperatures below 18ºC (64°F) and small gravel for spawning. May enter intertidal areas that contain brackish waters.	From northern Oregon to the Eel River, California	CNDDB	**None**: Coastal cutthroat trout documented in tributaries to Humboldt Bay (CDFW 2015). No coastal cutthroat trout have been documented in the project area. No tributaries flow into the project area.
Coho salmon (southern Oregon/ northern California Evolutionary Significant Unit ESU]) (*Oncorhynchus kisutch*)	FT/– critical habitat	Punta Gorda north to the Oregon border	Spawn in coastal streams and large mainstem rivers (i.e., Klamath/Trinity Rivers) in riffles and pool tails-outs and rear in pools > 3 ft deep with overhead cover with high levels oxygen and temperatures of 50–59°F.	NMFS[2]	**Low**: Smolts prefer deep water channels (NMFS 2014) and presence in Fisherman's Channel is unlikely. Adult spawning habitat is located in freshwater. Not likely to be present during project activities (July 1 to October 1). Designated critical habitat is present.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Steelhead (Northern California DPS) (*Oncorhynchus mykiss*)	FT/SSC (SSC refers to the summer-run only) critical habitat	Russian River north to Redwood Creek (Humboldt County)	Inhabits small coastal streams to large mainstem rivers with gravel-bottomed, fast-flowing habitat for spawning. However, habitat criteria for different life stages (spawning, fry rearing, juvenile rearing) are can vary significantly.	NMFS[2]	**Low**: Smolts prefer deep water channels (NMFS 2014) and presence in Fisherman's Channel is unlikely. Adult spawning habitat is located in freshwater. Not likely to be present during project activities (July 1 to October 1). Designated critical habitat is present.
Chinook salmon (California coastal ESU) (*Oncorhynchus tshawytscha*)	FT/– critical habitat	Russian River (Sonoma County) north to Redwood Creek (Humboldt County)	Coastal streams; spawns in gravel riffles	NMFS[2]	**Low**: Smolts prefer deep water channels (NMFS 2014) and presence in Fisherman's Channel is unlikely. Adult spawning habitat is located in freshwater. Not likely to be present during project activities (July 1 to October 1). Designated critical habitat is present.
Amphibians					
Northern red-legged frog (*Rana aurora*)	–/SSC	From Mills Creek in Mendocino County to Oregon border	Humid forests, woodlands, grasslands, and streamsides usually near dense cover. Generally near permanent water, but can be found far from water in damp woods and meadows during non-breeding season.	CNDDB	**High**: Egg masses, juveniles, and adults have been documented on the Fields Landing site adjacent to the mitigation area in intermittent pond. However, this species would not utilize Fisherman's Channel inside the high tide line as habitat.
Pacific tailed frog (*Ascaphus truei*)	–/SSC	Coastal Mendocino County north to the Oregon border, with an isolated population in Shasta region	In and adjacent to cold, clear, moderate- to fast-flowing, perennial mountain streams in conifer forest	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 5 mi from the project area.
Foothill yellow-legged frog (*Rana boylii*)	–/SSC	From the Oregon border along the coast to the Transverse Ranges, and south along the western side of the Sierra Nevada Mountains to Kern County; a possible isolated population in Baja California	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 5 mi from the project area (CDFW 2015).

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Southern torrent salamander (*Rhyacotriton variegatus*)	–/SSC	Coastal drainages from near Point Arena in Mendocino County to the Oregon border	Coastal redwood, Douglas-fir, mixed conifer, montane riparian and montane hardwood-conifer habitats. Seeps and small streams in coastal redwood, Douglas-fir, mixed conifer, montane riparian, and montane hardwood-conifer habitats.	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 5 mi from the project area (CDFW 2015).
Reptiles					
Loggerhead turtle (*Caretta caretta*)	FT/–	Warm waters of the Pacific coast, primarily from the Channel Islands south; does not nest in California.	Uses the open ocean near-shore zone; nests on high energy, relatively narrow, steep coarse-grained beaches.	NMFS[2]	**None**: Habitat not suitable.
Green sea turtle *Chelonia mydas (incl. agassizi)*	FT/–	Warm waters of the Pacific coast, primarily from San Diego south. Uncommon along the California coast; does not nest in California.	Uses convergence zones in the open ocean and benthic feeding grounds in coastal areas; nests on sandy ocean beaches	NMFS[2]	**None**: Habitat not suitable.
Leatherback sea Turtle *Dermochelys coriacea*	FE/– Critical habitat	Temperate and cool waters of the Pacific coast; most sightings in California are from boats out at sea; have been observed in open ocean near San Diego, Santa Barbara, Ventura, San Mateo, and Santa Cruz counties; does not nest in California	Pelagic, though also forages near coastal waters	NMFS[2]	**None**: Habitat not suitable. Critical habitat is located in the Pacific Ocean outside of the Project Area.
Olive (=Pacific) ridley sea turtle *Lepidochelys olivacea*	FT/–	Warm waters of the Pacific coast, primarily from southern California south; does not nest in California	Well out to sea in pelagic zone as well as coastal areas, including bays and estuaries; nests on sandy ocean beaches	NMFS[2]	**None**: Habitat not suitable.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Western pond turtle (*Actinemys marmorata*)	–/SSC	From the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Ponds, marshes, rivers, streams, and irrigation ditches with abundant vegetation, and either rocky or muddy bottoms, in woodland forest and grasslands. Below 6,000 ft elevation. Basking sites are located on logs, rocks, cattail mats, and exposed banks and egg-laying sites are located on suitable upland habitats (grassy open fields) up to 1,640 ft from water. May enter brackish water or seawater.	CNDDB	**None**: Habitat not suitable as there are limited basking and upland egg laying sites. Closest documented location is greater than 4 mi from the project area.
Birds					
Short-tailed albatross (*Phoebastris albatrus*)	FE/SSC	Pacific Ocean (nests in Japan)	Feeds in north Pacific	USFWS	**None**: Habitat not suitable.
Marbled murrelet (*Brachyramphus marmoratus*)	FT/– critical habitat	Nesting marbled murrelets in California mostly concentrated on coastal waters near Del Norte and Humboldt counties, and in lesser numbers near San Mateo and Santa Cruz counties; winter throughout nesting range, and in small numbers in southern California.	Most time spent on the ocean; nests inland in old-growth conifers with suitable platforms, especially redwoods near coastal areas.	USFWS	**Low**: No suitable foraging or nesting habitat within the general project area; however, daily migration corridor is present in the area based on occurrences documenting multiple individuals flying out of the bay to the ocean (eBird 2007). Critical habitat located more than 6 mi from the project area.
Xantus's murrelet (*Synthliboramphus hypoleucus*)	FC/–	Range extends from Mexico, west coast United States and Canada. Nests in the Channel Islands in southern California and on islands off the coast of Baja California.	Most time spent on the ocean.	USFWS	**None**: No suitable nesting or foraging habitat in the project area.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Northern spotted owl (*Strix occidentalis caurina*)	ST/SCT, SSC critical habitat	Northwestern California south to Marin County, and southeast to the Pit River area of Shasta County	Usually found in mature and old-growth coniferous forest with dense multi-layered structure	USFWS	**None**: Habitat not suitable. Critical habitat located more than 16 mi from the project area.
Bald eagle (*Haliaeetus leucocephalus*)	–/SE	Permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses adjacent snags or other perches; nests and winter communal roosts in advanced-successional conifer forest within 1 mi of open water	CNDDB	**Moderate**: Foraging habitat present in Humboldt Bay. Closest documented nesting location is about 4 mi from project area (CDFW 2015).
Bank swallow (*Riparia riparia*)	–/ST	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam. Forages over lakes, ponds, rivers and streams.	CNDDB	**None**: Habitat not suitable. Closest location within CNDDB is greater than 5 mi from the project area (CDFW 2015).
Western snowy plover (*Charadrius alexandrinus nivosus*)	FT (Pacific coastal population) /– critical habitat	Nests in locations along the California coast, including the Eel River in Humboldt County; nests in the interior of the state in the Central Valley, Klamath Basin, Modoc Plateau, and Great Basin, Mojave, and Colorado deserts; winters primarily along coast	Barren to sparsely vegetated beaches, barrier beaches, salt-evaporation pond levees, and shores of alkali lakes; also nests on gravel bars in rivers with wide flood plains; needs sandy, gravelly, or friable soils for nesting	USFWS CNDDB	**Low**: No nesting or foraging habitat is present in the project area; however, nesting may occur on nearby sandy beaches. Critical habitat is located about 1 mi west of the project area on the South Spit (land south of the harbor entrance).

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
California clapper rail (*Rallus longirostris obsoletus*)	FE/SE	Predominantly in the marshes of the San Francisco estuary: South San Francisco Bay, North San Francisco Bay, San Pablo Bay, and sporadically throughout the Suisun Marsh area east to Browns Island	Salt and brackish water marshes, typically dominated by pickleweed (*Salicornia virginica*) and Pacific cordgrass (*Spartina foliosa*)	CNDDB	**None**: No habitat present and outside of current distribution. Last observed in 1932 on Indian Island in Humboldt Bay (CDFW 2015).
Western yellow-billed cuckoo (*Coccyzus americanus*)	FT/SE	Breeds in limited portions of the Sacramento River and the South Fork Kern River; small populations may nest in Butte, Yuba, Sutter, San Bernardino, Riverside, Inyo, Los Angeles, and Imperial counties	Valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation	USFWS CNDDB	**None**: No habitat present. Rare recent observations have documented an individual at the Eel River Estuary (T. Leskiw, USDA Forest Service [retired], pers. comm., 2012).
Tricolored blackbird (*Agelaius tricolor*)	–/SE	Permanent resident, but makes extensive migrations both in breeding season and winter; common locally throughout Central Valley and in coastal areas from Sonoma County south	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey	CNDDB	**Low**: May inhabit coastal scrub, but preferred habitat is in grasslands and agricultural fields. Largest population centers in central and southern California. Closest location within CNDDB is more than 5 mi south of the project area (CDFW 2015).
Mammals					
Sonoma tree vole *Arborimus pomo*	–/SSC	North Coast fog belt between the northern Oregon border and Sonoma County	Associated nearly exclusively with Douglas-fir trees and occasionally grand fir, hemlock, or spruce trees	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 5 mi from the project area.
Townsend's big-eared bat (*Corynorhinus townsendii*)	–/SCT, SSC	Throughout California, found in all but subalpine and alpine habitats, details of distribution not well known	Most abundant in mesic habitats; also found in oak woodlands, desert, vegetated drainages, caves or cave-like structures (including basal hollows in large trees, mines, tunnels, and buildings)	CNDDB	**Low**: May roost in relatively dark, semi-enclosed buildings, but are easy to detect. Have not been observed in Fisherman's Channel area. Closest documented location is greater than 5 mi from the project area (CDFW 2015).

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Pallid bat (*Antrozous pallidus*)	–/SSC	Throughout California except for elevations greater than 3,000 m (9,842 ft) in the Sierra Nevada	Roosts in rock crevices, tree hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open terrestrial habitats	CNDDB	**Low**: Daily migration habitat may be present in project area. Roosting and foraging habitat may be present in man-made structures and open terrestrial habitats. Have not been observed in Fisherman's Channel area. The most recent CNDDB occurrence is from 1924 and is greater than 10 mi from the project area; however, individuals have been readily documented in the redwood/coastal fog belt (W. Rainey, pers. comm., 2013).
Humboldt marten *Martes americana humboldtensis*	–/SSC	Coastal redwood zone from the Oregon border south to Fort Ross, Sonoma County	Mid- to advanced-successional stands of conifers with complex structure near the ground and dense canopy closure	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 10 mi from the project area.
Pacific fisher *Martes pennanti (pacifica)* West Coast DPS	FPT/SCT, SSC Proposed critical habitat	Northern Coast Range and Klamath Province, and the southern Sierra Nevada	Advanced successional conifer forests, with complex forest structure being more important than tree species; den in hollow trees and snags	CNDDB	**None**: Habitat not suitable. Closest documented location is greater than 12 mi from the project area.
Steller (northern) sea-lion *Eumetopias jubatus*	FT/– Critical habitat	Coastal waters of California	Colder waters; haul outs and rookeries usually consist of beaches, ledges, or rocky reefs	NMFS[2]	**None**: Habitat not suitable. Critical habitat located about 30 mi south of the project area at Sugarloaf Island, Cape Mendocino.
Sei whale *Balaenoptera borealis*	FE/–	Pacific Ocean	Deep ocean waters far from the coastline	NMFS[2]	**None**: Habitat not suitable.
Blue whale *Balaenoptera musculus*	FE/–	Pacific Ocean	Deep ocean offshore waters; also can be found in coastal waters	NMFS[2]	**None**: Habitat not suitable.
Fin whale *Balaenoptera physalus*	FE/–	Pacific Ocean	Deep ocean waters	NMFS[2]	**None**: Habitat not suitable.
Humpback whale *Megaptera novaengliae*	FE/–	Pacific Ocean	Deep ocean waters	NMFS[2]	**None**: Habitat not suitable.

Species name	Status[1] Federal/ State	Distribution	Habitat associations	Source	Likelihood of occurrence (none, low, moderate, high)
Sperm whale *Physeter macrocephalus*	FE/–	Pacific Ocean	Deep ocean waters	NMFS[2]	**None**: Habitat not suitable.
Killer whale (Southern Resident DPS) (*Orcinus orca*)	FE/– Critical habitat	Pacific Ocean	Coastal waters and bays	USFWS	**None**: Habitat not suitable within the project area. Low likelihood of foraging and migratory habitat within Humboldt Bay based on a single documented occurrence in the harbor entrance. Critical habitat in Washington; potential project impacts on fisheries (prey base) would not affect populations of salmonids within critical habitat.

[1] **Status: Federal** **State**
FE Endangered SE Endangered
FT ThreatenedST Threatened
FC Candidate SSC Considered a species of special concern by CDFW
– No federal status – No state status

[2] Species identified from the USFWS query, but is listed by NMFS.

3.2.3 Wetland delineation

A preliminary wetland delineation was conducted in the survey area on 10 February 2015. Several small emergent wetlands are located on the former sawmill site that is adjacent to the eelgrass mitigation area at Fields Landing. This area will be traversed by the dredge pipeline. Preliminary delineation results of potential jurisdictional waters and wetlands at Fisherman's Channel Dredging Area and Fields Landing Mitigation Area are summarized in Table 5 and mapped in Figures 13 and 14.

Table 5. Potential USACE jurisdictional waters and wetlands in the survey area.

Description	Acreage
Waters of the U.S.	
Fisherman's Channel	7.7
Residential Canals	5.7
Humboldt Bay	0.8
Wetlands of the U.S.	
Seasonally flooded palustrine persistent emergent wetlands	0.4

All of the waters of the U.S. in the survey area are also considered waters of the State and CCC jurisdictional wetlands (1976 California Coastal Act, Public Resources Code Section 30000 *et seq*.).

Figure 13. Potential jurisdictional waters and wetlands documented in the Fields Landing Mitigation Area. Wetlands outside the survey area were approximated from the National Wetland Inventory (NWI) (USFWS 2015b).

Figure 14. Potential jurisdictional waters and wetlands documented in the Fields Landing Mitigation Area, Pipeline Alignment, and White Slough Beneficial Reuse Area. Wetlands outside the survey area were approximated from the NWI (USFWS 2015b).

3.2.4 Eelgrass survey

Eelgrass is present in both Fisherman's Channel and Residential Canals (Figures 9 and 12). A total of 4.93 ac of eelgrass vegetated cover was mapped in Fisherman's Channel and Residential Canals A–D in 2011 (Stillwater Sciences 2012) and 2014 (Stillwater Sciences 2014) (Table 6). Eelgrass is present throughout much of Fisherman's Channel and Residential Canals A, B, and D. Eelgrass is absent from much of Residential Canal C and the center of Fisherman's Channel, presumably due to greater depth and disturbance from boat traffic. Eelgrass density in the survey area ranges from 69 to 110 turions (shoots) per square meter (Table 7).

Eelgrass is also present along the Humboldt Bay shoreline in the Fields Landing Mitigation Area and adjacent to the pipeline route. Surveys have not been conducted in this area to determine the extent of the eelgrass in these locations. Surveys will be conducted in the Fields Landing Mitigation Area during the eelgrass growing season prior to mitigation implementation to document eelgrass density and extent.

Table 6. Eelgrass vegetated cover in the project area.

Location	Eelgrass vegetated cover (ac)
Fisherman's Channel	3.03 ac
Residential Canal A	0.47 ac
Residential Canal B	0.40 ac
Residential Canal C	0.05 ac
Residential Canal D	0.98 ac
Total	**4.93 ac**

Table 7. Eelgrass densities in the project area.

Location	Number of sample points	Average eelgrass density (turions/m^2)	Standard deviation[1]
Fisherman's Channel	22	79	47
Residential Canal A	5	110	27
Residential Canal B	20	71	44
Residential Canal C	3	69	50
Residential Canal D	16	99	33

[1] Standard deviations were relatively high because midpoints of ranges were used when calculating averages.

4 IMPACT ASSESSMENT

Potential impacts of the Project on special-status species, sensitive and critical habitat, and other resources (e.g., EFH under the MSA, and birds protected under the MBTA) are included below. In addition, minimization measures are proposed to reduce the risk of impacts or identify needs for further agency consultation or permitting.

4.1 Wetlands and Waters

No wetlands would be affected by Project activities in Fisherman's Channel. Isolated seasonal wetlands are present at the Fields Landing eelgrass mitigation site. These wetlands may be affected during pipeline placement and eelgrass mitigation activities.

Approximately 13.4 ac of Waters of the U.S. in Fisherman's Channel and Residential Canals are likely to be temporarily impacted by Project activities due to impeded boat navigation during dredging operations.

4.1.1 Impact minimization measures

- Project activities will be conducted as rapidly as possible (10 days to two weeks) to reduce boat navigation delays in Fisherman's Channel.
- The wetlands will be identified and flagged by a qualified biologist to help avoid impacts from Project operations.
- Appropriate soil erosion and sediment controls will be used and maintained in effective operating condition on all exposed soil and excavated material at the Fields Landing mitigation area. In addition, any work below the high tide line, must be permanently stabilized at the earliest practicable date.

4.2 Eelgrass

Eelgrass is present and widely distributed 3.03 ac in Fisherman's Channel and will be affected by the Project (Figure 9). Approximately 1.2 ac of eelgrass are expected to be directly impacted by the Project. Another 0.37 ac in the 5-ft buffer surrounding the dredging footprint will be indirectly impacted by turbidity generated during dredging.

The mouth of Fisherman's Channel will be ultimately dredged down to -8 ft MLLW and be subject to relatively frequent (approximate 10-year intervals) dredging due to the relatively rapid siltation rate at this location. The -8 ft MLLW finished depth will allow for eelgrass recolonization once it has silted in by about one foot, but the channel maintenance return interval would result in its removal about once a decade.

The remaining portion of Fisherman's Channel will be dredged to -6 ft MLLW. This area experiences a relatively low rate of sedimentation and therefore will be dredged on a 25-plus-year rotation basis, which will allow for the full development of eelgrass function. The eelgrass in this area is expected to revegetate the -6 ft MLLW dredge footprint in two or three years. Revegetation is expected to be successful since the post-dredge water depth and substrate characteristics will be the same as in other locations immediately adjacent to the dredge footprint that currently contain a large amount of eelgrass.

No dredging will occur along the side slopes outside of the designated dredge footprint, which will provide a source for recolonization immediately adjacent to the dredged area. Impacts on eelgrass in the buffer area will be indirect and limited to turbidity and settling of suspended sediment, which will clear in a few tidal cycles. Therefore, no mitigation is proposed for the buffer area.

Eelgrass is present in the Fields Landing mitigation area, with a significant amount growing between pilings. There may be some temporary effect on eelgrass as the pilings are removed and sediment reoccupies the hole occupied by the wood. Eelgrass will not be affected by sediment beneficial reuse at White Slough.

4.2.1 Impact minimization measures

Implementing the following measures will minimize and mitigate the risk of impacts on eelgrass:

- The dredging elevation will not extend below -8 ft MLLW at the channel entrance, which will allow for eelgrass recolonization once it has silted in about one foot.
- The dredging elevation will not extend below -6 ft MLLW in the main portion of Fisherman's Channel, which will allow for eelgrass recolonization within two to three years from adjacent eelgrass beds.
- No dredging will occur in the 5-ft buffer area outside of the designated dredge footprint. Impacts on eelgrass in the buffer area will be limited to turbidity and settling of suspended sediment, which will clear in a few tidal cycles.
- Direct impacts on eelgrass will be mitigated at a 1.2:1 ratio and will be fully mitigated by the removal of approximately 500 dilapidated pilings and excavation of cobble/gravel fill on 1.44 ac in the bay at Fields Landing, which will expand eelgrass habitat and coverage.

4.3 Sensitive Natural Communities

Northern coastal salt marsh is located at or near the high tide line along the margins of Fisherman's Channel and along Fields Landing Mitigation Area. It is unlikely that dredging activities will affect this vegetation community within the Fisherman's Channel Dredging Area. There may be potential temporary impacts on northern coastal salt marsh along the Humboldt Bay shoreline in the Fields Landing Mitigation Area.

Sitka spruce forest was documented in the upland portions of levees along Fisherman's Channel. Consequently, no project impacts on this community are anticipated.

4.3.1 Impact minimization measures

Northern coastal salt marsh and Sitka spruce forest are outside of the dredging footprint in the Fisherman's Channel Dredging Area, and therefore no mitigation is necessary at this location. In the unlikely event that areas of northern coastal salt marsh or Sitka spruce forest cannot be avoided, minimization and mitigation actions will be discussed in coordination with appropriate agencies.

4.4 Special-status Plants

Point Reyes bird's-beak and sea-watch were documented in or adjacent to the Fisherman's Channel Dredging Area. The Point Reyes bird's-beak population is located outside of the Fisherman's Channel Dredging Area and no impacts on this population are anticipated from project activities. Sea-watch populations were located throughout the upland coastal scrub vegetation along a levee berm within the Fisherman's Channel Dredging Area and along the southern-most shore of the Fields Landing Mitigation Area. Dredging within Fisherman's Channel will not affect special-status plant populations. The majority of the Fields Landing sea-watch populations are located outside of the eelgrass mitigation area.

4.4.1 Impact minimization measures

The measure described below would minimize impacts from the Project on special-status plant species.

- Special-status plants will marked for avoidance by a qualified biological monitor and avoided to the greatest extent practicable during project activities.

4.5 Fish

The Project includes a number of activities that may affect special-status fish species and designated critical habitat. These include pipeline installation, dredging operation, sediment disposal and reuse, and eelgrass restoration.

Project-related effects on special-status species may occur from:

- Potential entrainment into dredge equipment,
- Noise generated by the dredge equipment, and
- Suspended sediment generated by dredging, dredge spoils disposal for beneficial reuse, and eelgrass mitigation.

Project-related effects on designated critical habitat may occur from:

- Anchor placement for pipeline stability,
- Dredging operation,
- Suspended sediment generated by dredging and dredge spoils disposal for beneficial reuse, and
- Eelgrass mitigation.

It is expected that the dredging activity will result in a temporary loss of critical habitat. The Project's Biological Assessment (Stillwater Sciences 2016b) includes a detailed assessment of project effects on critical habitat. The USACE and NMFS ESA Section 7 consultations will also include an assessment of project-related impacts on critical habitat. This assessment will be included in NMFS' Biological Opinion for the project.

It is expected that the dredging activity will result in a temporary loss of EFH. This temporary loss is due to dredging affecting nursery and foraging habitat for commercial fish species. The Project's Biological Assessment (Stillwater Sciences 2016b) includes a detailed assessment of Project effects on MSA species and their EFH. MSA consultation between the USACE and NMFS will be conducted concurrently with the ESA Section 7 consultation for ESA-listed species. NMFS' Biological Opinion will include an assessment of project-related impacts on MSA species and their EFH.

4.5.1 Entrainment in dredge

Entrainment is the direct uptake of aquatic organisms by the suction field generated by hydraulic dredges (Reine and Clarke 1998). Entrainment occurs when an organism is trapped in the uptake of sediments and water being removed by dredging machinery (Reine and Clarke 1998). The potential for a fish to become entrained in a cutterhead dredge is a function of its proximity to the cutterhead, suction intake velocities, a fish's swim speed, and its ability to avoid disturbances.

Intake water velocities for seven differently-sized cutterhead dredge suction pipes ranging from 12 to 36 inches in diameter were studied by Clausner (2005). The dredge that will be used for the Project has a 12-in suction pipe and has a pumping rate of 15–20 ft/s (CCC 2005). The report found that 12-in suction pipes generated the lowest water velocities with an intake velocity of about 0.75 ft/s at 1.6 ft from the cutterhead to 0.16 ft/s at 3.3 ft from the cutterhead, respectively (Figure 15).

The Biological Assessment (Stillwater Sciences 2016b) and CDFW ITP (Stillwater Sciences 2016c) application provide detailed assessments of entrainment risk for listed species.

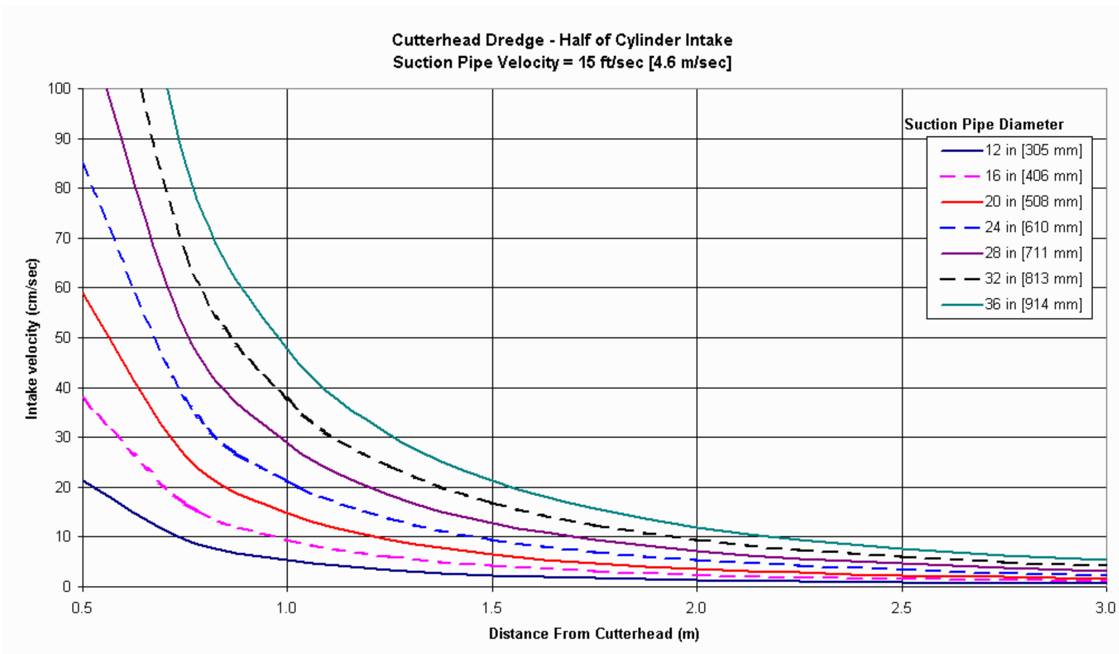

Figure 15. Cutterhead suction pipe approach velocities (Clausner 2005).

4.5.1.1 Green sturgeon

A study conducted by Kelly and Klimley (2011) reported green sturgeon swimming as rapidly as 2.1 m/s (7 ft/s) with a mean swimming speed of about 0.5–0.6 m/s (1.6–2.0 ft/s). The green sturgeon swim speeds reported above are well in excess of the cutterhead suction velocities associated with the dredge that will be used for the Project. It is expected that, given disturbance associated with dredging, any green sturgeon that may be in close proximity would easily be able to avoid the cutterhead.

4.5.1.2 Longfin smelt

No data were found regarding longfin smelt swim velocities. However, the EDRC (2013) used swim speed data developed by Sprengel and Luchtenberg (1991) for European smelt (*Osmerus eperlanus*) as a surrogate for longfin smelt. Swim speeds for the European smelt were conservatively estimated to be between 25 and 40 cm/s (ERDC 2013). Given that a 12-in cutterhead suction pipe has an intake velocity of about 20 cm/sec at 0.5 m (1.6 ft) from the opening, a smelt would need to be closer than 0.5 m (1.6 ft) from the cutterhead, ignore the high suspended sediment concentration in the immediate vicinity, and not be disturbed by the action of the cutterhead in order to be entrained. In addition, longfin smelt larvae and adults would not be present in the area during the late summer and fall when operations would occur. Juvenile longfin smelt would have a relatively low likelihood of presence during operations. Juvenile longfin smelt would also be able to avoid becoming entrained in the dredge because they could outswim the suction approach velocities and would likely leave the area of disturbance.

A take estimate for longfin smelt was developed by using two different methods. Both methods utilize the entrainment rates and take estimates contained in Gold et al. (2011) and ERDC (2013) that were based on hopper dredging, which has a significantly higher entrainment rate than the cutterhead dredge used for the Project. These take estimates were then compared with cutterhead dredge monitoring data (SCWA 2007, 2008, and 2009; Swedberg and Zentner 2009) collected in the San Francisco Bay region. The potential take of longfin smelt was conservatively estimated to be between less than one fish for the Project.

4.5.1.3 Salmonids

Coho salmon smolts have a swimming speed ranging from 3.5 to 5.5 body lengths per second (Glova and McInerney 1977). Assuming that a smolt's body length is 11 cm (4.3 in), then swim speed ranges from 38 to 60 cm/s. The fish would need to be nearly on top of the cutterhead to be entrained in the system. The life history patterns of salmon and steelhead indicate that they would not be present in the Project area during dredging operations that occur sometime for a brief period between July and October. Therefore, no take of salmonids is expected.

4.5.2 Noise exposure

A hydraulic cutterhead dredge can produce continuous noise in the range of 150–170 decibels (dB) when measured 32 ft from the cutterhead (CDWR 2013), with noise levels varying with dredge size and sediment type. This is comparable to underwater noise levels of 160–180 dB root mean square (rms) produced by small boats and ships (MALSF 2009).

Acoustic monitoring was conducted in the Stockton Ship Canal by Reine and Dickerson (2014) in November 2012 during dredging that used a cutterhead suction dredge with an 18-in diameter pipeline and 1,000-hp diesel engine. Sound recordings were made to a distance of nearly 1,640 ft astern of the dredge. Sound pressure levels (SPL) reached a maximum 148.3 dB rms at 275 ft (total distance to cutterhead = 385 ft) astern of the dredge. The actual distance to the cutterhead assembly was not crucial since most of the sound generated by the study dredge was associated with generator noise (generators were centrally located on the dredge plant), and not from the sediment excavation process (i.e., the rotation of the cutterhead in the soft silty sediment). Out of 5,000 discrete SPLs recorded, a total of nine exceeded 140 dB rms (Reine and Dickerson 2014). The majority of SPLs averaged 130 dB+3dB rms over distances of less than 328 ft astern of the dredge.

Studies on the effects of noise on anadromous Pacific coast fishes are primarily related to pile-driving activities. The interagency Fisheries Hydraulic Working Group has established interim criteria for noise impacts from pile driving on fishes (FHWG 2008). A peak SPL of 206 dB is considered injurious to fishes. Accumulated SPLs of 187 dB for fishes that are greater than 2 grams, and 183 dB for fishes below that weight, are considered to cause temporary shifts in hearing, resulting in temporarily decreased fitness (i.e., reduced foraging success, reduced ability to detect and avoid predators).

The 18-in dredge used in the Reine and Dickerson (2014) study was 6 inches in diameter larger than what will be used for the Project. In addition, the dredge that will be used for the Project will be powered by a brand-new 750-hp diesel engine, which is smaller than the one studied by Reine and Dickerson (2014). Therefore, it can be expected that the noise generated by the Project's dredge will be quieter than that monitored by Reine and Dickerson (2014), which did not exceed the FHWG (2009) threshold. Given that noise generated by the Project's dredge will likely be less than that monitored by Reine and Dickerson (2014), noise-related impacts on special-status fish species are also likely to be less.

4.5.3 Suspended sediment

Elevated suspended sediment concentrations (SSCs) in Humboldt Bay are a relatively frequent occurrence. SSC levels can naturally increase due to wave action on shallow mudflats, storm runoff being delivered from local tributaries, and turbid water from the Eel River entering on incoming tides. It is common for SSC in Humboldt Bay to range from 40 to 100 mg/L or more during the year (Swanson et al. 2012). Spikes in turbidity usually begin to occur in September or October with the onset of the wet season and peak between December and February (Swanson et al. 2012). However, higher peaks of turbidity in the nearshore, ranging from 50 to 250 NTU, have been generated during precipitation-related events between March and May (USACE 2012).

The disturbance of the channel bottom by the dredge equipment will result in the resuspension of sediment into the water column. Spillage from a cutter suction dredging operation occurs when material that is excavated from the cutter is not sucked up into the suction line. This material is also known as a "residual" and can either settle to the bottom or become re-suspended sediment (RSS) in the water column causing cloudiness or "turbidity" (Hendriksen 2009).

The suspended sediment resulting from dredging and the placement of dredged material may affect marine organisms and aquatic wildlife during various life stages by affecting respiration (clogging gills); reducing visibility and the ability to forage or avoid predators; and altering movement patterns (due to avoidance of turbid waters). Suspended sediments have been shown to affect fish behavior, including avoidance responses, territoriality, feeding, and homing behavior. Wilber and Clarke (2001, as cited in USACE and RWQCB 2014) found that suspended sediments result in cough reflexes, changes in swimming activity, and gill flaring. Generally, bottom-dwelling fish species are the most tolerant of suspended solids, and filter feeders are the most sensitive (USACE and RWQCB 2014).

Harbor dredging was conducted by the *Nehalem* (same cutterhead dredge that will be used for this Project) at Woodley Island Marina, Small Boat Basin, and the Fishermen's Terminal between November 2006 and March 2007. Approximately 120,000 yd^3 of sediment were removed during the project. Sediment at the 2006/2007 dredge sites was composed of approximately 15% sand, 45% silt, and 40% clays (CCC 2005). In accordance with the "Reasonable and Prudent Measures" (RPM) section of the Section 7 Consultation and Final Biological Opinion (File No. 151422SWR2004AR9177) issued by the NMFS Southwest Region for the project on December 6, 2005, the applicants were required to ensure that the plume of suspended sediment generated by dredging with concentrations greater than 200 mg/L be confined to a 1,000-ft-by-1,500-ft area in the immediate vicinity of the dredge, and the duration not exceed 3.5 days. Suspended sediment monitoring was conducted during the dredging operation to comply with the RPM. A total of 215 water samples were collected between 500 and 2,000 feet from the dredge during operations (Pacific Affiliates 2007). Reported SSCs ranged from 10 to 48 mg/L prior to dredging, 20 to 74 mg/L during dredging, 13 to 58 mg/L 24 hours following dredging, 18 to 100 mg/L three days following dredging, and 28 to 60 mg/L four days after dredging (Pacific Affiliates 2007).

However, many of the samples were collected following rainfall runoff events, which resulted in relatively high background turbidity from tributary stream runoff and elevated the reported SSCs.

The sediment composition found in Fisherman's Channel has a high silt and clay component, similar to that at the 2006/2007 dredge sites. However, the amount of sediment that will be removed from Fisherman's Channel during Project operations (4,150 yd^3) is only 3.5 percent of what was removed during 2006/2007 operations. Therefore, although the short-term local concentration of suspended sediments produced during the Project may be similar to what was reported by Pacific Affiliates (2007), the duration of exposure will likely be significantly less, which will reduce the level of impact.

There is also the potential that suspended sediment in water draining from the White Slough Unit beneficial reuse area could affect ESA-listed estuarine species. As stated in Section 2.4, the sediment reuse containment area will be properly sized to contain both the volume of dredged sediment and water transported in the pipeline. Water draining from the dredged material will flow south through a 4-ft high porous containment infiltration berm. Once through the berm, the water will then be filtered through a series of six silt fences and vegetation before it flows through a tidegate into the bay. Turbidity will be monitored periodically throughout implementation to ensure sufficient sediment removal. If necessary, additional silt fences may be installed. Impacts on ESA-listed fish species are not expected to occur from sediment reuse.

4.5.4 Exposure to chemical contaminants

There is potential that the suspended sediment generated during dredging could contain chemical contaminants that are currently locked up in the undisturbed sediments. The sediment sample analysis (GHD 2015) reported that arsenic and several polycyclic aromatic hydrocarbons (PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k)flouranthene, chrysene, and dibenz(a,h)anthracene]) exceeded the NCRWQCB Water Quality Objectives (WQOs) for Bays and Estuaries. However, these constituents did not exceed the SQuiRTS screening levels, indicating low potential for effects on aquatic species from chronic exposure. No WQOs or SQuiRTS screening levels have been established for cobalt and vanadium, which were detected in the samples and exceeded the Residential RSLs. The benthic analysis of the sediment samples indicates that Fisherman's Channel sediments are not acutely toxic to amphipods or polychaetes (GHD 2015). Exceedances are generally associated with chronic exposure thresholds, rather than short-term exposure associated with re-suspension of marine sediments during dredging. Given the generally low concentrations and short duration of dredging operations, re-suspension of sediment in Fisherman's Channel poses a little risk for toxicity to, or bioaccumulation of chemical contaminants in, special-status species.

Dredging would remove sediment, thereby diminishing the total amount of chemical contaminants present in the system and decreasing the long-term potential for chronic exposure and bioaccumulation effects on marine species. In addition, tidal flushing of Fisherman's Channel area would further reduce bioaccumulation potential through dilution and transport out of the project area. Therefore, dredging activities would be unlikely to result in significant adverse effects to fish due to contaminant exposure.

4.5.4.1 Impact minimization measures

Implementing the following measures will minimize the risk of impacts on special-status fish species, if present nearby:

- The in-water work portion of the Project will be limited to between July 1 and October 1 when no salmonids are expected to be present within Fisherman's Channel, thereby avoiding impacts on these species.
- The Harbor District will implement a hydrocarbon spill prevention and clean-up plan to minimize the potential for project-related hydrocarbon contamination of bay waters. The dredge and support facilities will contain spill kits.
- Dredge pump will be primed close to the bottom of the channel to reduce potential for longfin smelt entrainment.
- BMPs (a berm and silt fences) will be constructed/deployed in the White Slough Unit beneficial reuse area to contain and filter turbid water that may eventually be delivered to the bay during dredge spoils dewatering.

4.6 Amphibians

Northern red-legged frogs are seasonally present at the Fields Landing eelgrass mitigation site. Suitable habitat in the form of temporary shallow puddles is present on the former sawmill site at Fields Landing and adjacent to the area where the pilings will be removed as part of the eelgrass mitigation plan. Work associated with the eelgrass mitigation plan will be implemented from July 1 to October 1, which is outside of the breeding through metamorphosis period for this species. In addition, the shallow puddles on the Fields Landing site would typically be dry by the late summer/early fall period, which significantly reduces the site's habitat value for red-legged frogs.

4.6.1 Impact minimization measures

- The wetlands will be identified and flagged by a qualified biologist for avoidance.
- Any frogs observed on-site will be captured by a qualified biological monitor and relocated into suitable wetland habitat along the east side of the Fields Landing property.

4.7 Birds

A number of bird species have the potential to be in the Fisherman's Channel area and may experience impacts during the project activities from noise disturbance, removal of foraging habitat (e.g., eelgrass and low-elevation mudflat), re-suspension of contaminants within the sediment, and accidental release of toxic substances (e.g., gasoline, lubricants) from construction equipment during in-water dredging activity. Noise from construction equipment will likely displace individuals that are foraging and loafing (resting) within the channel; however, these impacts would be considered temporary. Loss of eelgrass (as discussed in Section 4.2) and low-elevation mudflats, which provide foraging opportunities in the channel, is anticipated; however, this type of habitat is available in many areas of Humboldt Bay.

Re-suspension of contaminants from dredging activities, as discussed in detail in Sections 3.2.1 and 4.5.4, will not result in significant adverse effects on marine biota, including benthic macroinvertebrates and fish, or birds that consume them. The sediment currently contains a few constituents that exceed threshold values associated with chronic exposure and/or freshwater bioaccumulation. Dredging would remove this sediment, thereby diminishing the total amount of contaminants present in the ecosystem and decreasing the long-term potential for chronic exposure and bioaccumulation effects on marine species.

BMPs would minimize impacts from toxic substances used or released during dredging activities as a result of spills or leakage from machinery during near or in-water construction activities.

Impacts on special-status species, critical habitat, and species protected under the MBTA are discussed further below.

Marbled murrelets. Although marbled murrelets may fly over Fisherman's Channel and surrounding areas, no impacts are anticipated to occur. Marbled murrelets may fly over the project area at twilight and just before dawn as they migrate from their nest location to forage in the bay and open ocean. It is anticipated that night-time work will not occur and no night-time lighting will be required. No impacts are anticipated on marbled murrelet critical habitat, which is located 6 mi from the project.

Bald eagles. Bald eagles could potentially forage adjacent to Fisherman's Channel, Fields Landing mitigation site, or White Slough Unit reuse area. Project-generated noise disturbance may result in short-term temporary displacement during foraging activities to nearby habitat of Humboldt Bay. Ambient noise at Fisherman's Channel is relatively low to moderate due to existing housing complexes, operating boat docks, and the nearby power plant; construction noise is anticipated to be above ambient with the use of dredging equipment (e.g., support boat, dredge, and booster pumps). As identified in the National Bald Eagle Management Guidelines (USFWS 2007), the type of construction activities proposed for similar projects would result in a maximum disturbance buffer of 600 ft to 0.5 mi. There are no trees suitable for nesting within at least 0.6 mi of the Project Area and therefore there would be no impact on nesting habitat.

Western snowy plover. Western snowy plover habitat is not present in Fisherman's Channel, Fields Landing mitigation area, or White Slough. However, it is possible that individuals could be present nearby, and critical habitat is located along the ocean-side of the south spit, about 1 mi from Fisherman's Channel. Plovers are highly mobile and would leave the area of disturbance. No impacts on individuals or their designated critical habitat of this species are anticipated.

Migratory birds. A number of birds protected by the MBTA have been documented within the area, such as great egret, snowy egret, great blue heron, black-crowned night heron, Cooper's hawk, double-crested cormorant, osprey, sharp-shinned hawk, and bald eagle (CDFW 2015). Species protected under the MBTA may be present foraging and loafing in the waterway or on exposed tidal mudflats, nesting in nearby bushes, trees, or manmade structures (houses, docks), and flying over the channel during daily and seasonal migrations. Night-time work is not planned. Noise (e.g., from dredging equipment) has the potential to cause short-term disturbance of nesting birds. However, because of the ambient noise due to presence of the residential housing, operating boat docks, and the nearby PG&E power plant, it is unlikely that an increase in construction noise would be significant enough to result in nest abandonment, as birds in the area are already habituated to noise. No nesting habitat (e.g., shrubs, structures) will be removed within the Fisherman's Channel Dredging Area and therefore no direct mortality of young or nest disturbance would occur from the dredging activities.

The dredge slurry pipeline will run from the Fields Landing area along the railroad right-of-way to White Slough. The pipeline will be placed between or immediately adjacent to the rails. Some vegetation clearing along the railroad right-of-way will likely be necessary to allow for pipeline placement and monitoring. The vegetation clearing would occur during the bird nesting season and could affect nests or young.

4.7.1 Impact minimization measure

- BMPs will be implemented to minimize impacts from toxic resulting from spills or leakage from machinery during near or in-water construction activities.

- Bird nesting surveys will be conducted for any activities (e.g., vegetation removal along pipeline route) that may disturb nests during the breeding season.

4.8 Mammals

No impacts on marine mammals or critical habitat are anticipated. Re-suspension of contaminants from dredging activities, as discussed in Section 3.2.1, will not result in significant adverse effects on marine biota, including benthic macroinvertebrates and fish, or mammals that consume them. The Project activities are not expected to impact fish (the prey base for marine mammals) to the extent that it would measurably affect populations of salmonids within designated off-site critical habitat. The risk of impacts from Project activities on marine mammals is considered non-existent to low, and thus no minimization measures are proposed.

Pallid and Townsend's big-eared bat migration habitat may be present over Fisherman's Channel and foraging habitat may be present in the upland staging area. Night-time work is not planned to occur, so lighting disturbance is not expected. Individuals foraging within the existing staging area may temporarily forage in nearby upland habitat. Roosting habitat is present in nearby man-made structures (e.g., houses); however, these structures will not be removed and therefore no direct effects would occur. The risk of impacts from Project activities on bats is considered non-existent to low, and thus no minimization measures are proposed.

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Appendix A

Eelgrass Mitigation Plan for the King Salmon Fisherman's Channel Dredging Project

JANUARY 2016 DRAFT

Eelgrass Mitigation Plan for the Fisherman's Channel Dredging Project

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Cover photos: Photos taken by Stillwater Sciences 2014–2015. Eelgrass at mouth of Fisherman's Channel (top left), Fields Landing Mitigation area (top right, bottom right, and bottom left).

Table of Contents

Tables

Figures

1 INTRODUCTION AND BACKGROUND

1.1 Project Description

The Humboldt Bay Harbor, Recreation, and Conservation District (Harbor District) is proposing to conduct maintenance dredging of Fisherman's Channel as part of a beneficial reuse dredging pilot project (Project) to facilitate improved navigation in the channel via dredging and subsequent beneficial reuse of the dredged sediments for salt marsh restoration at the White Sough Unit of the Humboldt Bay National Wildlife Refuge (Refuge). Fisherman's Channel is located in King Salmon, California, approximately 2.5 miles south of the City of Eureka along Humboldt Bay (Figure 1). Currently, Fisherman's Channel is inaccessible to larger vessels at a lower low tide due to a bar that has formed at the channel entrance. Dredging of the mouth of Fisherman's Channel and main channel is proposed to take place in summer or fall 2016. The areas to be dredged are shown in Figure 2. Dredging activities for the King Salmon residential canals that connect with the Fisherman's Channel are not part of this Project because the feasibility, funding, and timeline for dredging those canals are unknown at this time.

The Project objectives are described in the project description of the California Environmental Quality Act (CEQA) Initial Study and summarized below:

- Dredge the channel in the Fisherman's Channel to restore safe and consistent boat navigation at all tidal heights
- Provide dredged material to the White Sough Unit of the Refuge for beneficial reuse by the United States Fish and Wildlife Service (USFWS) for salt marsh restoration
- Carry out the Project to provide agencies with operations data that will facilitate future dredge and beneficial reuse design, permitting, and implementation elsewhere in Humboldt Bay
- Conduct water quality monitoring that will guide future dredging operations elsewhere within Humboldt Bay
- Implement and monitor success of eelgrass (*Zostera marina*) and longfin smelt (*Spirinchus thaleichthys*) mitigation
- Establish an acceptable standard protocol for sediment sampling methods and analysis for future dredging to focus on Constituents of Concern (COC) and possibly reduce redundancy in the sampling suite
- Provide Harbor District staff with dredging and beneficial reuse experience, particularly to address boat navigation, habitat restoration, and sea level rise issues within Humboldt Bay
- Inform a Humboldt Bay Sediment Master Plan

Portions of this Project have the potential to impact eelgrass and longfin smelt, requiring mitigation. The very low risk of take of longfin smelt associated with the Project will be fully mitigated through implementation of this eelgrass mitigation plan. The purpose of this mitigation and monitoring plan is to identify the amount of eelgrass habitat that requires mitigation, identify the location for completing the mitigation requirement, outline mitigation conceptual design and implementation steps, define performance criteria, describe the monitoring and reporting protocols, and describe the maintenance and remedial action plans.

Figure 1. Project area.

Figure 2. Fisherman's Channel Dredging Area.

1.2 Impacts on Existing Eelgrass Beds

Eelgrass is present and widely distributed in Fisherman's Channel and will be affected by dredging activities. There are a total of 3.03 acres (ac) of eelgrass in the main portion of the Fisherman's Channel and an additional 1.9 ac in the Residential Canals (Stillwater Sciences 2012).

The Project has been modified from the original design to substantially reduce the amount of eelgrass impacted. The dredging footprint was greatly reduced within the entire main channel to include only those specific locations where sediment accumulations are posing a navigation hazard. In addition, the dredging depth was decreased in most of the channel to allow for eelgrass to recolonize the channel following dredging. This change in dredging depth and width has resulted in a reduction of the eelgrass impact area from 2.8 ac to 1.2 ac.

The entrance of Fisherman's Channel will be dredged to a depth of -8 ft mean lower low water (MLLW) and will experience relatively frequent maintenance dredging (i.e., every 10 years) in the future to maintain boat access into Fisherman's Channel during low tides (Figure 2). The remainder of the dredging area farther up the channel will be dredged to a depth of -6 ft MLLW and is not expected to be subject to dredging more frequently than every 25 years.

A total of 1.2 ac of eelgrass will be directly affected by dredging activities; 0.23 ac in the entrance of the channel and 0.97 ac farther up the channel (Figure 3). An additional 0.37 ac of eelgrass, located within a 5-ft buffer surrounding the dredging footprint, may be indirectly impacted by increased turbidity during dredging activities, but the impact is expected to be minimal and temporary. This area is not included in the 1.2 ac of eelgrass that will be impacted by dredging.

All of the direct and indirect impacts on the eelgrass in Fisherman's Channel are considered to be temporary. Eelgrass is abundant in the channel at elevations of -7 ft MLLW and higher. The -8 ft MLLW dredging depth at the channel entrance will allow eelgrass to grow back once the channel has silted in about one foot (i.e., to -7 ft MLLW). The remainder of Fisherman's Channel, which will be dredged to -6 ft MLLW, will recolonize rapidly due to the large amount of eelgrass outside the dredging footprint and in the adjacent residential canals. No dredging will occur along the side slopes outside of the designated dredge footprint, which will provide a source for recolonization immediately adjacent to the dredged area.

Figure 3. Existing eelgrass coverage in Fisherman's Channel overlaid with dredging footprint and eelgrass impact interval.

1.3 Regulatory Setting and Compliance Requirements

Authorization to dredge and subsequently place dredged material in upland sites for beneficial reuse is provided through a variety of federal and state permitting processes. Humboldt Bay, along with its tributary rivers, streams, adjacent wetlands, and the Pacific Ocean out to the 3-mile limit, are "waters of the United States" pursuant to the Clean Water Act (CWA) Section 404 jurisdiction. The United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA) and the North Coast Regional Water Quality Control Board (NCRWQCB) regulate placement of dredged material in Humboldt Bay. The USACE implements Section 10 of the Rivers and Harbors Act and Section 404 of the CWA, and the USEPA has oversight authority. Under CWA Section 401, the NCRWQCB must certify that beneficial reuse of the dredged material will not violate state water quality standards and other applicable requirements.

The Project requires a permit under Section 10 of the Rivers and Harbors Act from the USACE, Section 401 Water Quality Certification from the NCRWQCB, a Coastal Development Permit (CDP) from the North Coast Division of the California Coastal Commission (CCC), a development permit from the Harbor District, an California Endangered Species Act (CESA) Incidental Take Permit (ITP) from the California Department of Fish and Wildlife (CDFW), and a Conditional Use Permit from the County of Humboldt. The Project is also subject to review under CEQA, the National Environmental Policy Act (NEPA), and regulation under the state and federal Endangered Species Acts. The Harbor District will act as lead agency for CEQA and the USACE is lead agency for NEPA.

In addition to those listed above, the following agencies may have permit authority and/or will be consulted:

- US Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)
- Humboldt Bay National Wildlife Refuge
- North Coast Railroad Authority

Permit applications will be filed in January 2016 and all necessary permits and approvals obtained prior to July 31, 2016.

1.4 Proposed mitigation ratios

As described above, all impacts to eelgrass will be temporary. The eelgrass restoration project (described below) is expected to be very successful because it involves creating eelgrass habitat adjacent to an existing eelgrass bed rather than transplanting eelgrass into potentially unsuitable habitat. Direct impacts on eelgrass (1.2 ac) will be mitigated at a 1.2:1 ratio, which will require 1.44 ac of mitigation area. The 1.2:1 ratio is warranted because (1) the eelgrass impacts are temporary, (2) the eelgrass mitigation is permanent, and (3) eelgrass mitigation has a high likelihood of success. All direct impacts on eelgrass will be mitigated for with permanent conservation of eelgrass habitat at the Fields Landing mitigation area. This, combined with the regrowth of eelgrass in Fisherman's Channel, will result in a net increase of eelgrass in south Humboldt Bay. Eelgrass restoration will occur during the same season as the dredging.

1.5 Mitigation Approach

Impacts on the eelgrass habitat affected by Project activities will be mitigated for by removing approximately 500 dilapidated pilings, excavating remnant gravel/cobble fill that currently limits eelgrass growth, and lowering shoreline elevations, to create a total of 1.44 ac of suitable eelgrass habitat at the Harbor District's Fields Landing Boat Yard property (Figure 4). The newly created eelgrass habitat is expected to be rapidly colonized by adjacent eelgrass, but will also be seeded to further ensure success. Appropriately, the mitigation site is only one mile from the dredging site.

The proposed eelgrass mitigation is intended, in part, to increase the quality and quantity of rearing habitat for listed estuarine species, including longfin smelt. The proposed habitat improvements would result in higher quality rearing conditions, greater amount of cover from predators, and ultimately increased survival rates over the current condition. Increased survival rates will help with the recovery of populations of longfin smelt and anadromous salmonids. The increased habitat area and survival rates will fully mitigate for the very low risk of take of longfin smelt associated with the Project.

Figure 4. Fields Landing mitigation area.

The Harbor District will be responsible for implementing this mitigation plan including the monitoring and reporting program, maintenance during the monitoring period, and any remedial action(s) determined necessary to achieve performance criteria.

1.6 Sea Level Rise

The Humboldt Bay area is and will continue to be affected by sea level rise. The CCC has taken steps to incorporate considerations of sea level rise into its CDP process and has recently issued guidance on doing so (CCC 2013). In California north of Cape Mendocino, the rate of sea level rise over the next 100 years is expected to range from 10 to 143 cm (0.3 to 4.69 feet [ft]) (National Research Council 2012). Locally in the Humboldt Bay/Eel River estuary area, however, subsidence counteracts the effects of tectonic uplift that are occurring elsewhere north of Cape Mendocino. The CCC's guidance document recommends replacing the estimates of tectonic uplift that apply in this region with a local sea level rise factor for the Humboldt Bay area of 4.14 mm/year.

The CCC draft sea level rise policy guidance document (CCC 2013) was used to estimate the amount of sea level rise that may occur in the Project area so that the effects could be evaluated for the proposed mitigation areas. The projected sea level rise in Humboldt Bay by 2030 and 2050 was calculated using the sea level rise rates and formulas in the guidance document (CCC 2013) for north of Cape Mendocino and then adjusting for Humboldt Bay subsidence per CCC (2013) by subtracting the North of Cape Mendocino factor and then adding the Humboldt Bay subsidence-per-year factor times the number of years (Table 1). The eelgrass mitigation area has been designed with sea level rise in mind and is expected to be able to withstand the predicted changes. The impact of sea level rise on the eelgrass mitigation area is described in Section 2.3.4 below.

Table 1. Projected sea level rise[1] in Humboldt Bay, per CCC (2013)

Projection	2030		2050	
	cm	in	cm	in
Low range	5.6	2.2	12.7	5.0
Projected	9.9	3.9	21.8	8.6
High range[2]	31.8	12.5	63.0	24.8

[1] Adjusted for Humboldt Bay subsidence per CCC (2013) by subtracting the North of Cape Mendocino factor and then adding the Humboldt Bay subsidence-per-year factor times the number of years.

[2] The high range was used for evaluating the impact of sea level rise on the mitigation area.

2 PROPOSED EELGRASS MITIGATION

The Harbor District will mitigate for direct impacts on eelgrass by removing approximately 500 dilapidated pilings and excavating approximately 4,600 yd^3 of gravel/cobble fill in a 1.44-ac area in the vicinity of the Fields Landing Boat Yard (Figure 4). The pilings and gravel/cobble fill on the site limit the available growing space for eelgrass; the pilings also limit sunlight to the eelgrass that is currently growing at the edge of the mitigation area (Figure 5). Removing the closely-spaced pilings and gravel/cobble fill will increase the available habitat for eelgrass and improve growing conditions for the existing eelgrass. Removing the pilings, which are likely treated with creosote, will also remove a source of potential water quality contamination from Humboldt Bay.

Figure 5. Remnant pilings and gravel/cobble fill in the mitigation area.

2.1 Existing Ecological Conditions

The eelgrass mitigation area is the site of a former dock that was part of a saw mill located on the Harbor District's Fields Landing property. The saw mill and most of the top deck of the dock have been removed, leaving the pilings in the bay and approximately 2–3 ft of gravel/cobble fill on top of the native clay soil layer. Wave action has caused erosion of the bank and redistributed some of the gravel/cobble fill from the adjacent road prism onto the bay substrate (Figure 6). Eelgrass is present in the deeper portions of the mitigation area along the outer edge of the pilings. The exact extent of the current eelgrass population is unknown; surveys will be conducted during the eelgrass growing season within 30 days of the start of excavation to determine the size of the existing eelgrass bed.

Figure 6. Eroding shoreline, remnant pilings, and gravel/cobble fill in the mitigation area.

2.2 Mitigation Implementation

2.2.1 Piling removal

The Harbor District will follow the U.S. Environmental Protection Agency (USEPA) best management practices (BMPs) for piling removal and disposal (USEPA 2007). This entails using a vibratory pile driver hammer to remove the pilings. The vibratory hammer would be mounted on a land-based crane that would operate from the shoreline.

The operation requires the vibratory hammer "wake up" the piling to break up its skin friction bond with sediment. Bond-breaking avoids pulling out a large block of sediment—possibly breaking off the piling in the process. Usually there is little to no sediment attached to the piling during withdrawal (USEPA 2007). In some cases material may be attached to the piling tip, in line with the piling. Once the piling is pulled, it will be placed in a contained storage site on the Fields Landing property prior to disposal at a landfill that is licensed to handle such material. Piling removal will take place at low tide and a turbidity curtain will be placed outside the pilings, both of which will minimize the production and dispersal of turbid water.

If the entire piling cannot be removed with the vibratory hammer (i.e., the piling breaks off or is already broken), then it would be cut below the mudline using a pneumatic underwater chainsaw or shears. Pilings that are exposed at low tide and not within eelgrass beds may be excavated 1 to 2 ft below the sediment surface and cutoff with a hydraulic saw or shears. Project-specific requirements for cutoff would be set by the project engineer considering the mudline elevation. The USEPA (2007) recommends that in general, pilings should be cut off at the mudline if the mudline is subtidal, to minimize disturbance of the sediment and pilings in intertidal areas should be cut off at least 1 ft below the mudline where the work can be accomplished during periods of low tide.

2.2.2 Gravel/cobble fill excavation

The Harbor District proposes to excavate approximately 1,400 linear feet of gravel/cobble fill along the shoreline within the 1.44-ac Fields Landing mitigation area to create conditions suitable for eelgrass colonization (Figure 4). The area proposed for excavation is located shoreward of the pilings that will be removed. This area is currently covered with gravel/cobble fill that has eroded from the shoreline and covered the original clay and bay mud layers. This fill material was originally used to create the base for a former sawmill operation. The excavation area will be lowered in a two-step process to reach an elevation of -1.0 to 0 ft MLLW to create the conditions suitable for natural eelgrass recolonization. It is currently estimated that approximately 4,600 cubic yards of material will be excavated. Excavation will occur during low tidal cycles to eliminate potential excavation-related direct impacts on longfin smelt and other bay species.

The first step in the excavation will be to remove the gravel/cobble fill layer. This material will be removed using an excavator positioned on the top of the bank. The sediment will be placed in a truck and moved to a different part of the Fields Landing Harbor District Property for storage or some other use on site. Potential uses may include improvements to the existing road, shoreline stabilization, and/or leveling of non-wetland areas on the property. Erosion control BMPs will be implemented to minimize movement of sediment and/or water into wetlands and waters of the state.

The second step in the excavation will be to remove the bay mud/clay to the elevations conducive for eelgrass recolonization beginning at the edge of the existing eelgrass and moving toward the shoreline. Sediment removed during this step will be stockpiled on the Fields Landing site while waiting final disposition. Potential future uses may include beneficial reuse at the White Slough Unit of the Refuge. Erosion control BMPs will be installed at the site to minimize movement of sediment and/or water into wetlands and waters of the state.

The shoreline in this area will require stabilization following excavation of the sediment to reduce wave-induced erosion that may increase due to lowering of the current wave slope. Stabilization could be accomplished using one or more of the following options; all of which will require further engineering and biological analyses:

- Installation of riprap along the exposed shoreline
- Placement of a plastic sheet pile wall along the shoreline
- Creating a new shoreline edge by excavating the existing shoreline back from the bay and gradually sloping up to the current road elevation

2.2.3 Eelgrass establishment

Eelgrass will not be initially planted in the mitigation area. It is anticipated that the existing eelgrass at the edge of the mitigation area will rapidly spread to colonize the mitigation area once the pilings and gravel/cobble fill are removed and the elevation is lowered to a depth conducive to eelgrass growth. Four seed buoys (mesh bags attached to buoys containing flowering shoots of eelgrass) will be deployed in the mitigation area during the first growing season following implementation to drop ripe seeds onto the substrate below and further facilitate colonization of eelgrass in the mitigation area.

2.2.4 Best management practices

All mitigation activities will conform to standard BMPs (e.g., hazardous material handling) to protect adjacent wetlands and waterways. Some of the BMPs that will be implemented for this Project include:

- Stockpiling of construction materials, including portable equipment and supplies, will be restricted to a designated staging area.
- All erosion control materials will be made of natural fibers and will not contain plastic or synthetic mono-filament.
- Extreme caution will be used when handling chemicals (fuel, hydraulic fluid, etc.) near waterways. The crew will abide by any and all laws and regulations and follow all applicable hazardous waste BMPs. Appropriate materials will be on site to prevent and manage spills.
- The Harbor District will implement a hydrocarbon spill prevention and clean-up plan to minimize the potential for Project-related hydrocarbon contamination of bay waters. The dredge and support facilities will contain spill kits.
- Dredging and eelgrass mitigation is scheduled to occur between July 1 and October 1 when no salmonids are expected to be present within Fisherman's Channel or at the Fields Landing Mitigation Area.
- An infiltration berm and silt fences will be constructed/deployed in the White Slough Unit beneficial reuse area to contain and filter turbid water that may eventually be delivered to the bay during dredge spoils dewatering.
- Silt fences, straw wattles, and other appropriate erosion control BMPs will be constructed/deployed around the sediment storage and placement locations at the Fields Landing mitigation area.

2.3 Mitigation Goals and Performance Criteria

The goal for the mitigation area is to create a self-sustaining eelgrass bed by the end of the five-year monitoring period. The final performance standard to determine success of the eelgrass mitigation area is 100% coverage of eelgrass and 85% density of the reference area.

The reference area will be selected in an undisturbed eelgrass bed in the vicinity of the mitigation area. This reference area will be monitored annually at the same time as the mitigation area to determine performance success and account for any seasonal changes that may be affecting eelgrass densities throughout the region. Monitoring methods for the reference area will be the same as described below for the mitigation area. Photopoints will also be established with the reference area for comparison with the mitigation area.

Milestones have been developed to track progress towards the final performance standard:

- One year following the mitigation implementation, the mitigation area will achieve at least 40% cover and 20% density of the reference area.
- Two years following the mitigation implementation, the mitigation area will achieve at least 85% cover and 70% density of the reference area.
- Three and four years following the mitigation implementation, the mitigation area will achieve at least 100% cover and 85% density of the reference area.

No performance standards are proposed for recolonization of the eelgrass in Fisherman's Channel.

2.4 Monitoring

2.4.1 Fields Landing mitigation area

The eelgrass mitigation area will be initially surveyed during the first growing season following mitigation implementation. Thereafter, the eelgrass mitigation area will be monitored annually for five years following implementation. Monitoring will be halted if the revegetation goals are met prior to year five. Monitoring will be conducted at the same time each year during the eelgrass growing season (May–August). The mitigation area will be surveyed to determine the spatial distribution and areal extent of vegetated cover, percent vegetated cover, and density of eelgrass as described in the California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA 2014). Spatial distribution and areal extent will be determined by mapping the extent of eelgrass vegetated cover and extending outward a distance of 16 ft using a handheld GPS receiver. Gaps within the vegetated cover that have individual plants greater than 33 ft from neighboring plants will be excluded and considered unvegetated habitat. Eelgrass percent cover will be visually estimated in quadrats placed randomly throughout the mitigation area using the seagrass percentage cover photo guide from the Manual for Scientific Monitoring of Seagrass Habitat (Short et al. 2006). Plant density will then be estimated by counting the number of eelgrass turions (shoots) in a sample area (i.e., quadrats). Photopoints will be established throughout the mitigation area at fixed locations to monitor site changes over time. Photographs will be taken during annual monitoring efforts at all photopoint locations. To ensure consistency, photopoint locations will be recorded using a handheld GPS receiver, all photos will be taken at a standing position, and a compass bearing of the direction the camera is facing will be taken (or the compass bearing for the start and end of a panoramic series of photographs).

2.4.2 Fisherman's Channel dredging area

It is anticipated that most of the dredged areas in the Fisherman's Channel will rapidly recolonize with eelgrass, though the amount of time it will take for the eelgrass to grow back is unknown. One aspect of this beneficial reuse pilot project is to inform future dredging projects in Humboldt Bay. Fisherman's Channel will be monitored annually during the eelgrass growing season for three years to determine the rate of eelgrass colonization of the dredged area. The dredged area will be surveyed to determine the spatial distribution and areal extent of vegetated cover, percent vegetated cover, and density of eelgrass as described above in Section 2.4.1. The undisturbed portions of Fisherman's Channel will be surveyed as a reference area to compare with the eelgrass growth in the dredged area. The depth and relatively high boat traffic in the main portion of Fisherman's Channel preclude a standard eelgrass survey. Therefore, the dredging area will be surveyed using underwater video camera and weighted quadrats.

2.5 Expectation of Success

Eelgrass is currently present along the edge of the mitigation area; therefore, the current and wave action are not limiting eelgrass growth. If the correct elevations are created in the mitigation area and the gravel/cobble fill is removed to expose the bay floor, then the likelihood of eelgrass successfully becoming establishing and surviving is high. The large eelgrass beds in the vicinity of the mitigation area will provide a source for recolonization.

As previously stated in Section 1.2, the eelgrass in Fisherman's Channel is expected to rapidly recolonize following dredging. Both Fisherman's Channel and the Residential Canals have large populations of eelgrass adjacent to the dredging area and will provide a large seed source for the dredged area. No dredging will occur along the side slopes outside of the designated dredge footprint; eelgrass outside the dredging footprint will spread into the dredged area.

2.6 Sea Level Rise

The eelgrass mitigation area will be designed to be 0 ft to -1 ft MLLW and then will slope up to areas of bare mudflat. Eelgrass in Humboldt Bay typically grows from +0.3 ft to -6.9 ft MLLW (Gilkerson 2008), so eelgrass in the mitigation area is expected to be able to withstand an increase in sea level. An increase in sea level would either cause a shift of the eelgrass beds towards the higher elevation mudflat areas or an increase in the size of the eelgrass beds. This would be the case for both the 2030 projected high-range increase in sea level of 12.5 inches (in) and the 2050 projected increase of 24.8 in. It is anticipated that there would be no loss of eelgrass habitat in the mitigation area as a result of the projected increases in sea level.

3 REPORTING

Results of the annual monitoring of the Fields Landing mitigation area will be summarized in a report and distributed to the appropriate regulatory agencies. These reports will present a summary of the data collected and present conclusions regarding whether the annual performance objectives are being met and, if needed, provide recommendations for remedial action (e.g., eelgrass transplanting). Reports will include the following sections:

- Introduction
- Maintenance activities performed
- Monitoring methods
- Monitoring results (e.g., qualitative and quantitative results compared with baseline data from the initial planting, comparisons with previous years' data, etc.)
- Time series photographs of the mitigation and reference area
- Achievement of performance criteria and milestones in the mitigation area
- Recommendations for remedial action, if needed

Annual monitoring of the mitigation area will occur up to five years or until success criteria are met, whichever comes first. Once the success criteria are met, then the annual monitoring and maintenance will cease and a final report demonstrating success of the mitigation will be prepared and submitted to the appropriate agencies.

4 REMEDIAL ACTION PLAN

If results from the annual monitoring indicate that eelgrass is not colonizing the area quickly enough to meet the performance objectives, eelgrass will be transplanted from nearby donor beds into the mitigation area. Any remedial action determined to be necessary will be initiated as soon as feasible to increase the likelihood of success. Eelgrass would be planted during extreme low-tide events at densities similar to those found in adjacent areas. Eelgrass will be collected from donor beds in the form of one-gallon plugs with 2–4 clumps of turions per plug and will be transplanted in plots distributed throughout the planting area. Turions will be collected from approximately the same tidal elevation as the area into which they will be transplanted. Collections from donor beds will be spaced well apart to minimize impacts on the donor beds. No more than 10% of any eelgrass bed will be used for transplanting purposes. A letter of permission to harvest and transplant eelgrass will be obtained from CDFW.

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Appendix B

Report of findings – Sediment sampling using ISM for Fisherman's Channel dredging and beneficial reuse, King Salmon, California

GHD

Report of Findings

Sediment Sampling Using ISM for Fisherman's Channel Dredging and Beneficial Reuse King Salmon, California

GHD Project Number 84/11747/08

November 2015

Report of Findings
Sediment Sampling Using ISM for Fisherman's Channel Dredging and Beneficial Reuse
King Salmon, California

GHD Project Number: 84/11747/08

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Executive Summary

The Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), in partnership with Pacific Gas & Electric (PG&E), propose to dredge accumulated sediment from Fisherman's Channel, located in King Salmon, California (Figure 1, Appendix A). The dredging will enable continued safe navigation of boats accessing private docks at King Salmon. Based on the 2012 bathymetry, it is estimated that approximately 1,140 cubic yards (cy) of sediment is present at the mouth of Fisherman's Channel (to an elevation of approximately -8 feet Mean Lower Low Water [MLLW]), and approximately 2,210 cy in the channel (to an elevation of approximately -6 MLLW). With an estimated sedimentation rate, it is anticipated that for a 2016 dredging, approximately 3,990 cy of material would need to be removed.

In preparation for a planned final maintenance dredging of Fisherman's Channel by PG&E, the sediment in Fisherman's Channel was sampled and analytically tested according to an agency-approved Workplan for Sediment Sampling and Analysis (SAP) Prior to Dredging (GHD 2012) in 2013. Since the 2013 sampling of Fisherman's Channel, the White Slough restoration area has been identified as a potential beneficial receiving site for the material dredged from Fisherman's Channel.

Initial sediment sampling at Fisherman's Channel did not utilize ISM protocol; it was decided to resample the proposed Fisherman's Channel dredge sediments using ISM so a statistical comparison of the Fisherman's Channel sample results with the White Slough background samples could be performed. Incremental Sampling Methodology (ISM) sampling of Fisherman's Channel was proposed in Final Sediment Sampling Workplan (GHD 2015 [hereafter Workplan]), which was submitted to the NCRWQCB in July 2015. Concurrence with the proposed scope of work was received from the NCRWQCB in electronic correspondence dated July 10, 2015.

This Report of Findings details use of ISM for resampling and characterization of the Fisherman's Channel dredge material to allow statistical comparison with existing baseline conditions documented at the United States Fish and Wildlife Service's (USFWS's) White Slough restoration project area. Based on statistical comparison of Fisherman's Channel ISM sediment sampling results with White Slough baseline concentrations and benthic acute toxicity testing, the proposed Fisherman's Channel dredge sediments are suitable for beneficial reuse at the White Slough restoration area.

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Table of Contents

Tables (Additional Tables found in Appendix C)

Appendices

1. Introduction

The Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), in partnership with Pacific Gas & Electric (PG&E), propose to dredge accumulated sediment from Fisherman's Channel, located in King Salmon, California (Figure 1, Appendix A). The dredging will enable continued safe navigation of boats accessing private docks at King Salmon. The HBHRCD is the project proponent and California Environmental Quality Act (CEQA) lead agency for the proposed project.

This Report of Findings details use of Incremental Sampling Methodology (ISM) for resampling and characterization of the Fisherman's Channel dredge material to allow statistical comparison with existing baseline conditions documented at the United States. Fish and Wildlife Service's (USFWS's) White Slough restoration project area, the preferred beneficial reuse receiving site. Results are also compared herein to regulatory criteria (such as United States Environmental Protection Agency [USEPA] Regional Screening Levels [RSLs] and NCRWQCB Water Quality Objectives [WQOs] for drinking water and bays and estuaries). Based on statistical comparison of Fisherman's Channel ISM sediment sampling results with White Slough baseline concentrations and benthic acute toxicity testing, the proposed Fisherman's Channel dredge sediments are suitable for beneficial reuse at the White Slough restoration area.

2. Background

Fisherman's Channel was created in 1947 by the dredging of a sand spit that extended south of Buhne Hill (Tuttle 2007). Dredging at that time also created four side-channels to the Fisherman's Channel. Residences with private docks were constructed along those channels in the community of King Salmon. In 1952, PG&E purchased the property that is now the Humboldt Bay Power Plant (HBPP) and around 1955 constructed an intake canal connecting to the Fisherman's Channel to provide once-through cooling water to the HBPP. PG&E also took ownership of the Fisherman's Channel at that time. The intake canal is no longer used by PG&E since the new Humboldt Bay Generating Station began operating in 2010, using closed-system radiators for cooling. The Fisherman's Channel has historically been maintained by PG&E for operational needs by maintenance dredging. The most recent dredging took place in 1982, at which time PG&E removed approximately 21,000 cubic yards (CY) of sediment.

In preparation for a planned final maintenance dredging of Fisherman's Channel by PG&E, the sediment in Fisherman's Channel was sampled and analytically tested according to an agency-approved Workplan for Sediment Sampling and Analysis (SAP) Prior to Dredging (GHD 2012) in 2013. The 2012 SAP, including sampling methodology, analytical suite, and detection limits, was submitted to the United States Army Corps of Engineers (USACE) San Francisco Bay District, the NCRWQCB, and the USEPA Region IX for review and concurrence. Concurrence was obtained from these three regulatory entities and the SAP was implemented and samples collected in 2013. The results of the sediment sampling were reported in Report of Findings (ROF) Sediment Sampling and Analysis for Fisherman's Channel (GHD 2013).

The results from the analysis of sediment proposed for dredging (per USACE requirements) were compared with the USEPA RSLs for soils at Residential sites (USEPA 2015a) and the State Water Resources Control Board (SWRCB) Low Threat Underground Storage Tank Case Closure Policy (SWRCB 2012). In instances where the 2012 Fisherman's Channel sampling results (GHD 2013) or the analytical laboratory Reporting Limit (RL) were above Residential RSLs, the constituents were compared with Industrial RSLs. This comparison was conducted to provide a context for initial discussion of suitability of the dredge material for various beneficial reuses or disposal. Concentrations of constituents within the proposed dredge material as documented in the two composite samples for the project area (collected per USACE guidance), Fisherman's Channel West and Fisherman's Channel East, were generally below the Residential RSLs (per latest version published at time of sampling) with the exception of the following:

- Dioxin (Fisherman's Channel East sample only)
  - 1,2,3,6,7,8-HxCDD
  - 1,2,3,7,8,9-HxCDD
- N-Nitrosodi-n-propylamine
- Arsenic
- Cobalt
- Vanadium

Since the 2013 sampling of Fisherman's Channel, the White Slough restoration area has been identified as a potential beneficial receiving site for the material dredged from Fisherman's Channel. The White Slough restoration project is an effort by the USFWS to restore portions of the White Slough segment of the Humboldt Bay National Wildlife Refuge that have experienced subsidence, reducing their ecological productivity. Dredged material from the Fisherman's Channel would assist the USFWS in raising elevations and restoring ecosystem function in this area.

The White Slough restoration project permitting included baseline ISM sampling of existing conditions at the site, and incorporated the ISM protocol into the 401 Water Quality Certification to facilitate suitability analysis of material from other sites considered for placement and beneficial reuse at the White Slough site.

Given that the initial sediment sampling at Fisherman's Channel did not utilize ISM protocol, it was decided to resample the proposed Fisherman's Channel dredge sediments using ISM so a statistical comparison of the Fisherman's Channel sample results with the White Slough background samples could be performed. ISM sampling of Fisherman's Channel was proposed in *Final Sediment Sampling Workplan* (GHD 2015 [hereafter Workplan]), which was submitted to the NCRWQCB in July 2015. Concurrence with the proposed scope of work was received from the NCRWQCB in electronic correspondence dated July 10, 2015. A copy of the electronic correspondence is included in Appendix B

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3. Project Summary

The dredging project proposes to remove material that is inhibiting navigation into and out of the Fisherman's Channel. The initial project plan for maintenance dredging was to return Fisherman's Channel to the 1955 design depth of approximately -8 feet Mean Lower Low Water (MLLW) with a bottom channel width of approximately 40 feet with 2:1 side-slopes. However, dredging the entirety of Fisherman's Channel to approximately -8 feet MLLW is complicated due to resulting level of impact to eelgrass which has established in the channel since the last maintenance dredge event. Therefore, the dredging plan has been redesigned to focus on removal of two sediment shoals: one located just outside, and one just inside the mouth of Fisherman's Channel (Figure 2, Appendix A) to the design depth of -8 MLLW due to a high sediment deposition rate at that location. Proposed dredge depth for the main channel (Figure 2, Appendix A) has been revised to approximately -6 MLLW in order to minimize impacts to eelgrass by reducing the dredging footprint, while providing an adequate depth for boat movement.

The proposed extent of dredging and dredge quantities are based on bathymetric survey data from 2012. Actual dredge amounts may vary during the performance of the dredging and will depend on the bathymetry at the time of dredging and the stability of the side slopes. For the 30-year period between the 1982 dredging operation and the 2012 bathymetric survey of Fisherman's Channel, it was calculated that approximately 4,770 cy of material had accumulated in the channel above the original design depth of -8 MLLW, with an average 160 cy of sedimentation accumulated per year. It is estimated that in the four years since the 2012 bathymetry, approximately 640 cy of additional material may have accumulated. Based on the 2012 bathymetry, it is estimated that approximately 1,140 cy of sediment is present at the channel mouth (to an elevation of approximately -8 MLLW), and approximately 2,210 cy in the channel (to an elevation of approximately -6 MLLW); with the estimated sedimentation rate it is anticipated that for a 2016 dredging, approximately 3,990 cy of material would need to be removed.

Additional details regarding the use of White Slough as a beneficial reuse site for Fisherman's Channel dredge material, including project description and dredge materials placement, containment, site capacity, dewatering techniques, and other topics will be addressed in supporting documents subsequent to this Report of Findings once it is ascertained that the Fisherman's Channel material is suitable for reuse at the White Slough site. Some of the supporting documentation are being developed as part of the Initial Study/Mitigated Negative Declaration that the HBHRCD is preparing pursuant to the California Environmental Quality Act (CEQA) and project permitting.

GHD completed ISM sampling of the proposed Fisherman's Channel dredge sediments to provide for a statistical comparison with White Slough existing baseline concentrations. GHD's investigation was performed in accordance with the NCRWQCB-approved Workplan (GHD 2015), which included the following:

- Thirty (30) sediment samples from the proposed dredge area with three replicates were collected per the ISM protocol (total of 90 samples), as shown in the 30-unit grid sampling layout (Figure 3, Appendix A).
- Three replicate samples were analyzed by Test America for constituents that are soluble and were reported as higher than White Slough baseline conditions, as listed in Table C1, located in Appendix C.

- Three replicate samples were analyzed by Test America for total constituents listed in Table C2 (sample results are listed in Tables C3 through C10.
- The three replicate samples were composited into one sample and the acute toxicity was tested via a bioassay by a laboratory specializing in benthic organism analysis (Pacific Ecorisk).
- A statistical analysis/comparison was performed to determine the constituents that are at higher levels at Fisherman’s Channel than at the White Slough receiving site. This analysis is presented on Table C11.

4. Sampling Activities

The proposed Fisherman's Channel dredging extent has been previously sampled per USACE guidance documents, the results of which were reported by GHD in the *Report of Findings, Sediment Sampling and Analysis for Fisherman's Channel* (GHD 2013). The area to be dredged was resampled utilizing ISM between September 21 and September 28, 2015. The ISM sampling of the Fisherman's Channel dredge area (Figure 2, Appendix A) is described below and the location of the decision unit (DU) cells are shown on Figure 3 (Appendix A). The use of hand-held Global Positioning System (GPS) equipment in the field on the barge allowed for field sampling in the proposed locations. If the barge could not setup on the proposed locations, a new GPS location was recorded with the handheld equipment. For the eight sample locations which could not be accessed by the barge, actual sample locations were within approximately 6 feet of the proposed location. Tables C3 through C10 (Appendix C) present the results of the laboratory analyses.

4.1 Decision Unit Selection

The Fisherman's Channel dredge sediments were assumed to be generally homogenous, based on the tidal nature of the site and lack of evidence of historical release or variation in sediment deposition across the site, as well as previous characterization of sediment (GHD 2013). The proposed dredge profile was designated as a single DU, as proposed in the approved Workplan (GHD 2015). The layout for the ISM DU is shown on Figure 3 (Appendix A).

4.2 Sample Locations

Systematic random sample locations were selected prior to conducting field work, and as proposed in the Workplan (GHD 2015), using geo-processing tools such as random point generator and point propagator. The proposed single DU for the site was divided into 30 sample grids of similar size, as shown on Figure 3 (Appendix A). GIS editing tools were used to refine the cells to an average size. The centroid of each cell was generated and a random cell was selected for generation of three random sample replicate points. A polyline was then used to triangulate the selected polygon's centroid to the three replicate points generated. The triangulated polyline was copied to each of the 30 cells centered on the centroid. Sample points were created by snapping to the vertices and end points of the triangulation.

4.3 Field Sampling

Pre-determined sample locations were navigated to in the field using a GPS unit with sub-meter accuracy, as well as the barge on-board navigation system. Actual achievable sample locations varied slightly on occasion from the initially planned location due to the tidal flow in Fisherman's Channel, which prevents the boat from stabilizing precisely on top of a given sample location. In one case also, the sample location was field-adjusted to avoid an existing dock.

Per ISM, three replicate soil samples were collected within each of the 30 sample grids, using depths specific to each replicate determined based on proposed dredge depth plus 2-foot over-dredge allowance (including a rounding factor, i.e. rounding up to the next deeper 0.5-foot increment). The samples were retrieved using a 4-inch outer diameter vibracore sampler operated by TEG Oceanographic Services. The samples were collected using an aluminum incremental sampling tube, lined with a plastic sleeve, driven to the proposed sample depth for each cell. Where total sample depth was not achieved during initial boring due to low recovery or boring refusal, a second attempt at sample recovery was conducted. Incremental sampling of each recovered core was performed by the following steps:

- Slicing the recovered portion of the sample core representing the target depth lengthwise in half using a putty knife.
- Collecting sediment from along the entire length inside of the core sampler with a sampling trowel or knife.
- Placing each subsample destined to be composited, processed by ISM, and analyzed by the analytical laboratory in a 50-milliliter (ml) sterile plastic sample container (destined for the chemical analyses laboratory).
- Placing material representing approximately 0.6 liters of sediment, and placing the subsamples in one of three replicate-labeled new food-grade 5-gallon buckets (destined for the benthic testing laboratory).

Excess sample material from each core was returned to Fisherman's Channel at the location of sampling, as approved by the NCRWQCB (Pers. comm., 2015). Subsamples for chemical analyses were labeled and placed in buckets chilled with ice. Immediately after each day's field work, the plastic sample containers were placed in GHD's sample refrigerator. The bulk replicate samples for benthic analysis (in 5-gallon buckets separated by replicate) were placed in large plastic tubs and surrounded by ice for overnight storage.

4.3.1 Equipment Decontamination

Decontamination of the sampling equipment was performed before and after the entire sampling event, using Alconox followed by deionized water rinse per GHD's SOP (Standard Operating Procedures for Decontamination of Sampling Equipment, Appendix D). Formal decontamination of sampling equipment was not completed between subsamples within each replicate or between replicates within the same DU as approved in the Workplan (GHD 2015). Non-disposable sampling equipment was completely rinsed with water collected from Fisherman's Channel between each replicate subsample. Rinse water was returned to Fisherman's Channel periodically throughout each sampling day and at the end of each day.

4.4 Analytical Laboratory Testing

Samples from dredge sediments were analyzed by the laboratory for constituents listed in Tables C1 and C2 and presented below:

- Dioxins and Furans by USEPA Method 8290
- Total Petroleum Hydrocarbons (TPH) as Diesel and Motor Oil with Silica Gel Cleanup (SGC) by USEPA Method 8015B
- Pentachlorophenol (PCP) by USEPA Method 8151A
- Total Organic Carbon (TOC) by USEPA Method 9060
- Organochlorine Pesticides by USEPA Method 8081A
- Polycyclic Aromatic Hydrocarbons (PAHs) by USEPA Method 8270C
- Polychlorinated Biphenyls (PCBs) by USEPA Method 8082
- California Assessment Metals, 17 Metals (CAM 17) by USEPA Method 6020
- Mercury by USEPA Method 7471A
- Soluble leachability for arsenic, barium, cadmium, and vanadium by Waste Extraction Test (WET) using deionized water and citrate

- Soluble leachability for PAHs (each cogener) and PCP by WET using deionized water

Laboratory RLs were requested for both total and soluble analyses to be comparative with the low RLs used for White Slough baseline conditions analysis, when possible. In many cases, constituents reported for White Slough baseline are below standard/repeatable RLs and could not be guaranteed by the laboratory or sub laboratories. In the event the dredged material would be deposited at a different receiving site, laboratory RLs were requested to also meet regulatory thresholds and guidance (where applicable). If constituent concentrations were detected by the laboratory yet were below their laboratory's RL (i.e. the value is between the method detection limit [MDL] and the RL), these results were estimated and "J-flagged" on the analytical reports.

4.5 Benthic Laboratory Testing

Sediment samples were collected and submitted to Pacific Ecorisk laboratory located in Fairfield, California for benthic biological analysis. The sample was evaluated with the 10-day bioassay acute toxicity test for benthic organisms based on the following:

- American Society for Testing and Materials (ASTM) Method E1367-03
- ASTM Method E1611-00
- Testing Manual for the Evaluation of Dredged Material Discharged in Waters of the U.S. (Inland Testing Manual, USEPA and USACE)
- Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods

Two biological tests were performed for the site composite sample:

- A 10-day sediment amphipod survival test with *Ampelisca abdita*
- A 10-day sediment juvenile polychaete survival test with *Neanthes arenaceodentata*

5. Sediment Sampling Results

Results of the sediment sampling activities are presented in the following subsections. Sediment sampling data forms and field photographs are included (Appendices E and F, respectively). Laboratory analytical results have been segregated by constituents and are presented on Tables C3 through C10. Test America laboratory analytical reports and Pacific Ecorisk benthic testing results are included in Appendix G. Levels of constituents above laboratory RLs and how they compare with the baseline levels documented for White Slough, as well as regulatory thresholds such as the USEPA RSLs, are discussed in Sections 6 and 7 of this report.

5.1 Sediment Lithology

Lithology of the sediments from Fisherman's Channel is relatively homogeneous. From the sediment surface to total depth of sampling (approximately -8 to -10 feet MLLW), sand and silt/clay were encountered, with the main channel consisting almost entirely of silt/clay, and the channel mouth area consisting of more sandy material interlaid with portions of silt/clay. The sediments encountered were generally gray to dark gray with varying amounts of organic matter. Organic material was encountered at various depths throughout Fisherman's Channel and included non-rooted remnant eelgrass, shells, worms, and roots. In some locations, a hydrogen sulfide odor was noted on the sediment core log sheets.

5.2 Laboratory Analytical Results

Laboratory analytical results are presented in Tables C3 through C10 (Appendix C) and laboratory analytical reports are included in Appendix G. Tables C3 and C4 present dioxin and furan sediment sample analytical results. Total organic carbon (TOC), PCP, and TPH diesel and motor oil analytical results are included in Table C5. Pesticide analytical data are included in Table C6. PAH analytical results are shown in Table C7. PCB analytical data are included in Table C8. CAM 17 metals analytical results are presented in Table C9. Leachability analytical results for PAHs and detected metals are presented in Table C10.

5.2.1 Test America Laboratory Notations

- Test America provided a case narrative for the analytical report prepared for the Fisherman's Channel ISM samples. Generally, exceptions to the laboratory analysis noted by Test America do not affect the validity of the data or the reported values as Quality Assurance/Quality Control (QA/QC) met applicable standards for surrogate recoveries for matrix spikes and duplicates and laboratory control samples. The laboratory analysis completed and analytical data reported are adequate to evaluate the suitability of the proposed Fisherman's Channel dredge material for the potential disposal/reuse options. Test America's notations for the analyses completed are presented below verbatim (with the exception of previously defined acronyms) from the laboratory analytical report. Laboratory notes have been numbered and keyed to GHD response/clarifications below. The samples were received on 9/29/2015 7:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 8.6º C.
- The following samples were received at the laboratory at 8.6 degrees Celsius, which is slightly above the recommended range of 0-6 degrees Celsius: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2) and FC-Replicate 3 (320-15188-3). No cooling agent was observed in the coolers upon receipt at the laboratory.

- Method 8270C SIM: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 440-287508 and analytical batch 440-287765. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.
- Method 8151A: The continuing calibration verification (CCV) associated with batch 580-203162 recovered above the upper control limit for Pentachlorophenol. The sample results associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.
- Method 8151A: The MS/MSD relative percent difference (RPD) for analytical batch 203973 was outside control limits for Pentachlorophenol. The individual recoveries were within limits, as was the LCS recovery.
- Method 8015B: Some of the MS/MSD recoveries for preparation batches 320-88569 and 320-88571 and analytical batch 320-88835 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated LCS recovery was within acceptance limits.[2]
- Method 8015B: The 8015 analyses for Diesel and Motor Oil were done both pre-and post-silica gel clean up. The silica gel clean up analyses were completed on October 12 at 3:38, 4:07, and 5:33PM, while the pre-SGC analyses were done on October 12 at 7:00, 7:29, and 8:56 PM.
- Method 8082: The Decachlorobiphenyl surrogate recoveries for the following samples were outside the upper control limit: FC-Replicate 2 (320-15188-2), FC-Replicate 3 (320-15188-3) and (320-15188-3- MSD). These samples did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.
- Method 8082: The MS/MSD recoveries for preparation batch 320-89031 and analytical batch 320-89179 were outside control limits for Aroclor 1016. Sample matrix interference and/or non-homogeneity are suspected because the associated LCS recovery was within acceptance limits. [2]
- Method 8081A: Some of the MS/MSD recoveries for preparation batch 320-89033 and analytical batch 320-89139 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated LCS recovery was within acceptance limits. [2]
- Method 6020: The MS/MSD recoveries for preparation batch 320-88304 and 320-88494 and analytical batch 320-88698 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated LCS recovery was within acceptance limits. [2]

Discussion of the above laboratory notes is as follows, where possible keyed to footnotes inserted in laboratory narrative above:

1. The samples were sent to the laboratory on ice. The ice had melted when the samples were received by the laboratory and the samples were not within the criteria for the USEPA analytical methods used in laboratory analysis. However, the temperature was only slightly above laboratory standards (9.8 degrees C, versus standard 4 degrees C).
2. Contrary to the laboratory note, it is unlikely that sample non-homogeneity contributed to the sample being outside control limits since ISM procedures ensure sample homogeneity. Therefore, sample matrix interference (as noted by the laboratory) could be a contributing factor.

3. Laboratory hold times for PAH leachability was not adhered to by Test America. However, as PAHs are not volatile, it is unlikely that analysis beyond the required hold times significantly altered the reported concentrations for leachability.

5.3 Benthic Results

5.3.1 Effects of the Fisherman's Channel ISM Sediments on **Ampelisca abdita**

The A. abdita used in these tests were obtained from a San Francisco Bay field population for the testing. Sediment tests were initiated on October 6, 2015. On the day preceding test initiation, the test replicates were set-up. There were five replicates for each test treatment. Each replicate consisted of a 1 liter (L) glass beaker to which approximately two centimeters (cm) depth of homogenized sediment was added. Additional porewater test replicates were similarly set up for the determination of sediment porewater water quality characteristics at test initiation and test termination. The overlying water consisted of 28 parts per trillion (ppt) seawater. Approximately 800 milliliters (mL) of the 28 ppt seawater was carefully poured into each test replicate so as to minimize disturbance of the sediment. Test replicates were similarly established for the Lab Control sediment. All test replicates were maintained in a temperature-controlled room at 20 degrees Celsius under continuous illumination from fluorescent lighting. Each test replicate was gently aerated.

The results of benthic analysis of the effect of Fisherman's Channel sediments on *Ampelisca abdita* are summarized in Table 1 below. There was a mean 93 percent survival in the Lab Control sediment, indicating acceptable survival responses by the test organisms, and this result also shows that amphipods had some sensitivity/response to the test procedures. There was mean 89 percent survival in the site sediment sample. The mean reduction in survival in the Fisherman's Channel sediment relative to the Lab Control survival response was less than 20 percent. The benthic laboratory reported that this indicates that the sediment sample is not acutely toxic to amphipods.

As shown below, Lab Control sample Replicate D and Fisherman's Channel Replicate A showed a similar individual subsample survival rate of 85 percent. T Fisherman's Channel Replicate A remained within 20 percent of the laboratory control. Pacific Ecorisk included a statistical analysis on the laboratory control and Fisherman's Channel data sets (Appendix D of Pacific Ecorisk's laboratory report, given in Appendix G of this document). Based on the statistical analysis using 95 percent upper confidence limits [95UCLs]), the data sets do not show variability from one another and are similar. Pacific Ecorisk did not note elevated toxicity in the Fisherman's Channel sample compared with the laboratory control.

Table 1: **Ampelisca abdita** Survival in the Fisherman's Channel Sediment

Sediment Site	% Survival in Test Replicates					Mean % Survival
	Rep A	Rep B	Rep C	Rep D	Rep E	
Lab Control	90	100	90	85	100	93
FC	85	90	90	90	90	89

5.3.2 Effects of the Fisherman's Channel ISM Sediments on **Neanthes arenaceodentata**

The N. arenaceodentata used in these tests were obtained from a commercial supplier (Aquatic Toxicology Support [ATS], Bremerton, WA), and were maintained at a salinity of 30 ppt prior to shipment to the testing lab. Sediment tests were initiated on October 6, 2015. There were five replicates for each sediment, each replicate consisting of a 1 L glass beaker to which approximately 200 mL (approximately 2.5 cm depth) of homogenized sediment was added. Additional test replicates were set up for the determination of sediment porewater water quality characteristics at test initiation and test termination. The overlying water consisted of 30 ppt seawater. Approximately 800 mL of this water was carefully poured into each test replicate so as to minimize disturbance of the sediment. Test replicates were similarly established for the Lab Control sediment. All test replicates were maintained in a temperature-controlled room at 20 degrees Celsius under continuous illumination from fluorescent lighting. Each test replicate was gently aerated.

The results of benthic analysis of the effect of Fisherman's Channel sediments on *Neanthes arenaceodentata* are summarized in Table 2 below. There was 100 percent survival in the Lab Control sediment, indicating acceptable survival responses by the test organisms. There was 100 percent survival in the site sediment sample, and the benthic laboratory reported that this indicates that the sediment sample is not acutely toxic to polychaetes.

Table 2: **Neanthes arenaceodentata** Survival in the Fisherman's Channel Sediment

Sediment Site	% Survival in Test Replicates					Mean % Survival
	Rep A	Rep B	Rep C	Rep D	Rep E	
Lab Control	100	100	100	100	100	100
FC	100	100	100	100	100	100

5.3.3 Pacific Ecorisk Laboratory Notations

Pacific Ecorisk noted the following in their reporting:

The accuracy of the responses of the test organisms to toxic stress was evaluated using positive Lab Controls (reference toxicant testing). The *Neanthes arenaceodentata* reference toxicant test exhibited an LC50 that was greater than the "typical response" range upper threshold, indicating that these test organisms may have been less sensitive to toxicant stress than is typical. The USEPA guidelines state that at the p less than 0.05, it is to be expected that 1 out of 20 reference toxicant tests will fall outside of the "typical response" range due to statistical probability, so our observation of this "outlier" is not unexpected nor cause for undue concern. However, based upon the observation of test organisms that may be more sensitive to toxicant stress than is typical, it is recommended that the results of the accompanying sediment toxicity test be interpreted judiciously. The key test concentration-response LC point estimate determined for the remaining test species was within the respective typical response ranges for these species, indicating that these test organisms were responding to toxic stress in a typical fashion.

5.4 Quality Assurance/Quality Control

QA/QC for fieldwork was provided by adherence to the approved Workplan (GHD 2015) and GHD SOPs. Quality control measures were conducted in the laboratory and include verification of the chain-of-custody, sample packing, and sample temperature upon receipt.

5.4.1 Sample Reanalysis and Corrective Action

Sample re-analysis was not performed for the sediment samples.

5.4.2 Data Validation

Test America subjected the analytical data to a systematic data validation process as specified by the USEPA Contract Laboratory Program (CLP) National Functional Guidelines. The data validation process involved a detailed review of the raw analytical data as well as the data summaries for each Sample Delivery Group (SDG). The laboratories utilized equipment calibration, surrogate recovery, method blanks, laboratory control spikes, spike duplicates, and reproducibility range comparisons. The data QA/QC and validation summaries for each SDG were completed by Test America and are included in the laboratory analytical report (Appendix G).

6. Suitability Comparison to White Slough Baseline Conditions

The analytical data generated from sediment sampling were compared with background constituent levels documented at White Slough (WS) and with applicable quality standards (i.e., USEPA residential RSL or NCRWQCB Drinking Water WQO). For purposes of statistical comparison and for conservative approach, the NCRWQCB Drinking Water WQO for drinking water was used as a base reference level for the leachability comparison, the results of which are presented within this Section 6. The NCRWQB WQO for bays and estuaries are discussed in Section 7, on a qualitative basis, in reference to project-specific details in regards for potential reuse at White Slough. The statistical comparisons were carried out using applicable analysis techniques per the ISM. The comparisons involved the computation of 95 percent upper confidence limits (95UCLs) on the population mean concentration for each study parameter. The 95UCL is widely used in assessing risks due to environmental exposure to contaminants, as exposures in risk scenarios are developed considering average contaminant concentrations. The use of an upper confidence limit on the mean takes into account sampling variability, providing an upper limit estimate on the true average concentration in the medium sampled (in this case, channel sediments). If a 95UCL value is below an applicable reference value (e.g., USEPA residential RSL or NCRWQCB Drinking Water WQO), then there is a high degree of confidence (95 percent) that the true mean of the population is also below the reference value.

It was originally proposed that USEPA's ProUCL software be used for UCL calculations. However, ProUCL does not recommend its calculations be used when a low number of samples are available (in this case, three ISM replicates per data group). Thus, the Interstate Technology Regulatory Council's (ITRC's) ISM methods (ITRC 2012a) along with the statistical ISM Calculator[1] (ITRC 2012b) were used to conduct the ISM analysis. With the low numbers of replicates typically generated using ISM methods (often less than five), data distributions (e.g. normal or lognormal) may not be meaningfully assessed. ITRC's ISM guidance recommends consideration of two 95UCL calculation methods (the Student's-t and Chebyshev Inequality methods), even when the number of ISM replicates is low. These two methods were used for 95UCL calculations for data sets containing at least 50 percent detected values (i.e., two of the three replicates yielded a detected parameter concentration).

The second set of statistical tests performed contrasted the Fisherman's Channel data to available White Slough data, in order to determine if a significant difference in mean parameter concentrations is evident between the two locations/sample result groups. These inter-group comparisons were conducted utilizing the Student *t*-test (comparing means) and the Wilcoxon Rank-Sum (WRS) test (comparing medians). ITRC's ISM guidance (2012) recognizes that although the statistical power of such comparisons can be limited by low numbers of ISM replicates, statistical comparisons can be augmented by simple graphical analyses to screen for differences between two groups of data. Since a difference in the two groups was detected by statistics, these limitations seem to not be an issue for analysis for this project. The ISM sample results for the Fisherman's Channel and White Slough groups were compared using the Student *t*-test and WRS test for cases where both the Fisherman's Channel and White Slough data reported at least 50 percent detected concentrations (i.e., two of three replicates yielded detected parameter

[1] Available at http://www.itrcweb.org/ism-1/documents/Calculate_95UCL_for_ISM.xls

concentrations). Computational details of these tests are available in Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance (USEPA 2009).

The results of the statistical procedures carried out are summarized in Table C11. Based on the comparisons of calculated 95UCL values against quality standards (USEPA residential RSLs or NCRWQB Drinking Water WQOs), the following data sets exceed the USEPA Residential RSLs:

- Arsenic (both White Slough and Fisherman's Channel)
- Cobalt (both White Slough and Fisherman's Channel)
- Vanadium (both White Slough and Fisherman's Channel)
- Motor oil range organics (C_{19}-C_{36}) with SGC (White Slough only)

Based on these results, it is apparent that where parameter concentrations exceed the USEPA Residential RSL in the sediment samples collected from Fisherman's Channel; these same parameters exceed the USEPA Residential RSL in White Slough. Additionally, in one case, the White Slough parameter concentrations exceed applicable standards, but the Fisherman's Channel sample data do not.

Considering the inter-group comparisons (*t*-test and WRS test results) for the Fisherman's Channel and White Slough groups, there were a fair number of statistically significant (with 95 percent confidence) differences observed. It appears that these differences are observable due to the consistency in the ISM sampling results, which reduces the variability present versus results from collecting discrete samples. As such, variation between ISM replicates was typically much lower than variation between Fisherman's Channel and White Slough groups, resulting in the identification of significant differences in mean or median parameter concentrations between White Slough and Fisherman's Channel results (to be expected as described above). The inter-group comparisons where statistically significant differences were noted are summarized in Table 3 below.

Table 3: Results of Statistical Comparison of Fisherman's Channel (FC) Sediments with White Slough (WS) Baseline Conditions

Parameter group	FC mean/median > WS mean/median	FC mean/median < WS mean/median
Metals	Barium; cadmium; cobalt	Antimony; arsenic; beryllium; chromium (total); copper; lead; molybdenum; nickel; selenium; silver; thallium; vanadium; zinc
PAHs	Acenaphthene; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(g,h,i)perylene; chrysene; fluoranthene; indeno(1,2,3-cd)pyrene; naphthalene; phenanthrene; pyrene	None
Dioxins & Furans	1,2,3,4,6,7,8-HpCDD; OCDD; 1,2,3,4,6,7,8-HxCDF; OCDF	None
Pesticides	Delta-BHC	Heptachlor epoxide
TPH	None	DRO (C_{10}-C_{24}) with SGC; MORO (C_{19}-C_{36}) with SGC
Other	None	Total organic carbon

Of the differences in mean constituent levels identified above, cobalt is the sole constituent where Fisherman's Channel concentrations are higher than both White Slough concentrations and the applicable water quality standard. For each of the other constituents, parameter concentrations observed in White Slough replicates are either higher than or no different from those observed in Fisherman’s Channel replicates, or Fisherman’s Channel replicates were below the applicable quality standards.

A number of parameters analyzed in the current study did not have applicable quality standards for comparison and/or were not included in previous White Slough analyses. In these cases, no statistical comparisons could be conducted.

7. Regulatory Context Discussion

The agency-required statistical analysis per ISM compared Fisherman's Channel results with baseline conditions at White Slough as described above. In addition, the proposed Fisherman's Channel dredge sediments were compared with the USEPA RSLs for land use (for sediment samples) and NCRWQCB Basin Plan Water Quality Objectives (WQOs) for solubility/leachability results), as statistically compared in the above section to the USEPA residential RSLs and the NCRWQCB WQOs for Drinking Water.

The NCRWQCB did not explicitly require a quality comparison of the Fisherman's Channel sediments with respect to USEPA residential RSLs or NCRWQCB WQOs for drinking water or Bays and Estuaries as part of this sampling effort and data analysis. USEPA Residential RSLs and NCRWQB drinking water and Bays and Estuaries WQOs are incorporated into the results discussion to provide context beyond whether or not Fisherman's Channel sediment is statistically different from White Slough data or acutely toxic to benthic organisms for the following reasons:

a) The White Slough baseline conditions were reported in some cases with very low laboratory RLs, well below quality standards or regulatory thresholds, and therefore actual regulatory and environmental implications are not certain in cases where a statistical difference between White Slough and Fisherman's Channel are noted yet are way below action levels (note: the benthic acute toxicity test is run to provide clarification in regards to this scenario).

b) The original sampling data (GHD 2013) for Fisherman's Channel had similar results to current ISM results with several constituents being noted as "elevated", and the 2013 data were similarly compared with regulatory thresholds to provide context for evaluation of the results.

c) NCRWQCB WQOs for "Bays and Estuaries" are applicable to the beneficial reuse site, provide regulatory context for discussion of leachability results, and can guide handling and placement activities/design.

d) USEPA Residential RSLs can provide context for soil placement and handling at potential beneficial reuse sites or screening for consideration of other potential disposal/reuse options.

It should be noted that further discussion of handling and placement of material will be discussed/analyzed in subsequent environmental documentation for the project, once the proposed beneficial reuse site is approved per the findings herein of this report based on the statistical comparison discussed above, the benthic analysis, and as guided by the White Slough guidance documents for beneficial reuse at the site.

Leachability levels for metals and PAHs were below the NCRWQCB WQOs for Bays and Estuaries with the following exceptions:

- Arsenic (FC-Replicates 1, 2, and 3)
- PAHs- benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k)flouranthene, chrysene, and dibenz(a.h)anthracene

Based on the laboratory analytical results, the following constituent concentrations either exceed the USEPA Residential RSL (as further detailed in statistical comparison in the section above), or may exceed the RSL (if the RL for Fisherman's Channel was above the RSL):

- Toxaphene was not detected in the three Fisherman's Channel replicate samples (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3); however, the laboratory reporting limit was above the USEPA Residential RSL.

- Benzo(a)pyrene and dibenz(a,h)anthracene were not detected in the three Fisherman's Channel replicate samples (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3); however, the laboratory reporting limit was above the USEPA Residential RSL.
- PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, and PCB-1260 were not detected in the three Fisherman's Channel replicate samples (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3); however, the laboratory reporting limit was above the USEPA Residential RSL.
- Arsenic, cobalt, and vanadium concentrations exceeded the USEPA Residential RSL in the three Fisherman's Channel samples (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3), which is consistent with previous sampling results (GHD 2013) from Fisherman's Channel.

7.1 Arsenic

Arsenic concentrations from 2015 ISM sampling of Fisherman's Channel ranged from 5.0 to 5.4 parts per million (ppm or milligrams per kilogram [mg/kg]), and are in a similar amount as concentrations reported for the 2013 Fisherman's Channel East and West sampling (ranging from 7.3 ppm to 7.2 ppm, respectively). The reported arsenic concentrations for the 2013 and 2015 Fisherman's Channel sediment samples are consistent with levels of naturally occurring arsenic commonly reported for soils and sediments in the Humboldt Bay area, and likely do not represent introduced contamination.

Studies of naturally occurring arsenic in soil have reported maximum concentrations of arsenic at 97 mg/kg in the western United States (Dragun and Chiasson, 1991), 69 mg/kg in California (Dragun and Chiasson, 1991), and a maximum of 31 mg/kg in Northern California (Lawrence Berkeley National Laboratory, 1995). Therefore, based on these studies, GHD is of the opinion that the concentrations of arsenic reported in sediments within Fisherman's Channel are within the background levels reported for Northern California, and are not at concentrations which present an environmental concern. Furthermore, the concentrations of Arsenic reported in the 2015 ISM sampling are below those reported for White Slough (9.1 to 9.5 mg/kg). Arsenic is a naturally occurring heavy metal that is normally immobile under ambient conditions.

Although elevated concentrations in soil can lead to the presence of arsenic in groundwater, leachability testing conducted as part of the 2015 ISM sampling resulted in soluble levels of 4.6 to 4.9 mg/L, which indicates that arsenic within the sediment is not likely to mobilize into groundwater to a level that would result in the presence of arsenic in groundwater above the applicable "Bays and Estuaries" WQO (36 mg/L). Since arsenic is not volatile, inhalation only becomes a potential hazard if there is exposure to airborne particulates containing arsenic. The following factors indicate that arsenic is not a concern for potential beneficial reuse of Fisherman's Channel sediments at White Sough:

- Arsenic concentrations in the sediments proposed for dredging are below the existing concentration at the White Slough receiving area.
- Arsenic concentrations in the sediments proposed for beneficial reuse are well below background levels reported for Northern California.
- Exposure pathways (An exposure pathway refers to the way a human can come into contact with a hazardous substance) for inhalation, ingestion, and direct contact are incomplete (meaning exposure is unlikely) due to:
  - The proposed dredge sediments will remain moist due to being placed within a vegetated wetland, which prevents the inhalation hazard.

– White Slough is not a high-use public access area, and people using the area would likely remain on the surrounding berms or dikes rather than entering the wetland directly, which generally prevents ingestion and direct contact hazards.

7.2 Cobalt

Concentrations of cobalt were reported in 2015 (11 ppm), as well as in the Fisherman's Channel West and East samples [GHD 2013] (11 to 12 ppm). Cobalt is a naturally occurring element that is primarily used in the preparation of magnetic, wear-resistant, and high-strength metal alloys. It is a naturally occurring heavy metal that in its metallic state is insoluble in water. Cobalt salts are soluble in water, with chloride complexes dominating in seawater. Note that there is no WQO value (NV) established for "Bays and Estuaries" or for Drinking Water, as presented in Table C1. Leachability testing conducted as part of the 2015 sampling resulted in concentrations of cobalt ranging from 0.84 to 0.87 µg/L or parts per billion (ppb), indicating that cobalt within the sediment is not likely to mobilize. Cobalt is not volatile, and inhalation is only a hazard if there is exposure to airborne particulates containing cobalt.

The following factors indicate that cobalt is not a concern for potential beneficial reuse of Fisherman's Channel sediments at White Sough:

- Cobalt concentrations in the sediments proposed for dredging are very slightly above the existing concentration at the White Slough receiving area.
- Cobalt soluble concentrations in the sediments proposed for beneficial reuse are very low, indicating a likely non-existent potential threat to groundwater quality.
- Exposure pathways for inhalation, ingestion, and direct contact are incomplete due to:
  – The proposed dredge sediments will remain moist due to being placed within a vegetated wetland, which prevents the inhalation hazard.
  – White Slough is not a high-use public access area, and people using the area would likely remain on the surrounding berms or dikes rather than entering the wetland directly, which generally prevents ingestion and direct contact hazards.

7.3 Vanadium

Concentrations of vanadium were reported in 2015 ISM sampling at concentrations ranging from 43 to 44 ppm, and were reported at similar concentrations ranging from 52 mg/kg to 53 mg/kg in the Fisherman's Channel West and East samples (GHD 2013). Vanadium is a naturally occurring heavy metal present in soil and water. Although vanadium is persistent in the environment, it is unusual to be present in the atmosphere unless there is a nearby oil-fired power plant (the nearby PG&E power plant primarily utilizes natural gas as a fuel source) or exposure to cigarette smoke. Note that there is no WQO value (NV) established for this metal for "Bays and Estuaries" or for Drinking Water, as presented in Table C10. The leachability results from 2015 were reported at 12 µg/L and 13 µg/L, indicating that vanadium within the sediment is not likely to mobilize. The primary exposure routes for vanadium are ingestion and inhalation. Vanadium is not known to be absorbed through dermal contact (ATSDR 2012). There is a low likelihood of human exposure to vanadium from the proposed beneficial reuse of sediment within a vegetated wetland for the following reasons:

- Vanadium concentrations in the sediments proposed for dredging are below the existing concentration at the White Slough receiving area.
- Vanadium soluble concentrations in the sediments proposed for beneficial reuse are very low, indicating a likely non-existent potential threat to groundwater quality.

- Exposure pathways for inhalation, ingestion, and direct contact are incomplete due to:
  - The proposed dredge sediments will remain moist due to being placed within a vegetated wetland, which prevents the inhalation hazard.
  - White Slough is not a high-use public access area, and people using the area would likely remain on the surrounding berms or dikes rather than entering the wetland directly, which generally prevents ingestion and direct contact hazards.

8. Conclusions

Based on the analytical and biological benthic data generated from ISM sampling of Fisherman's Channel in September 2015, the following conclusions regarding sediment characterization and suitability of the proposed dredge material are presented below:

- Benthic analysis indicates that the Fisherman's Channel sediment samples are not acutely toxic to amphipods or polychaetes.
- Laboratory analysis of ISM samples indicates that the following constituent concentrations either are above the USEPA Residential RSLs (arsenic, cobalt, vanadium), or have the potential to be above RSLs (where laboratory reporting limits were not achievable to match the respective RSLs):
  - Arsenic, cobalt, and vanadium (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3) were above the RSL as discussed above.
  - Toxaphene (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3 [samples were non-detect. Laboratory detection limit was 0.66 mg/kg which is above the residential RSL of 0.49 mg/kg.)
  - Benzo(a)pyrene and dibenz(a,h)anthracene (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3) samples were non-detect. Laboratory detection limits of 0.058 mg/kg and 0.061 mg/kg were above the residential RSLs of 0.0016 mg/kg for benzo(a)pyrene and 0.016 mg/kg for dibenz(a,h)anthracene.
  - PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, and PCB-1260 (FC-Replicate 1, FC-Replicate 2, and FC-Replicate 3) samples were non-detect. Laboratory detection limits of 0.32 mg/kg and 0.33 mg/kg were above the residential RSLs for PCBs which range from 0.12 mg/kg (PCB-1254) to 0.23 mg/kg (PCB-1242 and PCB-1248).
- Of the above constituents, the value for one constituent exceeds the White Slough baseline, and benthic analysis confirmed that this constituent does not pose acute toxicity to benthic organisms:
  - Benzo(a)pyrene
- Leachability analysis for metals and PAHs indicates concentrations below the NCRWQCB WQOs for Bays and Estuaries with the following exceptions:
  - Arsenic (FC-Replicates 1, 2, and 3)
  - PAHs- benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k) flouranthene, chrysene, and dibenz(a,h)anthracene
- Due to the low potential human exposure to soil or sediment containing dioxins, PAHs, PCBs, arsenic, cobalt, and vanadium from the proposed beneficial reuse of wetland restoration at White Slough, inhalation, ingestion, and direct contact exposure routes to recreational users are incomplete.
- Constituent concentrations that exceeded the Residential RSLs for the 2015 Fisherman's Channel ISM samples were similar to those reported for the 2013 samples collected from the channel.

- Statistical analysis of White Slough and Fisherman's Channel concentrations identified one constituent (cobalt) where Fisherman's Channel concentrations were higher than White Slough concentrations, and the 95UCL results indicated that the Fisherman's Channel data were above the applicable water quality standard. In each of the other constituents, concentrations reported in White Slough replicates were either higher than, or no different from, those observed in Fisherman's Channel replicates, or were below the water quality standards considered. The Fisherman's Channel value of 11 ppm for cobalt is slightly higher than the values ranging between 7.8 ppm and 8.6 ppm reported for White Slough.
- Based on statistical comparison of White Slough baseline concentrations with Fisherman's Channel ISM analytical and benthic results, GHD concludes that beneficial reuse of the Fisherman's Channel dredge sediments within the White Slough restoration area should be acceptable to the regulatory agencies.

9. Distribution

Copies of this report have been provided to the following individuals/organizations:

- Kris Vardas, PG&E, 735 Tank Farm Road, Suite 220, San Luis Obispo, California 93401
- Jack Crider, Humboldt Bay Harbor, Recreation, and Conservation District, 601 Startare Drive, Eureka, California 95502-1030
- Ed Kahler, PG&E, 1000 King Salmon Ave, Eureka, California 95503-6859
- Christine Champe, Stillwater Sciences, 850 G Street, Suite K, Arcata, California 95521
- Doug Davy, CH2M, 2485 Natomas Park Drive, Suite 600, Sacramento, California 95833
- Gil Falcone, North Coast Regional Water Quality Control Board, North Coast Region (1), Non-Point Source/401 Certification Unit, 5550 Skylane Boulevard, Suite A, Santa Rosa, California 95403

10. References

ATSDR 2012. *Public Health Statement for Vanadium. Agency for Toxic Substance & Disease Registry (ATSDR).* http://www.atsdr.cdc.gov/PHS/PHS.asp?id=274&tid=50. September.

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Appendices

Appendix A – Figures

Paper Size ANSI A

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Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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GHD

Stillwater Sciences
PG&E - Fisherman's Channel Dredging

Job Number	84-11747
Revision	2
Date	05 Nov 2015

Project Vicinity Map

Figure 1

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718 Third Street Eureka, CA 95501 **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Data source: ESRI: Street Map USA, Bing Orthoimagery, National Forests, Rivers/2012; GHD: Project Boundary; County of Del Norte: Park Boundaries/2012. Created by:JClark2

-8 MLLW Dredge Area

-6 MLLW Dredge Area

Fisherman's Channel East

Fisherman's Channel West

Paper Size 8.5" x 11" (ANSI A)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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GHD

Stillwater Sciences
PG&E - Fisherman's Channel Dredging

Proposed Fisherman's Channel Dredging Site Map

Job Number	8411747
Revision	A
Date	16 Nov 2015

Figure 2

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718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Data source: Humboldt County GIS: streets; ESRI: Aerial. Created by:gldavidson

Decision Unit

Sample Cells

Random Sample Points

FC-Replicate 1

FC-Replicate 2

FC-Replicate 3

Paper Size 8.5" x 11" (ANSI A)
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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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GHD

Stillwater Sciences
PG&E - Fisherman's Channel Dredging

Job Number	8411747
Revision	A
Date	09 Nov 2015

Incremental Sampling Locations
Proposed Fisherman's Channel Dredging

Figure 3

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718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Data source: Humboldt County GIS: streets; ESRI: Aerial. Created by:JClark2

Appendix B – Agency Correspondence

From:	Falcone, Gil@Waterboards
To:	Lia Webb
Cc:	KAV6@pge.com; Pat Kaspari
Subject:	RE: Draft Workplan for Fisherman"s Channel Dredge Seriment Sampling for Beneficial Reuse, King Salmon, CA
Date:	Friday, July 10, 2015 12:52:33 PM

Hi Lia,

Regional Board Staff concur with the workplan submitted for Fisherman's Channel. This is appropriate for sampling and analysis to be used in a suitability determination for possible beneficial reuse at the receiving site at White slough or other approved site.

Thanks for your work with the revisions here reflecting the revised plan. Please send us a final stamped copy.

Gil

Ps. P.12 of the workplan: I work in the Non-Point source / 401 certification unit at the Regional Water Board (Region 1)

Gil Falcone, M.S.
Environmental Scientist
Non-Point Source / 401 Certification Unit
North Coast Regional Water Quality Control Board
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403-1072
Voice (707) 576-2830
Gil.Falcone@waterboards.ca.gov

From: Lia Webb [mailto:Lia.Webb@ghd.com]
Sent: Thursday, July 02, 2015 10:42 AM
To: Falcone, Gil@Waterboards
Cc: KAV6@pge.com; Pat Kaspari
Subject: FW: Draft Workplan for Fisherman's Channel Dredge Seriment Sampling for Beneficial Reuse, King Salmon, CA
Importance: High

Hi Gil,

This email below was returned to us at GHD, didn't get through to you. We are submitting this draft Workplan on behalf of PG&E. Can you confirm that you received this Draft Workplan attached for your review?

Thanks,
Lia

707-498-9327 cell

From: Pat Kaspari
Sent: Friday, 3 July 2015 3:17 AM
To: Gil.Falconel@waterboards.ca.gov
Cc: KAV6@pge.com; Jack Crider (jcrider@humboldtbay.org); Smith, Mark G (HBPP); Christine Champe; Doug.Davy@CH2M.com; Emily King Teraoka (Emily@stillwatersci.com); Lia Webb
Subject: Draft Workplan for Fisherman's Channel Dredge Seriment Sampling for Beneficial Reuse, King Salmon, CA
Importance: High

Gil,
Lia is out so I am forwarding on this Draft Workplan for the sampling for the Fisherman's Channel Dredge project in King Salmon for your review. I typically don't stamp draft documents, but let me know if you want me to put my stamp on this. Also let me know if you want me to send you hardcopies for your review, and if so, how many.

I am also sure that the Harbor District and PG&E would like to know when you think you will be able to get around to reviewing this.

We appreciate all your help on this, and please let me know if you have any questions.

Patrick Kaspari, PE
Senior Project Manager

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WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

Appendix C – Tables

Table C1 – Laboratory Analyses for Soluble Constituents

Analyte	Test Method	Standard Laboratory Reporting Limit (RL) (µg/L)*	Requested RL for Fisherman's Channel [matches White Slough[1]] (µg/L)*	Water Quality Objectives (WQOs) or MCLs[2] (µg/L)*	WQOs for Bays and Estuaries[3] (µg/L)*
HEAVY METAL EXTRACTION					
Antimony	DI WET for CAM 17 Metals and WET (standard citric acid test) for CAM 17 Metals CCR Title 22 Method (Note: laboratory standard reporting limit DI WET RL/Citric Acid WET RL)	0.5/10	2.0	6.0	4,300
Arsenic		0.2/4	2.0	50	36
Barium		0.2/4	1.0	1,000	NV
Beryllium		0.2/4	1.0	4	5.3
Cadmium		0.1/2	1.0	10	9.3
Chromium (Total)		0.5/10	1.0	50	1,030
Chromium (VI)		10/10	5.0	NV	50
Cobalt		0.2/4	1.0	NV	NV
Copper		0.5/10	1.0	1,300	3.1
Lead		0.1/2	1.0	50	8.1
Mercury		2.0/2.0	0.5	2	0.94
Molybdenum		0.2/4	1.0	NV	NV
Nickel		0.3/6	2.0	NV	24
Selenium		0.6/12	2.0	10	71
Silver		0.2/4	1.0	50	1.9
Thallium		0.1/2	0.1	0.5	213
Vanadium		0.2/4	1.0	NV	NV
Zinc		5.0/100	5.0	5	81
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) EXTRACTION					
Acenaphthene	DI WET for PAHs CCR Title 22 Method (Citric acid test results included in Fisherman's Channel initial results)	0.1	0.1	0.2	500
Acenaphthylene					30
Anthracene					30
Benz(a)anthracene					30
Benzo(a)pyrene					30
Benzo(b)fluoranthene					30
Benzo(g,h,i)perylene					NV
Benzo(k)fluoranthene					30
Chrysene					30
Dibenz(a,h)anthracene					30
Fluoranthene					16
Fluorene					30
Indeno(1,2,3-cd)pyrene					30
Naphthalene					235
Phenanthrene					30
Pyrene					30

Notes:
The above table is for analysis of the following using Deionized water (DI) modified Waste Extraction Test (WET) and Citric Acid WET:
µg/L=micro grams per liter
NV=No value promulgated for this constituent
MCL=Maximum Contaminant Level, United States Environmental Protection Agency (USEPA)
ISM=Incremental Sampling Methodology
RL=Reporting Limits
WQO=Water Quality Objectives, N*orth Coast Regional Water Quality Control Board Basin Plan*

Test methods and laboratory RLs w ere requested from the laboratory to be comparable to White Slough existing baseline analytical results. Where possible, test methods and laboratory RLs matched those utilized for White Slough.
For analytes that are detected at concentrations below the laboratory's RL but above the method detection limit (MDL), the results w ill be estimated and "J-flagged" by the laboratory.

FOOTNOTES:
* = units are the same for the column unless otherw ise noted

1. White Slough ISM sampling did not include soluble extraction analyses.
2. Source: N*orth Coast Regional Water Quality Control Board Basin Plan*, Water Quality Objectives (WQO). The United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) w as used w here a NCRWQCB Basin Plan WQO is not specified. http://w ater.epa.gov/drink/contaminants/upload/mcl-2.pdf
3. Source: State Water Resources Control Board Water Quality-Based Assessment Thresholds, Toxicity for saltw ater aquatic life in Bays and Estuaries (California Toxics Rule [USEPA], 4-day average, dissolved), or USEPA National recommendation Water Quality Criteria, acute or chronic toxic info. http://w w w.waterboards.ca.gov/w ater_issues/programs/w ater_quality_goals/docs/w q_assessment_thresholds.xlsx (Assessment Thresholds Table)

Table C2 – Laboratory Analyses for Sediment Samples

Analyte	Test Method	Standard Laboratory Reporting Limit (RL) [mg/kg]*	Requested RL for Fisherman's Channel [matches White Slough] (mg/kg)*	Residential Soil Regional Screening Level[1] (RSL) [mg/kg]*
TOTAL HEAVY METALS				
Antimony	USEPA Method 6020	0.2	2.2	3.1
Arsenic		0.2	2.2	0.67
Barium		0.2	1.1	1,500
Beryllium		0.1	0.22	16
Cadmium		0.1	0.22	7.0
Total Chromium		0.2	0.54	NV
Hexavalent Chromium		0.5	0.5	0.3
Cobalt		0.1	0.54	2.3
Copper		0.2	1.6	310
Lead		0.1	1.1	400
Mercury		0.4	0.024	0.94
Molybdenum		0.2	2.2	39
Nickel		0.2	1.1	NV
Selenium		0.2	2.2	39
Silver		0.1	0.54	39
Thallium		0.1	2.2	NV
Vanadium		1.0	0.54	39
Zinc		1.0	2.2	2,300
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)				
Acenaphthene	USEPA Method 8270C	0.005	0.0054	350
Acenaphthylene				NV
Anthracene				1,700
Benz(a)anthracene				0.15
Benzo(a)pyrene				0.015
Benzo(b)fluoranthene				0.15
Benzo(g,h,i)perylene				NV
Benzo(k)fluoranthene				1.5
Chrysene				15
Dibenz(a,h)anthracene				0.015
Fluoranthene				230
Fluorene				230
Indeno(1,2,3-cd)pyrene				0.15
Naphthalene				3.8
Phenanthrene				NV
Pyrene				170
DIOXINS/FURANS				
Polychlorinated Dibenzodioxins (PCDDs)				
2,3,7,8-TCDD	USEPA Method 8290	1 pg/g	1.0 pg/g	4.9
1,2,3,7,8-PeCDD		5 pg/g	5.0 pg/g	NV
1,2,3,4,7,8-HxCDD		5 pg/g	5.0 pg/g	NV
1,2,3,6,7,8-HxCDD		5 pg/g	5.0 pg/g	1 pg/g[2]
1,2,3,7.126 ,8,9-HxCDD		5 pg/g	5.0 pg/g	1 pg/g[2]
1,2,3,4,6,7,8-HxCDD		5 pg/g	5.0 pg/g	1 pg/g[2]
OCDD		10 pg/g	10 pg/g	NV

Analyte	Test Method	Standard Laboratory Reporting Limit (RL) [mg/kg]*	Requested RL for Fisherman's Channel [matches White Slough] (mg/kg)*	Residential Soil Regional Screening Level[1] (RSL) [mg/kg]*
TEQ (toxicity equivalent)	Calculated Value	NA	NA	NA
Polychlorinated Dibenzofurans (PCDFs)				
2,3,7,8-TCDF	USEPA Method 8290	1 pg/g	1.0 pg/g	NV
1,2,3,7,8-PeCDF		5 pg/g	5.0 pg/g	NV
2,3,4,7,8-PeCDF		5 pg/g	5.0 pg/g	NV
1,2,3,4,7,8-HxCDF		5 pg/g	5.0 pg/g	NV
1,2,3,6,7,8-HxCDF		5 pg/g	5.0 pg/g	NV
1,2,3,7,8,9-HxCDF		5 pg/g	5.0 pg/g	NV
2,3,4,6,7,8-HxCDF		5 pg/g	5.0 pg/g	NV
1,2,3,4,6,7,8-HpCDF		5 pg/g	5.0 pg/g	NV
1,2,3,4,7,8,9-HpCDF		5 pg/g	5.0 pg/g	NV
OCDF		10 pg/g	10 pg/g	NV
TEQ (toxicity equivalent)		NA	NA	NA
PESTICIDES				
4,4'-DDD	USEPA Method 8081A	0.0017	0.0085	2.2
4,4'-DDE		0.0017		1.6
4,4'-DDT		0.0017		1.9
Aldrin		0.0017		0.031
alpha-BHC		0.0017		NV
beta-BHC		0.0017		NV
gamma-BHC		0.0017		NV
Delta-BHC		0.0017		NV
alpha-Chlordane		0.0017		1.8
gamma-Chlordane		0.0017		1.8
Dieldrin		0.0017		0.033
Endosulfan I		0.0017		37
Endosulfan II		0.0017		37
Endosulfan sulfate		0.0017		NV
Endrin		0.0017		1.8
Endrin aldehyde		0.0017		NV
Endrin ketone		0.0017		NV
Heptachlor		0.0017		0.12
Heptachlor epoxide		0.0017		0.059
Methoxychlor		0.0034		31
Toxaphene		0.067		0.48
POLYCHLORINATED BIPHENYLS (PCBs)[3]				
Aroclor 1016	USEPA Method 8082	0.033	0.1	0.4
Aroclor 1221				0.15
Aroclor 1232				0.15
Aroclor 1242				0.24
Aroclor 1248				0.24
Aroclor 1254				0.11
Aroclor 1260				0.24

Analyte	Test Method	Standard Laboratory Reporting Limit (RL) [mg/kg]*	Requested RL for Fisherman's Channel [matches White Slough] (mg/kg)*	Residential Soil Regional Screening Level[1] (RSL) [mg/kg]*
TOTAL PETROLEUM HYDROCARBONS (TPH)[4]				
Diesel (report results of both with and without Silica Gel Clean-up)	USEPA Method 8015B/3550B	1.0	1.0	100[3]
Motor Oil (report results of both with and without Silica Gel Clean-up)	USEPA Method 8015B/3550	5.0	10	100[3]
CHLORINATED HYDROCARBONS				
Pentachlorophenol (PCP)	USEPA 8151A	0.05	0.032	1.7
TCLP PCP	USEPA 8151A	2.5 µg/L	0.5 mg/L	NV
OTHER ANALYTES				
Total Organic Carbon	ASTM or EPA Standard Method	2.0 g/kg	4.0 g/kg	NA

Notes:
Dredge sediment sampling collected per ISM protocols were tested for the above constituents. Leachability for soluble constituents are listed in Table 1.
*=units same for column unless otherwise noted
mg/kg= milligram per kilogram
pg/g= picogram per gram
ISM=Incremental Sampling Methodology
NA=Not applicable
NV=No value promulgated for this constituent
TEQ=Toxicity equivalent
RL=Reporting Limit
RSL=Residential Soil Regional Screening Level
USEPA=United States Environmental Protection Agency
For analytes that are detected at concentrations below the laboratory's RL but above the method detection limit (MDL), the results will be estimated and "J-flagged" by the laboratory.
Test methods and laboratory RLs are being requested from the laboratory to be comparable to White Slough existing baseline analytical results. Where possible, test methods and laboratory RLs will match those utilized for White Slough.

Footnotes:
1- Source: USEPA Regional Screening Level Tables (New tables) for Residential Soil http://www.epa.gov/region9/superfund/prg/index.html
2- The residential soil RSL for Hexachlorodibenzo-p-dioxin mixture was used for this constituent.
3- The RL for PCBs at White Slough was 33 mg/kg. GHD proposed a RL of 0.1 mg/kg.
4- The State Water Resources Control Board's (SWRCB) Low Threat Underground Storage Tank Case Closure Policy for for Total Petroleum Hydrocarbons will be used for TPH-D and TPH-MO comparison.

TABLE C3: Laboratory Analytical Results- Dioxins and Furans (p/g)
Fisherman's Channel ISM Sampling

Constituent	White Slough (WSU-1) (p/g)	White Slough (WSU-2) (p/g)	White Slough (WSU-3) (p/g)	Residential RSL (pg/g)	FC-Replicate 1 (pg/g)	FC-Replicate 2 (pg/g)	FC-Replicate 3 (pg/g)
Polychlorinated Dibenzodioxins (PCDDs)							
2,3,7,8-TCDD	ND<1.0	0.12 [1]	ND<1.0	4.8	ND<1.0	**0.2 [1]**	ND<1.0
1,2,3,7,8-PeCDD	ND<5.0	ND<5.0	ND<5.0	NV	**0.22 [1]**	ND<5.0	**0.33 [1]**
1,2,3,4,6,7,8-HpCDD	4.1 [1]	3.5 [1]	3.8 [1]	NV	**28 [1]**	**23 [1]**	**24 [1]**
1,2,3,4,7,8-HxCDD	ND<5.0	0.13 [1]	0.16 [1]	100	**ND<5.1**	**ND<5.0**	**0.22 [1]**
1,2,3,6,7,8-HxCDD	ND<5.0	0.16 [1]	0.29 [1]	100	**2.1 [1]**	**1.7 [1]**	**1.7 [1]**
1,2,3,7,8,9-HxCDD	ND<5.0	0.50 [1]	0.44 [1]	100	**0.93 [1]**	**1.1 [1]**	**1.1 [1]**
OCDD	21	16	18	NV	**230**	**190**	**200**
Polychlorinated Dibenzofurans (PCDFs)							
2,3,7,8-TcDF	0.56 [1]	0.64 [1]	0.67 [1]	NV	**0.72 [1]**	**0.74 [1]**	**0.75 [1]**
1,2,3,7,8-PeCDF	ND<5.0	ND<5.0	ND<5.0	NV	ND<5.1	**0.17 [1]**	ND<5.0
2,3,4,7,8-PeCDF	ND<5.0	ND<5.0	ND<5.0	NV	ND<5.1	**0.11 [1]**	ND<5.0
1,2,3,4,7,8-HxCDF	ND<5.0	0.21 [1]	0.10 [1]	NV	ND<5.1	ND<5.0	**0.31 [1]**
1,2,3,6,7,8-HxCDF	ND<5.0	0.063 [1]	ND<5.0	NV	ND<5.1	ND<5.0	ND<5.0
2,3,4,6,7,8-HxCDF	0.95 [1]	ND<5.0	ND<5.0	NV	ND<5.1	ND<5.0	ND<5.0
1,2,3,7,8,9-HxCDF	ND<5.0	0.13 [1]	ND<5.0	NV	ND<5.1	ND<5.0	ND<5.0
1,2,3,4,6,7,8-HpCDF	0.62 [1]	0.57 [1]	0.59 [1]	NV	**5.9 [1]**	**4.3 [1]**	**4.2 [1]**
1,2,3,4,7,8,9-HpCDF	0.20 [1]	ND<5.0	ND<5.0	NV	ND<5.1	ND<5.0	ND<5.0
OCDF	1.3 [1]	1.1 [1]	1.0 [1]	NV	**26**	**15**	**15**

NOTES

pg/g = picograms per gram

ND< = Constituent was not present above the specified method detection limit.

Shaded values exceed the United States Environmental Protection Agency (USEPA) Residential Regional Screening Level (RSL)

The concentrations reported by Test America are estimated concentrations as the values reported were below the laboratory reporting limit but above the USEPA method detection limit (MDL) for USEPA method 8290.

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- Concentration was below the reporting limit and is an estimated concentration, above or equal to the detection limit

TABLE C4: Laboratory Analytical Results- Dioxins and Furans (TEQ)

Fisherman's Channel

Constituent	White Slough (WSU-1) (TEQ)	White Slough (WSU-2) (TEQ)	White Slough (WSU-3) (TEQ)	Residential RSL (TEQ)	FC-Replicate 1 (TEQ)	FC-Replicate 2 (TEQ)	FC-Replicate 3 (TEQ)
Polychlorinated Dibenzodioxins (PCDDs)							
2,3,7,8-TCDD	---	---	---	---	0.00	**0.20**	0.00
1,2,3,7,8-PeCDD	---	---	---	---	**0.22**	0.00	**0.33**
1,2,3,4,6,7,8-HpCDD	---	---	---	---	**0.28**	**0.23**	**0.24**
1,2,3,4,7,8-HxCDD	---	---	---	---	**0.00**	**0.00**	**0.022**
1,2,3,6,7,8-HxCDD	---	---	---	---	**0.21**	**0.17**	**0.17**
1,2,3,7,8,9-HxCDD	---	---	---	---	**0.093**	**0.11**	**0.11**
OCDD	---	---	---	---	**0.069**	**0.057**	**0.060**
Polychlorinated Dibenzofurans (PCDFs)							
2,3,7,8-TcDF	---	---	---	---	**0.072**	**0.074**	**0.075**
1,2,3,7,8-PeCDF	---	---	---	---	0.00	**0.0051**	0.00
2,3,4,7,8-PeCDF	---	---	---	---	0.00	**0.033**	0.00
1,2,3,4,7,8-HxCDF	---	---	---	---	0.00	0.00	**0.031**
1,2,3,6,7,8-HxCDF	---	---	---	---	0.00	0.00	0.00
2,3,4,6,7,8-HxCDF	---	---	---	---	0.00	0.00	0.00
1,2,3,7,8,9-HxCDF	---	---	---	---	0.00	0.00	0.00
1,2,3,4,6,7,8-HpCDF	---	---	---	---	**0.059**	**0.043**	**0.042**
1,2,3,4,7,8,9-HpCDF	---	---	---	---	0.00	0.00	0.00
OCDF	---	---	---	---	**0.0078**	**0.0045**	**0.0045**

NOTES

pg/g = picograms per gram

ND< = Constituent was not present above the specified method detection limit.

The concentrations reported by Test America are estimated concentrations as the values reported were below the laboratory reporting limit but above the United States Environmental Protection Agency (USEPA) method detection limit (MDL) for USEPA method 8290.

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- Concentration was below the reporting limit and is an estimated concentration, above or equal to the detection limit

TABLE C5: Laboratory Analytical Results- TPH, PCP and TOC
Fisherman's Channel ISM Sampling

Constituent	White Slough (WSU-1) (mg/kg)	White Slough (WSU-2) (mg/kg)	White Slough (WSU-3) (mg/kg)	Residential RSL (mg/kg)	FC-Replicate 1 (mg/kg)	FC-Replicate 2 (mg/kg)	FC-Replicate 3 (mg/kg)
Total Organic Carbon	37000 [1]	37000 [1]	43000 [1]	NV	**6,300**	**5,700**	**6,100**
Total Petroleum Hydrocarbons (TPH)							
Diesel Range Organics (C_{10}-C_{24})- with SGC	31	19	22	2,300	**13**	**14**	**12**
Diesel Range Organics (C_{10}-C_{24})	---	---	---	---	**17**	**17**	**14**
Motor Oil Range Organics (C_{19}-C_{36})-with SGC	210	130	140	2,300	**49**	**53**	**45**
Motor Oil Range Organics (C_{19}-C_{36})	---	---	---	---	**65**	**68**	**56**
Pentachlorophenol							
PCP	ND<0.032 [1]	ND<0.032 [1]	ND<0.032 [1]	1.0	ND<0.049	ND<0.048	ND<0.049

NOTES

mg/Kg = milligrams per kilogram

ND< = Constituent was not present above the specified method detection limit.

NV = No promulgated soil screening level.

Bolded concentrations are values reported above the detection limits.

MCL- Maximum Contaminant Level

RSL- Regional Screening Levels

USEPA- United States Environmental Protection Agency

PCP- Pentachlorophenol

TPH-Total Petroleum Hydrocarbons

TOC- Total Organic Carbon

SGC- Silica gel cleanup

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

1- White Slough data was reported in grams per kilogram (g/kg) and converted to milligrams per kilogram (mg/kg)

TABLE C6: Laboratory Analytical Results- Organochlorine Pesticides

Fisherman's Channel ISM Sampling

Constituent	White Slough (WSU-1)(mg/kg) [1]	White Slough (WSU-2)(mg/kg) [1]	White Slough (WSU-3)(mg/kg) [1]	Residential RSL (mg/kg)	FC-Replicate 1 (mg/kg)	FC-Replicate 2 (mg/kg)	FC-Replicate 3 (mg/kg)
4,4'-DDD	ND<0.0085	ND<0.0085	ND<0.0085	2.3	ND<0.017	ND<0.017	ND<0.017
4,4'-DDE	ND<0.0085	ND<0.0085	ND<0.0085	2.0	ND<0.017	ND<0.017	ND<0.017
4,4'-DDT	ND<0.0085	ND<0.0085	ND<0.0085	1.9	ND<0.017	ND<0.017	ND<0.017
Aldrin	ND<0.0085	ND<0.0085	ND<0.0085	0.039	ND<0.017	ND<0.017	ND<0.017
alpha-BHC	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
beta-BHC	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
gamma-BHC (Lindane)	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
Delta-BHC	ND<0.0085	ND<0.0085	ND<0.0085	NV	**0.0037** [2]	**0.0034** [2]	**0.0040** [2]
Delta-BHC	---	---	---	NV	**0.0030** [2]	**0.0032** [2]	**0.0025** [2]
alpha-Chlordane	ND<0.0085	ND<0.0085	ND<0.0085	1.7	ND<0.017	ND<0.017	ND<0.017
gamma-Chlordane	ND<0.0085	ND<0.0085	ND<0.0085	1.7	ND<0.017	ND<0.017	ND<0.017
Dieldrin	ND<0.0085	ND<0.0085	ND<0.0085	0.034	ND<0.017	ND<0.017	ND<0.017
Endosulfan I	ND<0.0085	ND<0.0085	ND<0.0085	47	ND<0.017	ND<0.017	ND<0.017
Endosulfan II	0.00013 [2]	ND<0.0085	ND<0.0085	47	ND<0.017	ND<0.017	ND<0.017
Endosulfan sulfate	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
Endrin	ND<0.0085	ND<0.0085	ND<0.0085	1.9	ND<0.017	ND<0.017	ND<0.017
Endrin aldehyde	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
Endrin ketone	ND<0.0085	ND<0.0085	ND<0.0085	NV	ND<0.017	ND<0.017	ND<0.017
Heptachlor	ND<0.0085	ND<0.0085	ND<0.0085	0.13	ND<0.017	ND<0.017	ND<0.017
Heptachlor epoxide	0.001 [2]	0.0012 [2]	0.0015 [2]	0.07	ND<0.017	ND<0.017	ND<0.017
Methoxychlor	ND<0.0085	ND<0.0085	ND<0.0085	32	ND<0.033	ND<0.034	ND<0.033
Toxaphene	ND<0.0085	ND<0.0085	ND<0.0085	0.49	ND<0.66	ND<0.67	ND<0.66

NOTES

mg/kg = milligrams per kilogram

ND< = Constituent was not present above the specified method detection limit.

NV = No promulgated soil screening level.

MCL- Maximum Contaminant Level

RSL- Regional Screening Levels

USEPA- United States Environmental Protection Agency

--- = Concentration data was not provided for this constituent.

The concentrations reported by Test America are estimated concentrations as the values reported were below the laboratory reporting limit but above the USEPA method detection limit (MDL) for USEPA method 8290.

Bolded concentrations are values reported above the detection limits.

Shaded values exceed the USEPA Residential RSL

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- White Slough data was reported in grams per kilogram (g/kg) and converted to milligrams per kilogram (mg/kg)

[2]- Concentration was below the reporting limit and is an estimated concentration, above or equal to the detection limit

TABLE C7: Laboratory Analytical Results- PAHs
Fisherman's Channel ISM Sampling

Constituent	White Slough (WSU-1) (mg/kg) [1]	White Slough (WSU-2) (mg/kg) [1]	White Slough (WSU-3) (mg/kg) [1]	Residential RSL (mg/kg)	FC-Replicate 1 (mg/kg)	FC-Replicate 2 (mg/kg)	FC-Replicate 3 (mg/kg)
Acenapthene	0.0017 [2]	0.0019 [2]	0.0023 [2]	360	ND<0.060	ND<0.058	ND<0.061
Acenaphthylene	ND<0.0054	ND<0.0054	ND<0.0054	NV	ND<0.060	ND<0.058	ND<0.061
Anthracene	0.00053 [2]	0.00049 [2]	ND<0.00545	1,800	ND<0.060	ND<0.058	ND<0.061
Benzo(a)anthracene	0.0018 [2]	0.0017 [2]	0.0019 [2]	0.16	**0.0083** [2]	ND<0.058	ND<0.061
Benzo(a)pyrene	0.0017 [2]	0.0012 [2]	0.0013 [2]	0.0016	ND<0.060	ND<0.058	ND<0.061
Benzo(b)fluoranthene	---	---	---	0.16	**0.016** [2]	**0.014** [2]	**0.012** [2]
Benzo(g,h,i)perylene	**0.0051**	0.0046 [2]	0.0044 [2]	NV	**0.011** [2]	**0.012** [2]	**0.0097** [2]
Benzo(k)fluoranthene	---	---	---	1.6	ND<0.060	ND<0.058	ND<0.061
Chrysene	**0.011**	**0.010**	**0.011**	16	**0.020** [2]	**0.017** [2]	**0.012** [2]
Dibenz(a,h)anthracene	ND<0.0054	ND<0.0054	ND<0.0054	0.016	ND<0.060	ND<0.058	ND<0.061
Fluoranthene	**0.0082**	0.0044 [2]	0.0046 [3]	240	**0.034** [2]	**0.029** [2]	**0.025** [2]
Fluorene	0.033 [2]	0.0041 [2]	0.0046 [2]	240	**0.016** [2]	**0.013** [2]	**0.014** [2]
Indeno[1,2,3-cd]pyrene	0.0019 [2]	0.0014 [2]	0.0013 [2]	0.16	ND<0.060	ND<0.058	ND<0.061
Naphthalene	**0.0062**	**0.0066**	**0.0087**	3.8	**0.019** [2]	**0.015** [2]	**0.016** [2]
Phenanthrene	**0.027**	**0.028**	**0.032**	NV	**0.055** [2]	**0.048** [2]	**0.044** [2]
Pyrene	**0.011**	**0.0072**	**0.008**	180	**0.039** [2]	**0.031** [2]	**0.026** [2]

NOTES

mg/kg = milligrams per kilogram

ND< = Constituent was not present at or above the specified laboratory reporting limit.

NV = No promulgated soil screening level.

PAH = Polycyclic aromatic hydrocarbon

MCL- Maximum Contaminant Level

RSL- Regional Screening Levels

Concentrations were reported by Test America in micrograms per kilogram (µg/kg). These reported values were converted to milligrams per kilogram (mg/kg).
Bolded concentrations are values reported above the laboratory reporting limits.

Shaded values exceed The USEPA Residential RSL.

--- = Concentration data was not provided for this constituent.

USEPA- United States Environmental Protection Agency

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- White Slough data was reported in micrograms per kilogram (µg/kg) and converted to milligrams per kilogram (mg/kg)

[2]- Concentration was below the reporting limit and is an estimated concentration, above or equal to the detection limit

TABLE C8: Laboratory Analytical Results- PCBs
Fisherman's Channel

Constituent	White Slough (WSU-1) (mg/kg)	White Slough (WSU-2) (mg/kg)	White Slough (WSU-3) (mg/kg)	USEPA Residential RSL (mg/kg)	FC- Replicate 1 (mg/kg)	FC-Replicate 2 (mg/kg)	FC-Replicate 3 (mg/kg)
PCB-1016	ND<33	ND<33	ND<33	0.41	ND<0.32	ND<0.33	ND<0.32
PCB-1221	ND<33	ND<33	ND<33	0.17	ND<0.32	ND<0.33	ND<0.32
PCB-1232	ND<33	ND<33	ND<33	0.17	ND<0.32	ND<0.33	ND<0.32
PCB-1242	ND<33	ND<33	ND<33	0.23	ND<0.32	ND<0.33	ND<0.32
PCB-1248	ND<33	ND<33	ND<33	0.23	ND<0.32	ND<0.33	ND<0.32
PCB-1254	ND<33	ND<33	ND<33	0.12	ND<0.32	ND<0.33	ND<0.32
PCB-1260	ND<33	ND<33	ND<33	0.24	ND<0.32	ND<0.33	ND<0.32

NOTES
mg/kg = milligrams per kilogram
ND< = Constituent was not present at or above the specified laboratory reporting limit.
NV = No promulgated soil screening level.
PCB = Polychlorinated biphenyl
Bolded concentrations are values reported above the laboratory reporting limits.
Shaded values exceed the USEPA Residential RSL
MCL- Maximum Contaminant Level
RSL- Regional Screening Levels
USEPA- United States Environmental Protection Agency
The concentrations reported by Test America are estimated concentrations as the values reported were below the laboratory reporting limit but above the USEPA method detection limit (MDL) for USEPA method 8290.

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

TABLE C9: Laboratory Analytical Results- CAM 17 Metals
Fisherman's Channel ISM Sampling

Constituent	White Slough (WSU-1) (mg/kg)	White Slough (WSU-2) (mg/kg)	White Slough (WSU-3) (mg/kg)	Residential RSL (mg/kg)	FC-Replicate 1 (mg/kg)	FC-Replicate 2 (mg/kg)	FC-Replicate 3 (mg/kg)
Antimony	1.1 [1]	ND<2.2	1.2 [1]	3.1	**0.11 [1]**	**0.12 [1]**	**0.14 [1]**
Arsenic	9.1	9.5	9.5	0.68	**5.4**	**5.0**	**5.2**
Barium	50	56	51	1,500	**68**	**64**	**67**
Beryllium	0.54	0.60	0.56	16	**0.40**	**0.38**	**0.37**
Cadmium	0.030 [1]	ND<0.22	ND<0.22	7.1	**0.14**	**0.14**	**0.15**
Chromium (Total)	85	90	93	NV	**71**	**69**	**72**
Chromium (VI)	---	---	---	0.3	ND<0.049	ND<0.050	ND<0.050
Cobalt	7.8	8.6	8.1	2.3	**11**	**11**	**11**
Copper	29	29	29	310	**23**	**21**	**22**
Lead	22	18	33	400	**6.3**	**6.0**	**6.3**
Mercury	0.095	0.078	0.022 [1]	0.94	**0.069**	**0.066**	**0.068**
Molybdenum	2.9	3.5	3.6	39	**1.1**	**0.91**	**0.97**
Nickel	84	88	85	NV	**79**	**75**	**79**
Selenium	1.6 [1]	ND<2.2	ND<2.2	39	**0.25**	**0.23**	**0.24**
Silver	ND<0.54	ND<0.54	ND<0.54	39	**0.071 [1]**	**0.076 [1]**	**0.074 [1]**
Thallium	ND<2.2	ND<2.2	ND<2.2	NV	**0.092 [1]**	**0.083 [1]**	**0.095 [1]**
Vanadium	58	62	62	39	**44**	**43**	**44**
Zinc	74	77	77	2,300	**58**	**57**	**57**

NOTES

mg/Kg = milligrams per kilogram
ND< = Constituent was not present at or above the specified laboratory reporting limit.
NV = No promulgated soil screening level.
Bolded concentrations are values reported above the laboratory reporting limits.
Shaded values exceed the USEPA Residential RSL
MCL- Maximum Contaminant Level

RSL- USEPA Regional Screening Levels

CAM- California Assessment Metal

USEPA- United States Environmental Protection Agency

--- = No data provided for this constituent

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- Concentration was below the reporting limit and is an estimated concentration, above or equal to the detection limit

Table C10: Leachability Analysis
Fisherman's ISM Sampling

Constituent (µg/L)	White Slough (WSU-1) (µg/L)	White Slough (WSU-2) (µg/L)	White Slough (WSU-3) (µg/L)	NCRWQCB WQO for Bays and Estauries (µg/L)	FC-Replicate 1 (µg/L, Citrate)	FC-Replicate 1 (µg/L, DI)	FC-Replicate 2 (µg/L, Citrate)	FC-Replicate 2 (µg/L, DI)	FC-Replicate 3 (µg/L, Citrate)	FC-Replicate 3 (µg/L, DI)
METALS										
Antimony	---	---	---	4,300	**---**	**---**	**---**	**---**	**---**	**---**
Arsenic	---	---	---	0.14	**180**	**4.6**	**170**	**4.9**	**160**	**4.8**
Barium	---	---	---	2,000 [1]	**1,400**	**19**	**1,400**	**18**	**1,300**	**19**
Cadmium	---	---	---	9.3	ND<40	ND<0.10	ND<40	ND<0.10	ND<40	ND<0.10
Cobalt	---	---	---	NV	**210**	**0.84**	**230**	**0.84**	**210**	**0.87**
Vanadium	---	---	---	NV	**500**	**12**	**510**	**12**	**490**	**13**
Polycyclic Aromatic Hydrocarbons										
Acenapthene	---	---	---	500	---	ND<1.0	---	ND<1.0	---	ND<1.0
Acenapthylene	---	---	---	30	---	ND<1.0	---	ND<1.0	---	ND<1.0
Anthracene	---	---	---	30	---	ND<1.0	---	ND<1.0	---	ND<1.0
Benzo(a)anthracene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Benzo(a)pyrene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Benzo(b)flouranthene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Benzo (g,h,i)perylene	---	---	---	NV	---	ND<1.0	---	ND<1.0	---	ND<1.0
Benzo(k)flouranthene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Chrysene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Dibenz(a,h)anthracene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Flouranthene	---	---	---	16	---	ND<1.0	---	ND<1.0	---	ND<1.0
Flourene	---	---	---	30	---	ND<1.0	---	ND<1.0	---	ND<1.0
Indeno(1,2,3-cd)pyrene	---	---	---	0.049	---	ND<1.0	---	ND<1.0	---	ND<1.0
Naphthalene	---	---	---	235	---	ND<1.0	---	ND<1.0	---	ND<1.0
Phenanthrene	---	---	---	30	---	ND<1.0	---	ND<1.0	---	ND<1.0
Pyrene	---	---	---	30	---	ND<1.0	---	ND<1.0	---	ND<1.0
PCP	---	---	---	NV	ND<2.5	---	ND<2.5	---	ND<2.5	**---**

NOTES
mg/Kg = milligrams per kilogram
ND< = Constituent was not present above the specified method detection limit.
NV = No promulgated soil screening level.
Bolded concentrations are values reported above the detection limits.
Shaded values exceed the NCRWQCB WQOs for Bays and Estuaries
NCRWQCB- North Coast Regional Water Quality Control Board

WQO- Water Quality Objective

PCP- Pentachlorophenol

White Slough data was collected by SHN Consulting Engineers in November 2014. GHD did not verify this data and concentrations shown in this table were tabulated from tables included in the SHN document Feasibility Study, Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay, California dated July 2015.

[1]- No value was promulgated for NCRFWQCB Bay and Estuaries criteria. The USEPA Maximum Contaminant Level (MCL) was used for evaluation.

TABLE C11: Statistical Summary and Comparison Results
Fisherman's Channel ISM Sampling

		Criteria/Objectives		White Slough (WS)			Fisherman's Channel (FC)			Group Comparisons	
		USEPA RSL	NCRWQCB	Percent	95UCL(1)		Percent	95UCL(1)		Student	Wilcoxon
Constituent	Units	Residential	WQO	Nondetect	Student-*t*	Chebyshev	Nondetect	Student-*t*	Chebyshev	*t*-test	Rank Sum
CAM 17 Metals											
Antimony	mg/kg	3.1	--	33%	1.23	1.28	0%	0.15	0.16	WS > FC	WS > FC
Arsenic	mg/kg	0.68	--	0%	9.76	9.95	0%	5.54	5.70	WS > FC	WS > FC
Barium	mg/kg	1500	--	0%	57.8	60.4	0%	69.8	71.6	FC > WS	FC > WS
Beryllium	mg/kg	16	--	0%	0.62	0.64	0%	0.41	0.42	WS > FC	WS > FC
Cadmium	mg/kg	7	--	67%	--	--	0%	0.15	0.16	FC > WS	FC > WS
Chromium (Total)	mg/kg	NV	--	0%	96.1	99.5	0%	73.2	74.5	WS > FC	WS > FC
Chromium (VI)	mg/kg	0.3	--	--	--	--	100%	--	--	--	--
Cobalt	mg/kg	2.3	--	0%	8.85	9.18	0%	11.00	11.00	FC > WS	FC > WS
Copper	mg/kg	310	--	0%	29.0	29.0	0%	23.7	24.5	WS > FC	WS > FC
Lead	mg/kg	400	--	0%	37.4	43.9	0%	6.49	6.64	WS > FC	WS > FC
Mercury	mg/kg	0.94	--	0%	0.13	0.16	0%	0.07	0.07	NSD	NSD
Molybdenum	mg/kg	39	--	0%	3.97	4.29	0%	1.16	1.24	WS > FC	WS > FC
Nickel	mg/kg	NV	--	0%	89.2	90.9	0%	81.6	83.5	WS > FC	WS > FC
Selenium	mg/kg	39	--	67%	--	--	0%	0.26	0.27	WS > FC	WS > FC
Silver	mg/kg	39	--	100%	--	--	0%	0.08	0.08	WS > FC	WS > FC
Thallium	mg/kg	NV	--	100%	--	--	0%	0.10	0.11	WS > FC	WS > FC
Vanadium	mg/kg	39	--	0%	64.6	66.5	0%	44.6	45.1	WS > FC	WS > FC
Zinc	mg/kg	2300	--	0%	78.9	80.4	0%	58.3	58.8	WS > FC	WS > FC
Leachable Metals (Citrate)											
Arsenic	µg/L	--	50	--	--	--	0%	187	195	--	--
Barium	µg/L	--	1000	--	--	--	0%	1464	1512	--	--
Cadmium	µg/L	--	10	--	--	--	100%	--	--	--	--
Cobalt	µg/L	--	NV	--	--	--	0%	236	246	--	--
Vanadium	µg/L	--	NV	--	--	--	0%	517	525	--	--
Leachable Metals (DI)											
Arsenic	µg/L	--	50	--	--	--	0%	5.02	5.15	--	--
Barium	µg/L	--	1000	--	--	--	0%	19.6	20.1	--	--
Cadmium	µg/L	--	10	--	--	--	100%	--	--	--	--
Cobalt	µg/L	--	NV	--	--	--	0%	0.88	0.89	--	--
Vanadium	µg/L	--	NV	--	--	--	0%	13.3	13.8	--	--

TABLE C11: Statistical Summary and Comparison Results
Fisherman's Channel ISM Sampling

		Criteria/Objectives		White Slough (WS)			Fisherman's Channel (FC)			Group Comparisons	
		USEPA RSL	NCRWQCB	Percent	95UCL(1)		Percent	95UCL(1)		Student	Wilcoxon
Constituent	Units	Residential	WQO	Nondetect	Student-*t*	Chebyshev	Nondetect	Student-*t*	Chebyshev	*t*-test	Rank Sum
Polynuclear Aromatic Hydrocarbons (PAHs)											
Acenapthene	mg/kg	350	--	0%	0.0025	0.0027	100%	--	--	FC > WS	FC > WS
Acenaphthylene	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
Anthracene	mg/kg	1700	--	33%	0.0034	0.0045	100%	--	--	FC > WS	FC > WS
Benzo(a)anthracene	mg/kg	0.15	--	0%	0.0020	0.0021	67%	--	--	FC > WS	FC > WS
Benzo(a)pyrene	mg/kg	0.015	--	0%	0.0018	0.0021	100%	--	--	FC > WS	FC > WS
Benzo(b)fluoranthene	mg/kg	0.15	--	--	--	--	0%	0.017	0.019	NSD	NSD
Benzo(g,h,i)perylene	mg/kg	NV	--	0%	0.0053	0.0056	0%	0.013	0.014	FC > WS	FC > WS
Benzo(k)fluoranthene	mg/kg	1.5	--	--	--	--	100%	--	--	--	--
Chrysene	mg/kg	15	--	0%	0.012	0.012	0%	0.023	0.027	FC > WS	FC > WS
Dibenz(a,h)anthracene	mg/kg	0.015	--	100%	--	--	100%	--	--	--	--
Fluoranthene	mg/kg	230	--	0%	0.0093	0.011	0%	0.037	0.041	FC > WS	FC > WS
Fluorene	mg/kg	230	--	0%	0.042	0.056	0%	0.017	0.018	NSD	NSD
Indeno[1,2,3-cd]pyrene	mg/kg	0.15	--	0%	0.0021	0.0023	100%	--	--	FC > WS	FC > WS
Naphthalene	mg/kg	3.8	--	0%	0.0094	0.011	0%	0.020	0.022	FC > WS	FC > WS
Phenanthrene	mg/kg	NV	--	0%	0.033	0.036	0%	0.058	0.063	FC > WS	FC > WS
Pyrene	mg/kg	170	--	0%	0.012	0.014	0%	0.043	0.049	FC > WS	FC > WS
Leachable Polynuclear Aromatic Hydrocarbons (PAHs; DI)											
Acenapthene	µg/L	--	500	--	--	--	100%	--	--	--	--
Acenaphthylene	µg/L	--	30	--	--	--	100%	--	--	--	--
Anthracene	µg/L	--	30	--	--	--	100%	--	--	--	--
Benzo(a)anthracene	µg/L	--	30	--	--	--	100%	--	--	--	--
Benzo(a)pyrene	µg/L	--	30	--	--	--	100%	--	--	--	--
Benzo(b)fluoranthene	µg/L	--	30	--	--	--	100%	--	--	--	--
Benzo(g,h,i)perylene	µg/L	--	NV	--	--	--	100%	--	--	--	--
Benzo(k)fluoranthene	µg/L	--	30	--	--	--	100%	--	--	--	--
Chrysene	µg/L	--	30	--	--	--	100%	--	--	--	--
Dibenz(a,h)anthracene	µg/L	--	30	--	--	--	100%	--	--	--	--
Fluoranthene	µg/L	--	16	--	--	--	100%	--	--	--	--
Fluorene	µg/L	--	30	--	--	--	100%	--	--	--	--
Indeno(1,2,3-cd)pyrene	µg/L	--	30	--	--	--	100%	--	--	--	--
Naphthalene	µg/L	--	235	--	--	--	100%	--	--	--	--
Phenanthrene	µg/L	--	30	--	--	--	100%	--	--	--	--
Pyrene	µg/L	--	30	--	--	--	100%	--	--	--	--

TABLE C11: Statistical Summary and Comparison Results
Fisherman's Channel ISM Sampling

		Criteria/Objectives		White Slough (WS)			Fisherman's Channel (FC)			Group Comparisons	
		USEPA RSL	NCRWQCB	Percent	95UCL(1)		Percent	95UCL(1)		Student	Wilcoxon
Constituent	Units	Residential	WQO	Nondetect	Student-*t*	Chebyshev	Nondetect	Student-*t*	Chebyshev	*t*-test	Rank Sum
Dioxins and Furans											
Polychlorinated Dibenzodioxins (PCDDs)											
2,3,7,8-TCDD	pg/g	4.9	--	67%	--	--	67%	--	--	--	--
1,2,3,7,8-PeCDD	pg/g	NV	--	100%	--	--	33%	3.18	4.25	NSD	NSD
1,2,3,4,6,7,8-HpCDD	pg/g	NV	--	0%	4.31	4.55	0%	29.5	31.7	FC > WS	FC > WS
1,2,3,4,7,8-HxCDD	pg/g	1	--	33%	3.22	4.35	67%	--	--	NSD	NSD
1,2,3,6,7,8-HxCDD	pg/g	1	--	33%	3.20	4.29	0%	2.22	2.41	NSD	NSD
1,2,3,7,8,9-HxCDD	pg/g	1	--	33%	3.12	4.10	0%	1.21	1.29	NSD	NSD
OCDD	pg/g	NV	--	0%	22.6	24.7	0%	242	259	FC > WS	FC > WS
Polychlorinated Dibenzofurans (PCDFs)											
2,3,7,8-TcDF	pg/g										
1,2,3,7,8-PeCDF	pg/g	NV	--	100%	--	--	67%	--	--	--	--
2,3,4,7,8-PeCDF	pg/g	NV	--	100%	--	--	67%	--	--	--	--
1,2,3,4,7,8-HxCDF	pg/g	NV	--	33%	3.22	4.35	67%	--	--	NSD	NSD
1,2,3,6,7,8-HxCDF	pg/g	NV	--	67%	--	--	100%	--	--	--	--
2,3,4,6,7,8-HxCDF	pg/g	NV	--	67%	--	--	100%	--	--	--	--
1,2,3,7,8,9-HxCDF	pg/g	NV	--	67%	--	--	100%	--	--	--	--
1,2,3,4,6,7,8-HpCDF	pg/g	NV	--	0%	0.64	0.66	0%	6.41	7.20	FC > WS	FC > WS
1,2,3,4,7,8,9-HpCDF	pg/g	NV	--	67%	--	--	100%	--	--	--	--
OCDF	pg/g	NV	--	0%	1.39	1.52	0%	29.4	34.6	FC > WS	FC > WS
Dioxins and Furans (Toxicity Equivalents -- TEQ)											
Polychlorinated Dibenzodioxins (PCDDs)											
2,3,7,8-TCDD	pg/g	---	--	--	--	--	50%	0.73	0.54	--	--
1,2,3,7,8-PeCDD	pg/g	---	--	--	--	--	50%	0.80	0.59	--	--
1,2,3,4,6,7,8-HpCDD	pg/g	---	--	--	--	--	0%	0.41	0.36	--	--
1,2,3,4,7,8-HxCDD	pg/g	---	--	--	--	--	100%	--	--	--	--
1,2,3,6,7,8-HxCDD	pg/g	---	--	--	--	--	0%	0.32	0.28	--	--
1,2,3,7,8,9-HxCDD	pg/g	---	--	--	--	--	0%	0.16	0.14	--	--
OCDD	pg/g	---	--	--	--	--	0%	0.10	0.089	--	--
Polychlorinated Dibenzofurans (PCDFs)											
2,3,7,8-TcDF	pg/g	---	--	--	--	--	0%	0.079	0.077	--	--
1,2,3,7,8-PeCDF	pg/g	---	--	--	--	--	50%	0.019	0.014	--	--
2,3,4,7,8-PeCDF	pg/g	---	--	--	--	--	50%	0.12	0.088	--	--
1,2,3,4,7,8-HxCDF	pg/g	---	--	--	--	--	100%	--	--	--	--
1,2,3,6,7,8-HxCDF	pg/g	---	--	--	--	--	100%	--	--	--	--
2,3,4,6,7,8-HxCDF	pg/g	---	--	--	--	--	100%	--	--	--	--
1,2,3,7,8,9-HxCDF	pg/g	---	--	--	--	--	100%	--	--	--	--
1,2,3,4,6,7,8-HpCDF	pg/g	---	--	--	--	--	0%	0.10	0.086	--	--
1,2,3,4,7,8,9-HpCDF	pg/g	---	--	--	--	--	100%	--	--	--	--
OCDF	pg/g	---	--	--	--	--	0%	0.017	0.013	--	--

TABLE C11: Statistical Summary and Comparison Results
Fisherman's Channel ISM Sampling

Constituent	Units	Criteria/Objectives USEPA RSL Residential	Criteria/Objectives NCRWQCB WQO	White Slough (WS) Percent Nondetect	White Slough (WS) 95UCL(1) Student-*t*	White Slough (WS) 95UCL(1) Chebyshev	Fisherman's Channel (FC) Percent Nondetect	Fisherman's Channel (FC) 95UCL(1) Student-*t*	Fisherman's Channel (FC) 95UCL(1) Chebyshev	Group Comparisons Student *t*-test	Group Comparisons Wilcoxon Rank Sum
Polychlorinated Biphenyls (PCBs)											
PCB-1016 (dry)	mg/kg	0.4	--	100%	--	--	100%	--	--	--	--
PCB-1221 (dry)	mg/kg	0.15	--	100%	--	--	100%	--	--	--	--
PCB-1232 (dry)	mg/kg	0.15	--	100%	--	--	100%	--	--	--	--
PCB-1242 (dry)	mg/kg	0.24	--	100%	--	--	100%	--	--	--	--
PCB-1248 (dry)	mg/kg	0.24	--	100%	--	--	100%	--	--	--	--
PCB-1254 (dry)	mg/kg	0.11	--	100%	--	--	100%	--	--	--	--
PCB-1260 (dry)	mg/kg	0.24	--	100%	--	--	100%	--	--	--	--
Organochlorine Pesticides											
4,4'-DDD	mg/kg	2.2	--	--	--	--	100%	--	--	--	--
4,4'-DDE	mg/kg	1.6	--	100%	--	--	100%	--	--	--	--
4,4'-DDT	mg/kg	1.9	--	100%	--	--	100%	--	--	--	--
Aldrin	mg/kg	0.031	--	100%	--	--	100%	--	--	--	--
alpha-BHC	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
beta-BHC	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
gamma-BHC (Lindane)	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
Delta-BHC	mg/kg	NV	--	100%	--	--	0%	0.0042	0.0045	WS > FC	WS > FC
Delta-BHC	mg/kg	NV	--	100%	--	--	0%	0.0042	0.0045	WS > FC	WS > FC
alpha-Chlordane	mg/kg	1.8	--	100%	--	--	100%	--	--	--	--
gamma-Chlordane	mg/kg	1.8	--	100%	--	--	100%	--	--	--	--
Dieldrin	mg/kg	0.033	--	100%	--	--	100%	--	--	--	--
Endosulfan I	mg/kg	37	--	100%	--	--	100%	--	--	--	--
Endosulfan II	mg/kg	37	--	67%	--	--	100%	--	--	--	--
Endosulfan sulfate	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
Endrin	mg/kg	1.8	--	100%	--	--	100%	--	--	--	--
Endrin aldehyde	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
Endrin ketone	mg/kg	NV	--	100%	--	--	100%	--	--	--	--
Heptachlor	mg/kg	0.12	--	100%	--	--	100%	--	--	--	--
Heptachlor epoxide	mg/kg	0.059	--	0%	0.0017	0.0019	100%	--	--	FC > WS	FC > WS
Methoxychlor	mg/kg	31	--	100%	--	--	100%	--	--	--	--
Toxaphene	mg/kg	0.48	--	100%	--	--	100%	--	--	--	--

TABLE C11: Statistical Summary and Comparison Results
Fisherman's Channel ISM Sampling

		Criteria/Objectives		White Slough (WS)			Fisherman's Channel (FC)			Group Comparisons	
		USEPA RSL	NCRWQCB	Percent	95UCL[(1)]		Percent	95UCL[(1)]		Student	Wilcoxon
Constituent	Units	Residential	WQO	Nondetect	Student-*t*	Chebyshev	Nondetect	Student-*t*	Chebyshev	*t*-test	Rank Sum
Petroleum Hydrocarbons											
Diesel Range Organics (C10-C24)- with SGC	mg/kg	100	--	0%	34.5	39.7	0%	14.7	15.5	WS > FC	WS > FC
Diesel Range Organics (C10-C24)	mg/kg	100	--	--	--	--	0%	18.9	20.4	NSD	NSD
Motor Oil Range Organics (C19-C36)-with SGC	mg/kg	100	--	0%	233	270	0%	55.7	59.1	WS > FC	WS > FC
Motor Oil Range Organics (C19-C36)	mg/kg	100	--	--	--	--	0%	73.5	78.7	NSD	NSD
General Chemistry / Other											
Total Organic Carbon	mg/kg	NV	--	0%	44840	47718	0%	6548	6802	WS > FC	WS > FC
PCP	mg/kg	1.7	--	100%	--	--	100%	--	--	--	--
Other -- Leachable											
PCP	µg/L	--	NV	--	--	--	100%	--	--	--	--

Notes:

(1) 95 Percent Upper Confidence Limit on the mean concentration. Calculations performed using the equations from the Interstate Technology Research Council's (ITRC's) ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean.

NSD No Significant Difference. The mean (Student t-test) or median (Wilcoxon Rank-Sum Test) values do not differ between the White Slough and Fisherman's Channel groups at a 95% significance level.

9.76 Shaded values indicate 95UCL values that exceed the corresponding criterion or water quality objective.

PCP Pentachlorophenol

Appendix D – Standard Operating Procedures (SOPs)

Standard Operating Procedures for Decontamination of Sampling Equipment

Standard Operating Procedures for Soil and Water Sampling from a Boring

STANDARD OPERATING PROCEDURES
for
DECONTAMINATION OF SAMPLING EQUIPMENT

1.0 OBJECTIVE

To establish accepted procedures for the decontamination of sampling equipment, to ensure that sampling equipment is not a residual source and field samples are representative of actual conditions.

1.1 Background

Non-disposable sampling equipment has the potential to cause cross-contamination of field samples if not cleaned correctly before and after collecting each sample. The specific method of decontamination may be decided on a case by case basis, or as required by project specifications. When utilizing the services of drilling company, sampling equipment is typically decontaminated with a steam cleaner or pressure washer. These Standard Operating Procedures (SOP) establish the procedures for decontamination of sampling equipment when a steam cleaner or pressure washer is not available.

1.2 Personnel Required and Responsibilities

Job Manager: The Job Manager (JM) is responsible for ensuring that field personnel have been trained in the use of these procedures and for verifying that decontamination activities are performed in compliance with this SOP.

Field Technician/Geologist/Scientist: The sampler is responsible for complying with this SOP, including: the decontamination of sampling equipment; the safe containerization of used decontamination solutions and decontamination rinsate; the documentation of field procedures; and, the labeling of containers.

2.0 DECONTAMINATION ACTIVITIES

2.1 Equipment Required

- Three 5-gallon buckets (typically plastic food grade)
- Assortment of brushes that fit inside the sampling equipment and sample containers
- Deionized or distilled water in sufficient quantity to fill the buckets to at least 1/3 of their capacity
- Alconox or Liquinox soap
- Buckets or drums with appropriate lids to store the decontamination rinsate
- Indelible marker
- Disposable gloves
- Drum labels

- Drum inventory form
- Sampling containers appropriate for the analyses of the decontamination rinsate for the contaminants anticipated to be encountered at the site (if characterizing at the time of waste generation)
- Chain-of-custody documentation
- Job Safety and Environmental Analysis (JSEA)

2.2. Decontamination Procedure

Prior to, and after, collecting each sample (soil, water, air, building material, etc.), non-disposable (reusable) sampling equipment shall be decontaminated as described below. Prior to sampling, each piece of sampling equipment will either be decontaminated, will be deemed clean (laboratory provided containers or sampling devices such as the encore sampler), new, or previously unused.

- Setup the three buckets in a row or label them 1,2 and 3
- Add deionized/distilled water to each bucket and fill them at least 1/3 of their capacity or with sufficient water that the sampling equipment can be predominantly submerged. Potable water may be utilized for the first bucket
- Add soap (Liquinox or Alconox powder) to the first bucket using manufacturers suggested amount and stir with brush(es)
- Sampling equipment should be placed in first bucket and scrubbed to remove gross contamination. The brushes in the first bucket should remain in that bucket.
- The second bucket is the first rinse to remove soap. A dedicated brush for the second bucket can be used to remove any visible remaining contamination or the equipment can be returned to the first bucket for additional cleaning.
- After rinsing in the second bucket, perform the final rinse in the third bucket. If the equipment is not planned for immediate use, either leave it in the third bucket or place on clean plastic sheeting.
- If decontaminating items that cannot be fully submerged in each bucket, ensure that each part of the equipment can be cleaned. Pumps should be operated in each bucket to ensure internal decontamination, and disposable tubing is preferred. Bailers can be inverted and rotated several times to clean the internal surfaces.
- Containerize decontamination water in 55-gallon drums or in 5-gallon buckets. Attach a label to the side of each container, and using an indelible marker record date, contents, origin and other pertinent information. Avoid labeling/marking the tops of containers as lids may be switched between containers. Note the number, condition and location of drums/buckets on site on a drum inventory form.

3.0 RINSATE SAMPLING

3.1 Sampling Procedure

Decontamination rinsate should either be homogenized by placing the contents of each container into a single bucket or drum, or by collecting a composite sample.

- Using laboratory provided sample containers, sample the homogenized rinsate by using a clean jar to transfer the water sample to the laboratory supplied containers. If the sample container does not contain a preservative, it may be submerged directly into the rinsate to be sampled. Do not submerge sample containers that contain preservative(s).
- Label the rinsate samples appropriately, dependent on the level of quality desired or specified (regular sample, blind sample, etc.)
- Enter the rinsate sample information on a separate chain-of-custody from the site samples, as the disposal company does not typically need the analytical results from other samples, and providing this data may cause confusion. The rinsate sample information may be entered along with other samples representing material designated for disposal, if you anticipate that only one disposal company will be utilized for both liquid and solid waste.

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STANDARD OPERATING PROCEDURES
for
SOIL AND WATER SAMPLING FROM A BORING

1. Objective

To establish accepted procedures for sampling soil and water from hollow-stem auger or direct push borings.

2. Background

During subsurface investigations it is necessary to obtain discrete soil and water samples from below the ground surface. Typically, heavy equipment is necessary to obtain these samples. This SOP establishes the procedures for collecting soil and groundwater samples from borings.

3. Personnel Required and Responsibilities

Project Manager: The Project Manager (PM) is responsible for ensuring that field personnel have been trained in the use of these procedures and for verifying that drilling water and soil sampling activities are performed in compliance with this SOP.

Project Scientist: The responsible professional in charge of the field work must determine the exact location and depth of each boring, and decide on the sampling interval. The project scientist must collect samples, prepare them for transport to the laboratory, and record lithologic and other observations. The Project Scientist is responsible for complying with this SOP.

Driller (Subcontractor): An appropriately licensed (C57) contractor must be equipped with truck- or tractor-mounted auger or direct push boring equipment and an OSHA-certified crew. The Driller is responsible for the safety and conduct of their employees. In addition, the Driller is responsible for the installation of borings according to the details specified in the Workplan. The Driller is responsible for maintaining industry standards and complying with the contract.

4. Equipment Required

Truck or tractor mounted auger or direct push rig

- Split spoon sampler or direct push sample barrel
- Acetate liners, brass or stainless steel sample liners and plastic end caps
- Aluminum foil or teflon sheeting
- Steam cleaner
- Containers for rinsate
- Disposable gloves
- Sample labels
- Munsell color charts

- Putty knife
- Boring logs
- Photoionization detector (PID)
- Ice/ice chest
- Sealable plastic storage bags
- Indelible marker

5. Procedure

Borings will be installed using hollow-stem augers, or 2-inch diameter pushrods. Borings will extend to the groundwater surface or deeper as specified by the project requirements. Typically, soil samples will be obtained either continuously, or at a minimum of 5-foot intervals for lithologic logging, on site field screening, and potential chemical analyses. Additional soil samples will be obtained at any notable changes in lithology and at any obvious areas of contamination.

- Soil samples will be collected in a split spoon sampler or direct-push sample barrel lined with clean brass or stainless steel sleeves. A six-inch interval of the sample will be capped with aluminum foil or Teflon sheeting and plastic end caps, labeled, wrapped in a plastic storage bag and stored in a cooler, on ice. Sample numbers and depths will be noted on the boring logs.
- The remaining sample will be used for color and soil type classification using the Unified Soil Classification System and Munsell color charts. A portion of each sample will be field-screened with a photo-ionization detector. Results of classification and field screening will be recorded on the boring logs.
- Sample equipment will be decontaminated with Alconox soap and distilled water between sampling intervals.
- Augers or push casing will be steam cleaned between each boring.
- If a hydropunch sampler is to be used to collect water samples, borings will terminate at the groundwater surface. A hydropunch-type groundwater sampling device will be lowered into the hollow stem augers or the drive casing, and driven three to four feet into the aquifer. Groundwater will be allowed to flow into the hydropunch.
- If a hydropunch type sampler is not used, the boring will be extended 3 to 5 feet into the aquifer. The augers or drive casing will be pulled back to allow for water to enter the boring. If caving of the bore hole occurs, temporary PVC casing may be lowered into the drive casing or hollow stem augers prior to retraction of the drive casing.
- Groundwater will be sampled using a small diameter stainless steel or disposable polyethylene bailer.
- Groundwater samples will be transferred from the bailer to appropriate size/type containers with the appropriate preservatives, as required by the project needs. Precautions will be taken to avoid capturing air bubbles in the samples. Sample containers will be labeled, wrapped in plastic bags and stored in a cooler, on ice. The water samples will be transported to a State-certified laboratory for the appropriate chemical analyses.
- Soil borings will be closed by filling to the surface with a cement/bentonite grout mixture, not exceeding 5% bentonite. The locations of each boring will be marked with spray paint.

Appendix E – Field Data Forms

Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-28-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: ID / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
1	1	11.0'	6.50	6.0'	1040	Sand from 3.0' to 4.5' shell fragments @ 4'
	2	11.0'	4.50	4.0'	1110	shell fragments @ 36" sand from 24" to bottom.
	3	12.0'	5.00	3.0'	1140 1150	Sample from first core sand from 18" to bottom live worm near surface

☐ GPS Actual Sample Location

Field Texture: gray sand overlain by clay/silt

Debris (Y/N, Type): shell fragments

Notes: 1-3 recovery at 3.0'; recore to attempt better recovery. 2nd core was only 2.0' feet; refusal

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-28-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: incoming

ISM Cell ID	Sub Sample ID	Existing ~~Elevation (feet MLLW)~~ water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
2	1	8.6'	7.00	5.5'	0855	Sand from 30" to depth Shell fragments @ 42"
	2	9.0'	5.00	3.5'	0930	refusal Sand from 20" to bottom
	3	8.5'	4.00	4' 8"	1000	Shell fragments @ 4' MEO @ 20" Sand from 30" to bottom

☐ GPS Actual Sample Location

Field Texture: Sand (gray) overlain by silt/clay

Debris (Y/N, Type): shell fragments

Notes: Bottom of channel measures deeper than bathymetry data which is several years old. Therefore short cores due to refusal are still representative of material to be dredged.

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging

Date: 9/27/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 3.5' MLLW

ISM Cell ID	Sub Sample ID	~~Existing Elevation~~ (feet MLLW) water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes 3-1S Field adjust sample length →
3	1	10.0	7.5	2.5	15:30	Actual surface is ~6.5' MLLW based on water depth + tide. Area is scoured, low recovery, sampled min of 1.5' for overdredge allow
	2	8.0'	5.5	5'1"	0825	
	3	7.75	5.0	4.25	16:00	shell fragments @ 3.5' sand from 2'4" to bottom

☐ GPS Actual Sample Location

Field Texture: Sand w/ some ~~[illegible]~~ silt layers, and 0-1 silt

Debris (Y/N, Type): lots of broken shells

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/27/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 6.75' MLLW

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ Water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
4	1	12.0	6.5	5.0	14:00	1 refusal @ 4.0' 2→ refusal @ 5.0 so sampled short
	2	8.5'	4.0	4.0	14:30	layered sand + silt
	3	7.0'	4.0	4.0	14:55	—

☐ GPS Actual Sample Location

Field Texture: Sand + silt

Debris (Y/N, Type): ~~eg~~ sea grass debris

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/27/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 7.0' MLLW

ISM Cell ID	Sub Sample ID	Existing ~~Elevation (feet MLLW)~~ water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
5	1	13.5	6.0	6.0	10:40	1-6' sand
	2	15.0	5.5	5.5	11:20	dense sand
	3	15.0	6.0	6.0	11:35	silt 0-1, sand 1-5, dense silt 5-6'

☐ GPS Actual Sample Location

Field Texture: sand

Debris (Y/N, Type): Y shells

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/27/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 3.0' MLLW

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet~~ MLLW) water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
6	1	8.0	1.0	1.0	9:00	
	2	10.0	3.0	3.0	9:50	Sulfur Smell
	3	11.0	2.0	3.0	10:15	

☐ GPS Actual Sample Location No

Field Texture: Silt over sand

Debris (Y/N, Type): Shells

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/25/15 + 9/27/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
7	1	5.3	1.0	3.0	15:30	
	2	7.0	4.5	4.5	15:48	
	3	8.0	4.5	2.5	16:05	~~NO SAMPLE - CORE TOO SHORT~~ Low recovery
(9/27)	3	9.5	4.5	4.5	8:30	

☐ GPS Actual Sample Location No

Field Texture: loam + sand

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 09/25/2015	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mi & Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ Feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
8	1	6.5	~~2.0~~ 4.0	6' 8"	2:45	PER FIELD CALCULATION, DEPTH OF CORE EXTENDED FROM 2.0' TO 4.0' due to dredge depth
	2	10.0	6.0	6' 3"	3:00	
	3	8.0	7.0	7' 2"	3:15	Sand 19"–60"

☐ GPS Actual Sample Location

Field Texture: loamy sand

Debris (Y/N, Type): shells, rock, wood pieces

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging

Date: 09/25/2015	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo & Sean
Sampler: JD / SH / LW / AG / Other GL	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ Feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
9	1	10.5	4.0	5.0	10:59	Shell at 28in, Hydrogen Sulfide Smell, Sand at 40in
	2	11.5	5.0	4.9 (with plug)	10:25	Hydrogen Sulfide Smell, Sand layer (10in-18), lots of Sand (18-22)
	3	11.0	6.0	5.10	11:46 *11.53	*taking 2nd core (first one was 5.6, too short) Hydrogen Sulfide Smell, Sand layer (20in - 36in), Shell particulate at 34in

☐ GPS Actual Sample Location

Field Texture: Silt clay

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 09/25/2015	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo & Sean
Sampler: JD / SH / LW / AG / Other GR	Tide: NA

ISM Cell ID	Sub Sample ID	Existing Elevation (~~feet MLLW~~) Feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
10	1	11.0	3.5	5.1	9:50	low sand, clam shell (8-14 in)
	2	11.0	4.5	5.3	10:13	sand layer (20-36 in), shell particulate (36 in),
	3	12.5	5.0	5.5	10:40	sand layer (15-22 in), shell particulate (26-33 in)

☐ GPS Actual Sample Location

Field Texture: silt clay

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 09/25/2015	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + SEAN
Sampler: JD / SH / LW / AG / Other GR	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ Feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
11	1	11.0	3.0	3.85	8:33	Hydrogen Sulfide Smell, Some Sand (16-20in), shell layer at 3ft
	2	10.2	3.5	3.5	~~8:57~~ 9:07	Sand layer (16-30in), Shell debris (at 12in); redwood at 18in
	3	11	3.5	4.1	9:25	sand layer (16-28in)

☐ GPS Actual Sample Location

Field Texture: silt / clay

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-24-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
12	1	7.5'	4.50	4.5'	1505	Shell frags @ 4' Sand layer 24" to 32"
	2	7.5'	4.00	4'5"	1530	Shell @ 3' Sand from 2-3'
	3	7.1'	4.00	4'2"	1550	Sand layer 22" to 32"

☐ GPS Actual Sample Location

Field Texture: Sand and Clay, gray to very dark gray

Debris (Y/N, Type): Shell

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-24-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	Existing Elevation (feet MLLW)	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
13	1	9.5	3.50	3' 11"	~~1325~~ 1340	Sand from 4" to 32" shell layer at 2'
	2	9.0	4.50	5.0'	1405	Sand layer 04" to 39" shell @ 4.5'
	3	7.0	3.50	3' 7"	1445	Sand layer 16" to 25" whole live clam @ 8"

☐ GPS Actual Sample Location

Field Texture: Gray sand overlying gray clay

Debris (Y/N, Type): Shell

Notes: 13-1 required 3 attempts as first two hit debris with zero penetration. Boat traffic causes delays as tie-off lines need to be released, raised and reset.

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-24-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
14	1	10.0'	4.50'	5' 1"	1105	Sand zone 3' to 4' Shells 3.5' to 4.0'
	2	10.5'	3.00'	2' 10"	1125	2.85' required attempt shells @ 14" sand @ 16" to bottom
	3	10.0'	3.00'	3.0'	1142	4" long sand zone from 1.8' to 2.0'

☐ GPS Actual Sample Location

Field Texture: Gray fat clay with sand

Debris (Y/N, Type): shell

Notes:

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T 1 707 443 8326 F 1 707 444 8330 E eureka@ghd.com W www.ghd.com

Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-24-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
15	1	11.0'	4.00	4.0'	0938	mild H_2S odor
	2	10.5'	2.50	2.5'	1000	clam shells @ 2'
	3	11.0'	2.50	3' 2"	~~1018~~ 1030	sand from 16" to 20"

☐ GPS Actual Sample Location

Field Texture: grey fat clay with sand zones

Debris (Y/N, Type): shell

Notes: 15-3 first attempt is 6" short, redrill

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Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
16	1	9.5	3.00	3'4"	0835	
	2	12.5	2.00	3.0'	0900	Sand zone 12" to 16" shell fragments
	3	11.7	2.50	4'8"	0915	Sand zone 11" to 20" pockets of sand with increasing sand at depth.

☐ GPS Actual Sample Location

Field Texture: gray fat clay with sand/silt

Debris (Y/N, Type): shell

Notes: Boat traffic causes delays

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Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
17	1	8.5'	3.00	3' 5"	1435	Sand layer 19" to 28" shells @2'
	2	8.0'	3.00	3' 5"	1455	
	3	8.4'	3.50	3.5'	1510	whole clam shells @16" @2', oxi-reduced nodule of clay colored brown

☐ GPS Actual Sample Location

Field Texture: fat clay, some areas only moist, predominantly wet

Debris (Y/N, Type): shell

Notes:

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Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
18	1	8.0'	4.50	4.5'	1305	whole clam shell @ 2', sandy zone 1.75' to 2.0'
	2	8.5'	3.00	3.0'	~~1325~~ 1335	Insufficient sample, Tarball shell fragments throughout, wood debris @ 1', sand 10"-16"
	3	8.7'	4.00	4' 7"	1412	shell fragments throughout, sandy layer 14" to 24"

☐ GPS Actual Sample Location

Field Texture: Fat clay, occasional sandy layers

Debris (Y/N, Type): shell, wood

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-23-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
19	1	11.8'	2.50	2'10"	1035	
	2	11.4'	2.00	1'9"	1058	actual core length required = 1.78'
	3	10.5'	2.00	2.0'	1118	Clay changes to sand at very bottom of sample.

☐ GPS Actual Sample Location

Field Texture: Bay Mud (fat clay)

Debris (Y/N, Type): shell, plastic, tar paper

Notes: 19-1 whole clam shell @ 2.5', shell debris @ 1.5', predominance of sand between 1.0 and 2.0', plastic debris @ 6.0', roofing paper @ surface

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Date: 9-23-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
20	1	10.5'	2.50	3.0'	0925	
	2	10.2'	3.00	3.0'	0942	
	3	9.0	3.00	3.0'	1008	mild H_2S

☐ GPS Actual Sample Location

Field Texture: fat clay

Debris (Y/N/Type):

Notes:

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Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
21	1	9.5'	3.50'	3.5'	0823	
	2	9.9'	4.00	4'5"	0847	Shell fragments @ 1.5' whole clam shells @ 2.0'
	3	10.0'	3.50	3'8"	0905	Sandy from 1.5' to 2.0'

☐ GPS Actual Sample Location

Field Texture: fat clay with occasional sand zone

Debris (Y/N, Type): Shell

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-22-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
22	1	9.5'	4.50	4.0	1530	short sample but pre-rounded depth [illegible] is 4.05, so proper depth reached.
	2	9.8'	5.00	5'9"	1550	Strong H_2S, wood debris @ 2'10", sandy section from 2.5 to 2.75'
	3	10.0'	3.50	3'10"	1610	large pile worm in sample

☐ GPS Actual Sample Location

Field Texture: Gray clay/silt with sand

Debris (Y/N, Type): wood, shell

Notes: whole oyster shell in 22-1 @ ~3.0'.

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-22-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
23	1	9.0	3.50	3.50	1440	Sand Zone from 2.0 to 2.5'
	2	7.5	3.00	3' 9"	1500	eelgrass in top of sample
	3	10.1	2.50	3.0	1515	

☐ GPS Actual Sample Location

Field Texture: gray clay/silt

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-22-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ water depth	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
24	1	9.0	3.00	5.0	1350	
	2	8.7	3.50	4.0	1405	
	3	9.1	3.00	3' 4"	1422	@ 1.5': wood debris

☐ GPS Actual Sample Location

Field Texture: Gray Clay

Debris (Y/N, Type): wood

Notes: Only sample to target depth, even when core is longer.

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/22/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 4.00' MLLW

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ Water depth	Total Sample Depth (with 2' Over Dredge)	Actual ~~Field Sample Depth~~ (core length, feet)	Sample Time	Notes
25	1	9'8"	4.0	4'8"	11:20	sand in bottom, sulfide smell
	2	9'.0"	2.5	3'3"	11:30	
	3	8.5	2.5	2'11"	11:45	

☐ GPS Actual Sample Location

Field Texture: silt

Debris (Y/N, Type):

Notes:

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Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/22/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 4.5' MLLW

ISM Cell ID	Sub Sample ID	Water ~~Existing Elevation~~ (feet MLLW)	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
26	1	11.0	1.5	1.5	10:20	plastic sheet debris
	2	11.5	1.5	1.5	10:35	
	3	11.5	1.5	3.0	10:55	shell (1)

☐ GPS Actual Sample Location

Field Texture: silt

Debris (Y/N, Type): small shells, plastic

Notes: Water = 11.5'

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9/22/15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo + Sean
Sampler: JD / SH / LW / AG / Other	Tide: 4.75' MLLW

ISM Cell ID	Sub Sample ID	Water ~~Existing~~ Elevation (feet MLLW)	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
27	1	10'5"	2.0	3.0 ~~3'1"~~ ~~3.0~~	9:20	
	2	11'9"	1.0	1.0 ~~2.0~~	9:35	already below dredge depth so
	3	12'	1.5	1.5 ~~3.0~~	9:50	1.0' sample collected for precaution per PK

☐ GPS Actual Sample Location

Field Texture: Silt

Debris (Y/N, Type):

Notes:

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-21-15 / 9-22-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + Sean
Sampler: JD / SH / LW / AG / Other	Tide: N/A

ISM Cell ID	Sub Sample ID	Existing ~~Elevation (feet MLLW)~~ depth water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
28	1	7.0	4.5	5.5'	1210	shell fragments in lower one foot; H2S odor
	2	8.0	4.5	4'9"	1230	little sand in lower one foot
	3	~~7.8~~ 8.0'	5.0	5'6"		

☐ GPS Actual Sample Location

Field Texture: Silt, Gray Clay with sand

Debris (Y/N, Type): shell

Notes: Delay between 28-2 and 28-3 due to winch failure.
1300 attempt 28-3 by hand, insufficient recovery, discard sample
1320 pull anchors & head for Fields landing
Shells - few in surface 28-3

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-21-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: Mo+Sean
Sampler: JD / SH / LW / AG / Other	Tide: NA

ISM Cell ID	Sub Sample ID	Existing Elevation (feet MLLW) feet water	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
29	1	5.0	~~4.0~~ 4.5	4.0	1042	eelgrass with orange encrustation + shell H_2S odor
	2	8.5'	~~5.0~~ 3.0	5'7"	~~1120~~ 1135	1st sample short, resample little sand on bottom foot of sample, H_2S
	3	6.5'	~~6.0~~ 5.0	5.5'	1100	wood debris @ 4'

☐ GPS Actual Sample Location

Field Texture: clay

Debris (Y/N, Type): shell, wood

Notes: 29-2 was short by almost one foot, resample since 29-3 was 6" short, collect extra 6" from 29-2 (5.5') note, record incorrect Target depths as spreadsheet page blew over in the wind.

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Sediment Sampling Data Form

Project: PGE Fisherman's Channel ISM Sediment Sampling Prior to Dredging	
Date: 9-21-15	Job Number: 8411747.07
Operator: TEG Oceanographic Services	Main Operator: Mark Metz
Sample Collection Method: 4" O.D. Vibracore	Assistant Operator: MO + ~~Seth~~ Sean
Sampler: JD / SH / LW / AG / Other	Tide: +4.25'

ISM Cell ID	Sub Sample ID	~~Existing Elevation (feet MLLW)~~ feet H_2O	Total Sample Depth (with 2' Over Dredge)	Actual Field Sample Depth (core length, feet)	Sample Time	Notes
30	1	6.0'	4.00	5.0	9:43	some shell debris Strong H_2S
	2	9.0'	2.50	2.5	1005	
	3	5.5'	4.00	5.0	1025	Shells @ edges & at surface of sample mild H_2S

☐ GPS Actual Sample Location

Field Texture: Gray Clay

Debris (Y/N, Type): Shell

Notes:

feet H_2O = thickness of water column

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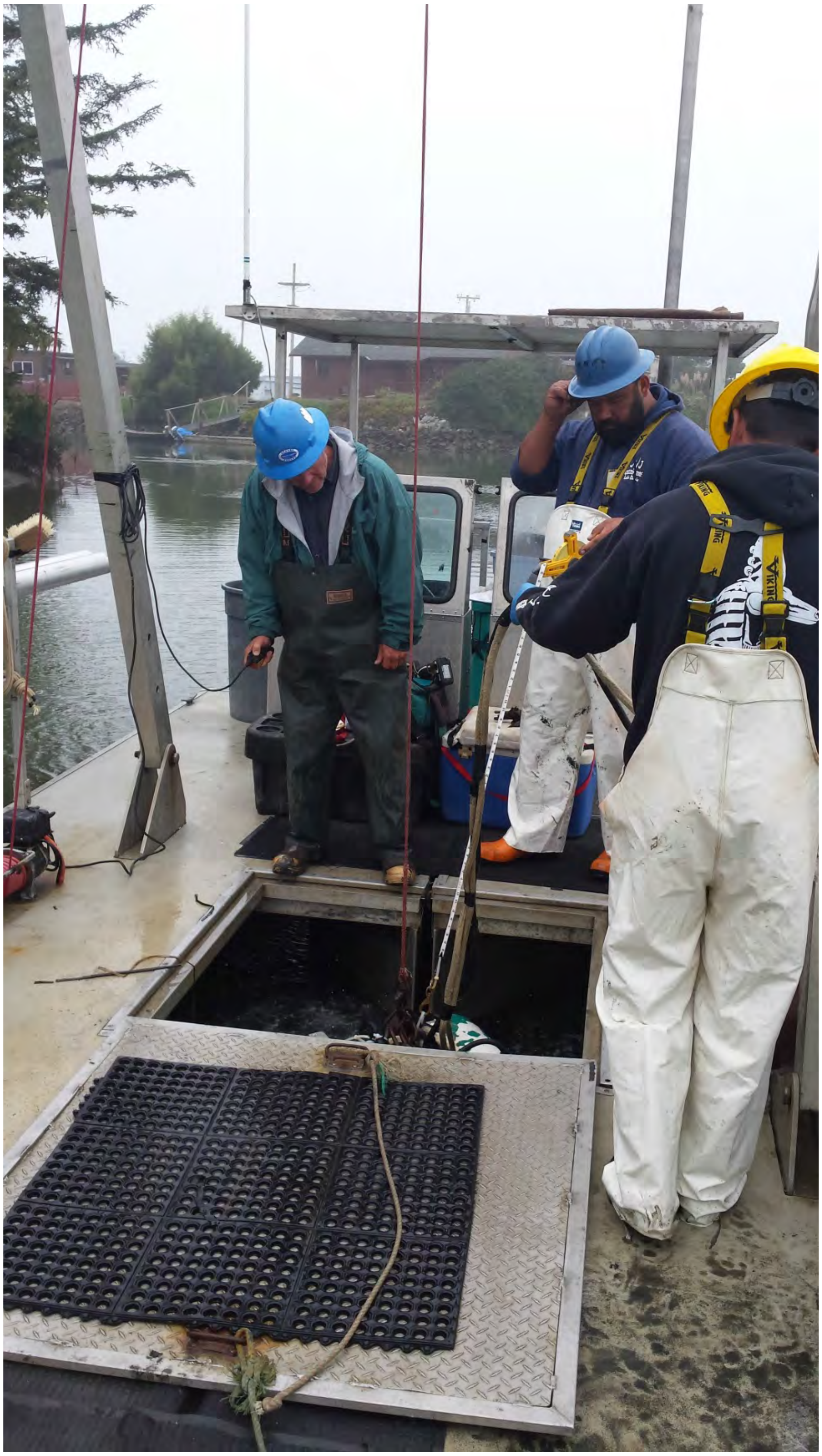
Appendix F – Photographs

Appendix F- Field Photographs
Fisherman's Channel ISM; September 2015
GHD Project Number 8411747.08



TEG Oceanograhic barge and sampling crew.

Appendix F- Field Photographs
Fisherman's Channel ISM; September 2015
GHD Project Number 8411747.08

Subsample 29-1.

Subsample 30-2. Gray silt/clay and sand.

Appendix G – Laboratory Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

TestAmerica Job ID: 320-15188-1
Client Project/Site: Fishermans Channel
Revision: 1

For:
GHD Services Inc.
718 Third Street
Eureka, California 95501

Attn: Jed Douglass

Authorized for release by:
11/17/2015 1:08:55 PM

Laura Turpen, Project Manager I
(916)374-4414
laura.turpen@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F2	MS/MSD RPD exceeds control limits
*	LCS or LCSD is outside acceptance limits.
X	Surrogate is outside control limits

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
X	Surrogate is outside control limits
P	The %RPD between the primary and confirmation column/detector is >40%. The higher value has been reported
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

Dioxin

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
q	The reported result is the estimated maximum possible concentration of this analyte, quantitated using the theoretical ion ratio. The measured ion ratio does not meet qualitative identification criteria and indicates a possible interference.
B	Compound was found in the blank and sample.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.
F1	MS and/or MSD Recovery is outside acceptance limits.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-15188-1

Laboratory: TestAmerica Sacramento

Narrative

Revision
This report was revised November 17, 2015 to remove the phrase "non-homogeneity" from the narrative and reword the receipt exceptions. No data changed as a result of this revision.

Receipt
The samples were received on 9/29/2015 7:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 8.6º C.

Receipt Exceptions
The following samples were received at the laboratory at 8.6 degrees Celsius, which is slightly above the recommended range of 0-6 degrees Celsius: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2) and FC-Replicate 3 (320-15188-3). No cooling agent was observed in the coolers upon receipt at the laboratory.

GC/MS Semi VOA
Method(s) 8270C SIM: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 440-287508 and analytical batch 440-287765. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

Method(s) 8151A: The continuing calibration verification (CCV) associated with batch 580-203162 recovered above the upper control limit for Pentachlorophenol. The sample results associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

Method(s) 8151A: The matrix spike / matrix spike duplicate (MS/MSD) RPD for analytical batch 203973 was outside control limits for Pentachlorophenol. The individual recoveries were within limits, as was the LCS recovery.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC Semi VOA
Method(s) 8015B: Some of the matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batches 320-88569 and 320-88571 and analytical batch 320-88835 were outside control limits. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Method(s) 8015B: The 8015 analyses for Diesel and Motor oil were done both pre-and post silica gel clean up. The silica gel clean up analyses were completed on October 12 at 3:38, 4:07, and 5:33PM, while the pre-SGC analyses were done on October 12 at 7:00, 7:29, and 8:56 PM.

Method(s) 8082: The Decachlorobiphenyl surrogate recoveries for the following samples were outside the upper control limit: FC-Replicate 2 (320-15188-2), FC-Replicate 3 (320-15188-3) and (320-15188-3- MSD). These samples did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8082: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 320-89031 and analytical batch 320-89179 were outside control limits for Aroclor 1016. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Method(s) 8081A: Some of the matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 320-89033 and analytical batch 320-89139 were outside control limits. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Dioxin
No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals

Job ID: 320-15188-1 (Continued)

Laboratory: TestAmerica Sacramento (Continued)

Method(s) 6020: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 320-88304 and 320-88494 and analytical batch 320-88698 were outside control limits. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

Method(s) 6020: The instrument blank for analytical batch 440-287597 contained Vanadium at a value that was greater than the reporting limit (RL). The samples were not re-analyzed since their Vanadium results were greater than 10X the amount present in the instrument blank.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep
Method(s) 3550B: The following samples required ten mercury clean-up steps, via EPA Method 3660A, to reduce matrix interferences caused by sulfur for method 8082-solid: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2), FC-Replicate 3 (320-15188-3), (320-15188-A-3-MS) and (320-15188-A-3-MSD). The reagent lot number used was: 0000097315.

Method(s) 3550B: The following samples required 14 or 15 mercury clean-ups, via EPA Method 3660A, to reduce matrix interferences caused by sulfur: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2), FC-Replicate 3 (320-15188-3), (320-15188-A-3-MS) and (320-15188-A-3-MSD). The reagent lot number used was: 0000097315.

Method(s) 3550B: Due to excessive sulfur, the following samples could not be concentrated to the final method required volume: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2), FC-Replicate 3 (320-15188-3), (320-15188-A-3-MS) and (320-15188-A-3-MSD). The reporting limits (RLs) are elevated proportionately. The samples were diluted 10X followed by the cleanup procedures to ensure the negative effects on chromatography caused by sulfur were mitigated prior to analysis.

Method(s) 3546: The following samples were prepared outside of preparation holding time in batch 287508 for 8270C SIM analysis. FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2) and FC-Replicate 3 (320-15188-3).

Method(s) 3546: The following samples was diluted due to the nature of their sample matrix: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2) and FC-Replicate 3 (320-15188-3). Elevated reporting limits (RLs) are provided.

Method(s) CA WET DI Leach: The following samples was prepared outside of preparation holding time in leachate batch 289123 for 8270C SIM analysis: FC-Replicate 1 (320-15188-1), FC-Replicate 2 (320-15188-2) and FC-Replicate 3 (320-15188-3).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Dioxin Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Client Sample ID: FC-Replicate 1

Lab Sample ID: 320-15188-1

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Incremented sample generated	0.00				NONE	1		Increment, prep	Total/NA

Analyte	Result	Qualifier	RL	EDL	Unit	Dil Fac	D	Method	Prep Type
2,3,7,8-TCDF	0.72	J	1.0	0.086	pg/g	1		8290	Total/NA
1,2,3,7,8-PeCDD	0.22	J q	5.1	0.11	pg/g	1		8290	Total/NA
1,2,3,6,7,8-HxCDD	2.1	J	5.1	0.15	pg/g	1		8290	Total/NA
1,2,3,7,8,9-HxCDD	0.93	J q	5.1	0.14	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDD	28		5.1	1.3	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDF	5.9		5.1	0.29	pg/g	1		8290	Total/NA
OCDD	230	B	10	2.0	pg/g	1		8290	Total/NA
OCDF	26		10	0.33	pg/g	1		8290	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[a]anthracene	0.0083	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Benzo[b]fluoranthene	0.016	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Benzo[g,h,i]perylene	0.011	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Chrysene	0.020	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Fluoranthene	0.034	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Fluorene	0.016	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Naphthalene	0.019	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Phenanthrene	0.055	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Pyrene	0.039	J H	0.060	0.0079	mg/Kg	1		8270C SIM	Total/NA
Diesel Range Organics (C10-C24)	13		0.98	0.49	mg/Kg	1		8015B	Total/NA
Diesel Range Organics (C10-C24)	17		0.98	0.49	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	49		4.9	3.7	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	65		4.9	3.7	mg/Kg	1		8015B	Total/NA
delta-BHC	0.0037	J	0.017	0.0016	mg/Kg	1		8081A	Total/NA
delta-BHC	0.0030	J	0.017	0.0016	mg/Kg	1		8081A	Total/NA
Arsenic	180		80	40	ug/L	20		6020	STLC Citrate
Cobalt	210		80	40	ug/L	20		6020	STLC Citrate
Vanadium	500		80	40	ug/L	20		6020	STLC Citrate
Barium	1400		80	40	ug/L	20		6020	STLC Citrate
Antimony	0.11	J	0.20	0.10	mg/Kg	2		6020	Total/NA
Arsenic	5.4		0.20	0.15	mg/Kg	2		6020	Total/NA
Barium	68		0.20	0.14	mg/Kg	2		6020	Total/NA
Beryllium	0.40		0.10	0.010	mg/Kg	2		6020	Total/NA
Cadmium	0.14		0.10	0.051	mg/Kg	2		6020	Total/NA
Chromium	71		0.20	0.10	mg/Kg	2		6020	Total/NA
Cobalt	11		0.10	0.061	mg/Kg	2		6020	Total/NA
Copper	23		0.20	0.10	mg/Kg	2		6020	Total/NA
Lead	6.3		0.10	0.061	mg/Kg	2		6020	Total/NA
Molybdenum	1.1		0.20	0.020	mg/Kg	2		6020	Total/NA
Nickel	79		0.20	0.10	mg/Kg	2		6020	Total/NA
Selenium	0.25		0.20	0.10	mg/Kg	2		6020	Total/NA
Silver	0.071	J	0.10	0.031	mg/Kg	2		6020	Total/NA
Thallium	0.092	J	0.10	0.051	mg/Kg	2		6020	Total/NA
Vanadium	44		1.0	0.31	mg/Kg	2		6020	Total/NA
Zinc	58		1.0	0.61	mg/Kg	2		6020	Total/NA
Arsenic	4.6		0.20	0.10	ug/L	1		6020	STLC DI
Cobalt	0.84		0.20	0.10	ug/L	1		6020	STLC DI
Vanadium	12	^	0.20	0.10	ug/L	1		6020	STLC DI
Barium	19		0.20	0.10	ug/L	1		6020	STLC DI

This Detection Summary does not include radiochemical test results.

Client Sample ID: FC-Replicate 1 (Continued) — Lab Sample ID: 320-15188-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Mercury	0.069		0.024	0.0052	mg/Kg	1		7471A	Total/NA
Total Organic Carbon - Average Dup	6300		2000	44	mg/Kg	1		9060	Total/NA

Client Sample ID: FC-Replicate 2 — Lab Sample ID: 320-15188-2

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Incremented sample generated	0.00				NONE	1		Increment, prep	Total/NA

Analyte	Result	Qualifier	RL	EDL	Unit	Dil Fac	D	Method	Prep Type
2,3,7,8-TCDD	0.20	J q	0.99	0.074	pg/g	1		8290	Total/NA
2,3,7,8-TCDF	0.74	J	0.99	0.060	pg/g	1		8290	Total/NA
1,2,3,7,8-PeCDF	0.17	J q	5.0	0.056	pg/g	1		8290	Total/NA
2,3,4,7,8-PeCDF	0.11	J q	5.0	0.059	pg/g	1		8290	Total/NA
1,2,3,6,7,8-HxCDD	1.7	J q	5.0	0.17	pg/g	1		8290	Total/NA
1,2,3,7,8,9-HxCDD	1.1	J	5.0	0.16	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDD	23		5.0	0.76	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDF	4.3	J	5.0	0.16	pg/g	1		8290	Total/NA
OCDD	190	B	9.9	1.5	pg/g	1		8290	Total/NA
OCDF	15		9.9	0.23	pg/g	1		8290	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[b]fluoranthene	0.014	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Benzo[g,h,i]perylene	0.012	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Chrysene	0.017	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Fluoranthene	0.029	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Fluorene	0.013	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Naphthalene	0.015	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Phenanthrene	0.048	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Pyrene	0.031	J H	0.058	0.0077	mg/Kg	1		8270C SIM	Total/NA
Diesel Range Organics (C10-C24)	14	F1	1.0	0.50	mg/Kg	1		8015B	Total/NA
Diesel Range Organics (C10-C24)	17	F1	1.0	0.50	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	53		5.0	3.8	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	68		5.0	3.8	mg/Kg	1		8015B	Total/NA
delta-BHC	0.0034	J	0.017	0.0016	mg/Kg	1		8081A	Total/NA
delta-BHC	0.0032	J	0.017	0.0016	mg/Kg	1		8081A	Total/NA
Arsenic	170		80	40	ug/L	20		6020	STLC Citrate
Cobalt	230		80	40	ug/L	20		6020	STLC Citrate
Vanadium	510		80	40	ug/L	20		6020	STLC Citrate
Barium	1400		80	40	ug/L	20		6020	STLC Citrate
Antimony	0.12	J	0.20	0.099	mg/Kg	2		6020	Total/NA
Arsenic	5.0		0.20	0.15	mg/Kg	2		6020	Total/NA
Barium	64		0.20	0.14	mg/Kg	2		6020	Total/NA
Beryllium	0.38		0.099	0.0099	mg/Kg	2		6020	Total/NA
Cadmium	0.14		0.099	0.049	mg/Kg	2		6020	Total/NA
Chromium	69		0.20	0.099	mg/Kg	2		6020	Total/NA
Cobalt	11		0.099	0.059	mg/Kg	2		6020	Total/NA
Copper	21		0.20	0.099	mg/Kg	2		6020	Total/NA
Lead	6.0		0.099	0.059	mg/Kg	2		6020	Total/NA
Molybdenum	0.91		0.20	0.020	mg/Kg	2		6020	Total/NA
Nickel	75		0.20	0.099	mg/Kg	2		6020	Total/NA
Selenium	0.23		0.20	0.099	mg/Kg	2		6020	Total/NA
Silver	0.076	J	0.099	0.030	mg/Kg	2		6020	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: FC-Replicate 2 (Continued)   Lab Sample ID: 320-15188-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Thallium	0.083	J	0.099	0.049	mg/Kg	2		6020	Total/NA
Vanadium	43		0.99	0.30	mg/Kg	2		6020	Total/NA
Zinc	57		0.99	0.59	mg/Kg	2		6020	Total/NA
Arsenic	4.9		0.20	0.10	ug/L	1		6020	STLC DI
Cobalt	0.84		0.20	0.10	ug/L	1		6020	STLC DI
Vanadium	12	^	0.20	0.10	ug/L	1		6020	STLC DI
Barium	18		0.20	0.10	ug/L	1		6020	STLC DI
Mercury	0.066		0.024	0.0051	mg/Kg	1		7471A	Total/NA
Total Organic Carbon - Average Dup	5700		2000	44	mg/Kg	1		9060	Total/NA

Client Sample ID: FC-Replicate 3   Lab Sample ID: 320-15188-3

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Incremented sample generated	0.00				NONE	1		Increment, prep	Total/NA

Analyte	Result	Qualifier	RL	EDL	Unit	Dil Fac	D	Method	Prep Type
2,3,7,8-TCDF	0.75	J	1.0	0.052	pg/g	1		8290	Total/NA
1,2,3,7,8-PeCDD	0.33	J	5.0	0.093	pg/g	1		8290	Total/NA
1,2,3,4,7,8-HxCDD	0.22	J	5.0	0.11	pg/g	1		8290	Total/NA
1,2,3,6,7,8-HxCDD	1.7	J	5.0	0.097	pg/g	1		8290	Total/NA
1,2,3,7,8,9-HxCDD	1.1	J q	5.0	0.092	pg/g	1		8290	Total/NA
1,2,3,4,7,8-HxCDF	0.31	J q	5.0	0.089	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDD	24		5.0	0.71	pg/g	1		8290	Total/NA
1,2,3,4,6,7,8-HpCDF	4.2	J	5.0	0.16	pg/g	1		8290	Total/NA
OCDD	200	B	10	1.2	pg/g	1		8290	Total/NA
OCDF	15		10	0.16	pg/g	1		8290	Total/NA

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[b]fluoranthene	0.012	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Benzo[g,h,i]perylene	0.0097	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Chrysene	0.012	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Fluoranthene	0.025	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Fluorene	0.014	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Naphthalene	0.016	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Phenanthrene	0.044	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Pyrene	0.026	J H	0.061	0.0081	mg/Kg	1		8270C SIM	Total/NA
Diesel Range Organics (C10-C24)	12		1.0	0.50	mg/Kg	1		8015B	Total/NA
Diesel Range Organics (C10-C24)	14		1.0	0.50	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	45		5.0	3.8	mg/Kg	1		8015B	Total/NA
Motor Oil Range Organics (C19-C36)	56		5.0	3.8	mg/Kg	1		8015B	Total/NA
delta-BHC	0.0040	J P	0.017	0.0016	mg/Kg	1		8081A	Total/NA
delta-BHC	0.0025	J	0.017	0.0016	mg/Kg	1		8081A	Total/NA
Arsenic	160		80	40	ug/L	20		6020	STLC Citrate
Cobalt	210		80	40	ug/L	20		6020	STLC Citrate
Vanadium	490		80	40	ug/L	20		6020	STLC Citrate
Barium	1300		80	40	ug/L	20		6020	STLC Citrate
Antimony	0.14	J F1	0.20	0.099	mg/Kg	2		6020	Total/NA
Arsenic	5.2		0.20	0.15	mg/Kg	2		6020	Total/NA
Barium	67		0.20	0.14	mg/Kg	2		6020	Total/NA
Beryllium	0.37		0.099	0.0099	mg/Kg	2		6020	Total/NA
Cadmium	0.15		0.099	0.050	mg/Kg	2		6020	Total/NA
Chromium	72		0.20	0.099	mg/Kg	2		6020	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: FC-Replicate 3 (Continued)

Lab Sample ID: 320-15188-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	11		0.099	0.060	mg/Kg	2		6020	Total/NA
Copper	22		0.20	0.099	mg/Kg	2		6020	Total/NA
Lead	6.3		0.099	0.060	mg/Kg	2		6020	Total/NA
Molybdenum	0.97		0.20	0.020	mg/Kg	2		6020	Total/NA
Nickel	79		0.20	0.099	mg/Kg	2		6020	Total/NA
Selenium	0.24		0.20	0.099	mg/Kg	2		6020	Total/NA
Silver	0.074	J	0.099	0.030	mg/Kg	2		6020	Total/NA
Thallium	0.095	J	0.099	0.050	mg/Kg	2		6020	Total/NA
Vanadium	44		0.99	0.30	mg/Kg	2		6020	Total/NA
Zinc	57		0.99	0.60	mg/Kg	2		6020	Total/NA
Arsenic	4.8		0.20	0.10	ug/L	1		6020	STLC DI
Cobalt	0.87		0.20	0.10	ug/L	1		6020	STLC DI
Vanadium	13	^	0.20	0.10	ug/L	1		6020	STLC DI
Barium	19		0.20	0.10	ug/L	1		6020	STLC DI
Mercury	0.068		0.024	0.0052	mg/Kg	1		7471A	Total/NA
Total Organic Carbon - Average Dup	6100		2000	44	mg/Kg	1		9060	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: FC-Replicate 1

Lab Sample ID: 320-15188-1

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Matrix: Solid

Method: 8151A - Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND	F2	0.049	0.012	mg/Kg		10/12/15 10:51	10/22/15 23:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*94*		*58 - 160*	*10/12/15 10:51*	*10/22/15 23:06*	*1*

Method: 8151A - TCLP Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND	*	2.5	0.30	ug/L		10/14/15 12:53	10/23/15 05:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*129*		*40 - 135*	*10/14/15 12:53*	*10/23/15 05:55*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Acenaphthylene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Anthracene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Benzo[a]anthracene	**0.0083**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Benzo[a]pyrene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Benzo[b]fluoranthene	**0.016**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Benzo[g,h,i]perylene	**0.011**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Benzo[k]fluoranthene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Chrysene	**0.020**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Dibenz(a,h)anthracene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Fluoranthene	**0.034**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Fluorene	**0.016**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Indeno[1,2,3-cd]pyrene	ND	H	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Naphthalene	**0.019**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Phenanthrene	**0.055**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1
Pyrene	**0.039**	**J H**	0.060	0.0079	mg/Kg		10/16/15 17:17	10/19/15 18:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Nitrobenzene-d5	*56*		*41 - 119*	*10/16/15 17:17*	*10/19/15 18:12*	*1*
2-Fluorobiphenyl (Surr)	*54*		*39 - 111*	*10/16/15 17:17*	*10/19/15 18:12*	*1*
Terphenyl-d14	*63*		*43 - 150*	*10/16/15 17:17*	*10/19/15 18:12*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Acenaphthylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Benzo[a]anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Benzo[a]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Benzo[b]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Benzo[g,h,i]perylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Benzo[k]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Chrysene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Dibenz(a,h)anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Fluorene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Indeno[1,2,3-cd]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Client Sample ID: FC-Replicate 1

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-1
Matrix: Solid

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) - STLC DI (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Phenanthrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1
Pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 21:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*52*		*50 - 104*	*10/26/15 12:27*	*10/27/15 21:07*	*1*
Nitrobenzene-d5	*67*		*46 - 109*	*10/26/15 12:27*	*10/27/15 21:07*	*1*
Terphenyl-d14	*71*		*28 - 124*	*10/26/15 12:27*	*10/27/15 21:07*	*1*

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (C10-C24)	**13**		0.98	0.49	mg/Kg		10/08/15 12:48	10/12/15 15:38	1
Diesel Range Organics (C10-C24)	**17**		0.98	0.49	mg/Kg		10/08/15 12:46	10/12/15 19:00	1
Motor Oil Range Organics (C19-C36)	**49**		4.9	3.7	mg/Kg		10/08/15 12:48	10/12/15 15:38	1
Motor Oil Range Organics (C19-C36)	**65**		4.9	3.7	mg/Kg		10/08/15 12:46	10/12/15 19:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*91*		*63 - 141*	*10/08/15 12:48*	*10/12/15 15:38*	*1*
o-Terphenyl (Surr)	*99*		*63 - 141*	*10/08/15 12:46*	*10/12/15 19:00*	*1*

Method: 8081A - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4,4'-DDD	ND		0.017	0.0025	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
4,4'-DDE	ND		0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
4,4'-DDT	ND		0.017	0.0039	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Aldrin	ND		0.017	0.0021	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
alpha-BHC	ND		0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
beta-BHC	ND		0.017	0.0032	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
gamma-BHC (Lindane)	ND		0.017	0.0017	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
delta-BHC	**0.0037**	**J**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
delta-BHC	**0.0030**	**J**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
alpha-Chlordane	ND		0.017	0.0020	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
gamma-Chlordane	ND		0.017	0.00052	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Dieldrin	ND		0.017	0.00089	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endosulfan I	ND		0.017	0.00051	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endosulfan II	ND		0.017	0.00098	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endosulfan sulfate	ND		0.017	0.00090	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endrin	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endrin aldehyde	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Endrin ketone	ND		0.017	0.0033	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Heptachlor	ND		0.017	0.0019	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Heptachlor epoxide	ND		0.017	0.0012	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Methoxychlor	ND		0.033	0.013	mg/Kg		10/08/15 12:35	10/14/15 18:28	1
Toxaphene	ND		0.66	0.20	mg/Kg		10/08/15 12:35	10/14/15 18:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*101*		*58 - 111*	*10/08/15 12:35*	*10/14/15 18:28*	*1*
Tetrachloro-m-xylene	*105*		*58 - 111*	*10/08/15 12:35*	*10/14/15 18:28*	*1*
DCB Decachlorobiphenyl	*114*		*49 - 119*	*10/08/15 12:35*	*10/14/15 18:28*	*1*

Client Sample ID: FC-Replicate 1

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-1

Matrix: Solid

Method: 8081A - Organochlorine Pesticides (GC) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
DCB Decachlorobiphenyl	*109*		*49 - 119*	*10/08/15 12:35*	*10/14/15 18:28*	*1*

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.32	0.033	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1221	ND		0.32	0.051	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1232	ND		0.32	0.063	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1242	ND		0.32	0.072	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1248	ND		0.32	0.056	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1254	ND		0.32	0.026	mg/Kg		10/08/15 12:39	10/14/15 18:32	1
PCB-1260	ND		0.32	0.028	mg/Kg		10/08/15 12:39	10/14/15 18:32	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
DCB Decachlorobiphenyl	*123*		*77 - 123*	*10/08/15 12:39*	*10/14/15 18:32*	*1*

Method: 8290 - Dioxins and Furans (HRGC/HRMS)

Analyte	Result	Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	ND		1.0	0.11	pg/g		10/07/15 14:17	10/09/15 14:16	1
2,3,7,8-TCDF	**0.72**	**J**	1.0	0.086	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,7,8-PeCDD	**0.22**	**J q**	5.1	0.11	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,7,8-PeCDF	ND		5.1	0.073	pg/g		10/07/15 14:17	10/09/15 14:16	1
2,3,4,7,8-PeCDF	ND		5.1	0.076	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,4,7,8-HxCDD	ND		5.1	0.18	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,6,7,8-HxCDD	**2.1**	**J**	5.1	0.15	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,7,8,9-HxCDD	**0.93**	**J q**	5.1	0.14	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,4,7,8-HxCDF	ND		5.1	0.15	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,6,7,8-HxCDF	ND		5.1	0.13	pg/g		10/07/15 14:17	10/09/15 14:16	1
2,3,4,6,7,8-HxCDF	ND		5.1	0.15	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,7,8,9-HxCDF	ND		5.1	0.16	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,4,6,7,8-HpCDD	**28**		5.1	1.3	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,4,6,7,8-HpCDF	**5.9**		5.1	0.29	pg/g		10/07/15 14:17	10/09/15 14:16	1
1,2,3,4,7,8,9-HpCDF	ND		5.1	0.35	pg/g		10/07/15 14:17	10/09/15 14:16	1
OCDD	**230**	**B**	10	2.0	pg/g		10/07/15 14:17	10/09/15 14:16	1
OCDF	**26**		10	0.33	pg/g		10/07/15 14:17	10/09/15 14:16	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C-2,3,7,8-TCDD	*66*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-2,3,7,8-TCDF	*70*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,7,8-PeCDD	*66*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,7,8-PeCDF	*70*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,6,7,8-HxCDD	*74*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,4,7,8-HxCDF	*60*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,4,6,7,8-HpCDD	*68*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-1,2,3,4,6,7,8-HpCDF	*72*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*
13C-OCDD	*61*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:16*	*1*

Method: 6020 - Inductively Coupled Plasma - Mass Spectrometry - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**180**		80	40	ug/L			10/23/15 12:55	20
Cobalt	**210**		80	40	ug/L			10/23/15 12:55	20
Vanadium	**500**		80	40	ug/L			10/23/15 12:55	20

Client Sample ID: FC-Replicate 1

Lab Sample ID: 320-15188-1
Date Collected: 09/28/15 00:00
Matrix: Solid
Date Received: 09/29/15 07:00

Method: 6020 - Inductively Coupled Plasma - Mass Spectrometry - STLC Citrate (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		40	20	ug/L			10/23/15 12:55	20
Barium	**1400**		80	40	ug/L			10/23/15 12:55	20

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.11**	**J**	0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Arsenic	**5.4**		0.20	0.15	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Barium	**68**		0.20	0.14	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Beryllium	**0.40**		0.10	0.010	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Cadmium	**0.14**		0.10	0.051	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Chromium	**71**		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Cobalt	**11**		0.10	0.061	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Copper	**23**		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Lead	**6.3**		0.10	0.061	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Molybdenum	**1.1**		0.20	0.020	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Nickel	**79**		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Selenium	**0.25**		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Silver	**0.071**	**J**	0.10	0.031	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Thallium	**0.092**	**J**	0.10	0.051	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Vanadium	**44**		1.0	0.31	mg/Kg		10/08/15 07:40	10/08/15 22:56	2
Zinc	**58**		1.0	0.61	mg/Kg		10/08/15 07:40	10/08/15 22:56	2

Method: 6020 - Metals (ICP/MS) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.6**		0.20	0.10	ug/L			10/16/15 20:18	1
Cobalt	**0.84**		0.20	0.10	ug/L			10/16/15 20:18	1
Vanadium	**12**	**^**	0.20	0.10	ug/L			10/16/15 20:18	1
Cadmium	ND		0.10	0.050	ug/L			10/16/15 20:18	1
Barium	**19**		0.20	0.10	ug/L			10/16/15 20:18	1

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.069**		0.024	0.0052	mg/Kg		10/09/15 10:30	10/09/15 14:03	1

General Chemistry

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Incremented sample generated	**0.00**				NONE			09/29/15 14:40	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium, hexavalent	ND		0.049	0.0099	mg/Kg			10/19/15 16:30	1
Total Organic Carbon - Average Dup	**6300**		2000	44	mg/Kg			10/15/15 12:42	1

Client Sample ID: FC-Replicate 2

Lab Sample ID: 320-15188-2
Date Collected: 09/28/15 00:00
Matrix: Solid
Date Received: 09/29/15 07:00

Method: 8151A - Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.048	0.012	mg/Kg		10/12/15 10:51	10/23/15 00:14	1

Client Sample ID: FC-Replicate 2

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-2

Matrix: Solid

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4-Dichlorophenylacetic acid	*77*		*58 - 160*	*10/12/15 10:51*	*10/23/15 00:14*	*1*

Method: 8151A - TCLP Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND	*	2.5	0.30	ug/L		10/14/15 12:53	10/23/15 06:18	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4-Dichlorophenylacetic acid	*105*		*40 - 135*	*10/14/15 12:53*	*10/23/15 06:18*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Acenaphthylene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Anthracene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Benzo[a]anthracene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Benzo[a]pyrene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Benzo[b]fluoranthene	**0.014**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Benzo[g,h,i]perylene	**0.012**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Benzo[k]fluoranthene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Chrysene	**0.017**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Dibenz(a,h)anthracene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Fluoranthene	**0.029**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Fluorene	**0.013**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Indeno[1,2,3-cd]pyrene	ND	H	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Naphthalene	**0.015**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Phenanthrene	**0.048**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1
Pyrene	**0.031**	**J H**	0.058	0.0077	mg/Kg		10/16/15 17:17	10/19/15 18:33	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Nitrobenzene-d5	*55*		*41 - 119*	*10/16/15 17:17*	*10/19/15 18:33*	*1*
2-Fluorobiphenyl (Surr)	*62*		*39 - 111*	*10/16/15 17:17*	*10/19/15 18:33*	*1*
Terphenyl-d14	*63*		*43 - 150*	*10/16/15 17:17*	*10/19/15 18:33*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Acenaphthylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Benzo[a]anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Benzo[a]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Benzo[b]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Benzo[g,h,i]perylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Benzo[k]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Chrysene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Dibenz(a,h)anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Fluorene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Indeno[1,2,3-cd]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Naphthalene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Phenanthrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1
Pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/28/15 00:53	1

Client Sample ID: FC-Replicate 2

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-2

Matrix: Solid

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	48	X	50 - 104	10/26/15 12:27	10/28/15 00:53	1
Nitrobenzene-d5	62		46 - 109	10/26/15 12:27	10/28/15 00:53	1
Terphenyl-d14	68		28 - 124	10/26/15 12:27	10/28/15 00:53	1

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (C10-C24)	**14**	**F1**	1.0	0.50	mg/Kg		10/08/15 12:48	10/12/15 16:07	1
Diesel Range Organics (C10-C24)	**17**	**F1**	1.0	0.50	mg/Kg		10/08/15 12:46	10/12/15 19:29	1
Motor Oil Range Organics (C19-C36)	**53**		5.0	3.8	mg/Kg		10/08/15 12:48	10/12/15 16:07	1
Motor Oil Range Organics (C19-C36)	**68**		5.0	3.8	mg/Kg		10/08/15 12:46	10/12/15 19:29	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl (Surr)	106		63 - 141	10/08/15 12:48	10/12/15 16:07	1
o-Terphenyl (Surr)	101		63 - 141	10/08/15 12:46	10/12/15 19:29	1

Method: 8081A - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4,4'-DDD	ND		0.017	0.0026	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
4,4'-DDE	ND		0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
4,4'-DDT	ND		0.017	0.0040	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Aldrin	ND		0.017	0.0021	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
alpha-BHC	ND		0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
beta-BHC	ND		0.017	0.0033	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
gamma-BHC (Lindane)	ND		0.017	0.0017	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
delta-BHC	**0.0034**	**J**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
delta-BHC	**0.0032**	**J**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
alpha-Chlordane	ND		0.017	0.0020	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
gamma-Chlordane	ND		0.017	0.00053	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Dieldrin	ND		0.017	0.00091	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endosulfan I	ND		0.017	0.00052	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endosulfan II	ND		0.017	0.0010	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endosulfan sulfate	ND		0.017	0.00092	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endrin	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endrin aldehyde	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Endrin ketone	ND		0.017	0.0034	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Heptachlor	ND		0.017	0.0019	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Heptachlor epoxide	ND		0.017	0.0012	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Methoxychlor	ND		0.034	0.013	mg/Kg		10/08/15 12:35	10/14/15 18:44	1
Toxaphene	ND		0.67	0.20	mg/Kg		10/08/15 12:35	10/14/15 18:44	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	96		58 - 111	10/08/15 12:35	10/14/15 18:44	1
Tetrachloro-m-xylene	106		58 - 111	10/08/15 12:35	10/14/15 18:44	1
DCB Decachlorobiphenyl	113		49 - 119	10/08/15 12:35	10/14/15 18:44	1
DCB Decachlorobiphenyl	107		49 - 119	10/08/15 12:35	10/14/15 18:44	1

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.33	0.034	mg/Kg		10/08/15 12:39	10/14/15 18:53	1
PCB-1221	ND		0.33	0.052	mg/Kg		10/08/15 12:39	10/14/15 18:53	1

Client Sample ID: FC-Replicate 2
Lab Sample ID: 320-15188-2
Date Collected: 09/28/15 00:00
Matrix: Solid
Date Received: 09/29/15 07:00

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1232	ND		0.33	0.064	mg/Kg		10/08/15 12:39	10/14/15 18:53	1
PCB-1242	ND		0.33	0.074	mg/Kg		10/08/15 12:39	10/14/15 18:53	1
PCB-1248	ND		0.33	0.057	mg/Kg		10/08/15 12:39	10/14/15 18:53	1
PCB-1254	ND		0.33	0.027	mg/Kg		10/08/15 12:39	10/14/15 18:53	1
PCB-1260	ND		0.33	0.029	mg/Kg		10/08/15 12:39	10/14/15 18:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl	*126*	*X*	*77 - 123*	*10/08/15 12:39*	*10/14/15 18:53*	*1*

Method: 8290 - Dioxins and Furans (HRGC/HRMS)

Analyte	Result	Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	**0.20**	**J q**	0.99	0.074	pg/g		10/07/15 14:17	10/09/15 14:58	1
2,3,7,8-TCDF	**0.74**	**J**	0.99	0.060	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,7,8-PeCDD	ND		5.0	0.17	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,7,8-PeCDF	**0.17**	**J q**	5.0	0.056	pg/g		10/07/15 14:17	10/09/15 14:58	1
2,3,4,7,8-PeCDF	**0.11**	**J q**	5.0	0.059	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,4,7,8-HxCDD	ND		5.0	0.19	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,6,7,8-HxCDD	**1.7**	**J q**	5.0	0.17	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,7,8,9-HxCDD	**1.1**	**J**	5.0	0.16	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,4,7,8-HxCDF	ND		5.0	0.18	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,6,7,8-HxCDF	ND		5.0	0.15	pg/g		10/07/15 14:17	10/09/15 14:58	1
2,3,4,6,7,8-HxCDF	ND		5.0	0.17	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,7,8,9-HxCDF	ND		5.0	0.18	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,4,6,7,8-HpCDD	**23**		5.0	0.76	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,4,6,7,8-HpCDF	**4.3**	**J**	5.0	0.16	pg/g		10/07/15 14:17	10/09/15 14:58	1
1,2,3,4,7,8,9-HpCDF	ND		5.0	0.19	pg/g		10/07/15 14:17	10/09/15 14:58	1
OCDD	**190**	**B**	9.9	1.5	pg/g		10/07/15 14:17	10/09/15 14:58	1
OCDF	**15**		9.9	0.23	pg/g		10/07/15 14:17	10/09/15 14:58	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*73*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-2,3,7,8-TCDF	*78*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,7,8-PeCDD	*74*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,7,8-PeCDF	*81*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,6,7,8-HxCDD	*83*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,4,7,8-HxCDF	*70*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,4,6,7,8-HpCDD	*76*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-1,2,3,4,6,7,8-HpCDF	*80*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*
13C-OCDD	*67*		*40 - 135*	*10/07/15 14:17*	*10/09/15 14:58*	*1*

Method: 6020 - Inductively Coupled Plasma - Mass Spectrometry - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**170**		80	40	ug/L			10/23/15 13:03	20
Cobalt	**230**		80	40	ug/L			10/23/15 13:03	20
Vanadium	**510**		80	40	ug/L			10/23/15 13:03	20
Cadmium	ND		40	20	ug/L			10/23/15 13:03	20
Barium	**1400**		80	40	ug/L			10/23/15 13:03	20

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.12**	**J**	0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2

Client Sample ID: FC-Replicate 2

Lab Sample ID: 320-15188-2

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Matrix: Solid

Method: 6020 - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	5.0		0.20	0.15	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Barium	64		0.20	0.14	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Beryllium	0.38		0.099	0.0099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Cadmium	0.14		0.099	0.049	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Chromium	69		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Cobalt	11		0.099	0.059	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Copper	21		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Lead	6.0		0.099	0.059	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Molybdenum	0.91		0.20	0.020	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Nickel	75		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Selenium	0.23		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Silver	0.076	J	0.099	0.030	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Thallium	0.083	J	0.099	0.049	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Vanadium	43		0.99	0.30	mg/Kg		10/08/15 07:40	10/08/15 23:00	2
Zinc	57		0.99	0.59	mg/Kg		10/08/15 07:40	10/08/15 23:00	2

Method: 6020 - Metals (ICP/MS) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.9		0.20	0.10	ug/L			10/16/15 20:25	1
Cobalt	0.84		0.20	0.10	ug/L			10/16/15 20:25	1
Vanadium	12	^	0.20	0.10	ug/L			10/16/15 20:25	1
Cadmium	ND		0.10	0.050	ug/L			10/16/15 20:25	1
Barium	18		0.20	0.10	ug/L			10/16/15 20:25	1

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.066		0.024	0.0051	mg/Kg		10/09/15 10:30	10/09/15 14:05	1

General Chemistry

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Incremented sample generated	0.00				NONE			09/29/15 14:40	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium, hexavalent	ND		0.050	0.010	mg/Kg			10/19/15 16:30	1
Total Organic Carbon - Average Dup	5700		2000	44	mg/Kg			10/15/15 12:59	1

Client Sample ID: FC-Replicate 3

Lab Sample ID: 320-15188-3

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Matrix: Solid

Method: 8151A - Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.049	0.012	mg/Kg		10/12/15 10:51	10/23/15 00:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*92*		*58 - 160*	*10/12/15 10:51*	*10/23/15 00:37*	*1*

Method: 8151A - TCLP Herbicides (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND	*	2.5	0.30	ug/L		10/14/15 12:53	10/23/15 06:41	1

Client Sample ID: FC-Replicate 3

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-3

Matrix: Solid

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2,4-Dichlorophenylacetic acid	*108*		*40 - 135*	*10/14/15 12:53*	*10/23/15 06:41*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Acenaphthylene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Anthracene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Benzo[a]anthracene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Benzo[a]pyrene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Benzo[b]fluoranthene	**0.012**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Benzo[g,h,i]perylene	**0.0097**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Benzo[k]fluoranthene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Chrysene	**0.012**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Dibenz(a,h)anthracene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Fluoranthene	**0.025**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Fluorene	**0.014**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Indeno[1,2,3-cd]pyrene	ND	H	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Naphthalene	**0.016**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Phenanthrene	**0.044**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1
Pyrene	**0.026**	**J H**	0.061	0.0081	mg/Kg		10/16/15 17:17	10/19/15 18:53	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Nitrobenzene-d5	*48*		*41 - 119*	*10/16/15 17:17*	*10/19/15 18:53*	*1*
2-Fluorobiphenyl (Surr)	*47*		*39 - 111*	*10/16/15 17:17*	*10/19/15 18:53*	*1*
Terphenyl-d14	*56*		*43 - 150*	*10/16/15 17:17*	*10/19/15 18:53*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Acenaphthylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Benzo[a]anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Benzo[a]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Benzo[b]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Benzo[g,h,i]perylene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Benzo[k]fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Chrysene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Dibenz(a,h)anthracene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Fluoranthene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Fluorene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Indeno[1,2,3-cd]pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Naphthalene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Phenanthrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1
Pyrene	ND	H	1.0	0.50	ug/L		10/26/15 12:27	10/27/15 22:09	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	*63*		*50 - 104*	*10/26/15 12:27*	*10/27/15 22:09*	*1*
Nitrobenzene-d5	*71*		*46 - 109*	*10/26/15 12:27*	*10/27/15 22:09*	*1*
Terphenyl-d14	*77*		*28 - 124*	*10/26/15 12:27*	*10/27/15 22:09*	*1*

Client Sample Results

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Client Sample ID: FC-Replicate 3
Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-3
Matrix: Solid

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (C10-C24)	**12**		1.0	0.50	mg/Kg		10/08/15 12:48	10/12/15 17:33	1
Diesel Range Organics (C10-C24)	**14**		1.0	0.50	mg/Kg		10/08/15 12:46	10/12/15 20:56	1
Motor Oil Range Organics (C19-C36)	**45**		5.0	3.8	mg/Kg		10/08/15 12:48	10/12/15 17:33	1
Motor Oil Range Organics (C19-C36)	**56**		5.0	3.8	mg/Kg		10/08/15 12:46	10/12/15 20:56	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*94*		*63 - 141*	*10/08/15 12:48*	*10/12/15 17:33*	*1*
o-Terphenyl (Surr)	*95*		*63 - 141*	*10/08/15 12:46*	*10/12/15 20:56*	*1*

Method: 8081A - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4,4'-DDD	ND		0.017	0.0025	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
4,4'-DDE	ND	F1	0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
4,4'-DDT	ND		0.017	0.0039	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Aldrin	ND		0.017	0.0021	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
alpha-BHC	ND		0.017	0.0022	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
beta-BHC	ND	F1	0.017	0.0032	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
gamma-BHC (Lindane)	ND		0.017	0.0017	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
delta-BHC	**0.0040**	**J P**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
delta-BHC	**0.0025**	**J**	0.017	0.0016	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
alpha-Chlordane	ND		0.017	0.0020	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
gamma-Chlordane	ND		0.017	0.00052	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Dieldrin	ND		0.017	0.00089	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endosulfan I	ND		0.017	0.00051	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endosulfan II	ND		0.017	0.00098	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endosulfan sulfate	ND		0.017	0.00090	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endrin	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endrin aldehyde	ND		0.017	0.0011	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Endrin ketone	ND		0.017	0.0033	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Heptachlor	ND		0.017	0.0019	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Heptachlor epoxide	ND		0.017	0.0012	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Methoxychlor	ND		0.033	0.013	mg/Kg		10/08/15 12:35	10/14/15 18:59	1
Toxaphene	ND		0.66	0.20	mg/Kg		10/08/15 12:35	10/14/15 18:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*96*		*58 - 111*	*10/08/15 12:35*	*10/14/15 18:59*	*1*
Tetrachloro-m-xylene	*104*		*58 - 111*	*10/08/15 12:35*	*10/14/15 18:59*	*1*
DCB Decachlorobiphenyl	*111*		*49 - 119*	*10/08/15 12:35*	*10/14/15 18:59*	*1*
DCB Decachlorobiphenyl	*104*		*49 - 119*	*10/08/15 12:35*	*10/14/15 18:59*	*1*

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND	F1	0.32	0.033	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1221	ND		0.32	0.051	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1232	ND		0.32	0.063	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1242	ND		0.32	0.072	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1248	ND		0.32	0.056	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1254	ND		0.32	0.026	mg/Kg		10/08/15 12:39	10/14/15 19:13	1
PCB-1260	ND		0.32	0.028	mg/Kg		10/08/15 12:39	10/14/15 19:13	1

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Client Sample ID: FC-Replicate 3

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-3
Matrix: Solid

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
DCB Decachlorobiphenyl	124	X	77 - 123	10/08/15 12:39	10/14/15 19:13	1

Method: 8290 - Dioxins and Furans (HRGC/HRMS)

Analyte	Result	Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	ND		1.0	0.071	pg/g		10/07/15 14:17	10/09/15 15:39	1
2,3,7,8-TCDF	**0.75**	**J**	1.0	0.052	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,7,8-PeCDD	**0.33**	**J**	5.0	0.093	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,7,8-PeCDF	ND		5.0	0.062	pg/g		10/07/15 14:17	10/09/15 15:39	1
2,3,4,7,8-PeCDF	ND		5.0	0.065	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,4,7,8-HxCDD	**0.22**	**J**	5.0	0.11	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,6,7,8-HxCDD	**1.7**	**J**	5.0	0.097	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,7,8,9-HxCDD	**1.1**	**J q**	5.0	0.092	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,4,7,8-HxCDF	**0.31**	**J q**	5.0	0.089	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,6,7,8-HxCDF	ND		5.0	0.078	pg/g		10/07/15 14:17	10/09/15 15:39	1
2,3,4,6,7,8-HxCDF	ND		5.0	0.12	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,7,8,9-HxCDF	ND		5.0	0.093	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,4,6,7,8-HpCDD	**24**		5.0	0.71	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,4,6,7,8-HpCDF	**4.2**	**J**	5.0	0.16	pg/g		10/07/15 14:17	10/09/15 15:39	1
1,2,3,4,7,8,9-HpCDF	ND		5.0	0.19	pg/g		10/07/15 14:17	10/09/15 15:39	1
OCDD	**200**	**B**	10	1.2	pg/g		10/07/15 14:17	10/09/15 15:39	1
OCDF	**15**		10	0.16	pg/g		10/07/15 14:17	10/09/15 15:39	1

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C-2,3,7,8-TCDD	85		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-2,3,7,8-TCDF	92		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,7,8-PeCDD	88		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,7,8-PeCDF	96		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,6,7,8-HxCDD	91		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,4,7,8-HxCDF	83		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,4,6,7,8-HpCDD	94		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-1,2,3,4,6,7,8-HpCDF	95		40 - 135	10/07/15 14:17	10/09/15 15:39	1
13C-OCDD	85		40 - 135	10/07/15 14:17	10/09/15 15:39	1

Method: 6020 - Inductively Coupled Plasma - Mass Spectrometry - STLC Citrate

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**160**		80	40	ug/L			10/23/15 13:08	20
Cobalt	**210**		80	40	ug/L			10/23/15 13:08	20
Vanadium	**490**		80	40	ug/L			10/23/15 13:08	20
Cadmium	ND		40	20	ug/L			10/23/15 13:08	20
Barium	**1300**		80	40	ug/L			10/23/15 13:08	20

Method: 6020 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.14**	**J F1**	0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Arsenic	**5.2**		0.20	0.15	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Barium	**67**		0.20	0.14	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Beryllium	**0.37**		0.099	0.0099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Cadmium	**0.15**		0.099	0.050	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Chromium	**72**		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Cobalt	**11**		0.099	0.060	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Copper	**22**		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2

Client Sample ID: FC-Replicate 3

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-3

Matrix: Solid

Method: 6020 - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	6.3		0.099	0.060	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Molybdenum	0.97		0.20	0.020	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Nickel	79		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Selenium	0.24		0.20	0.099	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Silver	0.074	J	0.099	0.030	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Thallium	0.095	J	0.099	0.050	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Vanadium	44		0.99	0.30	mg/Kg		10/08/15 07:40	10/08/15 22:39	2
Zinc	57		0.99	0.60	mg/Kg		10/08/15 07:40	10/08/15 22:39	2

Method: 6020 - Metals (ICP/MS) - STLC DI

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.8		0.20	0.10	ug/L			10/16/15 20:27	1
Cobalt	0.87		0.20	0.10	ug/L			10/16/15 20:27	1
Vanadium	13	^	0.20	0.10	ug/L			10/16/15 20:27	1
Cadmium	ND		0.10	0.050	ug/L			10/16/15 20:27	1
Barium	19		0.20	0.10	ug/L			10/16/15 20:27	1

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.068		0.024	0.0052	mg/Kg		10/09/15 10:30	10/09/15 14:17	1

General Chemistry

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Incremented sample generated	0.00				NONE			09/29/15 14:40	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium, hexavalent	ND		0.050	0.010	mg/Kg			10/19/15 16:30	1
Total Organic Carbon - Average Dup	6100		2000	44	mg/Kg			10/15/15 13:05	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Toxicity Summary

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Client Sample ID: FC-Replicate 1

Lab Sample ID: 320-15188-1

Analyte	Result	Qualifier	NONE	NONE	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
Total Dioxin/Furan TEQ					pg/L		1000	TEQ
Total TEQ					pg/L		1000	TEQ

Analyte	Result	Qualifier	RL	EDL	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
2,3,7,8-TCDD	ND		1.0	0.11	pg/g	1	0.00	8290
2,3,7,8-TCDF	**0.72**	**J**	1.0	0.086	pg/g	0.1	**0.072**	8290
1,2,3,7,8-PeCDD	**0.22**	**J q**	5.1	0.11	pg/g	1	**0.22**	8290
1,2,3,7,8-PeCDF	ND		5.1	0.073	pg/g	0.03	0.00	8290
2,3,4,7,8-PeCDF	ND		5.1	0.076	pg/g	0.3	0.00	8290
1,2,3,4,7,8-HxCDD	ND		5.1	0.18	pg/g	0.1	0.00	8290
1,2,3,6,7,8-HxCDD	**2.1**	**J**	5.1	0.15	pg/g	0.1	**0.21**	8290
1,2,3,7,8,9-HxCDD	**0.93**	**J q**	5.1	0.14	pg/g	0.1	**0.093**	8290
1,2,3,4,7,8-HxCDF	ND		5.1	0.15	pg/g	0.1	0.00	8290
1,2,3,6,7,8-HxCDF	ND		5.1	0.13	pg/g	0.1	0.00	8290
2,3,4,6,7,8-HxCDF	ND		5.1	0.15	pg/g	0.1	0.00	8290
1,2,3,7,8,9-HxCDF	ND		5.1	0.16	pg/g	0.1	0.00	8290
1,2,3,4,6,7,8-HpCDD	**28**		5.1	1.3	pg/g	0.01	**0.28**	8290
1,2,3,4,6,7,8-HpCDF	**5.9**		5.1	0.29	pg/g	0.01	**0.059**	8290
1,2,3,4,7,8,9-HpCDF	ND		5.1	0.35	pg/g	0.01	0.00	8290
OCDD	**230**	**B**	10	2.0	pg/g	0.0003	**0.069**	8290
OCDF	**26**		10	0.33	pg/g	0.0003	**0.0078**	8290

Client Sample ID: FC-Replicate 2

Lab Sample ID: 320-15188-2

Analyte	Result	Qualifier	NONE	NONE	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
Total Dioxin/Furan TEQ					pg/L		930	TEQ
Total TEQ					pg/L		930	TEQ

Analyte	Result	Qualifier	RL	EDL	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
2,3,7,8-TCDD	**0.20**	**J q**	0.99	0.074	pg/g	1	**0.20**	8290
2,3,7,8-TCDF	**0.74**	**J**	0.99	0.060	pg/g	0.1	**0.074**	8290
1,2,3,7,8-PeCDD	ND		5.0	0.17	pg/g	1	0.00	8290
1,2,3,7,8-PeCDF	**0.17**	**J q**	5.0	0.056	pg/g	0.03	**0.0051**	8290
2,3,4,7,8-PeCDF	**0.11**	**J q**	5.0	0.059	pg/g	0.3	**0.033**	8290
1,2,3,4,7,8-HxCDD	ND		5.0	0.19	pg/g	0.1	0.00	8290
1,2,3,6,7,8-HxCDD	**1.7**	**J q**	5.0	0.17	pg/g	0.1	**0.17**	8290
1,2,3,7,8,9-HxCDD	**1.1**	**J**	5.0	0.16	pg/g	0.1	**0.11**	8290
1,2,3,4,7,8-HxCDF	ND		5.0	0.18	pg/g	0.1	0.00	8290
1,2,3,6,7,8-HxCDF	ND		5.0	0.15	pg/g	0.1	0.00	8290
2,3,4,6,7,8-HxCDF	ND		5.0	0.17	pg/g	0.1	0.00	8290

TEF Reference:

WHO 2005 = World Health Organization (WHO) 2005 TEF, Dioxins, Furans and PCB Congeners

Client Sample ID: FC-Replicate 2 (Continued)

Lab Sample ID: 320-15188-2

Analyte	Result	Qualifier	RL	EDL	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
1,2,3,7,8,9-HxCDF	ND		5.0	0.18	pg/g	0.1	0.00	8290
1,2,3,4,6,7,8-HpCDD	**23**		5.0	0.76	pg/g	0.01	**0.23**	8290
1,2,3,4,6,7,8-HpCDF	**4.3**	**J**	5.0	0.16	pg/g	0.01	**0.043**	8290
1,2,3,4,7,8,9-HpCDF	ND		5.0	0.19	pg/g	0.01	0.00	8290
OCDD	**190**	**B**	9.9	1.5	pg/g	0.0003	**0.057**	8290
OCDF	**15**		9.9	0.23	pg/g	0.0003	**0.0045**	8290

Client Sample ID: FC-Replicate 3

Lab Sample ID: 320-15188-3

Analyte	Result	Qualifier	NONE	NONE	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
Total Dioxin/Furan TEQ					pg/L		1100	TEQ
Total TEQ					pg/L		1100	TEQ

Analyte	Result	Qualifier	RL	EDL	Unit	WHO 2005 ND = 0 TEF	WHO 2005 ND = 0 TEQ	Method
2,3,7,8-TCDD	ND		1.0	0.071	pg/g	1	0.00	8290
2,3,7,8-TCDF	**0.75**	**J**	1.0	0.052	pg/g	0.1	**0.075**	8290
1,2,3,7,8-PeCDD	**0.33**	**J**	5.0	0.093	pg/g	1	**0.33**	8290
1,2,3,7,8-PeCDF	ND		5.0	0.062	pg/g	0.03	0.00	8290
2,3,4,7,8-PeCDF	ND		5.0	0.065	pg/g	0.3	0.00	8290
1,2,3,4,7,8-HxCDD	**0.22**	**J**	5.0	0.11	pg/g	0.1	**0.022**	8290
1,2,3,6,7,8-HxCDD	**1.7**	**J**	5.0	0.097	pg/g	0.1	**0.17**	8290
1,2,3,7,8,9-HxCDD	**1.1**	**J q**	5.0	0.092	pg/g	0.1	**0.11**	8290
1,2,3,4,7,8-HxCDF	**0.31**	**J q**	5.0	0.089	pg/g	0.1	**0.031**	8290
1,2,3,6,7,8-HxCDF	ND		5.0	0.078	pg/g	0.1	0.00	8290
2,3,4,6,7,8-HxCDF	ND		5.0	0.12	pg/g	0.1	0.00	8290
1,2,3,7,8,9-HxCDF	ND		5.0	0.093	pg/g	0.1	0.00	8290
1,2,3,4,6,7,8-HpCDD	**24**		5.0	0.71	pg/g	0.01	**0.24**	8290
1,2,3,4,6,7,8-HpCDF	**4.2**	**J**	5.0	0.16	pg/g	0.01	**0.042**	8290
1,2,3,4,7,8,9-HpCDF	ND		5.0	0.19	pg/g	0.01	0.00	8290
OCDD	**200**	**B**	10	1.2	pg/g	0.0003	**0.060**	8290
OCDF	**15**		10	0.16	pg/g	0.0003	**0.0045**	8290

TEF Reference:

WHO 2005 = World Health Organization (WHO) 2005 TEF, Dioxins, Furans and PCB Congeners

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Method: 8151A - Herbicides (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCPA (58-160)
320-15188-1	FC-Replicate 1	94
320-15188-1 MS	FC-Replicate 1	63
320-15188-1 MSD	FC-Replicate 1	102
320-15188-2	FC-Replicate 2	77
320-15188-3	FC-Replicate 3	92
LCS 580-203074/2-A	Lab Control Sample	115
MB 580-203074/1-A	Method Blank	109

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Method: 8151A - TCLP Herbicides (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCPA (40-135)
320-15188-1	FC-Replicate 1	129
320-15188-2	FC-Replicate 2	105
320-15188-3	FC-Replicate 3	108
LCS 580-203347/2-A	Lab Control Sample	119
LCSD 580-203347/3-A	Lab Control Sample Dup	124
MB 580-203347/1-A	Method Blank	62

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Matrix: Solid **Prep Type: Total/NA**

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	NBZ (41-119)	FBP (39-111)	TPH (43-150)
320-15188-1	FC-Replicate 1	56	54	63
320-15188-2	FC-Replicate 2	55	62	63
320-15188-3	FC-Replicate 3	48	47	56
LCS 440-287508/2-A	Lab Control Sample	51	49	57
LCSD 440-287508/3-A	Lab Control Sample Dup	65	60	64
MB 440-287508/1-A	Method Blank	63	62	70

Surrogate Legend

NBZ = Nitrobenzene-d5

FBP = 2-Fluorobiphenyl (Surr)

TPH = Terphenyl-d14

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Matrix: Solid **Prep Type: STLC DI**

		Percent Surrogate Recovery (Acceptance Limits)		
		FBP	NBZ	TPH
Lab Sample ID	Client Sample ID	(50-104)	(46-109)	(28-124)
320-15188-1	FC-Replicate 1	52	67	71
320-15188-1 MS	FC-Replicate 1	59	67	72
320-15188-2	FC-Replicate 2	48 X	62	68
320-15188-3	FC-Replicate 3	63	71	77
LCS 440-289123/2-B	Lab Control Sample	67	74	78
MB 440-289123/1-B	Method Blank	52	68	67

Surrogate Legend

FBP = 2-Fluorobiphenyl (Surr)
NBZ = Nitrobenzene-d5
TPH = Terphenyl-d14

Method: 8015B - Diesel Range Organics (DRO) (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH1
Lab Sample ID	Client Sample ID	(63-141)
320-15188-1	FC-Replicate 1	91
320-15188-1	FC-Replicate 1	99
320-15188-2	FC-Replicate 2	106
320-15188-2	FC-Replicate 2	101
320-15188-2 MS	FC-Replicate 2	100
320-15188-2 MS	FC-Replicate 2	96
320-15188-2 MSD	FC-Replicate 2	102
320-15188-2 MSD	FC-Replicate 2	100
320-15188-3	FC-Replicate 3	94
320-15188-3	FC-Replicate 3	95
LCS 320-88569/2-A	Lab Control Sample	100
MB 320-88569/1-A	Method Blank	101

Surrogate Legend

OTPH = o-Terphenyl (Surr)

Method: 8015B - Diesel Range Organics (DRO) (GC)

Matrix: Solid **Prep Type: Silica Gel Cleanup**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH1
Lab Sample ID	Client Sample ID	(63-141)
LCS 320-88571/2-A	Lab Control Sample	100
MB 320-88571/1-A	Method Blank	99

Surrogate Legend

OTPH = o-Terphenyl (Surr)

Method: 8081A - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: Total/NA**

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	TCX1 (58-111)	TCX2 (58-111)	DCB1 (49-119)	DCB2 (49-119)
320-15188-1	FC-Replicate 1	101	105	114	109
320-15188-2	FC-Replicate 2	96	106	113	107
320-15188-3	FC-Replicate 3	96	104	111	104
320-15188-3 MS	FC-Replicate 3	95		110	
320-15188-3 MSD	FC-Replicate 3	103		118	
LCS 320-89033/2-A	Lab Control Sample	79		85	
LCS 320-89033/3-A	Lab Control Sample	83		87	
MB 320-89033/1-A	Method Blank	88	85	91	84

Surrogate Legend

TCX = Tetrachloro-m-xylene
DCB = DCB Decachlorobiphenyl

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Matrix: Solid **Prep Type: Total/NA**

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCB2 (77-123)
320-15188-1	FC-Replicate 1	123
320-15188-2	FC-Replicate 2	126 X
320-15188-3	FC-Replicate 3	124 X
320-15188-3 MS	FC-Replicate 3	122
320-15188-3 MSD	FC-Replicate 3	125 X
LCS 320-89031/2-A	Lab Control Sample	115
MB 320-89031/1-A	Method Blank	112

Surrogate Legend

DCB = DCB Decachlorobiphenyl

Method: 8290 - Dioxins and Furans (HRGC/HRMS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	TCDD (40-135)	TCDF (40-135)	PeCDD (40-135)	PeCDF1 (40-135)	HxCDD2 (40-135)	HxCDF1 (40-135)	HpCDD (40-135)	HpCDF1 (40-135)
320-15188-1	FC-Replicate 1	66	70	66	70	74	60	68	72
320-15188-2	FC-Replicate 2	73	78	74	81	83	70	76	80
320-15188-3	FC-Replicate 3	85	92	88	96	91	83	94	95
LCS 320-88426/2-A	Lab Control Sample	61	65	60	65	68	58	64	68
MB 320-88426/1-A	Method Blank	65	69	61	69	75	62	66	71

		Percent Isotope Dilution Recovery (Acceptance Limits)
Lab Sample ID	Client Sample ID	OCDD (40-135)
320-15188-1	FC-Replicate 1	61
320-15188-2	FC-Replicate 2	67
320-15188-3	FC-Replicate 3	85
LCS 320-88426/2-A	Lab Control Sample	57
MB 320-88426/1-A	Method Blank	55

Surrogate Legend

TCDD = 13C-2,3,7,8-TCDD
TCDF = 13C-2,3,7,8-TCDF
PeCDD = 13C-1,2,3,7,8-PeCDD
PeCDF1 = 13C-1,2,3,7,8-PeCDF
HxCDD2 = 13C-1,2,3,6,7,8-HxCDD
HxCDF1 = 13C-1,2,3,4,7,8-HxCDF
HpCDD = 13C-1,2,3,4,6,7,8-HpCDD
HpCDF1 = 13C-1,2,3,4,6,7,8-HpCDF
OCDD = 13C-OCDD

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Method: 8151A - Herbicides (GC/MS)

Lab Sample ID: MB 580-203074/1-A
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 203074

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.050	0.012	mg/Kg		10/12/15 10:51	10/22/15 22:21	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*109*		*58 - 160*	*10/12/15 10:51*	*10/22/15 22:21*	*1*

Lab Sample ID: LCS 580-203074/2-A
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 203074

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	0.333	0.257		mg/Kg		77	51 - 160

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*115*		*58 - 160*

Lab Sample ID: 320-15188-1 MS
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: FC-Replicate 1
Prep Type: Total/NA
Prep Batch: 203074

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	ND	F2	0.329	0.176		mg/Kg		54	51 - 160

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*63*		*58 - 160*

Lab Sample ID: 320-15188-1 MSD
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: FC-Replicate 1
Prep Type: Total/NA
Prep Batch: 203074

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Pentachlorophenol	ND	F2	0.319	0.297	F2	mg/Kg		93	51 - 160	51	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*102*		*58 - 160*

Method: 8151A - TCLP Herbicides (GC/MS)

Lab Sample ID: MB 580-203347/1-A
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 203347

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Pentachlorophenol	ND		0.25	0.030	ug/L		10/14/15 12:53	10/23/15 03:16	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*62*		*40 - 135*	*10/14/15 12:53*	*10/23/15 03:16*	*1*

Method: 8151A - TCLP Herbicides (GC/MS) (Continued)

Lab Sample ID: LCS 580-203347/2-A
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 203347

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Pentachlorophenol	5.00	5.95		ug/L		119	51 - 126

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*119*		*40 - 135*

Lab Sample ID: LCSD 580-203347/3-A
Matrix: Solid
Analysis Batch: 203973

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 203347

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Pentachlorophenol	5.00	6.56	*	ug/L		131	51 - 126	10	18

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*124*		*40 - 135*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM)

Lab Sample ID: MB 440-287508/1-A
Matrix: Solid
Analysis Batch: 287765

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 287508

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Acenaphthylene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Anthracene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Benzo[a]anthracene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Benzo[a]pyrene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Benzo[b]fluoranthene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Benzo[g,h,i]perylene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Benzo[k]fluoranthene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Chrysene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Dibenz(a,h)anthracene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Fluoranthene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Fluorene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Indeno[1,2,3-cd]pyrene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Naphthalene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Phenanthrene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1
Pyrene	ND		0.030	0.0040	mg/Kg		10/16/15 17:17	10/19/15 13:03	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorobiphenyl (Surr)	*62*		*39 - 111*	*10/16/15 17:17*	*10/19/15 13:03*	*1*
Nitrobenzene-d5	*63*		*41 - 119*	*10/16/15 17:17*	*10/19/15 13:03*	*1*
Terphenyl-d14	*70*		*43 - 150*	*10/16/15 17:17*	*10/19/15 13:03*	*1*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

Lab Sample ID: LCS 440-287508/2-A
Matrix: Solid
Analysis Batch: 287765

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 287508

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	0.0667	0.0415		mg/Kg		62	53 - 120
Acenaphthylene	0.0667	0.0418		mg/Kg		63	54 - 120
Anthracene	0.0667	0.0456		mg/Kg		68	53 - 120
Benzo[a]anthracene	0.0667	0.0454		mg/Kg		68	56 - 120
Benzo[a]pyrene	0.0667	0.0433		mg/Kg		65	53 - 120
Benzo[b]fluoranthene	0.0667	0.0436		mg/Kg		65	53 - 120
Benzo[g,h,i]perylene	0.0667	0.0522		mg/Kg		78	51 - 150
Benzo[k]fluoranthene	0.0667	0.0471		mg/Kg		71	53 - 124
Chrysene	0.0667	0.0487		mg/Kg		73	56 - 120
Dibenz(a,h)anthracene	0.0667	0.0439		mg/Kg		66	51 - 131
Fluoranthene	0.0667	0.0458		mg/Kg		69	57 - 120
Fluorene	0.0667	0.0443		mg/Kg		66	54 - 120
Indeno[1,2,3-cd]pyrene	0.0667	0.0529		mg/Kg		79	50 - 137
Naphthalene	0.0667	0.0404		mg/Kg		61	49 - 120
Phenanthrene	0.0667	0.0412		mg/Kg		62	55 - 120
Pyrene	0.0667	0.0392		mg/Kg		59	56 - 121

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*49*		*39 - 111*
Nitrobenzene-d5	*51*		*41 - 119*
Terphenyl-d14	*57*		*43 - 150*

Lab Sample ID: LCSD 440-287508/3-A
Matrix: Solid
Analysis Batch: 287765

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 287508

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acenaphthene	0.0667	0.0478		mg/Kg		72	53 - 120	14	35
Acenaphthylene	0.0667	0.0496		mg/Kg		74	54 - 120	17	35
Anthracene	0.0667	0.0470		mg/Kg		70	53 - 120	3	35
Benzo[a]anthracene	0.0667	0.0481		mg/Kg		72	56 - 120	6	35
Benzo[a]pyrene	0.0667	0.0474		mg/Kg		71	53 - 120	9	35
Benzo[b]fluoranthene	0.0667	0.0470		mg/Kg		70	53 - 120	7	35
Benzo[g,h,i]perylene	0.0667	0.0643		mg/Kg		96	51 - 150	21	35
Benzo[k]fluoranthene	0.0667	0.0504		mg/Kg		76	53 - 124	7	35
Chrysene	0.0667	0.0519		mg/Kg		78	56 - 120	6	35
Dibenz(a,h)anthracene	0.0667	0.0515		mg/Kg		77	51 - 131	16	35
Fluoranthene	0.0667	0.0444		mg/Kg		67	57 - 120	3	35
Fluorene	0.0667	0.0498		mg/Kg		75	54 - 120	12	35
Indeno[1,2,3-cd]pyrene	0.0667	0.0630		mg/Kg		94	50 - 137	17	35
Naphthalene	0.0667	0.0473		mg/Kg		71	49 - 120	16	35
Phenanthrene	0.0667	0.0455		mg/Kg		68	55 - 120	10	35
Pyrene	0.0667	0.0457		mg/Kg		69	56 - 121	15	35

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*60*		*39 - 111*
Nitrobenzene-d5	*65*		*41 - 119*

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

Lab Sample ID: LCSD 440-287508/3-A
Matrix: Solid
Analysis Batch: 287765

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 287508

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
Terphenyl-d14	*64*		*43 - 150*

Lab Sample ID: MB 440-289123/1-B
Matrix: Solid
Analysis Batch: 289719

Client Sample ID: Method Blank
Prep Type: STLC DI
Prep Batch: 289382

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Acenaphthylene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Anthracene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Benzo[a]anthracene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Benzo[a]pyrene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Benzo[b]fluoranthene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Benzo[g,h,i]perylene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Benzo[k]fluoranthene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Chrysene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Dibenz(a,h)anthracene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Fluoranthene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Fluorene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Indeno[1,2,3-cd]pyrene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Naphthalene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Phenanthrene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1
Pyrene	ND		1.0	0.50	ug/L		10/26/15 12:27	10/27/15 23:52	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	*52*		*50 - 104*	*10/26/15 12:27*	*10/27/15 23:52*	*1*
Nitrobenzene-d5	*68*		*46 - 109*	*10/26/15 12:27*	*10/27/15 23:52*	*1*
Terphenyl-d14	*67*		*28 - 124*	*10/26/15 12:27*	*10/27/15 23:52*	*1*

Lab Sample ID: LCS 440-289123/2-B
Matrix: Solid
Analysis Batch: 289719

Client Sample ID: Lab Control Sample
Prep Type: STLC DI
Prep Batch: 289382

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	5.00	3.83		ug/L		77	54 - 120
Acenaphthylene	5.00	3.96		ug/L		79	55 - 120
Anthracene	5.00	3.88		ug/L		78	56 - 120
Benzo[a]anthracene	5.00	3.95		ug/L		79	63 - 120
Benzo[a]pyrene	5.00	3.66		ug/L		73	54 - 120
Benzo[b]fluoranthene	5.00	3.81		ug/L		76	60 - 120
Benzo[g,h,i]perylene	5.00	4.75		ug/L		95	61 - 139
Benzo[k]fluoranthene	5.00	4.07		ug/L		81	62 - 120
Chrysene	5.00	4.12		ug/L		82	65 - 120
Dibenz(a,h)anthracene	5.00	3.88		ug/L		78	61 - 120
Fluoranthene	5.00	3.96		ug/L		79	61 - 120
Fluorene	5.00	4.10		ug/L		82	53 - 120
Indeno[1,2,3-cd]pyrene	5.00	4.79		ug/L		96	61 - 122
Naphthalene	5.00	3.38		ug/L		68	46 - 120

Method: 8270C SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

Lab Sample ID: LCS 440-289123/2-B
Matrix: Solid
Analysis Batch: 289719

Client Sample ID: Lab Control Sample
Prep Type: STLC DI
Prep Batch: 289382

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Phenanthrene			5.00	3.93		ug/L		79	60 - 120
Pyrene			5.00	4.05		ug/L		81	63 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*67*		*50 - 104*
Nitrobenzene-d5	*74*		*46 - 109*
Terphenyl-d14	*78*		*28 - 124*

Lab Sample ID: 320-15188-1 MS
Matrix: Solid
Analysis Batch: 289719

Client Sample ID: FC-Replicate 1
Prep Type: STLC DI
Prep Batch: 289382

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	ND	H	5.00	3.45		ug/L		69	60 - 120
Acenaphthylene	ND	H	5.00	3.51		ug/L		70	60 - 120
Anthracene	ND	H	5.00	3.68		ug/L		74	65 - 120
Benzo[a]anthracene	ND	H	5.00	3.70		ug/L		74	65 - 120
Benzo[a]pyrene	ND	H	5.00	3.42		ug/L		68	55 - 130
Benzo[b]fluoranthene	ND	H	5.00	3.63		ug/L		73	55 - 125
Benzo[g,h,i]perylene	ND	H	5.00	3.59		ug/L		72	45 - 135
Benzo[k]fluoranthene	ND	H	5.00	3.73		ug/L		75	55 - 125
Chrysene	ND	H	5.00	3.86		ug/L		77	65 - 120
Dibenz(a,h)anthracene	ND	H	5.00	2.94		ug/L		59	45 - 135
Fluoranthene	ND	H	5.00	3.64		ug/L		73	60 - 120
Fluorene	ND	H	5.00	3.67		ug/L		73	65 - 120
Indeno[1,2,3-cd]pyrene	ND	H	5.00	3.89		ug/L		78	40 - 135
Naphthalene	ND	H	5.00	3.55		ug/L		71	55 - 120
Phenanthrene	ND	H	5.00	3.72		ug/L		74	65 - 120
Pyrene	ND	H	5.00	3.84		ug/L		77	55 - 125

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2-Fluorobiphenyl (Surr)	*59*		*50 - 104*
Nitrobenzene-d5	*67*		*46 - 109*
Terphenyl-d14	*72*		*28 - 124*

Method: 8015B - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 320-88569/1-A
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 88569

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (C10-C24)	ND		1.0	0.50	mg/Kg		10/08/15 12:46	10/12/15 18:02	1
Motor Oil Range Organics (C19-C36)	ND		5.0	3.8	mg/Kg		10/08/15 12:46	10/12/15 18:02	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*101*		*63 - 141*	*10/08/15 12:46*	*10/12/15 18:02*	*1*

QC Sample Results

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Lab Sample ID: LCS 320-88569/2-A
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 88569

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Diesel Range Organics (C10-C24)			10.0	8.68		mg/Kg		87	67 - 113		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl (Surr)	*100*		*63 - 141*

Lab Sample ID: 320-15188-2 MS
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88569

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Diesel Range Organics (C10-C24)	17	F1	9.98	24.1		mg/Kg		69	67 - 113		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
o-Terphenyl (Surr)	*100*		*63 - 141*

Lab Sample ID: 320-15188-2 MSD
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88569

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Diesel Range Organics (C10-C24)	17	F1	10.0	22.5	F1	mg/Kg		52	67 - 113	7	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
o-Terphenyl (Surr)	*102*		*63 - 141*

Lab Sample ID: 320-15188-2 MS
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88571

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Diesel Range Organics (C10-C24)	14	F1	9.98	20.1	F1	mg/Kg		58	67 - 113		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
o-Terphenyl (Surr)	*96*		*63 - 141*

Lab Sample ID: 320-15188-2 MSD
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88571

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Diesel Range Organics (C10-C24)	14	F1	10.0	19.7	F1	mg/Kg		54	67 - 113	2	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
o-Terphenyl (Surr)	*100*		*63 - 141*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Method: 8015B - Diesel Range Organics (DRO) (GC) (Continued)

Lab Sample ID: MB 320-88571/1-A
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: Method Blank
Prep Type: Silica Gel Cleanup
Prep Batch: 88571

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (C10-C24)	ND		1.0	0.50	mg/Kg		10/08/15 12:48	10/12/15 14:39	1
Motor Oil Range Organics (C19-C36)	ND		5.0	3.8	mg/Kg		10/08/15 12:48	10/12/15 14:39	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*99*		*63 - 141*	*10/08/15 12:48*	*10/12/15 14:39*	*1*

Lab Sample ID: LCS 320-88571/2-A
Matrix: Solid
Analysis Batch: 88835

Client Sample ID: Lab Control Sample
Prep Type: Silica Gel Cleanup
Prep Batch: 88571

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Diesel Range Organics (C10-C24)	10.0	8.69		mg/Kg		87	67 - 113

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl (Surr)	*100*		*63 - 141*

Method: 8081A - Organochlorine Pesticides (GC)

Lab Sample ID: MB 320-89033/1-A
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 89033

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
4,4'-DDD	ND		0.0017	0.00026	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
4,4'-DDE	ND		0.0017	0.00022	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
4,4'-DDT	ND		0.0017	0.00040	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Aldrin	ND		0.0017	0.00021	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
alpha-BHC	ND		0.0017	0.00022	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
beta-BHC	ND		0.0017	0.00033	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
gamma-BHC (Lindane)	ND		0.0017	0.00017	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
delta-BHC	ND		0.0017	0.00016	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
alpha-Chlordane	ND		0.0017	0.00020	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
gamma-Chlordane	ND		0.0017	0.000053	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Dieldrin	ND		0.0017	0.000091	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endosulfan I	ND		0.0017	0.000052	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endosulfan II	ND		0.0017	0.00010	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endosulfan sulfate	ND		0.0017	0.000092	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endrin	ND		0.0017	0.00011	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endrin aldehyde	ND		0.0017	0.00011	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Endrin ketone	ND		0.0017	0.00034	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Heptachlor	ND		0.0017	0.00019	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Heptachlor epoxide	ND		0.0017	0.00012	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Methoxychlor	ND		0.0034	0.0013	mg/Kg		10/08/15 12:35	10/14/15 17:41	1
Toxaphene	ND		0.067	0.020	mg/Kg		10/08/15 12:35	10/14/15 17:41	1

Method: 8081A - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: MB 320-89033/1-A
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 89033

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	88		58 - 111	10/08/15 12:35	10/14/15 17:41	1
Tetrachloro-m-xylene	85		58 - 111	10/08/15 12:35	10/14/15 17:41	1
DCB Decachlorobiphenyl	91		49 - 119	10/08/15 12:35	10/14/15 17:41	1
DCB Decachlorobiphenyl	84		49 - 119	10/08/15 12:35	10/14/15 17:41	1

Lab Sample ID: LCS 320-89033/2-A
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 89033

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
4,4'-DDD	0.0167	0.0161		mg/Kg		96	79 - 124
4,4'-DDE	0.0167	0.0160		mg/Kg		96	71 - 129
4,4'-DDT	0.0167	0.0167		mg/Kg		100	68 - 129
Aldrin	0.0167	0.0143		mg/Kg		86	68 - 116
alpha-BHC	0.0167	0.0142		mg/Kg		85	71 - 121
beta-BHC	0.0167	0.0137		mg/Kg		82	72 - 111
gamma-BHC (Lindane)	0.0167	0.0143		mg/Kg		86	74 - 121
delta-BHC	0.0167	0.0159		mg/Kg		95	75 - 124
alpha-Chlordane	0.0167	0.0144		mg/Kg		86	71 - 116
gamma-Chlordane	0.0167	0.0144		mg/Kg		86	68 - 116
Dieldrin	0.0167	0.0156		mg/Kg		94	68 - 123
Endosulfan I	0.0167	0.0143		mg/Kg		86	62 - 111
Endosulfan II	0.0167	0.0154		mg/Kg		92	70 - 121
Endosulfan sulfate	0.0167	0.0148		mg/Kg		89	69 - 120
Endrin	0.0167	0.0160		mg/Kg		96	71 - 128
Endrin aldehyde	0.0167	0.0112		mg/Kg		67	21 - 112
Endrin ketone	0.0167	0.0146		mg/Kg		87	65 - 118
Heptachlor	0.0167	0.0154		mg/Kg		92	74 - 120
Heptachlor epoxide	0.0167	0.0146		mg/Kg		88	74 - 116
Methoxychlor	0.0167	0.0159		mg/Kg		96	71 - 123

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Tetrachloro-m-xylene	79		58 - 111
DCB Decachlorobiphenyl	85		49 - 119

Lab Sample ID: LCS 320-89033/3-A
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 89033

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Toxaphene	0.167	0.149		mg/Kg		90	41 - 128

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Tetrachloro-m-xylene	83		58 - 111
DCB Decachlorobiphenyl	87		49 - 119

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Method: 8081A - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: 320-15188-3 MS
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: FC-Replicate 3
Prep Type: Total/NA
Prep Batch: 89033

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
4,4'-DDD	ND		0.0167	0.0171		mg/Kg		102	79 - 124
4,4'-DDE	ND	F1	0.0167	0.0175		mg/Kg		104	71 - 129
4,4'-DDT	ND		0.0167	0.0158	J	mg/Kg		95	68 - 129
Aldrin	ND		0.0167	0.0163	J	mg/Kg		97	68 - 116
alpha-BHC	ND		0.0167	0.0168	J	mg/Kg		100	71 - 121
beta-BHC	ND	F1	0.0167	0.0218	F1	mg/Kg		131	72 - 111
gamma-BHC (Lindane)	ND		0.0167	0.0158	J	mg/Kg		95	74 - 121
delta-BHC	0.0040	J P	0.0167	0.0179		mg/Kg		83	75 - 124
alpha-Chlordane	ND		0.0167	0.0166	J	mg/Kg		99	71 - 116
gamma-Chlordane	ND		0.0167	0.0166	J	mg/Kg		99	68 - 116
Dieldrin	ND		0.0167	0.0165	J	mg/Kg		98	68 - 123
Endosulfan I	ND		0.0167	0.0165	J	mg/Kg		99	62 - 111
Endosulfan II	ND		0.0167	0.0174		mg/Kg		104	70 - 121
Endosulfan sulfate	ND		0.0167	0.0169	J	mg/Kg		101	69 - 120
Endrin	ND		0.0167	0.0172		mg/Kg		103	71 - 128
Endrin aldehyde	ND		0.0167	0.0130	J	mg/Kg		78	21 - 112
Endrin ketone	ND	F2 F1	0.0167	0.0163	J	mg/Kg		97	65 - 118
Heptachlor	ND		0.0167	0.0165	J	mg/Kg		99	74 - 120
Heptachlor epoxide	ND		0.0167	0.0167	J	mg/Kg		100	74 - 116
Methoxychlor	ND	F1	0.0167	0.0187	J	mg/Kg		112	71 - 123

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Tetrachloro-m-xylene	*95*		*58 - 111*
DCB Decachlorobiphenyl	*110*		*49 - 119*

Lab Sample ID: 320-15188-3 MSD
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: FC-Replicate 3
Prep Type: Total/NA
Prep Batch: 89033

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
4,4'-DDD	ND		0.0168	0.0179		mg/Kg		107	79 - 124	5	30
4,4'-DDE	ND	F1	0.0168	0.0228	F1	mg/Kg		136	71 - 129	27	30
4,4'-DDT	ND		0.0168	0.0171		mg/Kg		102	68 - 129	8	30
Aldrin	ND		0.0168	0.0166	J	mg/Kg		99	68 - 116	2	30
alpha-BHC	ND		0.0168	0.0179		mg/Kg		107	71 - 121	6	30
beta-BHC	ND	F1	0.0168	0.0237	F1	mg/Kg		141	72 - 111	8	30
gamma-BHC (Lindane)	ND		0.0168	0.0167	J	mg/Kg		100	74 - 121	6	30
delta-BHC	0.0025	J	0.0168	0.0187		mg/Kg		97	75 - 124	4	30
alpha-Chlordane	ND		0.0168	0.0173		mg/Kg		103	71 - 116	4	30
gamma-Chlordane	ND		0.0168	0.0176		mg/Kg		105	68 - 116	3	30
Dieldrin	ND		0.0168	0.0171		mg/Kg		102	68 - 123	3	30
Endosulfan I	ND		0.0168	0.0170		mg/Kg		101	62 - 111	0	30
Endosulfan II	ND		0.0168	0.0184		mg/Kg		110	70 - 121	6	30
Endosulfan sulfate	ND		0.0168	0.0174		mg/Kg		104	69 - 120	3	30
Endrin	ND		0.0168	0.0183		mg/Kg		109	71 - 128	6	30
Endrin aldehyde	ND		0.0168	0.0140	J	mg/Kg		84	21 - 112	8	30
Endrin ketone	ND		0.0168	0.0168	J p	mg/Kg		100	65 - 118	2	30
Heptachlor	ND		0.0168	0.0178		mg/Kg		106	74 - 120	8	30

Method: 8081A - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: 320-15188-3 MSD
Matrix: Solid
Analysis Batch: 89139

Client Sample ID: FC-Replicate 3
Prep Type: Total/NA
Prep Batch: 89033

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Heptachlor epoxide	ND		0.0168	0.0174		mg/Kg		104	74 - 116	4	30
Methoxychlor	ND		0.0168	0.0192	J	mg/Kg		115	71 - 123	11	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Tetrachloro-m-xylene	*103*		*58 - 111*
DCB Decachlorobiphenyl	*118*		*49 - 119*

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Lab Sample ID: MB 320-89031/1-A
Matrix: Solid
Analysis Batch: 89179

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 89031

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.033	0.0034	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1221	ND		0.033	0.0052	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1232	ND		0.033	0.0064	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1242	ND		0.033	0.0074	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1248	ND		0.033	0.0057	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1254	ND		0.033	0.0027	mg/Kg		10/08/15 12:39	10/14/15 17:51	1
PCB-1260	ND		0.033	0.0029	mg/Kg		10/08/15 12:39	10/14/15 17:51	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl	*112*		*77 - 123*	*10/08/15 12:39*	*10/14/15 17:51*	*1*

Lab Sample ID: LCS 320-89031/2-A
Matrix: Solid
Analysis Batch: 89179

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 89031

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
PCB-1016	0.0667	0.0680		mg/Kg		102	81 - 114
PCB-1260	0.0667	0.0743		mg/Kg		111	85 - 123

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl	*115*		*77 - 123*

Lab Sample ID: 320-15188-3 MS
Matrix: Solid
Analysis Batch: 89179

Client Sample ID: FC-Replicate 3
Prep Type: Total/NA
Prep Batch: 89031

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
PCB-1016	ND	F1	0.0675	0.0877	J F1	mg/Kg		130	81 - 114
PCB-1260	ND		0.0675	0.0830	J	mg/Kg		123	85 - 123

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
DCB Decachlorobiphenyl	*122*		*77 - 123*

Method: 8082 - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued)

Lab Sample ID: 320-15188-3 MSD
Matrix: Solid
Analysis Batch: 89179

Client Sample ID: FC-Replicate 3
Prep Type: Total/NA
Prep Batch: 89031

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
PCB-1016	ND	F1	0.0661	0.0816	J F1	mg/Kg		123	81 - 114	7	20
PCB-1260	ND		0.0661	0.0781	J	mg/Kg		118	85 - 123	6	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
DCB Decachlorobiphenyl	*125*	*X*	*77 - 123*

Method: 8290 - Dioxins and Furans (HRGC/HRMS)

Lab Sample ID: MB 320-88426/1-A
Matrix: Solid
Analysis Batch: 88695

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 88426

Analyte	MB Result	MB Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	ND		1.0	0.096	pg/g		10/07/15 14:17	10/09/15 11:06	1
2,3,7,8-TCDF	ND		1.0	0.046	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,7,8-PeCDD	ND		5.0	0.11	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,7,8-PeCDF	ND		5.0	0.056	pg/g		10/07/15 14:17	10/09/15 11:06	1
2,3,4,7,8-PeCDF	ND		5.0	0.058	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,4,7,8-HxCDD	ND		5.0	0.058	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,6,7,8-HxCDD	ND		5.0	0.050	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,7,8,9-HxCDD	ND		5.0	0.048	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,4,7,8-HxCDF	ND		5.0	0.077	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,6,7,8-HxCDF	ND	q	5.0	0.067	pg/g		10/07/15 14:17	10/09/15 11:06	1
2,3,4,6,7,8-HxCDF	ND		5.0	0.074	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,7,8,9-HxCDF	ND		5.0	0.080	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,4,6,7,8-HpCDD	ND		5.0	0.087	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,4,6,7,8-HpCDF	ND		5.0	0.041	pg/g		10/07/15 14:17	10/09/15 11:06	1
1,2,3,4,7,8,9-HpCDF	ND		5.0	0.050	pg/g		10/07/15 14:17	10/09/15 11:06	1
OCDD	0.613	J q	10	0.12	pg/g		10/07/15 14:17	10/09/15 11:06	1
OCDF	ND		10	0.13	pg/g		10/07/15 14:17	10/09/15 11:06	1

Isotope Dilution	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*65*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-2,3,7,8-TCDF	*69*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,7,8-PeCDD	*61*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,7,8-PeCDF	*69*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,6,7,8-HxCDD	*75*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,4,7,8-HxCDF	*62*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,4,6,7,8-HpCDD	*66*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-1,2,3,4,6,7,8-HpCDF	*71*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*
13C-OCDD	*55*		*40 - 135*	*10/07/15 14:17*	*10/09/15 11:06*	*1*

Lab Sample ID: LCS 320-88426/2-A
Matrix: Solid
Analysis Batch: 88695

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 88426

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,3,7,8-TCDD	20.0	22.6		pg/g		113	60 - 138

Method: 8290 - Dioxins and Furans (HRGC/HRMS) (Continued)

Lab Sample ID: LCS 320-88426/2-A
Matrix: Solid
Analysis Batch: 88695

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 88426

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,3,7,8-TCDF	20.0	22.7		pg/g		113	56 - 158
1,2,3,7,8-PeCDD	100	121		pg/g		121	70 - 122
1,2,3,7,8-PeCDF	100	118		pg/g		118	69 - 134
2,3,4,7,8-PeCDF	100	118		pg/g		118	70 - 131
1,2,3,4,7,8-HxCDD	100	98.2		pg/g		98	60 - 138
1,2,3,6,7,8-HxCDD	100	117		pg/g		117	68 - 136
1,2,3,7,8,9-HxCDD	100	107		pg/g		107	68 - 138
1,2,3,4,7,8-HxCDF	100	119		pg/g		119	74 - 128
1,2,3,6,7,8-HxCDF	100	128		pg/g		128	67 - 140
2,3,4,6,7,8-HxCDF	100	128		pg/g		128	71 - 137
1,2,3,7,8,9-HxCDF	100	122		pg/g		122	72 - 134
1,2,3,4,6,7,8-HpCDD	100	118		pg/g		118	71 - 128
1,2,3,4,6,7,8-HpCDF	100	117		pg/g		117	71 - 134
1,2,3,4,7,8,9-HpCDF	100	114		pg/g		114	68 - 129
OCDD	200	234		pg/g		117	70 - 128
OCDF	200	255		pg/g		128	63 - 141

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
13C-2,3,7,8-TCDD	*61*		*40 - 135*
13C-2,3,7,8-TCDF	*65*		*40 - 135*
13C-1,2,3,7,8-PeCDD	*60*		*40 - 135*
13C-1,2,3,7,8-PeCDF	*65*		*40 - 135*
13C-1,2,3,6,7,8-HxCDD	*68*		*40 - 135*
13C-1,2,3,4,7,8-HxCDF	*58*		*40 - 135*
13C-1,2,3,4,6,7,8-HpCDD	*64*		*40 - 135*
13C-1,2,3,4,6,7,8-HpCDF	*68*		*40 - 135*
13C-OCDD	*57*		*40 - 135*

Method: 6020 - Metals (ICP/MS)

Lab Sample ID: MB 320-88494/1-A
Matrix: Solid
Analysis Batch: 88698

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 88494

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Arsenic	ND		0.20	0.15	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Barium	ND		0.20	0.14	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Beryllium	ND		0.10	0.010	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Cadmium	ND		0.10	0.050	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Chromium	ND		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Cobalt	ND		0.10	0.060	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Copper	ND		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Lead	ND		0.10	0.060	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Molybdenum	ND		0.20	0.020	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Nickel	ND		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Selenium	ND		0.20	0.10	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Silver	ND		0.10	0.030	mg/Kg		10/08/15 07:40	10/08/15 21:27	1

Client: GHD Services Inc. TestAmerica Job ID: 320-15188-1
Project/Site: Fishermans Channel

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 320-88494/1-A **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 88698 **Prep Batch: 88494**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Thallium	ND		0.10	0.050	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Vanadium	ND		1.0	0.30	mg/Kg		10/08/15 07:40	10/08/15 21:27	1
Zinc	ND		1.0	0.60	mg/Kg		10/08/15 07:40	10/08/15 21:27	1

Lab Sample ID: LCS 320-88494/2-A **Client Sample ID: Lab Control Sample**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 88698 **Prep Batch: 88494**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	20.0	20.7		mg/Kg		104	80 - 120
Arsenic	20.0	21.9		mg/Kg		110	80 - 120
Barium	20.0	20.3		mg/Kg		102	80 - 120
Beryllium	20.0	19.6		mg/Kg		98	80 - 120
Cadmium	20.0	20.2		mg/Kg		101	80 - 120
Chromium	20.0	20.4		mg/Kg		102	80 - 120
Cobalt	20.0	20.2		mg/Kg		101	80 - 120
Copper	20.0	20.1		mg/Kg		101	80 - 120
Lead	20.0	19.5		mg/Kg		98	80 - 120
Molybdenum	20.0	21.9		mg/Kg		110	80 - 120
Nickel	20.0	20.2		mg/Kg		101	80 - 120
Selenium	20.0	21.9		mg/Kg		109	80 - 120
Silver	5.00	4.92		mg/Kg		98	80 - 120
Thallium	5.00	4.82		mg/Kg		96	80 - 120
Vanadium	20.0	20.3		mg/Kg		101	80 - 120
Zinc	20.0	21.4		mg/Kg		107	80 - 120

Lab Sample ID: 320-15188-3 MS **Client Sample ID: FC-Replicate 3**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 88698 **Prep Batch: 88494**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	0.14	J F1	9.88	6.33	F1	mg/Kg		63	80 - 120
Arsenic	5.2		9.88	14.8		mg/Kg		97	80 - 120
Barium	67		9.88	77.7	4	mg/Kg		111	80 - 120
Beryllium	0.37		9.88	9.66		mg/Kg		94	80 - 120
Cadmium	0.15		9.88	9.62		mg/Kg		96	80 - 120
Chromium	72		9.88	81.7	4	mg/Kg		93	80 - 120
Cobalt	11		9.88	20.0		mg/Kg		93	80 - 120
Copper	22		9.88	31.4		mg/Kg		96	80 - 120
Lead	6.3		9.88	15.5		mg/Kg		93	80 - 120
Molybdenum	0.97		9.88	10.5		mg/Kg		97	80 - 120
Nickel	79		9.88	87.8	4	mg/Kg		88	80 - 120
Selenium	0.24		9.88	8.60		mg/Kg		85	80 - 120
Silver	0.074	J	2.47	2.51		mg/Kg		99	80 - 120
Thallium	0.095	J	2.47	2.30		mg/Kg		89	80 - 120
Vanadium	44		9.88	53.7	4	mg/Kg		101	80 - 120
Zinc	57		9.88	70.1	4	mg/Kg		131	80 - 120

Client: GHD Services Inc. TestAmerica Job ID: 320-15188-1
Project/Site: Fishermans Channel

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: 320-15188-3 MSD **Client Sample ID: FC-Replicate 3**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 88698 **Prep Batch: 88494**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	0.14	J F1	9.95	5.92	F1	mg/Kg		58	80 - 120	7	20
Arsenic	5.2		9.95	14.7		mg/Kg		96	80 - 120	0	20
Barium	67		9.95	78.2	4	mg/Kg		116	80 - 120	1	20
Beryllium	0.37		9.95	9.85		mg/Kg		95	80 - 120	2	20
Cadmium	0.15		9.95	9.57		mg/Kg		95	80 - 120	0	20
Chromium	72		9.95	82.3	4	mg/Kg		99	80 - 120	1	20
Cobalt	11		9.95	20.3		mg/Kg		95	80 - 120	2	20
Copper	22		9.95	31.5		mg/Kg		96	80 - 120	0	20
Lead	6.3		9.95	15.4		mg/Kg		91	80 - 120	1	20
Molybdenum	0.97		9.95	10.6		mg/Kg		97	80 - 120	1	20
Nickel	79		9.95	89.0	4	mg/Kg		100	80 - 120	1	20
Selenium	0.24		9.95	8.28		mg/Kg		81	80 - 120	4	20
Silver	0.074	J	2.49	2.49		mg/Kg		97	80 - 120	1	47
Thallium	0.095	J	2.49	2.34		mg/Kg		90	80 - 120	2	20
Vanadium	44		9.95	54.2	4	mg/Kg		106	80 - 120	1	20
Zinc	57		9.95	68.7	4	mg/Kg		115	80 - 120	2	20

Lab Sample ID: MB 440-285931/1-A **Client Sample ID: Method Blank**
Matrix: Solid **Prep Type: STLC DI**
Analysis Batch: 287597

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.20	0.10	ug/L			10/16/15 20:13	1
Cobalt	ND		0.20	0.10	ug/L			10/16/15 20:13	1
Vanadium	ND		0.20	0.10	ug/L			10/16/15 20:13	1
Cadmium	ND		0.10	0.050	ug/L			10/16/15 20:13	1
Barium	ND		0.20	0.10	ug/L			10/16/15 20:13	1

Lab Sample ID: LCS 440-285931/2-A **Client Sample ID: Lab Control Sample**
Matrix: Solid **Prep Type: STLC DI**
Analysis Batch: 287597

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	80.0	77.8		ug/L		97	80 - 120
Cobalt	80.0	77.3		ug/L		97	80 - 120
Vanadium	80.0	79.5		ug/L		99	80 - 120
Cadmium	80.0	77.7		ug/L		97	80 - 120
Barium	80.0	78.5		ug/L		98	80 - 120

Lab Sample ID: 320-15188-1 MS **Client Sample ID: FC-Replicate 1**
Matrix: Solid **Prep Type: STLC DI**
Analysis Batch: 287597

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.6		80.0	80.5		ug/L		95	75 - 125
Cobalt	0.84		80.0	71.8		ug/L		89	75 - 125
Vanadium	12	^	80.0	90.8		ug/L		98	75 - 125
Cadmium	ND		80.0	71.4		ug/L		89	75 - 125
Barium	19		80.0	99.4		ug/L		100	75 - 125

Lab Sample ID: 320-15188-1 MSD
Matrix: Solid
Analysis Batch: 287597

Client Sample ID: FC-Replicate 1
Prep Type: STLC DI

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.6		80.0	81.5		ug/L		96	75 - 125	1	20
Cobalt	0.84		80.0	72.9		ug/L		90	75 - 125	2	20
Vanadium	12	^	80.0	92.9		ug/L		101	75 - 125	2	20
Cadmium	ND		80.0	72.4		ug/L		91	75 - 125	1	20
Barium	19		80.0	100		ug/L		102	75 - 125	1	20

Method: 6020 - Inductively Coupled Plasma - Mass Spectrometry

Lab Sample ID: MB 440-285932/1-A ^20
Matrix: Solid
Analysis Batch: 289010

Client Sample ID: Method Blank
Prep Type: STLC Citrate

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		80	40	ug/L			10/23/15 12:50	20
Cobalt	ND		80	40	ug/L			10/23/15 12:50	20
Vanadium	ND		80	40	ug/L			10/23/15 12:50	20
Cadmium	ND		40	20	ug/L			10/23/15 12:50	20
Barium	ND		80	40	ug/L			10/23/15 12:50	20

Lab Sample ID: LCS 440-285932/2-A ^20
Matrix: Solid
Analysis Batch: 289010

Client Sample ID: Lab Control Sample
Prep Type: STLC Citrate

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1600	1600		ug/L		100	80 - 120
Cobalt	1600	1440		ug/L		90	80 - 120
Vanadium	1600	1640		ug/L		102	80 - 120
Cadmium	1600	1490		ug/L		93	80 - 120
Barium	1600	1670		ug/L		104	80 - 120

Lab Sample ID: 320-15188-1 MS
Matrix: Solid
Analysis Batch: 289010

Client Sample ID: FC-Replicate 1
Prep Type: STLC Citrate

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	180		1600	1750		ug/L		98	75 - 125
Cobalt	210		1600	1630		ug/L		89	75 - 125
Vanadium	500		1600	2030		ug/L		96	75 - 125
Cadmium	ND		1600	1480		ug/L		93	75 - 125
Barium	1400		1600	3080		ug/L		104	75 - 125

Lab Sample ID: 320-15188-1 MSD
Matrix: Solid
Analysis Batch: 289010

Client Sample ID: FC-Replicate 1
Prep Type: STLC Citrate

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	180		1600	1780		ug/L		100	75 - 125	2	20
Cobalt	210		1600	1620		ug/L		88	75 - 125	0	20
Vanadium	500		1600	2070		ug/L		98	75 - 125	2	20
Cadmium	ND		1600	1490		ug/L		93	75 - 125	0	20
Barium	1400		1600	3130		ug/L		107	75 - 125	1	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 320-88692/11-A
Matrix: Solid
Analysis Batch: 88720
Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 88692

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.040	0.0086	mg/Kg		10/09/15 10:30	10/09/15 13:53	1

Lab Sample ID: LCS 320-88692/12-A
Matrix: Solid
Analysis Batch: 88720
Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 88692

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.0833	0.0828		mg/Kg		99	86 - 114

Lab Sample ID: 320-15188-2 MS
Matrix: Solid
Analysis Batch: 88720
Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88692

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.066		0.151	0.211		mg/Kg		96	86 - 114

Lab Sample ID: 320-15188-2 MSD
Matrix: Solid
Analysis Batch: 88720
Client Sample ID: FC-Replicate 2
Prep Type: Total/NA
Prep Batch: 88692

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.066		0.151	0.210		mg/Kg		95	86 - 114	1	17

Method: 7196A - Chromium, Hexavalent

Lab Sample ID: 320-15188-3 MS
Matrix: Solid
Analysis Batch: 89692
Client Sample ID: FC-Replicate 3
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chromium, hexavalent	ND		0.250	0.227		mg/Kg		91	85 - 115

Lab Sample ID: 320-15188-3 MSD
Matrix: Solid
Analysis Batch: 89692
Client Sample ID: FC-Replicate 3
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chromium, hexavalent	ND		0.250	0.221		mg/Kg		89	85 - 115	3	15

Lab Sample ID: MB 320-89592/8-A
Matrix: Solid
Analysis Batch: 89692
Client Sample ID: Method Blank
Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium, hexavalent	ND		0.050	0.010	mg/Kg			10/19/15 16:30	1

Method: 7196A - Chromium, Hexavalent (Continued)

Lab Sample ID: LCS 320-89592/9-A
Matrix: Solid
Analysis Batch: 89692

Client Sample ID: Lab Control Sample
Prep Type: Soluble

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chromium, hexavalent	0.201	0.197		mg/Kg		98	85 - 115

Method: 9060 - Organic Carbon, Total (TOC)

Lab Sample ID: MB 580-203481/3
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Carbon - Average Dup	ND		2000	44	mg/Kg			10/15/15 12:34	1

Lab Sample ID: LCS 580-203481/4
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon - Average Dup	4620	4030		mg/Kg		87	49 - 151

Lab Sample ID: LCSD 580-203481/5
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Carbon - Average Dup	4620	4190		mg/Kg		91	49 - 151	4	35

Lab Sample ID: 320-15188-1 MS
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: FC-Replicate 1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Carbon - Average Dup	6300		57700	57300		mg/Kg		88	50 - 140

Lab Sample ID: 320-15188-1 MSD
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: FC-Replicate 1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Carbon - Average Dup	6300		62600	61200		mg/Kg		88	50 - 140	6	35

Lab Sample ID: 320-15188-1 DU
Matrix: Solid
Analysis Batch: 203481

Client Sample ID: FC-Replicate 1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Organic Carbon - Average Dup	6300		6250		mg/Kg		1	50

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

GC/MS Semi VOA

Prep Batch: 203074

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8151A	
320-15188-1 MS	FC-Replicate 1	Total/NA	Solid	8151A	
320-15188-1 MSD	FC-Replicate 1	Total/NA	Solid	8151A	
320-15188-2	FC-Replicate 2	Total/NA	Solid	8151A	
320-15188-3	FC-Replicate 3	Total/NA	Solid	8151A	
LCS 580-203074/2-A	Lab Control Sample	Total/NA	Solid	8151A	
MB 580-203074/1-A	Method Blank	Total/NA	Solid	8151A	

Leach Batch: 203119

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	1311	
320-15188-2	FC-Replicate 2	Total/NA	Solid	1311	
320-15188-3	FC-Replicate 3	Total/NA	Solid	1311	

Prep Batch: 203347

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8151A	203119
320-15188-2	FC-Replicate 2	Total/NA	Solid	8151A	203119
320-15188-3	FC-Replicate 3	Total/NA	Solid	8151A	203119
LCS 580-203347/2-A	Lab Control Sample	Total/NA	Solid	8151A	
LCSD 580-203347/3-A	Lab Control Sample Dup	Total/NA	Solid	8151A	
MB 580-203347/1-A	Method Blank	Total/NA	Solid	8151A	

Analysis Batch: 203973

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8151A	203074
320-15188-1 MS	FC-Replicate 1	Total/NA	Solid	8151A	203074
320-15188-1 MSD	FC-Replicate 1	Total/NA	Solid	8151A	203074
320-15188-2	FC-Replicate 2	Total/NA	Solid	8151A	203074
320-15188-3	FC-Replicate 3	Total/NA	Solid	8151A	203074
LCS 580-203074/2-A	Lab Control Sample	Total/NA	Solid	8151A	203074
LCS 580-203347/2-A	Lab Control Sample	Total/NA	Solid	8151A	203347
LCSD 580-203347/3-A	Lab Control Sample Dup	Total/NA	Solid	8151A	203347
MB 580-203074/1-A	Method Blank	Total/NA	Solid	8151A	203074
MB 580-203347/1-A	Method Blank	Total/NA	Solid	8151A	203347

Analysis Batch: 204061

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8151A	203347
320-15188-2	FC-Replicate 2	Total/NA	Solid	8151A	203347
320-15188-3	FC-Replicate 3	Total/NA	Solid	8151A	203347

Prep Batch: 287508

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3546	
320-15188-2	FC-Replicate 2	Total/NA	Solid	3546	
320-15188-3	FC-Replicate 3	Total/NA	Solid	3546	
LCS 440-287508/2-A	Lab Control Sample	Total/NA	Solid	3546	
LCSD 440-287508/3-A	Lab Control Sample Dup	Total/NA	Solid	3546	
MB 440-287508/1-A	Method Blank	Total/NA	Solid	3546	

QC Association Summary

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

GC/MS Semi VOA (Continued)

Analysis Batch: 287765

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8270C SIM	287508
320-15188-2	FC-Replicate 2	Total/NA	Solid	8270C SIM	287508
320-15188-3	FC-Replicate 3	Total/NA	Solid	8270C SIM	287508
LCS 440-287508/2-A	Lab Control Sample	Total/NA	Solid	8270C SIM	287508
LCSD 440-287508/3-A	Lab Control Sample Dup	Total/NA	Solid	8270C SIM	287508
MB 440-287508/1-A	Method Blank	Total/NA	Solid	8270C SIM	287508

Leach Batch: 289123

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC DI	Solid	CA WET DI Leach	
320-15188-1 MS	FC-Replicate 1	STLC DI	Solid	CA WET DI Leach	
320-15188-2	FC-Replicate 2	STLC DI	Solid	CA WET DI Leach	
320-15188-3	FC-Replicate 3	STLC DI	Solid	CA WET DI Leach	
LCS 440-289123/2-B	Lab Control Sample	STLC DI	Solid	CA WET DI Leach	
MB 440-289123/1-B	Method Blank	STLC DI	Solid	CA WET DI Leach	

Prep Batch: 289382

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC DI	Solid	3520C	289123
320-15188-1 MS	FC-Replicate 1	STLC DI	Solid	3520C	289123
320-15188-2	FC-Replicate 2	STLC DI	Solid	3520C	289123
320-15188-3	FC-Replicate 3	STLC DI	Solid	3520C	289123
LCS 440-289123/2-B	Lab Control Sample	STLC DI	Solid	3520C	289123
MB 440-289123/1-B	Method Blank	STLC DI	Solid	3520C	289123

Analysis Batch: 289719

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC DI	Solid	8270C SIM	289382
320-15188-1 MS	FC-Replicate 1	STLC DI	Solid	8270C SIM	289382
320-15188-2	FC-Replicate 2	STLC DI	Solid	8270C SIM	289382
320-15188-3	FC-Replicate 3	STLC DI	Solid	8270C SIM	289382
LCS 440-289123/2-B	Lab Control Sample	STLC DI	Solid	8270C SIM	289382
MB 440-289123/1-B	Method Blank	STLC DI	Solid	8270C SIM	289382

GC Semi VOA

ISM Prep Batch: 88304

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	Increment, prep	

GC Semi VOA (Continued)

ISM Prep Batch: 88543

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	

Prep Batch: 88569

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3550B	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	3550B	88304
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	3550B	88304
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	3550B	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	3550B	88304
LCS 320-88569/2-A	Lab Control Sample	Total/NA	Solid	3550B	
MB 320-88569/1-A	Method Blank	Total/NA	Solid	3550B	

Prep Batch: 88571

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3550B	88543
320-15188-2	FC-Replicate 2	Total/NA	Solid	3550B	88543
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	3550B	88543
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	3550B	88543
320-15188-3	FC-Replicate 3	Total/NA	Solid	3550B	88543
LCS 320-88571/2-A	Lab Control Sample	Silica Gel Cleanup	Solid	3550B	
MB 320-88571/1-A	Method Blank	Silica Gel Cleanup	Solid	3550B	

Analysis Batch: 88835

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8015B	88571
320-15188-1	FC-Replicate 1	Total/NA	Solid	8015B	88569
320-15188-2	FC-Replicate 2	Total/NA	Solid	8015B	88571
320-15188-2	FC-Replicate 2	Total/NA	Solid	8015B	88569
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	8015B	88571
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	8015B	88569
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	8015B	88571
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	8015B	88569
320-15188-3	FC-Replicate 3	Total/NA	Solid	8015B	88571
320-15188-3	FC-Replicate 3	Total/NA	Solid	8015B	88569
LCS 320-88569/2-A	Lab Control Sample	Total/NA	Solid	8015B	88569
LCS 320-88571/2-A	Lab Control Sample	Silica Gel Cleanup	Solid	8015B	88571
MB 320-88569/1-A	Method Blank	Total/NA	Solid	8015B	88569
MB 320-88571/1-A	Method Blank	Silica Gel Cleanup	Solid	8015B	88571

Prep Batch: 89031

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3550B	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	3550B	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	3550B	88304
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	3550B	88304
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	3550B	88304
LCS 320-89031/2-A	Lab Control Sample	Total/NA	Solid	3550B	

GC Semi VOA (Continued)

Prep Batch: 89031 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 320-89031/1-A	Method Blank	Total/NA	Solid	3550B	

Prep Batch: 89033

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3550B	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	3550B	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	3550B	88304
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	3550B	88304
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	3550B	88304
LCS 320-89033/2-A	Lab Control Sample	Total/NA	Solid	3550B	
LCS 320-89033/3-A	Lab Control Sample	Total/NA	Solid	3550B	
MB 320-89033/1-A	Method Blank	Total/NA	Solid	3550B	

Analysis Batch: 89139

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8081A	89033
320-15188-2	FC-Replicate 2	Total/NA	Solid	8081A	89033
320-15188-3	FC-Replicate 3	Total/NA	Solid	8081A	89033
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	8081A	89033
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	8081A	89033
LCS 320-89033/2-A	Lab Control Sample	Total/NA	Solid	8081A	89033
LCS 320-89033/3-A	Lab Control Sample	Total/NA	Solid	8081A	89033
MB 320-89033/1-A	Method Blank	Total/NA	Solid	8081A	89033

Analysis Batch: 89179

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8082	89031
320-15188-2	FC-Replicate 2	Total/NA	Solid	8082	89031
320-15188-3	FC-Replicate 3	Total/NA	Solid	8082	89031
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	8082	89031
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	8082	89031
LCS 320-89031/2-A	Lab Control Sample	Total/NA	Solid	8082	89031
MB 320-89031/1-A	Method Blank	Total/NA	Solid	8082	89031

Specialty Organics

ISM Prep Batch: 88304

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	

Prep Batch: 88426

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8290	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	8290	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	8290	88304
LCS 320-88426/2-A	Lab Control Sample	Total/NA	Solid	8290	
MB 320-88426/1-A	Method Blank	Total/NA	Solid	8290	

Specialty Organics (Continued)

Analysis Batch: 88695

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 320-88426/2-A	Lab Control Sample	Total/NA	Solid	8290	88426
MB 320-88426/1-A	Method Blank	Total/NA	Solid	8290	88426

Analysis Batch: 88697

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	8290	88426
320-15188-2	FC-Replicate 2	Total/NA	Solid	8290	88426
320-15188-3	FC-Replicate 3	Total/NA	Solid	8290	88426

Metals

ISM Prep Batch: 88304

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	Increment, prep	

Prep Batch: 88494

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	3050B	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	3050B	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	3050B	88304
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	3050B	88304
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	3050B	88304
LCS 320-88494/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 320-88494/1-A	Method Blank	Total/NA	Solid	3050B	

Prep Batch: 88692

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	7471A	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	7471A	88304
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	7471A	88304
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	7471A	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	7471A	88304
LCS 320-88692/12-A	Lab Control Sample	Total/NA	Solid	7471A	
MB 320-88692/11-A	Method Blank	Total/NA	Solid	7471A	

Analysis Batch: 88698

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	6020	88494
320-15188-2	FC-Replicate 2	Total/NA	Solid	6020	88494
320-15188-3	FC-Replicate 3	Total/NA	Solid	6020	88494
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	6020	88494
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	6020	88494
LCS 320-88494/2-A	Lab Control Sample	Total/NA	Solid	6020	88494
MB 320-88494/1-A	Method Blank	Total/NA	Solid	6020	88494

Metals (Continued)

Analysis Batch: 88720

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	7471A	88692
320-15188-2	FC-Replicate 2	Total/NA	Solid	7471A	88692
320-15188-2 MS	FC-Replicate 2	Total/NA	Solid	7471A	88692
320-15188-2 MSD	FC-Replicate 2	Total/NA	Solid	7471A	88692
320-15188-3	FC-Replicate 3	Total/NA	Solid	7471A	88692
LCS 320-88692/12-A	Lab Control Sample	Total/NA	Solid	7471A	88692
MB 320-88692/11-A	Method Blank	Total/NA	Solid	7471A	88692

Leach Batch: 285931

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC DI	Solid	CA WET DI	
320-15188-1 MS	FC-Replicate 1	STLC DI	Solid	CA WET DI	
320-15188-1 MSD	FC-Replicate 1	STLC DI	Solid	CA WET DI	
320-15188-2	FC-Replicate 2	STLC DI	Solid	CA WET DI	
320-15188-3	FC-Replicate 3	STLC DI	Solid	CA WET DI	
LCS 440-285931/2-A	Lab Control Sample	STLC DI	Solid	CA WET DI	
MB 440-285931/1-A	Method Blank	STLC DI	Solid	CA WET DI	

Leach Batch: 285932

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC Citrate	Solid	CA WET Citrate	
320-15188-1 MS	FC-Replicate 1	STLC Citrate	Solid	CA WET Citrate	
320-15188-1 MSD	FC-Replicate 1	STLC Citrate	Solid	CA WET Citrate	
320-15188-2	FC-Replicate 2	STLC Citrate	Solid	CA WET Citrate	
320-15188-3	FC-Replicate 3	STLC Citrate	Solid	CA WET Citrate	
LCS 440-285932/2-A ^20	Lab Control Sample	STLC Citrate	Solid	CA WET Citrate	
MB 440-285932/1-A ^20	Method Blank	STLC Citrate	Solid	CA WET Citrate	

Analysis Batch: 287597

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC DI	Solid	6020	285931
320-15188-1 MS	FC-Replicate 1	STLC DI	Solid	6020	285931
320-15188-1 MSD	FC-Replicate 1	STLC DI	Solid	6020	285931
320-15188-2	FC-Replicate 2	STLC DI	Solid	6020	285931
320-15188-3	FC-Replicate 3	STLC DI	Solid	6020	285931
LCS 440-285931/2-A	Lab Control Sample	STLC DI	Solid	6020	285931
MB 440-285931/1-A	Method Blank	STLC DI	Solid	6020	285931

Analysis Batch: 289010

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	STLC Citrate	Solid	6020	285932
320-15188-1 MS	FC-Replicate 1	STLC Citrate	Solid	6020	285932
320-15188-1 MSD	FC-Replicate 1	STLC Citrate	Solid	6020	285932
320-15188-2	FC-Replicate 2	STLC Citrate	Solid	6020	285932
320-15188-3	FC-Replicate 3	STLC Citrate	Solid	6020	285932
LCS 440-285932/2-A ^20	Lab Control Sample	STLC Citrate	Solid	6020	285932
MB 440-285932/1-A ^20	Method Blank	STLC Citrate	Solid	6020	285932

General Chemistry

ISM Prep Batch: 88304

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	Increment, prep	
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	Increment, prep	

Analysis Batch: 88979

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	Increment, prep	
320-15188-2	FC-Replicate 2	Total/NA	Solid	Increment, prep	
320-15188-3	FC-Replicate 3	Total/NA	Solid	Increment, prep	

Leach Batch: 89592

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	DI Leach	88304
320-15188-2	FC-Replicate 2	Total/NA	Solid	DI Leach	88304
320-15188-3	FC-Replicate 3	Total/NA	Solid	DI Leach	88304
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	DI Leach	88304
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	DI Leach	88304
LCS 320-89592/9-A	Lab Control Sample	Soluble	Solid	DI Leach	
MB 320-89592/8-A	Method Blank	Soluble	Solid	DI Leach	

Analysis Batch: 89692

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	7196A	89592
320-15188-2	FC-Replicate 2	Total/NA	Solid	7196A	89592
320-15188-3	FC-Replicate 3	Total/NA	Solid	7196A	89592
320-15188-3 MS	FC-Replicate 3	Total/NA	Solid	7196A	89592
320-15188-3 MSD	FC-Replicate 3	Total/NA	Solid	7196A	89592
LCS 320-89592/9-A	Lab Control Sample	Soluble	Solid	7196A	89592
MB 320-89592/8-A	Method Blank	Soluble	Solid	7196A	89592

Analysis Batch: 203481

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-15188-1	FC-Replicate 1	Total/NA	Solid	9060	
320-15188-1 DU	FC-Replicate 1	Total/NA	Solid	9060	
320-15188-1 MS	FC-Replicate 1	Total/NA	Solid	9060	
320-15188-1 MSD	FC-Replicate 1	Total/NA	Solid	9060	
320-15188-2	FC-Replicate 2	Total/NA	Solid	9060	
320-15188-3	FC-Replicate 3	Total/NA	Solid	9060	
LCS 580-203481/4	Lab Control Sample	Total/NA	Solid	9060	
LCSD 580-203481/5	Lab Control Sample Dup	Total/NA	Solid	9060	
MB 580-203481/3	Method Blank	Total/NA	Solid	9060	

Client Sample ID: FC-Replicate 1

Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-1

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8151A			15.279 g	10 mL	203074	10/12/15 10:51	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	15.279 g	10 mL	203973	10/22/15 23:06	ERB	TAL SEA
Total/NA	Leach	1311			100 g	2000 mL	203119	10/12/15 16:14	RBL	TAL SEA
Total/NA	Prep	8151A			100 mL	10 mL	203347	10/14/15 12:53	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	100 mL	10 mL	204061	10/23/15 05:55	ERB	TAL SEA
STLC DI	Leach	CA WET DI Leach			50.03 g	500 mL	289123	10/24/15 09:13	EN	TAL IRV
STLC DI	Prep	3520C			200 mL	1 mL	289382	10/26/15 12:27	IVA	TAL IRV
STLC DI	Analysis	8270C SIM		1	200 mL	1 mL	289719	10/27/15 21:07	AI	TAL IRV
Total/NA	Prep	3546			7.55 g	1 mL	287508	10/16/15 17:17	BAW	TAL IRV
Total/NA	Analysis	8270C SIM		1	7.55 g	1 mL	287765	10/19/15 18:12	TL	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88543	09/08/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.67 g	3 mL	88571	10/08/15 12:48	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.67 g	3 mL	88835	10/12/15 15:38	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.67 g	3 mL	88569	10/08/15 12:46	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.67 g	3 mL	88835	10/12/15 19:00	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.68 g	100 mL	89033	10/08/15 12:35	AVM	TAL SAC
Total/NA	Analysis	8081A		1	30.68 g	100 mL	89139	10/14/15 18:28	UFB	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.68 g	100 mL	89031	10/08/15 12:39	AVM	TAL SAC
Total/NA	Analysis	8082		1	30.68 g	100 mL	89179	10/14/15 18:32	SXH	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	8290			9.89 g	20 uL	88426	10/07/15 14:17	GDB	TAL SAC
Total/NA	Analysis	8290		1	9.89 g	20 uL	88697	10/09/15 14:16	ALM	TAL SAC
STLC Citrate	Leach	CA WET Citrate			50.04 g	500 mL	285932	10/10/15 06:13	CH	TAL IRV
STLC Citrate	Analysis	6020		20			289010	10/23/15 12:55	RC	TAL IRV
STLC DI	Leach	CA WET DI			500 g	1.0 mL	285931	10/10/15 06:08	CH	TAL IRV
STLC DI	Analysis	6020		1			287597	10/16/15 20:18	NH	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3050B			9.82 g	500 mL	88494	10/08/15 07:40	NIM	TAL SAC
Total/NA	Analysis	6020		2	9.82 g	500 mL	88698	10/08/15 22:56	TTP	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	7471A			9.89 g	500 mL	88692	10/09/15 10:30	JMD	TAL SAC
Total/NA	Analysis	7471A		1	9.89 g	500 mL	88720	10/09/15 14:03	JMD	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Leach	DI Leach			10.12 g	50 mL	89592	10/19/15 09:28	DLG	TAL SAC
Total/NA	Analysis	7196A		1	10 mL	10 mL	89692	10/19/15 16:30	LW1	TAL SAC
Total/NA	Analysis	9060		1			203481	10/15/15 12:42	JSM	TAL SEA
Total/NA	Analysis	Increment, prep		1			88979	09/29/15 14:40	ALH	TAL SAC

Client Sample ID: FC-Replicate 2 Lab Sample ID: 320-15188-2

Date Collected: 09/28/15 00:00 **Matrix: Solid**
Date Received: 09/29/15 07:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8151A			15.694 g	10 mL	203074	10/12/15 10:51	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	15.694 g	10 mL	203973	10/23/15 00:14	ERB	TAL SEA
Total/NA	Leach	1311			100 g	2000 mL	203119	10/12/15 16:14	RBL	TAL SEA
Total/NA	Prep	8151A			100 mL	10 mL	203347	10/14/15 12:53	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	100 mL	10 mL	204061	10/23/15 06:18	ERB	TAL SEA
STLC DI	Leach	CA WET DI Leach			50.06 g	500 mL	289123	10/24/15 09:13	EN	TAL IRV
STLC DI	Prep	3520C			200 mL	1 mL	289382	10/26/15 12:27	IVA	TAL IRV
STLC DI	Analysis	8270C SIM		1	200 mL	1 mL	289719	10/28/15 00:53	AI	TAL IRV
Total/NA	Prep	3546			7.77 g	1 mL	287508	10/16/15 17:17	BAW	TAL IRV
Total/NA	Analysis	8270C SIM		1	7.77 g	1 mL	287765	10/19/15 18:33	TL	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88543	09/08/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.14 g	3 mL	88571	10/08/15 12:48	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.14 g	3 mL	88835	10/12/15 16:07	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.14 g	3 mL	88569	10/08/15 12:46	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.14 g	3 mL	88835	10/12/15 19:29	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.15 g	100 mL	89033	10/08/15 12:35	AVM	TAL SAC
Total/NA	Analysis	8081A		1	30.15 g	100 mL	89139	10/14/15 18:44	UFB	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.15 g	100 mL	89031	10/08/15 12:39	AVM	TAL SAC
Total/NA	Analysis	8082		1	30.15 g	100 mL	89179	10/14/15 18:53	SXH	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	8290			10.09 g	20 uL	88426	10/07/15 14:17	GDB	TAL SAC
Total/NA	Analysis	8290		1	10.09 g	20 uL	88697	10/09/15 14:58	ALM	TAL SAC
STLC Citrate	Leach	CA WET Citrate			50.06 g	500 mL	285932	10/10/15 06:13	CH	TAL IRV
STLC Citrate	Analysis	6020		20			289010	10/23/15 13:03	RC	TAL IRV
STLC DI	Leach	CA WET DI			500 g	1.0 mL	285931	10/10/15 06:08	CH	TAL IRV
STLC DI	Analysis	6020		1			287597	10/16/15 20:25	NH	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3050B			10.14 g	500 mL	88494	10/08/15 07:40	NIM	TAL SAC
Total/NA	Analysis	6020		2	10.14 g	500 mL	88698	10/08/15 23:00	TTP	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	7471A			10.02 g	500 mL	88692	10/09/15 10:30	JMD	TAL SAC
Total/NA	Analysis	7471A		1	10.02 g	500 mL	88720	10/09/15 14:05	JMD	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Leach	DI Leach			9.95 g	50 mL	89592	10/19/15 09:28	DLG	TAL SAC
Total/NA	Analysis	7196A		1	10 mL	10 mL	89692	10/19/15 16:30	LW1	TAL SAC
Total/NA	Analysis	9060		1			203481	10/15/15 12:59	JSM	TAL SEA
Total/NA	Analysis	Increment, prep		1			88979	09/29/15 14:40	ALH	TAL SAC

Client Sample ID: FC-Replicate 3
Date Collected: 09/28/15 00:00
Date Received: 09/29/15 07:00

Lab Sample ID: 320-15188-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8151A			15.431 g	10 mL	203074	10/12/15 10:51	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	15.431 g	10 mL	203973	10/23/15 00:37	ERB	TAL SEA
Total/NA	Leach	1311			100 g	2000 mL	203119	10/12/15 16:14	RBL	TAL SEA
Total/NA	Prep	8151A			100 mL	10 mL	203347	10/14/15 12:53	ERZ	TAL SEA
Total/NA	Analysis	8151A		1	100 mL	10 mL	204061	10/23/15 06:41	ERB	TAL SEA
STLC DI	Leach	CA WET DI Leach			50.01 g	500 mL	289123	10/24/15 09:13	EN	TAL IRV
STLC DI	Prep	3520C			200 mL	1 mL	289382	10/26/15 12:27	IVA	TAL IRV
STLC DI	Analysis	8270C SIM		1	200 mL	1 mL	289719	10/27/15 22:09	AI	TAL IRV
Total/NA	Prep	3546			7.39 g	1 mL	287508	10/16/15 17:17	BAW	TAL IRV
Total/NA	Analysis	8270C SIM		1	7.39 g	1 mL	287765	10/19/15 18:53	TL	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88543	09/08/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.04 g	3 mL	88571	10/08/15 12:48	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.04 g	3 mL	88835	10/12/15 17:33	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.04 g	3 mL	88569	10/08/15 12:46	NGK	TAL SAC
Total/NA	Analysis	8015B		1	30.04 g	3 mL	88835	10/12/15 20:56	AVM	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.67 g	100 mL	89033	10/08/15 12:35	AVM	TAL SAC
Total/NA	Analysis	8081A		1	30.67 g	100 mL	89139	10/14/15 18:59	UFB	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3550B			30.67 g	100 mL	89031	10/08/15 12:39	AVM	TAL SAC
Total/NA	Analysis	8082		1	30.67 g	100 mL	89179	10/14/15 19:13	SXH	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	8290			10.00 g	20 uL	88426	10/07/15 14:17	GDB	TAL SAC
Total/NA	Analysis	8290		1	10.00 g	20 uL	88697	10/09/15 15:39	ALM	TAL SAC
STLC Citrate	Leach	CA WET Citrate			50.02 g	500 mL	285932	10/10/15 06:13	CH	TAL IRV
STLC Citrate	Analysis	6020		20			289010	10/23/15 13:08	RC	TAL IRV
STLC DI	Leach	CA WET DI			500 g	1.0 mL	285931	10/10/15 06:08	CH	TAL IRV
STLC DI	Analysis	6020		1			287597	10/16/15 20:27	NH	TAL IRV
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	3050B			10.07 g	500 mL	88494	10/08/15 07:40	NIM	TAL SAC
Total/NA	Analysis	6020		2	10.07 g	500 mL	88698	10/08/15 22:39	TTP	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Prep	7471A			9.95 g	500 mL	88692	10/09/15 10:30	JMD	TAL SAC
Total/NA	Analysis	7471A		1	9.95 g	500 mL	88720	10/09/15 14:17	JMD	TAL SAC
Total/NA	ISM Prep	Increment, prep				1.0 g	88304	09/29/15 14:40	ALH	TAL SAC
Total/NA	Leach	DI Leach			9.93 g	50 mL	89592	10/19/15 09:28	DLG	TAL SAC
Total/NA	Analysis	7196A		1	10 mL	10 mL	89692	10/19/15 16:30	LW1	TAL SAC
Total/NA	Analysis	9060		1			203481	10/15/15 13:05	JSM	TAL SEA
Total/NA	Analysis	Increment, prep		1			88979	09/29/15 14:40	ALH	TAL SAC

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Laboratory: TestAmerica Sacramento

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2928-01	01-31-16
Alaska (UST)	State Program	10	UST-055	12-18-15
Arizona	State Program	9	AZ0708	08-11-16
Arkansas DEQ	State Program	6	88-0691	06-17-16
California	State Program	9	2897	01-31-16
Colorado	State Program	8	N/A	08-31-16
Connecticut	State Program	1	PH-0691	06-30-17
Florida	NELAP	4	E87570	06-30-16
Hawaii	State Program	9	N/A	01-29-16
Illinois	NELAP	5	200060	03-17-16
Kansas	NELAP	7	E-10375	01-31-16
Louisiana	NELAP	6	30612	06-30-16
Michigan	State Program	5	9947	01-31-16
Nevada	State Program	9	CA44	07-31-16
New Jersey	NELAP	2	CA005	06-30-16
New York	NELAP	2	11666	04-01-16
Oregon	NELAP	10	CA200005	01-29-16
Pennsylvania	NELAP	3	9947	03-31-16
Texas	NELAP	6	T104704399-15-9	05-31-16
US Fish & Wildlife	Federal		LE148388-0	02-28-16
USDA	Federal		P330-11-00436	12-30-17
USEPA UCMR	Federal	1	CA00044	11-06-16
Utah	NELAP	8	QUAN1	02-28-16
Virginia	NELAP Secondary AB	3	460278	03-14-16
Washington	State Program	10	C581	05-04-16
West Virginia (DW)	State Program	3	9930C	12-31-15
Wyoming	State Program	8	8TMS-Q	01-29-16

Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	CA01531	06-30-16
Arizona	State Program	9	AZ0671	10-13-16
California	LA Cty Sanitation Districts	9	10256	01-31-16 *
California	State Program	9	2706	06-30-16
Guam	State Program	9	Cert. No. 12.002r	01-23-16
Hawaii	State Program	9	N/A	01-29-16
Kansas	NELAP Secondary AB	7	E-10420	07-31-16
Nevada	State Program	9	CA015312007A	07-31-16 *
New Mexico	State Program	6	N/A	01-29-16
Northern Mariana Islands	State Program	9	MP0002	01-29-16
Oregon	NELAP	10	4005	01-29-16
USDA	Federal		P330-09-00080	07-08-18

Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-16
California	State Program	9	2901	01-31-17

* Certification renewal pending - certification considered valid.

Laboratory: TestAmerica Seattle (Continued)

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
L-A-B	DoD ELAP		L2236	01-19-16
L-A-B	ISO/IEC 17025		L2236	01-19-16
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-06-16
US Fish & Wildlife	Federal		LE058448-0	02-28-16
USDA	Federal		P330-14-00126	04-08-17
Washington	State Program	10	C553	02-17-16

Method Summary

Client: GHD Services Inc.
Project/Site: Fishermans Channel

TestAmerica Job ID: 320-15188-1

Method	Method Description	Protocol	Laboratory
8151A	TCLP Herbicides (GC/MS)	SW846	TAL SEA
8151A	Herbicides (GC/MS)	SW846	TAL SEA
8270C SIM	Semivolatile Organic Compounds (GC/MS SIM)	SW846	TAL IRV
8015B	Diesel Range Organics (DRO) (GC)	SW846	TAL SAC
8081A	Organochlorine Pesticides (GC)	SW846	TAL SAC
8082	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	SW846	TAL SAC
8290	Dioxins and Furans (HRGC/HRMS)	SW846	TAL SAC
6020	Inductively Coupled Plasma - Mass Spectrometry	SW846	TAL IRV
6020	Metals (ICP/MS)	SW846	TAL IRV
6020	Metals (ICP/MS)	SW846	TAL SAC
7471A	Mercury (CVAA)	SW846	TAL SAC
7196A	Chromium, Hexavalent	SW846	TAL SAC
9060	Organic Carbon, Total (TOC)	SW846	TAL SEA
Increment, prep	Incremental Sampling Method - Dry, Disaggregate, Sieve, Split, Subsample	EPA	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

TAL SAC = TestAmerica Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
320-15188-1	FC-Replicate 1	Solid	09/28/15 00:00	09/29/15 07:00
320-15188-2	FC-Replicate 2	Solid	09/28/15 00:00	09/29/15 07:00
320-15188-3	FC-Replicate 3	Solid	09/28/15 00:00	09/29/15 07:00

TestAmerica Sacramento
880 Riverside Parkway

West Sacramento, CA 95605-1500
phone 916.373.5600 fax 303.467.7248

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Lia Webb	Site Contact: Lia Webb	Date: Sept 29, 2015	COC No:
GHD	Tel/Fax: 707.267.2242	Lab Contact: Laura Turpen	Carrier:	__1__ of __1__ COCs
718 Third Street	**Analysis Turnaround Time**			Sampler. JD/SH/LW
Eureka, CA 95501	☐ CALENDAR DAYS ☑ WORKING DAYS			**For Lab Use Only:**
707.443.8326	TAT if different from Below __5____			Walk-in Client:
707.444.8330	☐ 2 weeks			Lab Sampling.
Fisherman's Channel ISM	☐ 1 week			
Site: King Salmon	☐ 2 days			Job / SDG No.
P O # 8411747.07	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	CAM 17 (6020/7471A)	Hexavalent Chromium (7196A)	PAHs (EPA 8270C)	Dioxins/Furans (EPA 8290)	Organochlorine Pesticides (EPA8081A)	PCB Aroclors (EPA 8082)	TPH Diesel (EPA 8015B) w SG	TPH Motor Oil (EPA 8015B) w SG	Pentachlorophenol (EPA 8151A)	Pentachlorophenol TCLP (1311)	Percent Moisture and pH	Total Organic Carbon	PAHs DI WET (CA WET DI)	Texture (ASTM D422)	Incremental Sampling Methodology	Metals DI WET (CA WET DI)	Metals Citrate WET (CA WET Citrate)	Sample Specific Notes:
FC-Replicate 1	9/21/15		ISM	sed	30	N	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	see special instructions section
FC-Replicate 2	through		ISM	sed	30	N	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	see special instructions section
FC-Replicate 3	9/28/15		ISM	sed	30	N	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	see special instructions section

320-15188 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other __1______

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☑ Archive for __6__ Months

Special Instructions/QC Requirements & Comments: Sort sample tubes per attached table instructions. Perform ISM protocol prior to any analysis. Expedite (5 business days) analysis of all analytes except Texture. Perform metals leachate tests on individual metals if total metals result for any individual metal exceeds the values shown on the attached table. Report TPH-D & TPH-MO results both with and without silica gel cleanup. Expedite reporting for all analytes except Texture.

Custody Seals Intact. ☐ Yes ☐ No	Custody Seal No.: NA		Cooler Temp. (°C) Obs'd: 4.8 Corr'd: 8.6		Therm ID No 12
Relinquished by: [signature]	Company. GHD	Date/Time: 9-28-15 1500	Received by: [signature]	Company: [signature]	Date/Time: 9/29/15 700
Relinquished by.	Company	Date/Time:	Received by.	Company:	Date/Time:
Relinquished by:	Company	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.6, dated 09/02/2015

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Phone (916) 373-5600 Fax (916) 372-1059

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Turpen, Laura	Carrier Tracking No(s):	COC No: 320-56381.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: laura.turpen@testamericainc.com		Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc				Job #: 320-15188-1
Address: 17461 Derian Ave, Suite 100,	Due Date Requested: 10/15/2015			
City: Irvine	TAT Requested (days):			
State, Zip: CA, 92614-5817				
Phone: 949-261-1022(Tel) 949-260-3297(Fax)	PO #:			
Email:	WO #:			
Project Name: Fishermans Channel	Project #: 32007221			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6020_LL/CA_WET_CIT_MET (MOD) California Administrative Manual L	6020_LL/CA_WET_DI_MET (MOD) California Administrative Manual L	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
FC-Replicate 1 (320-15188-1)	9/28/15	Pacific		Solid			X	X	4	
FC-Replicate 2 (320-15188-2)	9/28/15	Pacific		Solid			X	X	4	
FC-Replicate 3 (320-15188-3)	9/28/15	Pacific		Solid			X	X	7	

Possible Hazard Identification
Unconfirmed
Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Return To Client *Disposal By Lab* *Archive For ________ Months*
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: [signature]	Date/Time: 10-6-15 1630	Company [signature]	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by: [signature] CS	Date/Time: 10/07/15 0940	Company TAI
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: #23-3.4°/2.4°, 2.7°/1.7°, 4.6°/3.6° 4895 5404 1010 - FED.		

Send w/ samples

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Page 1 of 1 Batch(es) NA

West Sacramento
Incremental Sampling Methodology

Sample ID		Date/Time/ Initials Sample Drying Started	Date/Time/ Initials Sample Drying Ended	Date/ Initial of ISM/ Weighing	Balance ID	Sieve Size	Project Specific Data (Method and Required Sample Mass in Header) Record Final Mass of Each Requested Test. Primary on top left, backup on bottom right.									
							8151A ~~TPH~~	TOC ~~8081~~	8270SIM w/ ~~8082~~	TCLP ~~8290~~ 8151A	DI WET ~~6010~~ ~~6020~~	Wet Citrate 6020	~~7471~~	Wet Citrate PAHSIM		
Login #	Smp #						~~30~~ 100 ±1g	~~30~~ 150 ±1g	~~30~~ 110g ±1g	100 ~~±0.5g~~ g	10 ±0.2g	~~40~~ 50 ±0.2g	10 ±0.2g	30g ±1.0g		
320-15188	1	9/29/15 14:40 CBW	10/02/15 14:25 CBW	10/5/15 CBW	QA-63	C	100.07 / 99.82	150.16 / 150.19	110.02 / 110.04	100.49 / 100.09	9.92 / 9.85	50.67 / 49.81		30.40 / 30.26		
	2						100.67 / 99.75	149.89 / 149.91	109.88 / 110.18	99.77 / 100.29	9.95 / 10.13	49.75 / 50.06		29.87 / 29.78		
	3						100.04 / 100.01	149.76 / No Backup	109.91 / 110.18	100.39 / 100.30	9.98 / 10.09	47.89 / No Backup		30.59 / 30.13		
	3MS						100.53(DL) / 100.18				10.02 / 9.94			~~30.13~~		
	3MSD										10.16 / 9.93			~~29.93~~		
	2MS													30.10 / 30.00		
	2MSD													29.91 / 30.15		

Comments: Subsample(s) created using the Incremental Sampling Methodology (ISM)

Particle Size: C = Coarse = 10 mesh (2mm)
F= Fine = 30 mesh (0.6 mm)

QA-562 r3
ERS 11/04/2011

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Phone (916) 373-5600 Fax (916) 372-1059

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Turpen, Laura	Carrier Tracking No(s):	COC No: 320-56888.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: laura.turpen@testamericainc.com		Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc				Job #: 320-15188-1

Address: 17461 Derian Ave, Suite 100,	**Due Date Requested:** 10/15/2015
City: Irvine	**TAT Requested (days):**
State, Zip: CA, 92614-5817	
Phone: 949-261-1022(Tel) 949-260-3297(Fax)	PO #:
Email:	WO #:
Project Name: Fishermans Channel	Project #: 32007221
Site:	SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	**Sample Date**	**Sample Time**	**Sample Type (C=comp, G=grab)**	**Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)**	**Field Filtered Sample (Yes or No)**	**Perform MS/MSD (Yes or No)**	**8270C_SIM/DI_LEACH PAH SIM**	**8270C_SIM/ISM_AC PAHs**	**Total Number of containers**	**Special Instructions/Note:**
			Preservation Code:							
FC-Replicate 1 (320-15188-1)	9/28/15	Pacific		Solid			X	X	4	ISM done in Sacramento - use sample appropriately!
FC-Replicate 2 (320-15188-2)	9/28/15	Pacific		Solid			X	X	8	ISM done in Sacramento - use sample appropriately!
FC-Replicate 3 (320-15188-3)	9/28/15	Pacific		Solid			X	X	4	ISM done in Sacramento - use sample appropriately!

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date: 10-15-15	Time:	Method of Shipment: Fed: 489554041606

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
[signature]	10/14/15 1400		Vu Banh	10/16/15 9:50	TAI

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: (cs) 2.8/3.7 IR-77

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Page 1 of 1 Batch(es) NA

West Sacramento
Incremental Sampling Methodology

Sample ID: Login #	Sample ID: Smp #	Date/Time/ Initials Sample Drying Started	Date/Time/ Initials Sample Drying Ended	Date/ Initial of ISM/ Weighing	Balance ID	Sieve Size	TPH 30 ±1g	8081 30 ±1g	8082 30 ±1g	8290 10 ±0.5g	6010 10 ±0.2g	6020 10 ±0.2g	7471 10 ±0.2g	DI Wet 50g	PAH 15g	
320-15188	1	*	*	10/15/15 ALH	QA-063	*								50.51 49.99	14.99 15.29	
	2	*	*			*								50.24 50.17	15.46 15.06	
	2MS	*	*			*								ALH 10/15/15	15.34 14.95	
	2MSD	*	*			*									15.04 15.15	
	3	*	*			*								50.02 49.58	15.29 15.19	

Project Specific Data (Method and Required Sample Mass in Header) Record Final Mass of Each Requested Test. Primary on top left, backup on bottom right.

ALH 10/15/15

ALH 10/15/15

ALH 10/15/15

Comments: Subsample(s) created using the Incremental Sampling Methodology (ISM) * see original incremental sampling methodology sheet for raw data. ALH 10/15/15

Particle Size: C = Coarse = 10 mesh (2mm)
F= Fine = 30 mesh (0.6 mm)

QA-562 r3
ERS 11/04/2011

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Page 1 of 1 Batch(es) NA

West Sacramento
Incremental Sampling Methodology

Sample ID: Login #	Sample ID: Smp #	Date/Time/ Initials Sample Drying Started	Date/Time/ Initials Sample Drying Ended	Date/ Initial of ISM/ Weighing	Balance ID	Sieve Size	8151A ~~TPH~~ ~~30~~ 100 ±1g	TOC ~~8081~~ ~~30~~ 150 ±1g	8270SIM w/ 8082 03 ~~8082~~ ~~30~~ 110g ±1g	TCLP ~~8290~~ 8151A 100 ~~10~~ ±0.5g	DI WET ~~6010~~ ~~6020~~ 10 ±0.2g	Wet Citrate 6020 ~~10~~ 50 ±0.2g	~~7474~~ 10 ±0.2g	WET CITRATE PAHSIM 30g ±1.0g		
320-15188	1	9/29/15 14:40 CBW	10/02/15 14:25 CBW	10/5/15 CBW	QA-63	C	100.07 / 99.82	150.16 / 150.17	110.02 / 110.04	100.49 / 100.09	9.92 / 9.85	50.67 / 49.81		30.40 / 30.26		
↓	2	↓	↓	↓	↓	↓	100.67 / 99.75	149.89 / 149.91	109.88 / 110.18	99.77 / 100.29	9.95 / 10.13	49.75 / 50.06		29.87 / 29.78		
↓	3	↓	↓	↓	↓	↓	100.04 / 100.01	149.76 / No Backup	109.91 / 110.18	100.39 / 100.30	9.98 / 10.09	49.89 / No Backup		30.57 / 30.13		
↓	3MS	↓	↓	↓	↓	↓	100.53 (ok) / 100.18				10.02 / 9.94			~~30.13~~		
↓	3MSD	↓	↓	↓	↓	↓					10.16 / 9.93			~~29.93~~		
↓	2MS	↓	↓	↓	↓	↓								30.10 / 30.00		
↓	2MSD	↓	↓	↓	↓	↓								29.91 / 30.15		

ALH 10/6/15

Comments: Subsample(s) created using the Incremental Sampling Methodology (ISM) All correction made by CBW on 10/5/15 signed by ALH 10/6/15. All samples sent out to sister labs.

Particle Size: C = Coarse = 10 mesh (2mm)
F= Fine = 30 mesh (0.6 mm)

QA-562 r3
ERS 11/04/2011

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Phone (916) 373-5600 Fax (916) 372-1059

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Turpen, Laura	Carrier Tracking No(s):	COC No: 320-56380.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: laura.turpen@testamericainc.com		Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		**Analysis Requested**		Job #: 320-15188-1
Address: 5755 8th Street East, ,	**Due Date Requested:** 10/15/2015			**Preservation Codes:**
City: Tacoma	**TAT Requested (days):**			
State, Zip: WA, 98424				
Phone: 253-922-2310(Tel) 253-922-5047(Fax)	PO #:			
Email:	WO #:			
Project Name: Fishermans Channel	Project #: 32007221			
Site:	SSOW#:			Other:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8151A_MS/MULTI_INC_AC (MOD) TCLP analyte list - PCB only	8151A_MS/MULTI_INC_AC Pentachlorophenol-following ISM Prep	9060/MULTI_INC_AC Standard Soil TOC	Total Number of containers	Special Instructions/Note:
			Preservation Code:								
FC-Replicate 1 (320-15188-1)	9/28/15	Pacific		Solid			X	X	X	6	
FC-Replicate 2 (320-15188-2)	9/28/15	Pacific		Solid			X	X	X	6	IR = 4.5/4.9 w/c
FC-Replicate 3 (320-15188-3)	9/28/15	Pacific		Solid			X	X	X	7	

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:	
Relinquished by: [illegible]	Date/Time: 10-6-15 1630	Company: ATAS	Received by: [illegible]	Date/Time: 10/7/15 1020	Company: TA SEA
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:	

Login Sample Receipt Checklist

Client: GHD Services Inc. Job Number: 320-15188-1

Login Number: 15188 **List Source: TestAmerica Sacramento**
List Number: 1
Creator: Nelson, Kym D

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No Ice
Cooler Temperature is acceptable.	False	Cooler temperature outside required temperature criteria.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	False	Refer to Job Narrative for details.
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: GHD Services Inc. | Job Number: 320-15188-1

Login Number: 15188
List Number: 2
Creator: Ornelas, Olga

List Source: TestAmerica Irvine
List Creation: 10/07/15 03:01 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: GHD Services Inc. | Job Number: 320-15188-1

Login Number: 15188
List Number: 4
Creator: Ornelas, Olga

List Source: TestAmerica Irvine
List Creation: 10/16/15 12:55 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: GHD Services Inc. Job Number: 320-15188-1

Login Number: 15188
List Number: 3
Creator: Abello, Andrea N

List Source: TestAmerica Seattle
List Creation: 10/10/15 11:25 AM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	IR#1 = 4.5 / 4.9
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	Received project as a subcontract.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

PACIFIC ECORISK | ENVIRONMENTAL CONSULTING & TESTING

Ms. Lia Webb
GHD
718 Third St.
Eureka, CA 95501

October 19, 2015

Dear Ms. Webb:

Please find attached an electronic copy of the report "Biological Testing of the Sediment Samples Collected from the Fisherman's Channel ISM" in PDF format. Hard copies can be provided upon request.

If you have any questions, please give me a call at (707) 207-7761. I look forward to hearing from you.

Sincerely,

Jeffrey Cotsifas
President
Special Projects Director

NELAP ACCREDITED TNI LABORATORY

Pacific EcoRisk is accredited in accordance with NELAP (ORELAP ID 4043). Pacific EcoRisk certifies that the test results reported herein conform to the most current NELAP requirements for parameters for which accreditation is required and available. Any exceptions to NELAP requirements are noted, where applicable, in the body of the report. This report shall not be reproduced, except in full, without the written consent of Pacific EcoRisk. This testing was performed under Lab Order 24711.

2250 Cordelia Road, Fairfield, CA 94534 phone: 707.207.7760 fax: 707.207.7916 www.pacificecorisk.com

DATA REPORT

Biological Testing of the Sediment Samples Collected from the Fisherman's Channel ISM

Prepared for

GHD
718 Third St.
Eureka, CA 95501

Prepared by

Pacific EcoRisk
2250 Cordelia Road
Fairfield, CA 94534

October 2015

Table of Contents

Appendices

List of Tables

Page

1. INTRODUCTION

GHD has contracted Pacific EcoRisk (PER) to perform whole sediment bioassay tests of sediments in support of the Fisherman's Channel ISM sampling and testing program. The performance and results of this testing are presented in this report.

2. METHODS

2.1 Biological Testing Procedures

There were two different biological tests performed for the site composite sample:

1. a 10-day sediment amphipod survival test with *Ampelisca abdita*; and
2. a 10-day sediment juvenile polychaete survival test with *Neanthes arenaceodentata*.

The methods used in this testing followed established guidelines:

- ASTM Method E1367-03. Standard guide for conducting 10-day static toxicity tests with marine and estuarine amphipods (ASTM 2013);
- ASTM Method E1611-00. Standard guide for conducting sediment tests with marine and estuarine polychaetous annelids (ASTM 2013);
- Testing Manual for the Evaluation of Dredged Material Discharged in Waters of the U.S. (Inland Testing Manual, US EPA/ACOE, 1998); and
- Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods. (US EPA 1994).

2.2 Receipt and Handling of Sediment Samples

On September 21-28, 2015, a sediment sample was collected from the Fisherman's Channel ISM. This sample was delivered to the PER testing lab, on ice and under chain-of-custody (COC), on September 30, 2015. Upon receipt at the PER testing laboratory, the sediment sample was logged in and stored at 4°C in the dark until needed. The COC records for the collection and delivery of these samples are presented in Appendix A.

Additionally, sediment from Paradise Cove was collected for use as a Lab Control sediment.

2.3 Source of Natural Seawater

The natural seawater used in these tests was obtained from the UC Davis Granite Canyon Marine Laboratory, and is characterized as "pristine"; this water was stored at the PER laboratory in a 3000-gallon insulated HDPE tank at 4˚C. This seawater was 1-µm filtered and then adjusted to the desired test salinity (e.g., 30 ppt) via addition of Type 1 lab water (reverse-osmosis, deionized water) prior to use in these tests (these diluted natural seawaters are referred to using the adjusted salinity level [e.g., '30 ppt seawater']).

2.4 Sediment Porewater Characterization

Upon receipt, the sediment sample was homogenized in a large stainless steel bowl. An aliquot of the homogenized site composite sediment was centrifuged at 2,500 g for 15 minutes; the resulting supernatant porewaters was carefully collected and analyzed for routine water quality characteristics (Table 2-1).

Table 2-1. Sediment Porewater Initial Water Quality Characteristics.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
FC	7.80	33.0	29.2	0.060

2.4.1 Purging of Sediment Porewater Ammonia for the Amphipod and Polychaete Tests

The sediment porewater ammonia concentrations in the Fisherman's Channel ISM sample (Table 2-1) exceeded the ACOE guidelines-recommended threshold of 15 mg/L. Accordingly, the sediment was purged of ammonia by daily replacement of the overlying water with fresh 28 ppt seawater, coupled with aeration, until the porewater total ammonia levels were below 15 mg/L, after which the tests were initiated. The sediment porewater ammonia concentrations measured at test initiation and at test termination are presented in Appendix B.

2.5 Solid-Phase Sediment Toxicity Testing with *Ampelisca abdita*

The *A. abdita* used in these tests were obtained from a San Francisco Bay field population for the testing. The *A. abdita* were maintained in the PER lab at a salinity of 28 ppt at 20˚C prior to use in the testing.

The tests were initiated on October 6, 2015. On the day preceding test initiation, the test replicates were set-up. There were five replicates for each test treatment, each replicate consisting of a 1-L glass beaker to which approximately 2-cm depth of homogenized sediment was added; additional "porewater" test replicates were similarly set up for the determination of sediment porewater water quality characteristics at test initiation and test termination. The overlying water consisted of 28 ppt seawater; approximately 800 mL of the 28 ppt seawater was carefully poured into each test replicate so as to minimize disturbance of the sediment. Test replicates were similarly established for the Lab Control (Paradise Cove) sediment. All test replicates were maintained in a temperature-controlled room at 20˚C under continuous illumination from fluorescent lighting. Each test replicate was gently aerated.

The following day, and immediately prior to test initiation, routine water quality characteristics (temperature, pH, dissolved oxygen [D.O.], and salinity) were determined for the overlying water in each test replicate; in addition, a small sample of the overlying water was collected from each replicate and composited for each treatment for determination of the total ammonia in the overlying water at that treatment. At this time, one of the “porewater” test replicates at each test treatment was sacrificed for the determination of “initial” porewater water quality characteristics (Appendix B). The tests were then initiated with the random allocation of 20 randomly-selected *A. abdita* into each replicate container (aeration was shut off until the amphipods re-buried themselves, approximately 1 hr after their introduction). Each day, for the next nine days, the temperature, pH, D.O., and salinity of the overlying water were measured in one test replicate for each treatment.

After 10 days exposure, routine water quality characteristics (temperature, pH, D.O., and salinity) were again determined for each test replicate; in addition, a small sample of the overlying water was collected from each replicate and composited for each treatment for determination of the total ammonia in the overlying water at that treatment. At this time, the remaining “porewater” test replicate was sacrificed for the determination of “final” porewater water quality characteristics (Appendix B). Then, the contents of each replicate beaker were sieved and examined, and the surviving amphipods were collected and counted. The resulting survival data were statistically analyzed using the CETIS® statistical software (Tidepool Scientific, McKinleyville, CA). The results of these tests are summarized in Section 3.1.

2.5.1 Potassium Chloride Reference Toxicant Testing of the *Ampelisca abdita*

In order to assess the sensitivity of the organisms used in these tests to chemical stress, concurrent reference toxicant testing was performed. The reference toxicant testing was performed as a 96-hr static waterborne exposure using test solutions consisting of 28 ppt seawater spiked with potassium chloride (KCl) at test concentrations of 0.25, 0.5, 1, 2, and 4 g/L. A thin layer of clean Lab Control sediment was added to each test replicate to reduce stress to the organisms.

There were two replicates at each treatment, each replicate consisting of 400 mL of test solution in a 600-mL HDPE beaker. The test was initiated by randomly allocating 10 amphipods into each replicate beaker. The beakers were placed in a temperature-controlled room at 20˚C under continual darkness. Routine water quality characteristics (D.O., pH, and temperature) of the treatment waters were measured and recorded for one randomly selected replicate per treatment each day.

After ~96 hrs, the number of live amphipods in each replicate beaker was determined. The resulting test response data were statistically analyzed to determine key dose-response point estimates (e.g., EC_{50}); all statistical analyses were made using the CETIS® software. These response endpoints were then compared to the typical response range established by the mean ±

2 SD of the point estimates generated by the 20 most recent previous reference toxicant tests performed by this lab. The results of these tests are summarized in Section 3.1.1.

2.6 Solid-Phase Sediment Toxicity Testing with *Neanthes arenaceodentata*

The *N. arenaceodentata* used in these tests were obtained from a commercial supplier (Aquatic Toxicology Support [ATS], Bremerton, WA), and were maintained at a salinity of 30 ppt prior to shipment to the testing lab; upon receipt, the test organisms were held in 30 ppt seawater at 20˚C.

These sediment tests were initiated on October 6, 2015. There were five replicates for each sediment, each replicate consisting of a 1-L glass beaker to which approximately 200 mL (approximately 2.5 cm depth) of homogenized sediment was added; additional test replicates were set up for the determination of sediment porewater water quality characteristics at test initiation and test termination. The overlying water consisted of 30 ppt seawater; approximately 800 mL of this water was carefully poured into each test replicate so as to minimize disturbance of the sediment. Test replicates were similarly established for the Lab Control (Paradise Cove) sediment. All test replicates were maintained in a temperature-controlled room at 20˚C under continuous illumination from fluorescent lighting. Each test replicate was gently aerated.

The following day, and immediately prior to test initiation, routine water quality characteristics (temperature, pH, D.O., and salinity) were determined for the overlying water in each test replicate; in addition, a small sample of the overlying water was collected from each replicate and composited for each treatment for determination of the total ammonia in the overlying water at that treatment. At this time, one of the "porewater" test replicates was sacrificed for the determination of "initial" porewater water quality characteristics (Appendix B). The tests were then initiated with the random allocation of 10 randomly-selected polychaetes into each replicate container (aeration was shut off until the polychaetes re-buried themselves, approximately 1 hr after their introduction). Each day, for the next 10 days, the temperature, pH, D.O., and salinity of the overlying water were measured in one test replicate for each treatment.

After 10 days exposure, routine water quality characteristics (temperature, pH, D.O., and salinity) were again determined for each test replicate; in addition, a small sample of the overlying water was collected from each replicate and composited for each treatment for determination of the total ammonia in the overlying water at that treatment. At this time, the remaining "porewater" test replicate was sacrificed for the determination of "final" porewater water quality characteristics (Appendix B). Then, the contents of each replicate beaker were sieved and examined, and the surviving polychaetes were collected and counted. The resulting survival data were statistically analyzed using the CETIS® statistical software. The results of these tests are summarized in Section 3.2.

2.6.1 Potassium Chloride Reference Toxicant Testing of the *Neanthes arenaceodentata*

In order to assess the sensitivity of the organisms used in these tests to chemical stress, concurrent reference toxicant testing was performed. The reference toxicant testing consists of a static acute 96-hr survival toxicity test of waterborne KCl, at test treatment concentrations of 0.25, 0.5, 1, 2, and 4 g/L.

There were two replicates at each treatment, each replicate consisting of 400 mL of test media in a 600-mL HDPE beaker. The test was initiated by randomly allocating five polychaetes into each replicate beaker. The beakers were placed in a temperature-controlled room at 20˚C under continual darkness. Each replicate container was examined daily, and the number of live polychaetes in each was recorded at this time. Routine water quality characteristics (temperature, pH, D.O., and salinity) of the test solutions were measured and recorded for one randomly selected replicate per treatment each day.

After ~96 hrs, the number of live organisms in each replicate beaker was determined. The resulting test response data were statistically analyzed to determine key dose-response point estimates (e.g., EC_{50}); all statistical analyses were made using the CETIS® software. These response endpoints were then compared to the typical response range established by the mean ± 2 SD of the point estimates generated by the 20 most recent previous reference toxicant tests performed by this lab. The results of this test are summarized in Section 3.2.1.

3. BIOLOGICAL TESTING RESULTS

The results of the two biological tests performed for the Fisherman’s Channel ISM sediments are summarized below. A summary table of the whole-sediment test water quality characteristics and sediment porewater water quality characteristics at test initiation and test termination are presented in Appendix B. Summaries of test conditions and test acceptability criteria are provided in Appendix G.

3.1 Effects of the Fisherman’s Channel ISM Sediments on *Ampelisca abdita*

The results of this test are summarized in Table 3-1. There was 93% survival in the Lab Control sediment, indicating acceptable survival responses by the test organisms. There was 89% survival in the site sediment sample; the reduction in survival in the site sediment relative to the Lab Control survival response was <20%, indicating that this sediment is ***not*** toxic to amphipods.

The test data and summary of statistical analyses for this test are presented as Appendix C.

Table 3-1. *Ampelisca abdita* Survival in the Fisherman’s Channel ISM Sediments.

Sediment Site	% Survival in Test Replicates					Mean % Survival
	Rep A	Rep B	Rep C	Rep D	Rep E	
Lab Control	90	100	90	85	100	93
FC	85	90	90	90	90	89

3.1.1 Potassium Chloride Reference Toxicant Toxicity to *Ampelisca abdita*

The results of this test are presented in Table 3-2. The LC_{50} for this test was consistent with the reference toxicant test database for this species, indicating that these test organisms were responding to toxic stress in a typical fashion. The test data and summary of statistical analyses for this test is presented in Appendix D.

Table 3-2. Reference Toxicant Testing: Effects of KCl on *Ampelisca abdita.*

KCl Treatment (g/L)	Mean % Survival
Lab Control	100
0.25	95
0.5	100
1	95
2	**0***
4	**0***
LC_{50} =	1.38 g/L KCl
Typical Response Range (mean ± 2 SD) =	0.031 – 2.01 g/L KCl

* The response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

3.2 Effects of the Fisherman's Channel ISM Sediments on *Neanthes arenaceodentata*

The results of this test are summarized in Table 3-3. There was 100% survival in the Lab Control sediment, indicating acceptable survival responses by the test organisms. There was 100% survival in the site sediment sample, indicating that this sediment is ***not*** toxic to polychaetes.

The test data and summary of statistical analyses for this test are presented as Appendix E.

Table 3-3. *Neanthes arenaceodentata* Survival in the Fisherman's Channel ISM Sediments.

Sediment Site	% Survival in Test Replicates					Mean % Survival
	Rep A	Rep B	Rep C	Rep D	Rep E	
Lab Control	100	100	100	100	100	100
FC	100	100	100	100	100	100

3.2.1 Potassium Chloride Reference Toxicant Toxicity to *Neanthes arenaceodentata*

The results of this test are summarized in Table 3-4. The reference toxicant test LC_{50} of 2.80 g/L KCl was slightly greater than the "typical response" range upper threshold of 2.57 g/L KCl, indicating that these test organisms may have been slightly less sensitive to toxicant stress than is typical. The U.S. EPA guidelines state that at the $p<0.05$ level, it is to be expected that 1 out of 20 reference toxicant tests will fall outside of the "typical response" range due to statistical probability, so our observation of this "outlier" is not unexpected nor cause for undue concern.

The test data and summary of statistical analyses for this test is presented in Appendix F.

Table 3-4. Reference Toxicant Testing: Effects of KCl on *Neanthes arenaceodentata.*

KCl Treatment (g/L)	Mean % Survival
Lab Control	100
0.25	90
0.5	100
1	100
2	100
4	**0***
LC_{50} =	2.80 g/L KCl[A]
Typical Response Range (mean ± 2 SD) =	1.18 – 2.57 g/L KCl
Typical Response Range (mean ± 3 SD) =	0.834 – 2.92 g/L KCl

* The response at this treatment was significantly less than the Lab Control response at $p < 0.05$.

A - The reference toxicant test LC50 of 2.80 g/L KCl was slightly greater than the "typical response" range upper threshold of 2.57 g/L KCl, indicating that these test organisms may have been slightly less sensitive to toxicant stress than is typical. The U.S. EPA guidelines state that at the p<0.05 level, it is to be expected that 1 out of 20 reference toxicant tests will fall outside of the "typical response" range due to statistical probability, so our observation of this "outlier" is not unexpected nor cause for undue concern.

3.3 Biological Testing QA/QC Summary

The biological testing of the Fisherman's Channel ISM sediments incorporated standard QA/QC procedures to ensure that the test results were valid, including the use of negative Lab Controls, positive Lab Controls, test replicates, and measurements of water quality during testing.

Quality assurance procedures that were used for sediment testing are consistent with methods described in the U.S.EPA/ACOE (1998). Sediments for the bioassay testing were stored appropriately at ≤4°C and were used within the 8-week holding time period. Sediment interstitial water characteristics were within test acceptability limits at the start of the tests. The toxicity test overlying waters consisted of high-quality natural seawater.

All measurements of routine water quality characteristics were performed as described in the PER Lab Standard Operating Procedures (SOPs). All biological testing water quality conditions were within the appropriate limits. Laboratory instruments were calibrated daily according to Lab SOPs, and calibration data were logged and initialed. All values in the report tables have been checked against the test data sheets and statistical reports where appropriate.

Negative Lab Control – The biological responses for the test organisms at the negative Lab Control treatments were within acceptable limits for the sediment tests.

Positive Lab Control – The accuracy of the responses of the test organisms to toxic stress was evaluated using positive Lab Controls (reference toxicant testing). The *N. arenacoedentata* reference toxicant test exhibited an LC_{50} that was greater than the "typical response" range upper threshold, indicating that these test organisms may have been less sensitive to toxicant stress than is typical. The U.S. EPA guidelines state that at the $p< 0.05$ level, it is to be expected that 1 out of 20 reference toxicant tests will fall outside of the "typical response" range due to statistical probability, so our observation of this "outlier" is not unexpected nor cause for undue concern. However, based upon the observation of test organisms that may be more sensitive to toxicant stress than is typical, it is recommended that the results of the accompanying sediment toxicity test be interpreted judiciously.

The key test concentration-response LC point estimate determined for the remaining test species was within the respective typical response ranges for these species, indicating that these test organisms were responding to toxic stress in a typical fashion.

Concentration Response Relationships – The concentration-response relationships for the sediment elutriate tests and reference toxicant tests were evaluated as per EPA guidelines (EPA-821-B-00-004), and were determined to be acceptable.

4. REFERENCES

ASTM (2013) Method E1367-03. Standard Guide for conducting 10 day static toxicity tests with marine and estuarine amphipods. ASTM Standards on Biological Effects and Environmental Fate. American Society for Testing and Materials, Philadelphia, PA.

ASTM (2013) Method E1611-00. Standard Guide for conducting sediment tests with marine and estuarine polychaetous annelids. ASTM Standards on Biological Effects and Environmental Fate. American Society for Testing and Materials, Philadelphia, PA.

US EPA (1994) 'Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods', EPA-600/R-94/025. U.S. EPA, Env. Research Laboratory, Narragansett, RI.

USACE (2001) Public Notice 01-01. DMMO Guidelines for Implementing of the Inland Testing Manual in the San Francisco Bay Region. U.S. Army Corps of Engineers, US Army Corps of Engineers Operations and Readiness Branch, San Francisco, CA.

US EPA/ACOE (1998) Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (Inland Testing Manual). U.S. Environmental Protection Agency/U.S. Army Corps of Engineers. EPA/823/B-94/002. Office of Water. Washington, DC 20460.

Appendix A

Chain-of-Custody Records for the Collection and Delivery of the Fisherman's Channel ISM Sediments

Pacific EcoRisk
2250 Cordelia Rd., Fairfield, CA 94534
(707) 207-7760 FAX (707) 207-7916

CHAIN-OF-CUSTODY RECORD

Results To:	GHD	**Invoice To:**	GHD
Address:	718 Third Street Eureka, CA 95501	**Address:**	718 Third St Eureka, CA 95501
Phone:	707.443.8326	**Phone:**	707.443.8326
Attn:	Lia Webb	**Attn:**	Lia Webb
E-mail:	lia.webb@ghd.com	**E-mail:**	lia.webb@ghd.com
Project Name:	Fisherman's Channel ISM		
P.O.#/Ref:	8411747.07		

REQUESTED ANALYSIS

	Client Sample ID	Sample Date	Sample Time	Sample Matrix*	Grab/ Comp	Container Number	Container Type	Toxicity Test (10-day Amphipod)	Toxicity test (10-day Polychaete)	Bioaccumulation test (polychaete)	Bioaccumulation test (bivalve)							
1	FC-Replicate 1	9-21		sediment	Comp	1	5-gallon pail	X	X									
2	FC-Relicate 2	through		sediment	Comp	2	5-gallon pail	X	X									
3	FC-Replicate 3	9/28/15		sediment	Comp	3	5-gallon pail	X	X									
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Samples collected by: SH/JD/LW

Comments/Special Instruction:

Archive samples for 6 months . Bioaccumulation tests may be performed after results of toxicity testing are received and reviewed.

RELINQUISHED BY:		**RECEIVED BY:**	
Signature:	[signature]	**Signature:**	[signature]
Print:	Ted Douglas	**Print:**	Rosie Burke
Organization:	GHD	**Organization:**	AAA Courier
Date:	9-29-15 **Time:** 1510	**Date:**	9-29-15 **Time:** 3:10
RELINQUISHED BY:		**RECEIVED BY:**	
Signature:	[signature]	**Signature:**	[signature]
Print:	Rose	**Print:**	Y. Khadizyeva
Organization:	AAA Courier	**Organization:**	Pacific EcoRisk
Date:	9-30-15 **Time:** 8:30	**Date:**	9-30-15 **Time:** 08:33

*Example Matrix Codes: (EFF - Effluent) (FW = Freshwater); (SW = Saltwater); (WW = Wastewater); (STRMW = Stormwater); (SED = Sediment); or other

Appendix B

Whole Sediment Test Porewater and Overlying Water Water Quality Characteristics

Table B-1. Sediment Porewater Test Initiation Water Quality Characteristics for *Ampelisca abdita* Benthic Toxicity Tests.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
Lab Control	6.82	30.5	<1.00	0.034
FC	7.72	29.1	5.10	0.174

Table B-2. Sediment Porewater Test Termination Water Quality Characteristics for *Ampelisca abdita* Benthic Toxicity Tests.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
Lab Control	7.00	49.2	<1.00	0.032
FC	7.39	48.7	3.63	0.238

Table B-3. Sediment Overlying Water Total Ammonia Levels for *Ampelisca abdita* Benthic Toxicity Tests.

Sample ID	Total Ammonia (mg/L N)	
	Test Initiation	Test Termination
Lab Control	<1.00	<1.00
FC	<1.00	<1.00

Table B-4. Sediment Porewater Test Initiation Water Quality Characteristics for *Neanthes arenaceodentata* Benthic Toxicity Test.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
Lab Control	6.82	30.5	<1.00	0.034
FC	7.72	29.1	5.10	0.174

Table B-5. Sediment Porewater Test Termination Water Quality Characteristics for *Neanthes arenaceodentata* Benthic Toxicity Test.

Sample ID	pH	Salinity (ppt)	Total Ammonia (mg/L N)	Total Sulfide (mg/L)
Lab Control	7.00	49.2	<1.00	0.032
FC	7.39	48.7	3.63	0.238

Table B-6. Sediment Overlying Water Total Ammonia Levels for *Neanthes arenaceodentata* Tests.

Sample ID	Total Ammonia (mg/L N)	
	Test Initiation	Test Termination
Lab Control	<1.00	<1.00
FC	<1.00	<1.00

Appendix C

Test Data and Summary of Statistics for the Toxicity Evaluation of the Fisherman's Channel ISM Sediments with the Amphipod, *Ampelisca abdita*

Acute Amphipod Survival Test	Pacific EcoRisk

Batch ID:	00-2996-4818	Test Type:	Survival	Analyst:	Mike McElroy
Start Date:	06 Oct-15 15:00	Protocol:	ASTM E1367-99 (Amphipod)	Diluent:	Not Applicable
Ending Date:	16 Oct-15 09:30	Species:	Ampelisca abdita	Brine:	Not Applicable
Duration:	9d 19h	Source:	Pacific EcoRisk	Age:	NA

Sample ID:	11-4083-8659	Code:	DMMO	Client:	GHD
Sample Date:	21 Sep-15	Material:	Sediment	Project:	24711
Receive Date:	30 Sep-15 08:33	Source:	GHD		
Sample Age:	15d 15h (0 °C)	Station:	FC		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
18-3709-2719	Survival Rate	100	>100	NA	6.3%	1	Equal Variance t Two-Sample Test

Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Control Sed	5	0.93	0.847	1	0.85	1	0.03	0.0671	7.21%	0.0%
100		5	0.89	0.862	0.918	0.85	0.9	0.01	0.0224	2.51%	4.3%

Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Control Sed	0.9	1	0.9	0.85	1
100		0.85	0.9	0.9	0.9	0.9

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Control Sed	18/20	20/20	18/20	17/20	20/20
100		17/20	18/20	18/20	18/20	18/20

Analyst: MM QA: LE

CETIS Analytical Report

Report Date: 16 Oct-15 16:20 (p 1 of 1)
Test Code: 64625 | 00-1442-2629

Acute Amphipod Survival Test — **Pacific EcoRisk**

Analysis ID:	18-3709-2719	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Oct-15 16:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Angular (Corrected)	NA	C > T	NA	NA	6.3%	Passes survival rate

Equal Variance t Two-Sample Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control Sed		100	1.37	1.86	0.114	8	0.1036	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0175918	0.0175918	1	1.88	0.2073	Non-Significant Effect
Error	0.07474654	0.009343318	8			
Total	0.09233835		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	15.2	23.2	0.0219	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.906	0.741	0.2526	Normal Distribution

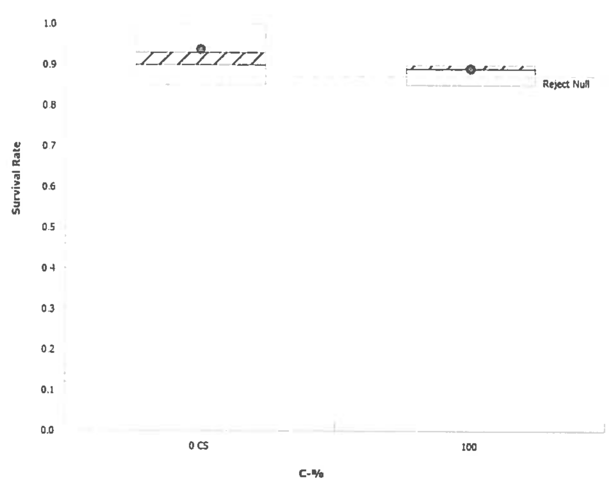
Survival Rate Summary

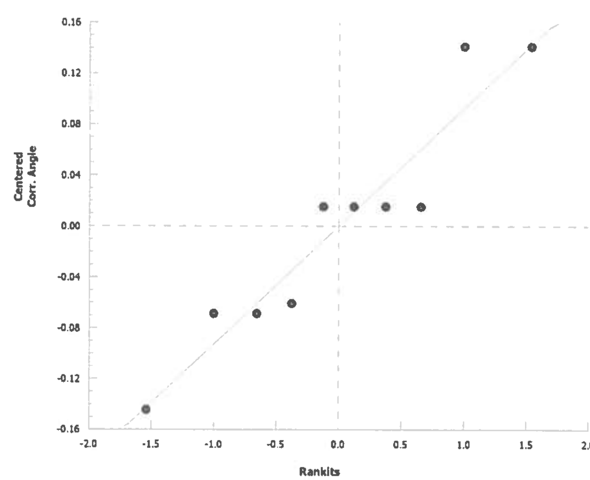
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Control Sed	5	0.93	0.847	1	0.9	0.85	1	0.03	7.21%	0.0%
100		5	0.89	0.862	0.918	0.9	0.85	0.9	0.01	2.51%	4.3%

Angular (Corrected) Transformed Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Control Sed	5	1.32	1.15	1.48	1.25	1.17	1.46	0.0592	10.0%	0.0%
100		5	1.23	1.19	1.28	1.25	1.17	1.25	0.0152	2.75%	6.37%

Graphics





10-Day Estuarine/Marine Sediment Toxicity Test Data

Client: GHD - Fisherman's Channel ISM Test ID#: 64625 Date (Day 0): 10/6/15

Species: *Ampelisca abdita* Project #: 24711 Organism Supplier: PER

Organism Log # : 9203

Sample ID: **Lab Control**

Day of Test	Test Replicate	Temp (°C)	pH	D.O. (mg/L)	Salinity (ppt)	# Alive	Sign-Off
Day 0	Rep A	20.1	7.41	7.7	29.2	20	Date: 10/6/15
	Rep B	20.1	7.45	7.8	29.2	20	Time: 0900 / 1500
	Rep C	20.1	7.47	7.8	29.2	20	WQ: DM
	Rep D	20.1	7.50	7.8	29.2	20	Scientist Initiation: CD
	Rep E	20.1	7.51	7.8	29.2	20	Scientist Confirmation: SM
Day 1	Rep A	20.1	7.54	7.6	29.6		Date: 10/7/15 Time: 1245 WQ: [illegible]
Day 2	Rep B	20.3	7.72	7.5	27.5		Date: 10/8/15 Time: 0840 WQ: SCD
Day 3	Rep C	19.9	~~7.81~~ 7.73	7.7	~~29.1~~ 28.6		Date: 10/9/15 Time: 0845 WQ: JO
Day 4	Rep D	20.1	7.74	7.6	28.9		Date: 10/10/15 Time: 0850 WQ: [illegible]
Day 5	Rep E	20.0	7.71	7.6	29.5		Date: 10/11/15 Time: 0950 WQ: C.J.
Day 6	Rep A	20.2	7.74	7.8	27.2		Date: 10/12/15 Time: 1010 WQ: [illegible]
Day 7	Rep B	19.9	7.53	7.4	27.2		Date: 10/13/15 Time: 0900 WQ: C.J.
Day 8	Rep C	20.3	7.49	7.7	28.3		Date: 10/14/15 Time: 1030 WQ: [illegible]
Day 9	Rep D	19.9	7.76	7.7	29.2		Date: 10/15/15 Time: 1020 WQ: C.J.
Day 10	Rep A	20.3	7.59	7.4	28.0	18	Date: 10/16/15
	Rep B	20.3	7.55	7.3	27.8	20	Time: 0930
	Rep C	20.3	7.61	7.4	28.7	18	WQ: WC
	Rep D	20.3	7.62	7.5	29.6	17	Scientist Counts: MM
	Rep E	20.3	7.62	7.5	29.5	20	

Day of Test	Matrix	pH	D.O. (mg/L)	Salinity (ppt)	Total Sulfide (mg/L)	Total Ammonia (mg/L)	Sign-Off
Day 0	Porewater	6.82	4.4	30.5	~~0.34~~ 0.034 DM	<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Overlying Water					<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Meter ID	PH19	RD09	EC10	DR14000	DR3800	
Day 10	Porewater	7.00	5.5	49.7	0.032	<1.00	Date: 10/16/15 Time: 0940 WQ: WC
	Overlying Water					<1.00	Date: 10/16/15 Time: 0940 WQ: WC
	Meter ID	PH21	RD11	EC08	DR/4000	DR3800	

10-Day Estuarine/Marine Sediment Toxicity Test Data

Client: GHD - Fisherman's Channel ISM Test ID#: 64625 Date (Day 0): 10/6/15

Species: *Ampelisca abdita* Project #: 24711 Organism Supplier: PER

Organism Log # : 9203

Sample ID: **FC**

Day of Test	Test Replicate	Temp (°C)	pH	D.O. (mg/L)	Salinity (ppt)	# Alive	Sign-Off
Day 0	Rep A	20.1	7.50	7.7	29.5	20	Date: 10/6/15
	Rep B	20.1	7.55	7.8	29.5	20	Time: 0900
	Rep C	20.1	7.56	7.8	29.5	20	WQ: DM
	Rep D	20.1	7.57	7.7	29.5	20	Scientist Initiation: CD
	Rep E	20.1	7.57	7.7	29.4	20	Scientist Confirmation: SM
Day 1	Rep A	20.1	7.60	7.5	29.8		Date: 10/7/15 Time: 1245 WQ: [illegible]
Day 2	Rep B	20.3	7.80	7.5	29.1		Date: 10/8/15 Time: 0840 WQ: SCD
Day 3	Rep C	19.9	7.81	7.7	29.1		Date: 10/9/15 Time: 0845 WQ: JO
Day 4	Rep D	20.1	7.81	7.6	29.2		Date: 10/10/15 Time: 0850 WQ: [illegible]
Day 5	Rep E	20.0	7.91	7.6	29.2		Date: 10/11/15 Time: 0950 WQ: C.J.
Day 6	Rep A	20.2	7.89	7.8	28.5		Date: 10/12/15 Time: 1010 WQ: [illegible]
Day 7	Rep B	19.9	7.91	7.5	29.1		Date: 10/13/15 Time: 0900 WQ: C.J.
Day 8	Rep C	20.3	7.88	7.6	28.0		Date: 10/14/15 Time: 1030 WQ: [illegible]
Day 9	Rep D	19.9	8.05	7.7	28.4		Date: 10/15/15 Time: 1020 WQ: C.J.
Day 10	Rep A	20.3	7.98	7.4	29.0	17	Date: 10/16/15
	Rep B	20.3	7.94	7.3	29.6	18	Time: 0930
	Rep C	20.3	7.93	7.4	29.1	18	WQ: WC
	Rep D	20.3	7.95	7.5	28.9	18	Scientist Counts: [illegible]
	Rep E	20.3	7.97	7.5	28.5	18	

Day of Test	Matrix	pH	D.O. (mg/L)	Salinity (ppt)	Total Sulfide (mg/L)	Total Ammonia (mg/L)	Sign-Off
Day 0	Porewater	7.72	6.3	29.1	~~0.087~~ ~~0.87~~ 0.174 DM 10/6/15	5.10	Date: 10/6/15 Time: 0900 WQ: DM
	Overlying Water					<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Meter ID	PH19	RD09	EC10	DR/4000	DR3800	
Day 10	Porewater	7.39	6.4	48.7	0.238	3.63	Date: 10/16/15 Time: 0940 WQ: WC
	Overlying Water					<1.00	Date: 10/16/15 Time: 0940 WQ: WC
	Meter ID	PH21	RD11	EC08	DR/4000	DR3800	

Appendix D

Test Data and Summary of Statistics for the Potassium Chloride Reference Toxicant Evaluation of the Amphipod, *Ampelisca abdita*

CETIS Summary Report

Report Date: 12 Oct-15 10:00 (p 1 of 1)
Test Code: 64627 | 12-2198-2000

Acute Amphipod Survival Test — Pacific EcoRisk

Batch ID:	20-1484-6301	**Test Type:**	Survival	**Analyst:**	Padrick Anderson
Start Date:	06 Oct-15 15:00	**Protocol:**	ASTM E1367-99 (Amphipod)	**Diluent:**	Diluted Seawater
Ending Date:	10 Oct-15 15:30	**Species:**	Ampelisca abdita	**Brine:**	Not Applicable
Duration:	4d 1h	**Source:**	Pacific EcoRisk	**Age:**	n/a

Sample ID:	11-4808-3546	**Code:**	KCl	**Client:**	Pacific Ecorisk
Sample Date:	06 Oct-15 15:00	**Material:**	Potassium chloride	**Project:**	24717
Receive Date:	06 Oct-15 15:00	**Source:**	Reference Toxicant		
Sample Age:	NA (20.1 °C)	**Station:**	In House		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
00-5003-8231	Survival Rate	1	2	1.414	NA		Fisher Exact Test

Point Estimate Summary

Analysis ID	Endpoint	Level	g/L	95% LCL	95% UCL	TU	Method
04-3913-7033	Survival Rate	EC50	1.38	1.28	1.48		Trimmed Spearman-Kärber

Survival Rate Summary

C-g/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water Contr	2	1	1	1	1	1	0	0	0.0%	0.0%
0.25		2	0.95	0.315	1	0.9	1	0.05	0.0707	7.44%	5.0%
0.5		2	1	1	1	1	1	0	0	0.0%	0.0%
1		2	0.95	0.315	1	0.9	1	0.05	0.0707	7.44%	5.0%
2		2	0	0	0	0	0	0	0		100.0%
4		2	0	0	0	0	0	0	0		100.0%

Survival Rate Detail

C-g/L	Control Type	Rep 1	Rep 2
0	Lab Water Contr	1	1
0.25		0.9	1
0.5		1	1
1		0.9	1
2		0	0
4		0	0

Survival Rate Binomials

C-g/L	Control Type	Rep 1	Rep 2
0	Lab Water Contr	10/10	10/10
0.25		9/10	10/10
0.5		10/10	10/10
1		9/10	10/10
2		0/10	0/10
4		0/10	0/10

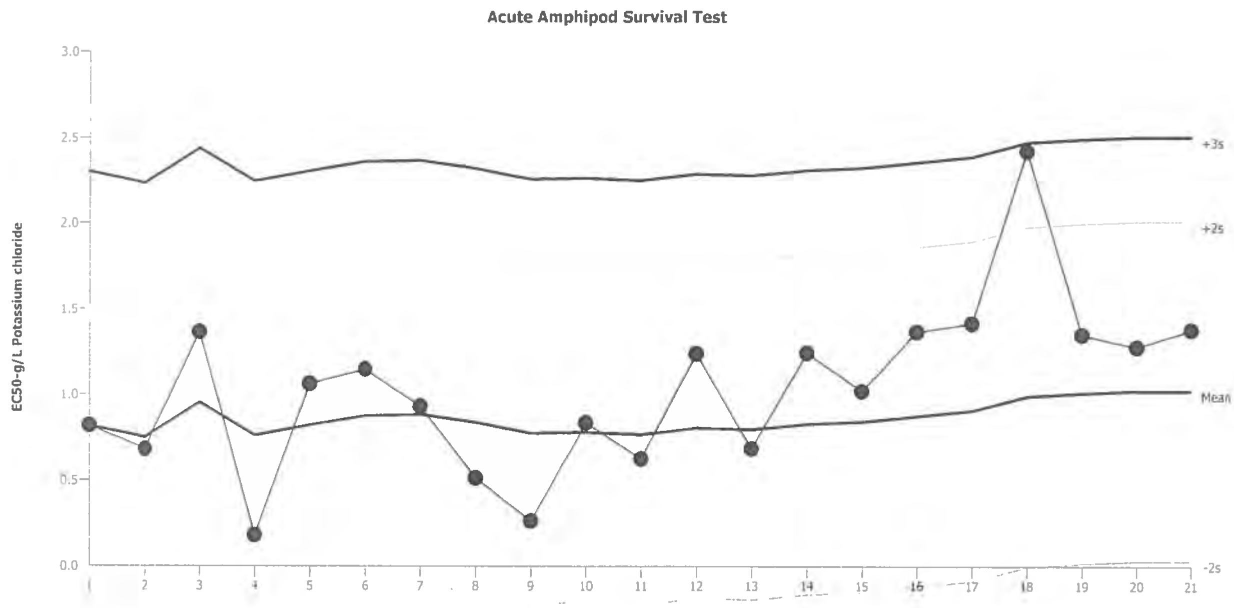
Analyst: QA:

CETIS QC Plot

Report Date: 12 Oct-15 10:00 (1 of 1)

Acute Amphipod Survival Test | **Pacific EcoRisk**

Test Type:	Survival	**Organism:**	Ampelisca abdita (Amphipod)	**Material:**	Potassium chloride
Protocol:	ASTM E1367-99 (Amphipod)	**Endpoint:**	Survival Rate	**Source:**	Reference Toxicant-REF



Mean:	1.021	**Count:**	20	**-2s Warning Limit:**	0.03059	**-3s Action Limit:**	-0.4645
Sigma:	0.4951	**CV:**	48.50%	**+2s Warning Limit:**	2.011	**+3s Action Limit:**	2.506

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2014	Aug	30	11:45	0.8161	-0.2049	-0.4138			02-1733-7650	18-5660-3193
2		Oct	5	15 00	0.679	-0.342	-0.6907			13-6824-0637	02-8998-3107
3			28	15:30	1.364	0.3426	0.6919			14-3907-8069	14-4171-8757
4			28	15:31	0.18	-0.841	-1.699			01-7699-5249	13-3679-0477
5		Nov	20	16:00	1.061	0.04003	0.08086			17-2913-1157	17-9437-9895
6		Dec	8	16:45	1.146	0.1249	0.2522			12-3040-5992	02-4451-3725
7	2015	Jan	12	16:40	0.9291	-0.09188	-0.1856			19-4115-1941	00-3554-7297
8			19	17:00	0.5133	-0.5077	-1.025			13-3215-1366	09-7782-9808
9			19	17:05	0.2625	-0.7585	-1.532			13-9891-9803	03-8167-5029
10		Feb	3	16:30	0.833	-0.188	-0.3798			16-0082-5744	05-7962-9382
11		Apr	22	17:00	0.6239	-0.3971	-0.802			03-5270-9745	09-6386-6426
12		May	7	17:00	1.237	0.2164	0.437			05-7590-6752	13-8626-0097
13			30	15:30	0.6819	-0.3391	-0.685			13-5901-3130	05-1868-3295
14		Jun	6	16:15	1.243	0.2218	0.4479			14-4452-6842	19-1454-6002
15			29	16:50	1.018	-0.00259	-0.00524			09-1158-7562	01-9022-8937
16		Jul	12	15:40	1.366	0.345	0.6969			00-9134-8429	19-8518-4583
17			18	15:40	1.414	0.3932	0.7942			17-0659-8128	01-6954-5382
18		Aug	1	16:10	2.423	1.402	2.832	(+)		06-7659-9751	02-7823-8852
19			24	11:00	1.348	0.3272	0.6609			11-2004-3957	14-7879-4749
20			30	17:00	1.277	0.2556	0.5162			18-6941-0255	15-1138-0751
21		Oct	6	15:00	1.376	0.3554	0.7178			12-2198-2000	04-3913-7033

Analyst: QA:

Pacific EcoRisk Environmental Consulting and Testing

96 Hour *Ampelisca abdita* Marine Reference Toxicant Test Data

Client: **Reference Toxicant** Organism Log #: 9203

Test Material: Potassium Chloride Control/Diluent: 28 ppt Seawater (+/-1 ppt)

Test ID#: 64627 Project #: 24717 Test Date: 10/6/15

T0 Feeding: CD T48 Feeding: CD Randomization: 2.61

Treatment (g KCl /L)	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Salinity (ppt) new	Salinity (ppt) old	# Live Organisms A	# Live Organisms B	SIGN-OFF
Control	20.1	7.53		8.1		27.6		10	10	Date: 10/6/15
0.25	20.1	7.62		8.3		28.2		10	10	Test Solution Prep: CD
0.5	20.1	7.68		8.3		28.5		10	10	New WQ: WC
1	20.1	7.74		8.4		29.5		10	10	Initiation Time: 1500
2	20.1	7.76		8.4		31.0		10	10	Initiation Signoff: CD
4	20.1	7.80		8.7		33.9		10	10	RT Stock Batch #: 50
Meter ID:	84A	PH15		RD11		EC11				+1hr Inspection: CD
Control	20.2		7.47		6.7		27.7			Date: 10/7/15
0.25	20.2		7.48		6.5		28.4			Count Time: 1050
0.5	20.2		7.49		6.4		28.8			Count Signoff: Fe
1	20.2		7.49		6.4		29.7			Old WQ: RS
2	20.2		7.51		6.5		31.2			PM Inspection: JBL
4	20.2		7.51		6.6		34.2			
Meter ID:	84A		PH15		RD12		EC08			
Control	20.7		7.41		6.0		27.7			Date: 10/8/15
0.25	20.7		7.42		6.1		28.4			Count Time: 1118
0.5	20.7		7.44		6.0		28.7			Count Signoff: CD
1	20.7		7.46		6.1		29.6			Old WQ: C.L.
2	20.7		7.46		5.9		31.2			PM Inspection: CSD
4	20.7		7.47		6.1		34.08			
Meter ID:	84A		PH15		RD12		EC11			
Control	20.1		7.68		7.0		~~27.~~ 28.0			Date: 10/9/15
0.25	20.1		7.73		7.1		28.6			Count Time: 1020
0.5	20.1		7.73		7.1		28.7			Count Signoff: Fe
1	20.1		7.72		7.0		29.8			Old WQ: EL
2	20.1		7.75		7.1		31.4			PM Inspection: PG
4	20.1		7.75		7.2		34.4			
Meter ID:	84A		PH21		RD12		EC10			
Control	20.0		7.63		7.5		28.2	10	10	Date: 10/10/15
0.25	20.0		7.71		7.5		28.9	9	10	Termination Time: 1530
0.5	20.0		7.71		7.5		29.1	10	10	Termination Signoff: CD
1	20.0		7.72		7.5		30.0	9	10	Old WQ: CL
2	20.0		7.71		7.5		31.6	0	0	
4	20.0		7.74		7.6		34.5	0	0	
Meter ID:	84D		PH22		RD11		EC09			

Appendix E

Test Data and Summary of Statistics for the Toxicity Evaluation of the Fisherman's Channel ISM Sediments with the Polychaete, *Neanthes arenaceodentata*

CETIS Summary Report

Report Date: 16 Oct-15 16:25 (p 1 of 1)
Test Code: 64626 | 19-5033-5029

Acute Polychaete Survival Test — **Pacific EcoRisk**

Batch ID:	19-5817-1526	**Test Type:**	Survival	**Analyst:**	Mike McElroy
Start Date:	06 Oct-15 15:50	**Protocol:**	ASTM E1611-00 (2007)	**Diluent:**	Not Applicable
Ending Date:	16 Oct-15 13:50	**Species:**	Neanthes arenaceodentata	**Brine:**	Not Applicable
Duration:	9d 22h	**Source:**	Aquatic Tox. Sup.	**Age:**	NA

Sample ID:	13-2433-3219	**Code:**	DMMO	**Client:**	GHD
Sample Date:	21 Sep-15	**Material:**	Sediment	**Project:**	24711
Receive Date:	30 Sep-15 08:33	**Source:**	GHD		
Sample Age:	15d 16h (0 °C)	**Station:**	FC		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
06-3397-4769	Survival Rate	100	>100	NA	NA	1	Wilcoxon Rank Sum Two-Sample Test

Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Control Sed	5	1	1	1	1	1	0	0	0.0%	0.0%
100		5	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Control Sed	1	1	1	1	1
100		1	1	1	1	1

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0	Control Sed	10/10	10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10	10/10

Acute Polychaete Survival Test			Pacific EcoRisk
Analysis ID: 06-3397-4769	**Endpoint:** Survival Rate	**CETIS Version:** CETISv1.8.7	
Analyzed: 16 Oct-15 16:25	**Analysis:** Nonparametric-Two Sample	**Official Results:** Yes	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Angular (Corrected)	NA	C > T	NA	NA	Passes survival rate

Wilcoxon Rank Sum Two-Sample Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control Sed		100	27.5	NA	1	8	1.0000	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	65500	<0.0001	Significant Effect
Error	0	0	8			
Total	0		9			

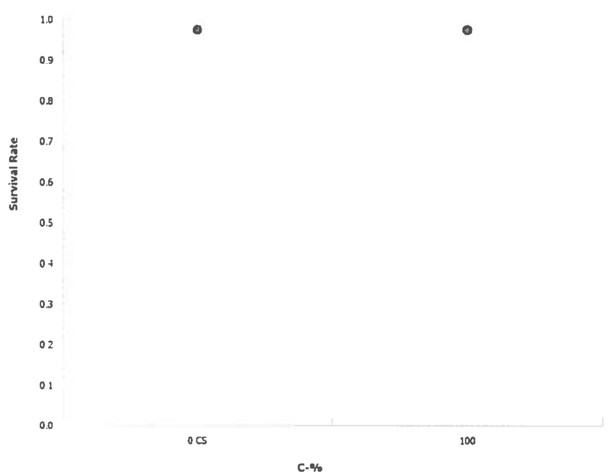
Survival Rate Summary

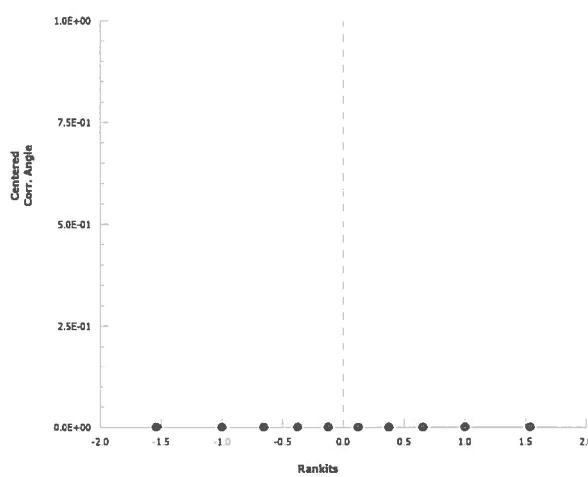
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Control Sed	5	1	1	1	1	1	1	0	0.0%	0.0%
100		5	1	1	1	1	1	1	0	0.0%	0.0%

Angular (Corrected) Transformed Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Control Sed	5	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%
100		5	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%

Graphics





Analyst: [illegible] QA: [illegible]

10-Day Estuarine/Marine Sediment Toxicity Test Data

Client: GHD - Fisherman's Channel ISM Test ID#: 64626 Date (Day 0): 10/6/15

Species: *Neanthes arenoceodentata* Project #: 24711 T+1hr Inspection: KP

Organism Log #: 9206 Organism Supplier: ATS

Day of Test	Test Replicate	Sample ID: **Lab Control** Temp °C	pH	D.O. mg/L	Salinity ppt	# Alive	Sign-Off
Day 0	Rep A	20.1	7.51	7.7	29.4	10	Date: 10/6/15
	Rep B	20.1	7.53	7.7	29.4	10	WQ Initial & Time: DM 0900
	Rep C	20.1	7.55	7.7	29.5	10	Initiation Time: 1550
	Rep D	20.1	7.56	7.7	29.4	10	Scientist Initiation: CD
	Rep E	20.1	7.57	7.7	29.5	10	Scientist Confirmation: KP
Day 1	Rep A	20.1	7.54	7.6	29.8		Date: 10/7/15 Time: 1245 WQ: YK
Day 2	Rep B	20.3	7.74	7.7	30.0		Date: 10/8/15 Time: 0845 WQ: SCD
Day 3	Rep C	19.9	7.76	7.6	30.5		Date: 10/9/15 Time: 0845 WQ: JO
Day 4	Rep D	20.1	7.76	7.6	30.6		Date: 10/10/15 Time: 0855 WQ: CL
Day 5	Rep E	20.0	7.75	7.6	30.9		Date: 10/11/15 Time: 0937 WQ: E.Z.
Day 6	Rep A	20.2	7.68	7.8	30.8		Date: 10/12/15 Time: 1015 WQ: YK
Day 7	Rep B	19.8	7.69	7.5	31.1		Date: 10/13/15 Time: 0845 WQ: E.Z.
Day 8	Rep C	20.3	7.29	7.4	31.3		Date: 10-14-15 Time: 1030 WQ: YK
Day 9	Rep D	19.9	7.70	7.5	31.0		Date: 10/15/15 Time: 1007 WQ: E.Z.
Day 10	Rep A	20.3	7.56	7.4	31.8	10	Date: 10/16/15
	Rep B	20.3	7.62	7.5	31.7	10	Time: 0910
	Rep C	20.3	7.65	7.5	30.5	10	WQ: WC
	Rep D	20.3	7.62	7.4	31.5	10	Termination Time: 1350
	Rep E	20.3	7.64	7.5	31.7	10	Scientist Counts: KWA

Day of Test	Matrix	pH	D.O. mg/L	Salinity ppt	Total Sulfide mg/L	Total Ammonia mg/L	Sign-Off
Day 0	Porewater	6.82	4.4	30.5	0.034	<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Overlying Water					<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Meter ID	PH19	RD09	EC10	DR/4000	DR3800	
Day 10	Porewater	7.00	~~6.98~~ 5.5 WC 10/16/15	~~5.5~~ 49.2 WC 10/16/15	0.032	<1.00	Date: 10/16/15 Time: 0910 WQ: WC
	Overlying Water					<1.00	Date: 10/16/15 Time: 0910 WQ: WC
	Meter ID	~~PH21~~ PH21 WC 10/16/15	~~PH21~~ RD11 WC 10/16/15	~~RD11~~ EC08 WC 10/16/15	~~EC08~~ DR/4000 WC 10/16/15	DR3800	

10-Day Estuarine/Marine Sediment Toxicity Test Data

Client: GHD - Fisherman's Channel ISM Test ID#: 64626 Date (Day 0): 10/6/15

Species: *Neanthes arenoceodentata* Project #: 24711 T+1hr Inspection: KP

Organism Log #: 9206 Organism Supplier: ATS

Sample ID: **FC**

Day of Test	Test Replicate	Temp °C	pH	D.O. mg/L	Salinity ppt	# Alive	Sign-Off
Day 0	Rep A	20.1	7.55	7.6	29.6	10	Date: 10/6/15
	Rep B	20.1	7.56	7.6	29.6	10	WQ Initial & Time: DM 0900
	Rep C	20.1	7.57	7.7	29.6	10	Initiation Time: 1550
	Rep D	20.1	7.58	7.7	29.7	10	Scientist Initiation: CD
	Rep E	20.1	7.59	7.7	29.6	10	Scientist Confirmation: KP
Day 1	Rep A	20.1	7.57	7.5	29.9		Date: 10/7/15 Time: 1245 WQ: YU
Day 2	Rep B	20.3	7.75	7.7	29.8		Date: 10/8/15 Time: 0845 WQ: SCD
Day 3	Rep C	19.9	7.76	7.6	30.5		Date: 10/9/15 Time: 0845 WQ: JO
Day 4	Rep D	20.1	7.84	7.6	30.6		Date: 10/10/15 Time: 0855 WQ: CC
Day 5	Rep E	20.0	7.90	7.4	30.3		Date: 10/11/15 Time: 0937 WQ: e.s.
Day 6	Rep A	20.2	7.85	7.8	30.2		Date: 10/12/15 Time: 1015 WQ: YU
Day 7	Rep B	19.8	7.78	7.5	30.4		Date: 10/13/15 Time: 0845 WQ: e.s.
Day 8	Rep C	20.3	7.68	7.6	31.3		Date: 10/14/15 Time: 1030 WQ: YU
Day 9	Rep D	19.9	8.07	7.4	31.1		Date: 10/15/15 Time: 1007 WQ: e.s.
Day 10	Rep A	20.3	7.86	7.5	31.6	10	Date: 10/16/15
	Rep B	20.3	7.87	7.4	31.1	10	Time: 0910
	Rep C	20.3	7.94	6.7	31.9	10	WQ: WC
	Rep D	20.3	7.98	7.3	31.4	10	Termination Time: 1350
	Rep E	20.3	7.99	7.4	30.8	10	Scientist Counts: MM

Day of Test	Matrix	pH	D.O. mg/L	Salinity ppt	Total Sulfide mg/L	Total Ammonia mg/L	Sign-Off
Day 0	Porewater	7.72	6.3	29.1	0.174 ~~0.087~~ DM 10/6/15	5.10	Date: 10/6/15 Time: 0900 WQ: DM
	Overlying Water					<1.00	Date: 10/6/15 Time: 0900 WQ: DM
	Meter ID	PH19	RD09	EC10	DR/4000	DR3800	
Day 10	Porewater	7.39	6.4	48.7	0.238	3.63	Date: 10/16/15 Time: 0910 WQ: WC
	Overlying Water					<1.00	Date: 10/16/15 Time: 0910 WQ: WC
	Meter ID	PH21	RD11	EC08	DR/4000	DR3800	

Appendix F

Test Data and Summary of Statistics for the Potassium Chloride Reference Toxicant Evaluation of the Polychaete, *Neanthes arenaceodentata*

Acute Polychaete Survival Test			Pacific EcoRisk

Batch ID:	09-8796-1228	**Test Type:**	Survival	**Analyst:**	Padrick Anderson
Start Date:	06 Oct-15 15:50	**Protocol:**	ASTM E1611-00 (2007)	**Diluent:**	Diluted Seawater
Ending Date:	10 Oct-15 15:20	**Species:**	Neanthes arenaceodentata	**Brine:**	Not Applicable
Duration:	96h	**Source:**	Aquatic Tox. Sup.	**Age:**	n/a

Sample ID:	20-7627-1814	**Code:**	KCl	**Client:**	Reference Toxicant
Sample Date:	06 Oct-15 15:50	**Material:**	Potassium chloride	**Project:**	24718
Receive Date:	06 Oct-15 15:50	**Source:**	Reference Toxicant		
Sample Age:	NA (20.1 °C)	**Station:**	In House		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
13-1417-5091	Survival Rate	2	4	2.828	NA		Fisher Exact Test

Point Estimate Summary

Analysis ID	Endpoint	Level	g/L	95% LCL	95% UCL	TU	Method
04-5468-8944	Survival Rate	EC50	2.8	2.7	2.91		Trimmed Spearman-Kärber

Survival Rate Summary

C-g/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water Contr	2	1	1	1	1	1	0	0	0.0%	0.0%
0.25		2	0.9	0	1	0.8	1	0.1	0.141	15.7%	10.0%
0.5		2	1	1	1	1	1	0	0	0.0%	0.0%
1		2	1	1	1	1	1	0	0	0.0%	0.0%
2		2	1	1	1	1	1	0	0	0.0%	0.0%
4		2	0	0	0	0	0	0	0		100.0%

Survival Rate Detail

C-g/L	Control Type	Rep 1	Rep 2
0	Lab Water Contr	1	1
0.25		0.8	1
0.5		1	1
1		1	1
2		1	1
4		0	0

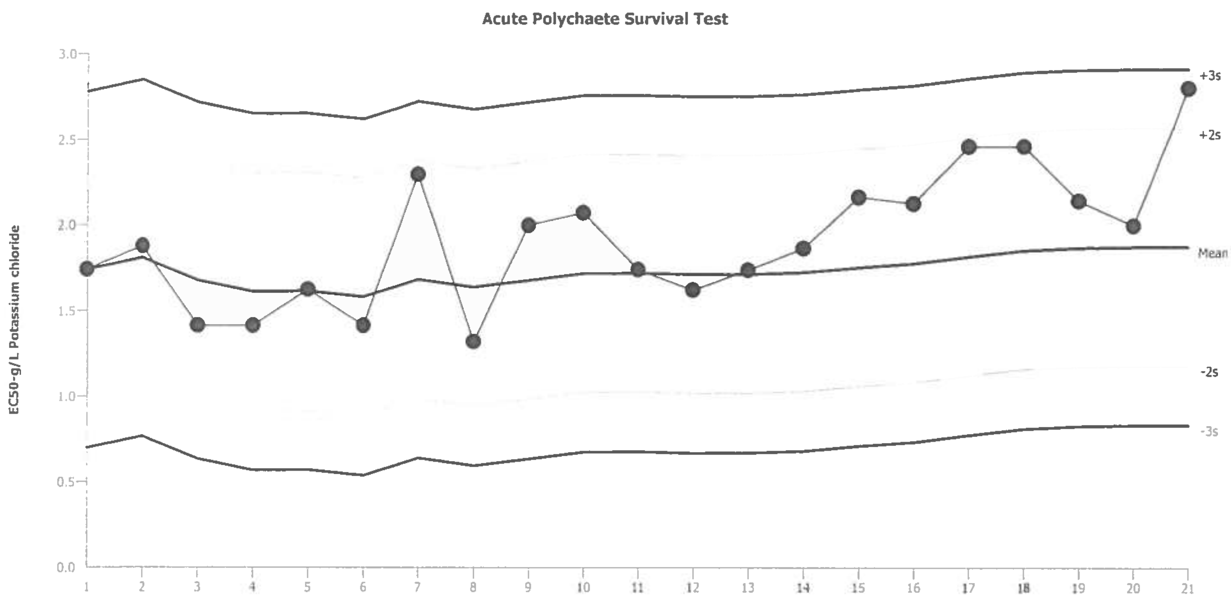
Survival Rate Binomials

C-g/L	Control Type	Rep 1	Rep 2
0	Lab Water Contr	5/5	5/5
0.25		4/5	5/5
0.5		5/5	5/5
1		5/5	5/5
2		5/5	5/5
4		0/5	0/5

CETIS QC Plot

Report Date: 12 Oct-15 09:57 (1 of 1)

Acute Polychaete Survival Test			Pacific EcoRisk
Test Type: Survival	**Organism:** Neanthes arenaceodentata (Polycha	**Material:** Potassium chloride	
Protocol: ASTM E1611-00 (2007)	**Endpoint:** Survival Rate	**Source:** Reference Toxicant-REF	



Mean:	1.875	**Count:**	20	**-2s Warning Limit:**	1.181	**-3s Action Limit:**	0.834
Sigma:	0.3471	**CV:**	18.50%	**+2s Warning Limit:**	2.57	**+3s Action Limit:**	2.917

Quality Control Data

Point	Year	Month	Day	Time	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2014	Aug	10	13:45	1.741	-0.1339	-0.3858			16-9730-8709	02-6217-3865
2			29	16:45	1.879	0.00438	0.01262			05-7382-6503	06-9550-5915
3		Oct	4	15:00	1.414	-0.4608	-1.328			19-9656-1288	02-3614-8987
4			24	14:35	1.414	-0.4608	-1.328			10-1184-0671	14-8173-1504
5			28	17:00	1.625	-0.2505	-0.7217			16-7583-3759	15-1388-1107
6		Nov	20	15:40	1.414	-0.4608	-1.328			06-3148-6920	13-9072-2785
7		Dec	9	15:10	2.297	0.4224	1.217			07-5960-2007	05-7493-7285
8	2015	Jan	13	14:45	1.32	-0.5555	-1.6			13-2783-7637	15-6385-9105
9		Mar	7	15:25	2	0.125	0.3601			10-2699-0081	06-6102-3690
10			14	16:40	2.073	0.198	0.5705			04-4644-1940	05-5241-6006
11			28	14:40	1.741	-0.1339	-0.3858			19-0074-4988	10-0773-2379
12		Apr	19	15:00	1.62	-0.255	-0.7348			09-4979-7832	14-2852-9590
13		May	4	16:45	1.738	-0.137	-0.3946			06-2198-2514	02-2706-1313
14			25	14:20	1.866	-0.00893	-0.02574			18-7392-1989	20-0679-4537
15		Jun	7	14:40	2.167	0.2915	0.8399			19-8010-0405	04-4850-0401
16			28	14:10	2.129	0.2542	0.7322			07-2970-6966	05-7691-9682
17		Jul	11	14:40	2.462	0.5873	1.692			05-0703-4782	08-5000-6801
18			26	14:20	2.462	0.5873	1.692			02-4713-5003	00-7944-7789
19		Aug	23	14:20	2.144	0.2685	0.7737			01-2748-1177	12-6611-0143
20			30	15:00	2	0.125	0.3601			09-2304-5641	14-4825-3912
21		Oct	6	15:50	2.803	0.9284	2.675	(+)		18-3697-6312	04-5468-8944

96 Hour *Neanthes arenaceodentata* Marine Reference Toxicant Test Data

Client: **Reference Toxicant** Organism Log #: 9206

Test Material: Potassium Chloride Control/Diluent: 30 ppt Seawater (+/-1 ppt)

Test ID#: 64628 Project # 24718 Test Date: 10/6/15

T0 Feeding: N/A T48 Feeding: N/A Randomization: 2.6.2

Treatment (g KCl /L)	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Salinity (ppt) new	Salinity (ppt) old	# Live Organisms A	# Live Organisms B	SIGN-OFF
Control	20.1	7.72		9.1		29.4		5	5	Date: 10/6/15
0.25	20.1	7.76		9.2		30.1		5	5	Test Solution Prep: CD
0.5	20.1	7.77		9.3		30.5		5	5	New WQ: WC
1	20.1	7.78		9.6		31.2		5	5	Initiation Time: 1550
2	20.1	7.76		9.7		32.5		5	5	Initiation Signoff: CD
4	20.1	7.77		10.0		35.2		5	5	RT Stock Batch #: 46
Meter ID:	84A	PH22		RD12		EC09				
Control	20.2		7.22		7.4		29.9	5	5	Date: 10/7/15
0.25	20.2		7.29		7.2		30.4	5	5	Count Time: 1100
0.5	20.2		7.34		7.2		30.9	5	5	Count Signoff: Le
1	20.2		7.37		7.2		31.4	5	5	Old WQ: RS
2	20.2		7.41		7.1		32.8	5	5	
4	20.2		7.44		7.1		35.4	0	0	
Meter ID:	84A		pH15		RD12		EC08			
Control	20.7		7.26		7.1		29.7	5	5	Date: 10/8/15
0.25	20.7		7.33		7.2		30.3	5	5	Count Time: 1120
0.5	20.7		7.39		7.1		30.7	5	5	Count Signoff: CD
1	20.7		7.43		7.0		31.3	5	5	Old WQ: C.L.
2	20.7		7.45		6.9		32.6	5	5	PM Inspection: —
4	—		—		—		—	—	—	
Meter ID:	84A		PH15		RD12		EC11			
Control	20.1		7.66		7.2		29.74	5	5	Date: 10/9/15
0.25	20.1		7.70		7.2		30.51	5	5	Count Time: 1015
0.5	20.1		7.72		7.2		31.0	5	5	Count Signoff: Le
1	20.1		7.72		7.3		31.5	5	5	Old WQ: EL
2	20.1		7.70		7.2		32.8	5	5	
4	—		—		—		—	—	—	
Meter ID:	84A		PH21		RD12		EC10			
Control	20.6		7.76		7.2		30.1	5	5	Date: 10/10/15
0.25	20.6		7.69		7.3		30.5	4	5	Termination Time: 1520
0.5	20.6		7.70		7.4		30.8	5	5	Termination Signoff: CD
1	20.0		7.69		7.4		31.5	5	5	Old WQ: CL
2	20.6		7.66		7.2		32.8	5	5	
4	—		—		—		—	—	—	
Meter ID:	84A		PH22		RD11		EC09			

Appendix G

Bioassay Standard Test Conditions

Summary of Test Conditions and Acceptability Criteria for the Amphipod (*Ampelisca abdita*) 10-Day Sediment Toxicity Test.	
1. Test type	Static non-renewal
2. Test duration	10 d
3. Temperature	20 ± 1°C
4. Salinity	28 ± 2 ppt
5. Light quality	Ambient Laboratory
6. Light intensity	50 – 100 ft candles
7. Photoperiod	Continuous
8. Test chamber size	1 L
9. Seawater volume	800 mL
10. Sediment depth	20 mm
11. Renewal of seawater	None
12. Age of test organisms	Wild population, immature juveniles
13. # of organisms per test chamber	20
14. # of replicate chambers/concentration	5
15. # of organisms per sediment type	100
16. Feeding regime	None
17. Test chamber cleaning	Lab washing prior to test
18. Test solution aeration	Low bubble (~100/minute)
19. Overlying water	0.45 µm-filtered seawater (at test salinity)
20. Test materials	Test sites, reference and control
21. Dilution series	None
22. Endpoint	% Survival
23. Sample holding requirements	< 8 weeks
24. Sample volume required	4 L
25. Test acceptability criteria	≥ 90% survival in the Control treatment
26. Reference toxicant results	Within 2 SD of laboratory mean

Summary of Test Conditions and Acceptability Criteria for the Marine Polychaete (*Neanthes arenaceodentata)* 10-Day Sediment Toxicity Test.		
1.	Test type	Static-renewal
2.	Test duration	10 d
3.	Temperature	20 ± 1°C
4.	Salinity	28 ± 2 ppt
5.	Light quality	Ambient Laboratory
6.	Light intensity	50 – 100 ft c.
7.	Photoperiod	12L/12D
8.	Test chamber size	1 L glass beakers
9.	Test solution volume	800 L
10.	Sediment depth	25 mm (200 mL)
11.	Renewal of seawater	None, unless needed. If needed, renew 80% of overlying water at 48 hour intervals
12.	Age of test organisms	2-3 weeks
13.	# of organisms per test chamber	5
14.	# of replicate chambers/concentration	5
15.	# of organisms per sediment type	25
16.	Feeding regime	None
17.	Test chamber cleaning	Lab washing prior to test
18.	Test solution aeration	Low bubble (~100/minute)
19.	Overlying water	0.45 µm-filtered seawater, at test salinity
20.	Test concentrations	Test sites, reference and Control
21.	Dilution series	None
22.	Endpoint	Survival
23.	Sample holding requirements	< 8 weeks
24.	Sample volume required	4 L
25.	Test acceptability criteria	≥ 90% survival in the Control treatment
26.	Reference toxicant results	Within 2 SD of laboratory mean

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	Lia Webb	Pat Kaspari		Pat Kaspari		11/18/15
2						
3						

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Appendix C

Comprehensive List of Plant Species in Project Area

Table C-1. Comprehensive plant list from botanical surveys in the Fisherman's Channel Dredging Area.

Scientific name	Common name	Family
Achillea millefolium	common yarrow	Asteraceae
Alnus rubra	red alder	Betulaceae
Angelica lucida	sea-watch	Apiaceae
Anthoxanthum odoratum	sweet vernal grass	Poaceae
Atriplex prostrata	fat-hen	Chenopodiaceae
Baccharis pilularis	coyote brush	Asteraceae
Carpobrotus chilensis	sea fig	Aizoaceae
Carpobrotus edulis	hottentot fig	Aizoaceae
Chloropyron maritimum ssp. *palustre*	Point Reyes bird's	Orobanchaceae
Cirsium sp.	thistle	Asteraceae
Cirsium vulgare	bull thistle	Asteraceae
Cotoneaster sp.	cotoneaster	Rosaceae
Cortaderia spp.	pampas grass	Poaceae
Cuscuta pacifica var. *pacifica*	goldenthread dodder	Convolvulaceae
Cytisus scoparius	Scotch broom	Fabaceae
Daucus carota	Queen Anne's lace	Apiaceae
Deschampsia cespitosa	tufted hair grass	Poaceae
Dipsacus fullonum	wild teasel	Dipsacaceae
Distichlis spicata	salt grass	Poaceae
Erigeron glaucus	seaside daisy	Asteraceae
Festuca microstachys	Nuttall's fescue	Poaceae
Festuca perennis	Italian ryegrass	Poaceae
Festuca rubra	red fescue	Poaceae
Foeniculum vulgare	sweet fennel	Apiaceae
Frangula purshiana	cascara	Rhamnaceae
Garrya elliptica	silk tassel bush	Garryaceae
Geranium dissectum	cutleaf geranium	Geraniaceae
Hedera helix	English ivy	Araliaceae
Helminthotheca echioides	bristly ox tongue	Asteraceae
Heracleum maximum	cow parsnip	Apiaceae
Holcus lanatus	common velvetgrass	Poaceae
Ilex aquifolium	English holly	Aquifoliaceae
Juncus brewerii	Brewer's rush	Juncaceae
Juncus effusus	soft rush	Juncaceae
Juncus lescurii	San Francisco rush	Juncaceae
Lonicera involucrata	twinberry	Caprifoliaceae
Lotus corniculatus	bird's-foot trefoil	Fabaceae
Lupinus rivularis	riverbank lupine	Fabaceae
Morella californica	wax myrtle	Myricaceae
Oenanthe sarmentosa	water parsely	Apiaceae
Picea sitchensis	Sitka spruce	Pinaceae

Pinus contorta ssp. *contorta*	shore pine	Pinaceae
Plantago coronopus	buckhorn plantain	Plantaginaceae
Plantago lanceolata	English plantain	Plantaginaceae
Plantago maritima	seaside plantain	Plantaginaceae
Polypodium spp.	various polypody ferns	Polypodiaceae
Polystichum munitum	western sword fern	Dryopteridaceae
Raphanus sativus	cultivated radish	Brassicaceae
Rubus armeniacus	Himalayan blackberry	Rosaceae
Rubus thyrsiflorus	thimbleberry	Rosaceae
Rubus ursinus	California blackberry	Rosaceae
Rumex acestosella	common sheep sorrel	Polygonaceae
Rumex crispus	curly dock	Polygonaceae
Rumex occidentalis	western dock	Polygonaceae
Salicornia pacifica	Pacific pickleweed	Chenopodiaceae
Salix hookeriana	coastal willow	Salicaceae
Scrophularia californica	California figwort	Scrophulariaceae
Senecio vulgaris	common groundsel	Asteraceae
Spartina densiflora	dense-flower cordgrass	Poaceae
Spergularia macrotheca var. *macrotheca*	sticky sandspurry	Caryophyllaceae
Symphyotrichum chilense	Pacific aster	Asteraceae
Trifolium spp.	various clover	Fabaceae
Triglochin maritima	seaside arrowgrass	Juncaginaceae
Vicia spp.	various vetch	Fabaceae
Zostera marina	eelgrass	Zosteraceae

Table C-2. Comprehensive plant list from botanical surveys conducted on 21 May and 4 June 2015 in the Fields Landing Mitigation Area.

Scientific name	Common name	Family
Achillea millefolium	common yarrow	Asteraceae
Acmispon parviflorus	desert deervetch	Fabaceae
Agrostis stolonifera	creeping bentgrass	Poaceae
Aira caryophyllea	silver hairgrass	Poaceae
Allium triquetrum	three corner leek	Alliaceae
Alnus rubra	red alder	Betulaceae
Amaryllis belladonna	belladonna lily	Amaryllidaceae
Anagallis arvensis	scarlet pimpernel	Myrsinaceae
Angelica lucida	sea-watch	Apiaceae
Anthoxanthum odoratum	sweet vernal grass	Poaceae
Armeria maritima ssp. *californica*	California sea pink	Plumbaginaceae
Atriplex prostrata	fat-hen	Chenopodiaceae
Avena sativa	common oat	Poaceae
Baccharis glutinosa	mule-fat	Asteraceae

Scientific name	Common name	Family
Baccharis pilularis	coyote brush	Asteraceae
Bolboschoenus maritimus ssp. *paludosus*	saltmarsh bulrush	Cyperaceae
Brassica rapa	field mustard	Brassicaceae
Briza maxima	big quaking grass	Poaceae
Briza minor	little quaking grass	Poaceae
Bromus carinatus	California brome	Poaceae
Bromus diandrus	ripgut brome	Poaceae
Bromus hordeaceus	soft brome	Poaceae
Bromus tectorum	cheat grass	Poaceae
Cardionema ramosissimum	beach sandmat	Caryophyllaceae
Carex obnupta	slough sedge	Cyperaceae
Centaurea sp.	knapweed	Asteraceae
Conium maculatum	poison hemlock	Apiaceae
Cortaderia jubata	purple pampas grass	Poaceae
Cotula coronopifolia	common brass buttons	Asteraceae
Cuscuta pacifica var. *pacifica*	goldenthread dodder	Convolvulaceae
Cynosurus echinatus	bristly dogtail grass	Poaceae
Cyperus eragrostis	tall flatsedge	Cyperaceae
Cytisus scoparius	Scotch broom	Fabaceae
Dactylis glomerata	orchard grass	Poaceae
Danthonia californica	California oatgrass	Poaceae
Daucus carota	Queen Anne's lace	Apiaceae
Daucus pusillus	American wild carrot	Apiaceae
Deschampsia cespitosa	tufted hairgrass	Poaceae
Dipsacus fullonum	Fuller's teasel	Dipsacaceae
Distichlis spicata	salt grass	Poaceae
Eleocharis macrostachya	pale spikerush	Cyperaceae
Elymus triticoides	beardless wildrye	Poaceae
Epilobium ciliatum	fringed willow herb	Onagraceae
Equisetum arvense	field horsetail	Equisetaceae
Festuca bromoides	brome fescue	Poaceae
Festuca perennis	Italian ryegrass	Poaceae
Festuca rubra	red fescue	Poaceae
Foeniculum vulgare	sweet fennel	Apiaceae
Frangula purshiana	Cascara buckthorn	Rhamnaceae
Galium aparine	sticky willy	Rubiaceae
Geranium dissectum	cutleaf geranium	Geraniaceae
Glaux maritima	sea milkwort	Myrsinaceae
Grindelia stricta var. *stricta*	Oregon gumweed	Asteraceae
Hedera helix	English ivy	Araliaceae
Helminthotheca echioides	bristly ox tongue	Asteraceae
Heracleum maximum	common cow parsnip	Apiaceae

Scientific name	Common name	Family
Hirschfeldia incana	short pod mustard	Brassicaceae
Holcus lanatus	common velvet grass	Poaceae
Hordeum brachyantherum	meadow barley	Poaceae
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	Poaceae
Hordeum murinum	mouse barley	Poaceae
Isolepis cernua	low bulrush	Cyperaceae
Juncus breweri	Brewer's rush	Juncaceae
Juncus bufonius var. *bufonius*	toad rush	Juncaceae
Juncus effusus	soft rush	Juncaceae
Juncus lescurii	San Francisco rush	Juncaceae
Leontodon saxatilis	lesser hawkbit	Asteraceae
Leucanthemum vulgare	oxeye daisy	Asteraceae
Linum bienne	pale flax	Linaceae
Lonicera involucrata	twinberry	Caprifoliaceae
Lotus corniculatus	bird's-foot trefoil	Fabaceae
Lupinus rivularis	riverbank lupine	Fabaceae
Lythrum hyssopifolia	hyssop loosestrife	Lythraceae
Madia sativa	coast tarweed	Asteraceae
Medicago polymorpha	bur clover	Fabaceae
Mentha pulegium	pennyroyal	Lamiaceae
Morella californica	California wax myrtle	Myricaceae
Parapholis strigosa	strigose sickle grass	Poaceae
Parentucellia viscosa	yellow glandweed	Orobanchaceae
Picea sitchensis	Sitka spruce	Pinaceae
Pinus radiata	Monterey pine	Pinaceae
Plantago coronopus	buckhorn plantain	Plantaginaceae
Plantago lanceolata	narrow leaf plantain	Plantaginaceae
Poa pratensis ssp. *pratensis*	Kentucky bluegrass	Poaceae
Polypogon monspeliensis	annual rabbitsfoot grass	Poaceae
Polystichum munitum	western sword fern	Dryopteridaceae
Potentilla anserina	Pacific silverweed	Rosaceae
Raphanus sativus	cultivated radish	Brassicaceae
Ribes sanguineum	red-flowering currant	Grossulariaceae
Rubus armeniacus	Himalayan blackberry	Rosaceae
Rubus ursinus	California blackberry	Rosaceae
Rumex acetosella	common sheep sorrel	Polygonaceae
Rumex crispus	curly dock	Polygonaceae
Rumex occidentalis	western dock	Polygonaceae
Salicornia pacifica	Pacific pickleweed	Chenopodiaceae
Salix hookeriana	dune willow	Salicaceae
Salix sitchensis	Sitka willow	Salicaceae
Sambucus racemosa	red elderberry	Adoxaceae

Scientific name	Common name	Family
Scrophularia californica	California figwort	Scrophulariaceae
Senecio glomeratus	cutleaf burnweed	Asteraceae
Solidago spathulata	coast goldenrod	Asteraceae
Sonchus asper ssp. *asper*	spiny sow thistle	Asteraceae
Spartina densiflora	dense-flowered cordgrass	Poaceae
Spergularia macrotheca var. *macrotheca*	sticky sandspurry	Caryophyllaceae
Spiranthes romanzoffiana	hooded lady's tresses	Orchidaceae
Stachys ajugoides	ajuga hedgenettle	Lamiaceae
Symphyotrichum chilense	Pacific aster	Asteraceae
Trifolium repens	white clover	Fabaceae
Triglochin maritima	seaside arrowgrass	Juncaginaceae
Typha latifolia	broad-leaved cattail	Typhaceae
Vicia hirsuta	tiny vetch	Fabaceae
Vicia sativa ssp. *sativa*	garden vetch	Fabaceae
Zeltnera muehlenbergii	Muhlenberg's centaury	Gentianaceae
Zostera marina	eelgrass	Zosteraceae

Appendix D
Harbor District Protocols for Inadvertent Archaeological Discovery

PROTOCOLS FOR INADVERTENT ARCHAEOLOGICAL DISCOVERIES FOR GROUND DISTURBING PROJECT PERMITS, LEASES AND FRANCHISES ISSUED BY THE HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT, HUMBOLDT BAY, CALIFORNIA

April 22, 2015

Background

Humboldt Bay is the ancestral heartland of the Wiyot Indians, whose native language is affiliated with the Algonquian language family and who had occupied the bay area for at least 2000 years by the time the first recorded European maritime explorers entered the Bay in 1806 and the first American towns were established in 1850. There are hundreds of known and undiscovered archaeological sites around Humboldt Bay that evidence Wiyot history and prehistory. Today, citizens of Wiyot ancestry are affiliated with three federally-recognized tribes located in the ancestral homeland: Blue Lake Rancheria; Bear River Band of the Rohnerville Rancheria; and the Wiyot Table at Table Bluff Reservation.

Applicable Laws

A number of State and Federal historic preservation laws, regulations and policies address the need to manage potentially significant and/or sensitive (e.g., human remains) archaeological and Native American resources identified during advance project or permit review or discovered inadvertently.

- California Environmental Quality Act (CEQA) – Requires analysis by the Lead Agency under CEQA, to determine if a proposed project will cause a significant impact to "historical resources" including archaeological and Native American sites. Project approval may be conditional, for example, avoidance or mitigation (data recovery) of known archaeological resources, monitoring of ground disturbing activities in identified sensitive areas by local Tribal Representatives and/or professional archaeologists, and implementation of protocols for inadvertent archaeological discoveries.

- Section 106 of the National Historic Preservation Act (NHPA) – Requires analysis by the Lead Federal Agency and consultation with the California State Historic Preservation Officer (SHPO), Advisory Council on Historic Preservation (ACHP), culturally affiliated Native American Tribes, and others, as appropriate, to "resolve adverse effects" on "historic properties" including archaeological and Native American sites. Section 106 is the key Federal historic preservation law, and final approval of the undertaking may be conditional as specified in a legally binding Agreement among the parties.

Several laws and their implementing regulations spell out evaluation criteria to determine what constitutes a significant 'site' or a significant 'discovery':

- California Register of Historical Resources criteria (California Code of Regulations, Title 14, Chapter 3, Section 15064.5), for archaeological and Native American resources qualifying for consideration under CEQA;

- National Register of Historic Places criteria (36 CFR 63), qualifying for consideration under Section 106 review and NEPA;

State laws call for specific procedures and timelines to be followed in cases when human remains are discovered on private or non-Federal public land in California. It includes penalties (felony) for violating the rules for reporting discoveries, or for possessing or receiving Native American remains or grave goods:

- Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the Public Resources Code (PRC) outline requirements for handling inadvertent discoveries of human remains, including those determined to be Native American with or without associated grave goods, found on private or non-Federal public lands. PRC 5097.99 (as amended by SB 447) specifies penalties for illegally possessing or obtaining Native American remains or associated grave goods.

Another California law imposes strong civil penalties for maliciously digging, destroying or defacing a California Indian cultural or sacred site:

- California Native American Historic Resource Protection Act of 2002 (SB 1816, adding Chapter 1.76 to Division 5 of the PRC), imposes civil penalties including imprisonment and fines up to $50,000 per violation, for persons who unlawfully and maliciously excavate upon, remove, destroy, injure, or deface a Native American historic, cultural, or sacred site that is listed or may be listed in the California Register of Historic Resources.

Standard Mitigation Language for CEQA Initial Studies

The following language may be employed by the Humboldt Bay Harbor, Recreation and Conservation District (Harbor District) when cultural resources screening (e.g., comment by Wiyot area Tribal Historic Preservation Officers (THPOs), formal record searches, current cultural resources studies) indicates a particular permit, leasehold or franchise area under its jurisdiction does not have known archaeological sites, however, unknown buried artifacts and archaeological deposits may exist and be impacted by the proposed action.

CR-1 Should an archaeological resource be inadvertently discovered during ground-disturbing activities, the Tribal Historic Preservation Officers (THPO) appointed by the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria and Wiyot Tribe shall be immediately notified and a qualified archaeologist with local experience retained to consult with the Harbor District, the three THPOs, the Permittee and other applicable regulatory agencies to employ best practices for assessing the significance of the find, developing and implementing a mitigation plan if avoidance is not feasible, and reporting in accordance with the Harbor District's Standard Operating Procedures (SOP, below).

CR-2 Should human remains be inadvertently discovered during ground-disturbing activities, work at the discovery locale shall be halted immediately, the Harbor District and County Coroner contacted, and the Harbor District's SOP shall be followed, consistent with state law.

Standard Operating Procedures

The following standard operating procedures for addressing inadvertent archaeological discoveries shall apply to all phases and aspects of work carried out under the authority of the Harbor District for those parties that obtain a permit, lease or franchise for projects that involve ground-disturbing activities within its jurisdiction. It shall apply as well to the Harbor District's activities involving ground disturbances. In all cases, these SOPs shall apply to their respective employees, officers and agents, including contractors whose activities may potentially expose and impact significant or sensitive resources.

The intent is to avoid or minimize direct or indirect impacts to significant archaeological or Native American discoveries that may qualify for inclusion in the California Register of Historical Resources and/or the National Register of Historic Places.

These Protocols are intended to serve as standard guidelines to the Harbor District for compliance with CEQA and NHPA Section 106 requirements for considering inadvertent archaeological discoveries.

Responsibility for Retaining Services of As-Needed Professional Archaeologist

If an inadvertent discovery of archeological resources, human remains and/or grave goods occurs, the Harbor District or those parties that obtain a permit, lease or franchise shall be responsible for retaining as-needed services of a qualified Archaeologist, meaning the individual meets the Secretary of the Interior's Professional Standards for an Archaeological Principal Investigator and/or is listed as Registered Professional Archaeologist (see website at www.rpanet.org). The professional will provide as-needed services to conduct rapid assessments of potentially significant archaeological finds discovered during the Project implementation.

Designated Points of Contact (POC) for Notification of Discoveries

The Harbor District, those entities that obtain a permit, lease or franchise from the Harbor District, their construction contractor(s), and other applicable local, state or federal agencies shall each designate a representative who shall act as its official Point of Contact (POC) and who shall be notified immediately upon the inadvertent discovery of an archaeological find or the inadvertent discovery of human remains and /or grave goods during Project implementation.

The federally-recognized Blue Lake Rancheria, Bear River Band of the Rohnerville Rancheria and Wiyot Tribe each has citizens that recognize Wiyot ancestry. Each Tribe's appointed Tribal Historic Preservation Officer (THPO) is designated as the POC (below) and shall be immediately notified by the Harbor District's POC should an archaeological site (with or without human remains) be inadvertently discovered. The Harbor District POC is also listed below.

Designated Tribal and Harbor District Points-of-Contact (*as of 4/15/15)

Tribe	Address	Office Telephone	Cultural Staff*
Blue Lake Rancheria	428 Chartin Road P.O. Box 428 Blue Lake, CA 95525	(707) 668-5101 x1037 Fax (707) 688-4272 Cell (530) 623-0663	Janet Eidsness, THPO
Bear River Band of the Rohnerville Rancheria	266 Keisner Road Loleta, CA 95551	(707) 733-1900 x233 Fax (707) 733-1972 Cell (707) 502-5233	Erika Cooper, THPO
Wiyot Tribe	1000 Wiyot Drive Loleta, CA 95551	(707) 733-5055 Fax (707) 733-5601 Cell (406) 850-2220	Tom Torma, THPO
Harbor District	601 Startare Drive, Eureka, CA 95501	(707) 443-0801 Fax (707) 443-0800 Cell (707) 496-2088	Adam Wagchal, Deputy Director

Interested Tribal Representatives shall be invited to inspect a discovery site and meet with the Harbor District's and other applicable delegated POCs and Consulting Professional Archaeologist, as appropriate, to make a rapid assessment of the potential significance of a find and participate in the development and implementation of a Treatment Plan, as appropriate.

Note: In the event that Native American skeletal remains are discovered, State law specifies that the "Most Likely Descendent (MLD)" appointed by the NAHC has the authority to make recommendations for the final treatment and disposition of said remains and associated grave goods – see below.

A. SOP for Inadvertent Archaeological Discovery (General)

1. Ground-disturbing activities shall be immediately stopped if potentially significant historic or archaeological materials are discovered. Examples include, but are not limited to, concentrations of historic artifacts (e.g., bottles, ceramics) or prehistoric artifacts (chipped chert or obsidian, arrow points, groundstone mortars and pestles), culturally altered ash-stained midden soils associated with pre-contact Native American habitation sites, concentrations of fire-altered rock and/or burned or charred organic materials, and historic structure remains such as stone-lined building foundations, wells or privy pits. Ground-disturbing project activities may continue in other areas that are outside the discovery locale.

2. An "exclusion zone" where unauthorized equipment and personnel are not permitted shall be established (e.g., taped off) around the discovery area plus a reasonable buffer zone by the Contractor Foreman or authorized representative, or party who made the discovery and initiated these SOP.

3. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the Harbor District if considered prudent to avoid further disturbances.

4. The Contractor Foreman or authorized representative, or party who made the discovery and initiated these SOP, shall be responsible for immediately contacting by telephone the parties listed below to report the find:
   (a) the Harbor District's authorized POC and
   (b) the Applicant's (District's permittee, lease or franchise holder) authorized POC, and it's General Contractor's POC if applicable.

5. Upon learning about a discovery, the Harbor District's POC shall be responsible for immediately contacting by telephone the POCs listed below to initiate the consultation process for its treatment and disposition:
   (a) THPOs with Blue Lake Rancheria, Bear River Band and Wiyot Tribe; and
   Other applicable agencies involved in Project permitting (e.g., US Army Corps of Engineers, US Fish & Wildlife Service, California Department of Fish & Wildlife, etc.).

6. Ground-disturbing project work at the find locality shall be suspended temporarily while Harbor District, the three THPOs, consulting archaeologist and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a Treatment Plan will be developed within three working days of discovery notification. Where the project can be modified to avoid disturbing the find (e.g., through project redesign), this may be the preferred option. Should Native American remains be encountered, the provisions of State laws shall apply (see below). The Treatment Plan shall reference appropriate laws and include provisions for analyses, reporting, and final disposition of data recovery documentation and any collected artifacts or other archaeological constituents. Ideally, the field phase of the Treatment Plan may be accomplished within five (5) days after its approval, however, circumstances may require longer periods for data recovery.

7. The Harbor District's officers, employees and agents, including contractors, permittees, holders of leases or franchises, and applicable property owners shall be obligated to protect significant cultural resource discoveries and may be subject to prosecution if applicable State or Federal laws are violated. In no event shall unauthorized persons collect artifacts.

8. Any and all inadvertent discoveries shall be considered strictly confidential, with information about their location and nature being disclosed only to those with a need to know. The Harbor District's authorized representative shall be responsible for coordinating with any requests by or contacts to the media about a discovery.

9. These SOPs shall be communicated to the field work force (including contractors, employees, officers and agents) of those entities that obtain a permit, lease or franchise from the Harbor District, and such communications may be made and documented at weekly tailgate safety briefings.

10. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the Harbor District.

11. In cases where a known or suspected Native American burial or human remains are uncovered:
    (a) The following contacts shall be notified immediately: Humboldt County Coroner (707-445-7242) and the property owner of the discovery site, and
    (b) The SOP for Inadvertent Discovery of Native American Remains and Grave Goods (B below) shall be followed.

B. SOP for Inadvertent Discovery of Native American Remains and Grave Goods

In the event that known or suspected Native American remains are encountered, the above procedures of SOP paragraph A for Inadvertent Archaeological Discovery (General) shall be followed, as well as:

1. If human remains are encountered, they shall be treated with dignity and respect. Discovery of Native American remains is a very sensitive issue and serious concern of affiliated Native Americans. Information about such a discovery shall be held in confidence by all project personnel on a need-to-know basis. The rights of Native Americans to practice ceremonial observances on sites, in labs and around artifacts shall be upheld.

2. Violators of Section 7050.5 of the California Health and Safety Code may be subject to prosecution to the full extent of applicable law (felony offense).

In addition, the provisions of California law (Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the California Public Resources Code) will be followed:

1. The Coroner has two working days to examine the remains after being notified of the discovery. If the remains are Native American, the Coroner has 24 hours to notify the Native American Heritage Commission (NAHC) in Sacramento at (916) 653-4082.

2. The NAHC is responsible for identifying and immediately notifying the Most Likely Descendant (MLD) of the deceased Native American. (Note: NAHC policy holds that the Native American Monitor will not be designated the MLD.)

3. Within 48 hours of their notification by the NAHC, the MLD will be granted permission by the property owner of the discovery locale to inspect the discovery site if they so choose.

4. Within 48 hours of their notification by the NAHC, the MLD may recommend to the owner of the property (discovery site) the means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods. The recommendation may include the scientific removal and non-destructive or destructive analysis of human remains and items associated with Native American burials. Only those osteological analyses (if any) recommended by the MLD may be considered and carried out.

5. Whenever the NAHC is unable to identify a MLD, or the MLD identified fails to make a recommendation, or the property owner rejects the recommendation of the MLD and mediation between the parties by NAHC fails to provide measures acceptable to the property owner, he/she shall cause the re-burial of the human remains and associated grave offerings with appropriate dignity on the property in a location not subject to further subsurface disturbance.

C. SOP for Documenting Inadvertent Archaeological Discoveries

1. The Contractor Foreman or authorized representative, or party who made the discovery and initiated these SOP, shall make written notes available to the Harbor District describing: the circumstances, date, time, location and nature of the discovery; date and time each POC was informed about the discovery; and when and how security measures were implemented.

2. The Harbor District POC shall prepare or authorize the preparation of a summary report which shall include: the time and nature of the discovery; who and when parties were notified; outcome of consultations with appropriate agencies and Native American representatives; how, when and by whom the approved Treatment Plan was carried out; and final disposition of any collected archaeological specimens.

3. The Contractor Foreman or authorized representative shall record how the discovery downtime affected the immediate and near-term contracted work schedule, for purposes of negotiating contract changes where applicable.

4. If applicable, Monitoring Archaeologists and Tribal Representatives shall maintain daily fieldnotes, and upon completion, submit a written report to the Harbor District and the three Wiyot area THPOs.

5. Treatment Plans and corresponding Data Recovery Reports shall be authored by professionals who meet the Federal criteria for Principal Investigator Archaeologist and reference the *Secretary of the Interior's Standards and Guidelines for Archaeological Documentation* (48 FR 44734-44737).

6. Final disposition of all collected archaeological materials shall be documented in the final Data Recovery Report and its disposition decided in consultation with Tribal representatives.

7. Final Data Recovery Reports along with updated confidential, standard California site record forms (DPR 523 series) shall be filed at the Northwest Information Center of the California Historical Resources Information System and the Harbor District, with report copies provided to the three Wiyot area THPOs.

8. Confidential information concerning the discovery location, treatment and final disposition of Native American remains shall be prepared by the THPOs and forwarded to the Sacred Sites Inventory maintained by the NAHC.