UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

FINAL Project Instructions

Date Submitted: June 14, 2013

Platform: NOAA Ship *Hi'ialakai*

Project Number: HA-13-02 (OMAO)

Project Title: Site monitoring of U.S. Environmental Protection Agency (EPA)-designated ocean dredged material disposal sites in Hawaiian Islands (South Oahu and Hilo sites)

Project Dates: June 25, 2013 to July 2, 2013 (8 at-sea days)

Prepared by: _____ Dated: 6/14/13
Allan Ota
Chief Scientist
U.S. Environmental Protection Agency (Region 9)

Approved by: _____ Dated: 6/17/13
Jason Brush
Supervisor, Wetlands Regulatory Office, Water Division
U.S. Environmental Protection Agency (Region 9)

Approved by: _____ Dated: 6/17/13
Jane Diamond
Director, Water Division
U.S. Environmental Protection Agency (Region 9)

Approved by: _____ Dated: 20 JUNE 2013
Commander Robert Kamphaus, NOAA
Commanding Officer
Marine Operations Center – Pacific Islands

I. Overview

A. Brief Summary and Project Period

The South Oahu and Hilo ocean dredged material disposal sites (ODMDS) were, designated by EPA Region 9 and actively used beginning in the 1980s. The South Oahu site has received the highest volume of dredged material, generated from construction and maintenance dredging by the U.S. Navy in Pearl Harbor. The primary objective of site monitoring is to assess performance and site conditions relative to disposal operations, including: determination of the horizontal extent of the dredged material deposit footprint relative to site boundaries; no adverse impacts of disposal of dredged material (i.e., no impacts on benthic fauna); and confirmation of pre-disposal sediment testing (i.e., no adverse chemical contamination issues, relative to ambient conditions). Site monitoring activities are expected to include: multi-beam bathymetry, sediment profile imaging (SPI) with plan view camera, and sediment sampling (grain size, chemistry, and benthic community).

B. Service Level Agreements

All of the 8 DAS scheduled for this project are funded by EPA. This project is estimated to exhibit a High Operational Tempo.

C. Operating Area (include optional map/figure showing op area)

South of Pearl Harbor (Oahu) and northeast of Hilo (Hawaii) – see map figures in Appendix.

D. Summary of Objectives

The Environmental Protection Agency (EPA) is conducting monitoring activities at two EPA-designated ODMDS to assess performance and site conditions relative to disposal operations, including: determination of the horizontal extent of the dredged material deposit footprint relative to site boundaries; confirmation of no adverse impacts of disposal of dredged material (i.e., no impacts on benthic fauna); and confirmation of pre-disposal sediment testing (i.e., no adverse chemical contamination issues, relative to ambient conditions). The locations and sizes of these ODMDS were evaluated during the site designation process, and a determination of the horizontal extent of the dredged material (DM) deposit footprint will confirm the original expectations of DM dispersion and deposition modeling in conjunction with evaluation of compliance monitoring records for tracking disposal operations (i.e., proper disposal within the sites). Pre-disposal sediment testing is conducted for every proposed dredging project to limit ocean disposal to only clean (non-toxic) sediments. Analysis of sediment samples collected from the ODMDS will be conducted to allow evaluation of potential physical, chemical, and biological impacts from DM disposal, which is expected to be limited to temporary localized physical impacts (i.e., burial).

The purpose of the cruise will be to conduct site monitoring at two active ODMDS, utilizing the following methods: multi-beam bathymetry (if available), sediment profile imaging (SPI) and plan view photography (PVP), and sediment sampling (grain size, chemistry, and benthic community). Multi-beam survey will be conducted to confirm bathymetry and identify any special bottom features prior to deployment of equipment to the seabed. Sediment profile

imaging (SPI) is intended to provide photographic vertical profile images of the seabed surface (sediment water interface) and subsurface. The plan view photography (PVP) is intended to document features of the seabed surface and context for associated subsurface vertical profile images. The sediment samples will be analyzed to assess any significant changes due to elevated chemistry or benthic infauna relative to native (ambient) conditions.

E. Participating Institutions

U.S. Environmental Protection Agency (Region 9), U.S. Navy, U.S. Army Corps of Engineers, NOAA – full complement of science personnel still to be determined

F. Personnel/Science Party: name, title, gender, affiliation, and nationality

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
Browning, David	Scientist	6/24/13	7/03/13	Male	Contractor	US
Germano, Joseph	Scientist	6/24/13	7/03/13	Male	Contractor	US
Hanser, Sean	Scientist	6/24/13	7/02/13	Male	US Navy	US
O'Connor, Robert	Scientist	6/24/13	7/03/13	Male	NOAA	US
Ota, Allan	Chief Scientist	6/23/13	7/03/13	Male	USEPA	US
Robinson, Leslie	Scientist	6/24/13	7/03/13	Female	US Navy	US
Ross, Brian	Scientist	6/24/13	7/03/13	Male	USEPA	US
Smith, Christine	Scientist	6/24/13	7/03/13	Female	Contractor	US
Smith, Thomas	Scientist	6/24/13	7/03/13	Male	USACE	US
Wagner, Amy	Scientist	6/23/13	7/03/13	Female	USEPA	US

G. Administrative

1. Points of Contacts:

Chief Scientist: Allan Ota, U.S. EPA (Region 9), 75 Hawthorne Street, San Francisco, CA 94105, telephone: 415-972-3476, e-mail: ota.allan@epa.gov

2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of the United States. No diplomatic clearance is necessary.

3. Licenses and Permits

No licenses or permits are necessary for this cruise. The Chief Scientist will coordinate with the U.S. Coast Guard to publish a Notice to Mariners of planned activities and operational areas.

II. Operations

A. Project Itinerary

Actual survey locations will be made available to the Operations Officer during the daily operations meeting. There is still some uncertainty in regard to availability of the multi-beam, as of this date and writing of the draft survey plan. Multi-beam survey time is roughly estimated because NOAA Survey Tech was in training at time of this document preparation. Depending on time limitations or adverse weather conditions, multi-beam survey of the Hilo site may be limited or deleted from survey plan. The following are general descriptions of areas. Weather conditions may require changes to itinerary, including sequencing of the Study Areas and sampling locations.

24 June (Monday): Staging / mobilization of equipment; 1800 team meeting / orientation

25 June (Tuesday): Depart for South Oahu site study grid @ 1000 (after engine warm-up and departure checklists); assume approximate one-hour transit to site @ 8 kts); begin multi-beam echo sounder (MBES) survey if this equipment is operational – estimated 10- to 12-hour survey (completed about 2100) – one Survey Technician needed to cover this; SPI / PVP survey will start earlier if MBES is not operational; 24-hour operations; one winch operator per 12-hour work shift for SPI / PVP survey; EPA science crew can handle tag lines and frame

26 June (Wednesday): 0000 Begin SPI / PVP survey grid after MBES survey; continued 24-hours operations; one winch operator per 12-hour work shift for SPI / PVP survey; EPA science crew can handle tag lines and frame

27 June (Thursday): 0000 Commence sediment sampling grid; continued 24-hour operations; one winch operator per 12-hour work shift for sediment sampling; EPA science crew can handle tag lines and frame

28 June (Friday): 0000 Commence transit to Hilo site (assume about 22-23 hours @ 8 kts); 2300 Commence MBES survey if this equipment is operational – estimated 10- to 12-hour survey (completed no later than 1200 next day) – one Survey Technician needed to cover this; SPI / PVP survey will start earlier if MBES is not operational; continued 24-hour operations

29 June (Saturday): 1200 Begin SPI / PVP survey grid; continued 24-hour operations; one winch operator per 12-hour work shift for SPI / PVP survey; EPA science crew can handle tag lines and frame

30 June (Sunday): 1200 Commence sediment sampling grid; continued 24-hour operations; one winch operator per 12-hour work shift for sediment sampling; EPA science crew can handle tag lines and frame

01 July (Monday): Sediment sampling; continued 24-hour operations; one winch operator per 12-hour work shift for sediment sampling; EPA science crew can handle tag lines and frame; complete sediment sampling work by 1600 to depart for Honolulu

02 July (Tuesday): Return to port in daylight hours (estimated arrival no later than 1600)

03 July (Wednesday): De-staging / demobilization, as needed (if earlier arrival on 02 July does not occur)

B. Staging and De-staging

SPI and sediment sampling gear will be loaded and assembled on the vessel in Honolulu. [EPA contractors and suppliers yet to be determined; other details to be added]

C. Operations to be Conducted

The order of monitoring and sampling operations is expected to be the same for both ODMDS, utilizing the following methods: multi-beam bathymetry (if available), sediment profile imaging (SPI) and plan view photography (PVP), and sediment sampling (grain size, chemistry, and benthic community). Multi-beam survey will be conducted to confirm bathymetry and identify any special bottom features prior to deployment of equipment to the seabed. At the time of writing this draft survey plan, operating specifications were not made available (i.e., typical ship speed; swath width in depths of about 450 to 500 meters) – rough assumption of about 10- to 12-hour survey. Sediment profile imaging (SPI) is intended to provide photographic vertical profile images of the seabed surface (sediment water interface) and subsurface. The plan view photography (PVP) is intended to document features of the seabed surface and context for associated subsurface vertical profile images. At these depths, and assuming wire deployment rates of 40- to 60-meters per minute, the ship is expected to be on station for no more than 30 minutes per station. Sample processing will be conducted on deck or in wet lab to prepare sediment samples that will be analyzed later to assess any significant changes due to elevated chemistry or benthic infauna relative to native (ambient) conditions.

D. Dive Plan

There are no dives planned for this survey.

E. Applicable Restrictions

Conditions which preclude normal operations include poor weather conditions, equipment failure, safety concerns, and unforeseen circumstances. In the case of equipment failure, ship time will be used productively, to the maximum extent practicable, using other survey methods as available (e.g., providing additional coverage or higher resolution coverage for ongoing NOAA mapping efforts) until repairs can be made to affected equipment. In the event of poor weather conditions, survey time will be redirected to other areas if practicable for forecasted conditions. Except in cases of safety, Chief Scientist will make decisions regarding reallocation of survey time in consultation with ship crew.

III. Equipment

A. Equipment and Capabilities provided by the ship (verify and/or discuss with NOAA as appropriate)

1) Hand held radios for communication between bridge and deck
2) Navigation / Positioning System – navigate to sampling stations and along transects; with standard dGPS accuracy
3) Multi-beam echo sounder (MBES) and associated hardware / software – high resolution bathymetry; seabed features
4) A-frame
5) Freezer – storage of sediment samples
6) Running seawater (access on working deck; benthic sample washing / sieving)
7) Running freshwater (freshwater rinse of sampling gear on deck)
8) Wet lab / de-ionized water (cleaning of sample processing equipment)

B. Equipment and Capabilities provided by the scientists (itemized, tentative, pending final selection of contractors through EPA national contract)

1) Sediment profile imaging (SPI) camera system and plan view camera with frame (maximum weight, with all added weights: 1,200 lbs; height: 68 inches; footprint: 62 inches by 56 inches
2) Backup SPI and plan view cameras (same size as item #1)
3) Weights for SPI frame
4) Acoustic transponder
5) Sediment sampler (double Van Veen) with frame: similar footprint as item #1
6) Backup sampler
7) Weights for sediment sampler frame
8) Sample containers (various sizes)
9) Ice chests (transportation of samples after completion of survey)
10) Field laptop computer with external drives; navigation planning software
11) Spare parts, materials, and tools
12) Work vests (PFDs), hard hats, and steel-toed boots

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and a chemical hygiene plan. Documentation regarding those requirements will be provided by the Commander, Marine Operations Center, Pacific Islands, upon request.

Per FEC 07, the scientific party will include with their project instructions and provide to the CO of the respective ship 60 to 90 days before departure:

- A list of hazardous materials by name and anticipated quantity
- Include a chemical spill plan the addresses all of the chemicals the program is bringing aboard. This shall include:
  - Procedures on how the spilled chemicals will be contained and cleaned up.
  - A complete inventory (including volumes/amounts) of the chemical spill supplies and equipment brought aboard by the program. This must be sufficient to clean and neutralize all of the chemicals brought aboard by the program.
  - A list of the trained personnel that will be accompanying the project and the training they've completed.

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Formaldehyde solution (2%)	60 x 1 L	Preservative; store separately from acids and bases; well ventilated area	Amy Wagner	F
Formaldehyde solution (37%)	1 x 10 L	Preservative; store separately from acids and bases; well ventilated area	Amy Wagner	F
Sodium borate	1 x 3 kg	Inorganic salt (buffer for formaldehyde); store in well ventilated area	Amy Wagner	See link *

SPILL CONTROL

F: Formalin/Formaldehyde

- Ventilate area of leak or spill. Remove all sources of ignition.
- Wear appropriate personal protective equipment.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container.
- Do not use combustible materials, such as saw dust.

Inventory of Spill Kit supplies

Product Name	**Amount**	**Chemicals it is useful against**	**Amount it can clean up**
Vermiculite	TBD	Formaldehyde	TBD
Formaldehyde polymerizer	TBD	Formaldehyde	TBD

* No specific spill kit for sodium borate - Link: http://www.setonresourcecenter.com/msdshazcom/htdocs//MSDS/E/EMD/Docs/wcd00035/wcd035d1.pdf

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program.

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory of hazardous material indicating all materials have been used or removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of scientific chemicals is not permitted during projects aboard NOAA ships.

B. Radioactive Isotopes: N/A

C. Inventory (itemized) of Radioactive Materials: N/A

V. Additional Projects

A. Supplementary ("Piggyback") Projects – none; there will be no idle periods because EPA operations conducted 24/7

B. NOAA Fleet Ancillary Projects – none; there will be no idle periods because EPA operations conducted 24/7

VI. Disposition of Data and Reports

A. Data Responsibilities

All ship collected data (SCS, weather observations, multibeam) will be archived and provided to the chief scientist upon departure from the vessel or transmitted to them via traceable means. The SCS data and weather observations will be submitted through OMAO processes to the national data archives in accordance with OMAO policy unless specifically directed otherwise by an approved data management plan.

B. Pre and Post Project Meeting

Prior to departure, the Chief Scientist will conduct a meeting of the scientific party to train them in sample collection and inform them of project objectives. Some vessel protocols, e.g., meals, watches, etiquette, etc. will be presented by the ship's Operations Officer.

Post-Project Meeting: Upon completion of the project, a meeting will be held during return transit (unless prior alternate arrangements are made) and attended by the ship's officers, the Chief Scientist and members of the scientific party to review the project. Concerns regarding safety, efficiency, and suggestions for improvements for future projects should be discussed. Minutes of the post-project meeting will be distributed to all participants by email, and to the Ship's Commanding Officer and the Commanding Officer, Marine Operation Center - Pacific Islands.

C. Ship Operation Evaluation Report

Within seven days of the completion of the project, a Ship Operation Evaluation form is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to omao.customer.satisfaction@noaa.gov. If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

VII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan and send the form via secure email (i.e. DOC Accellion) using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the project to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the form, and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

Contact information:

Regional Director of Health Services
Marine Operations Center – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number. Operations Officer will provide blank emergency contact and berthing forms.

C. Shipboard Safety

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats with chin straps are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
(2) Installation of the latest critical operating system security patches.
(3) No external public Internet Service Provider (ISP) connections.
(4) Provide the Electronics Technician a spreadsheet with the following information:

Device	Name	Operating System	LAN MAC Address	WAN MAC Address
Example:				
iPhone	[name]	iOS	21:34:6K:P8:W6:77	21:34:6K:P8:W6:78
Laptop	[name]	Windows XP	23:34:6K:P8:M6:77	23:34:6K:P8:M6:78

Completion of the above requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

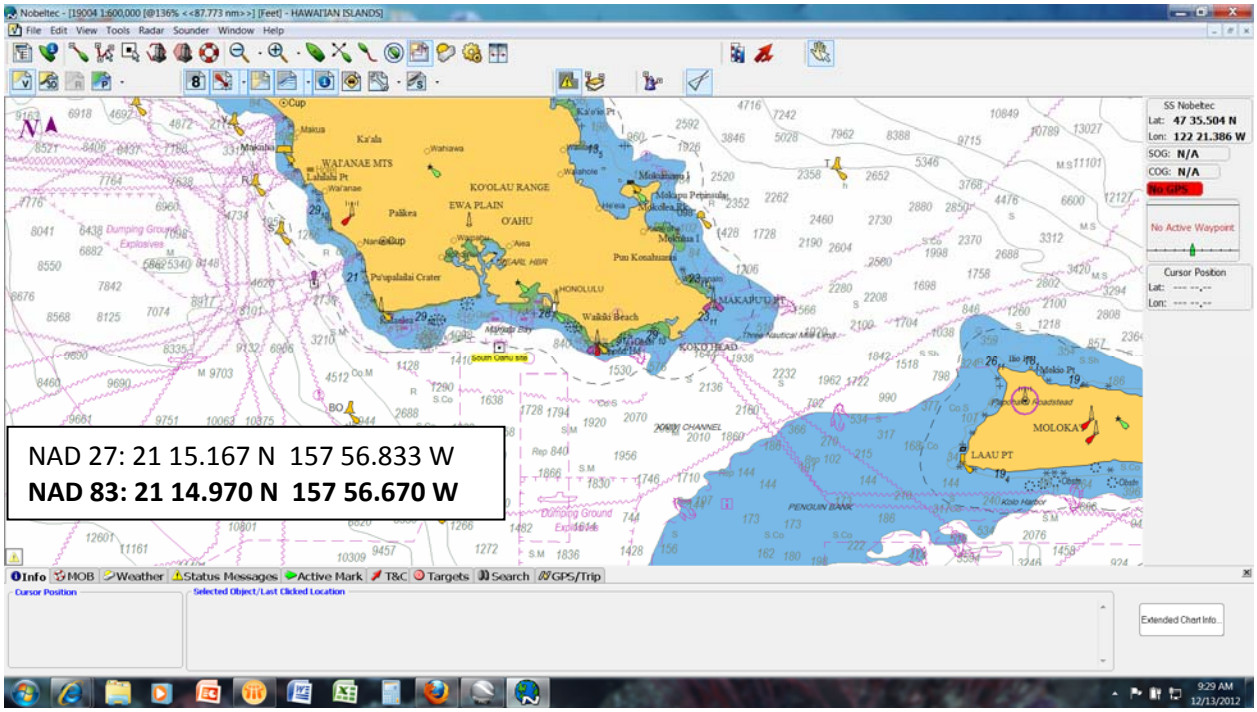
F. Foreign National Guests Access to OMAO Facilities and Platforms

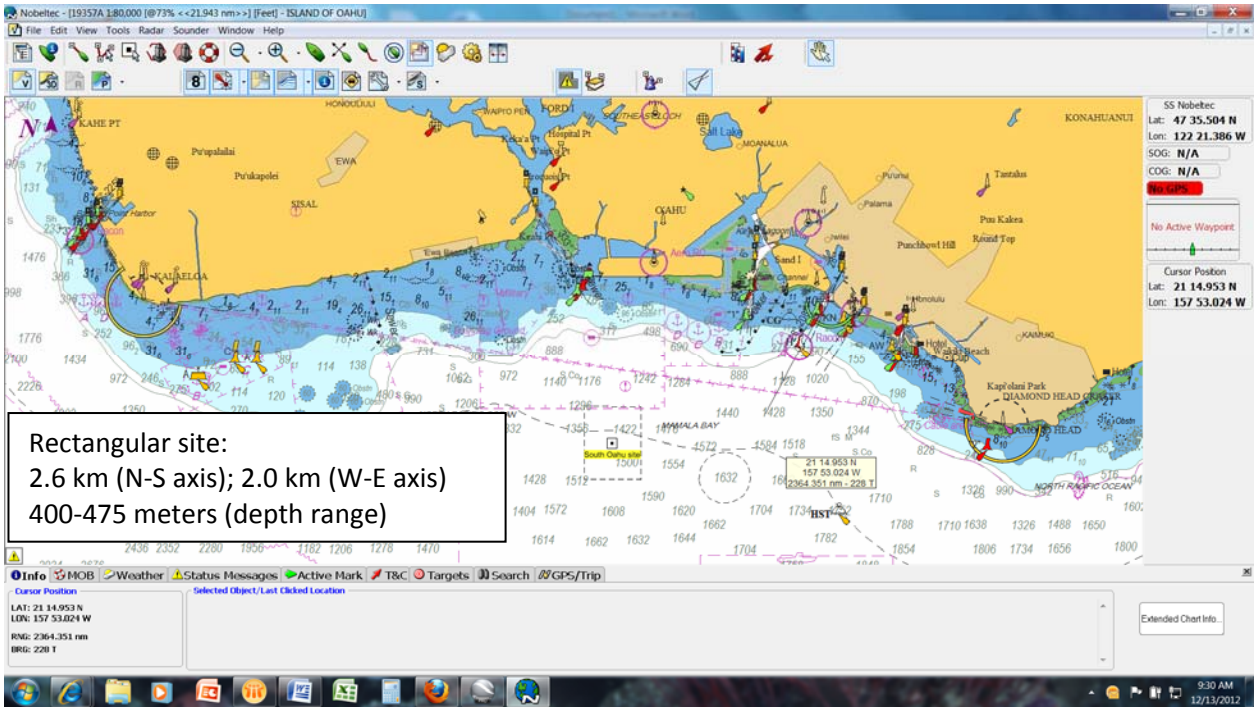
No foreign nationals are scheduled to participate in this project.

Appendices

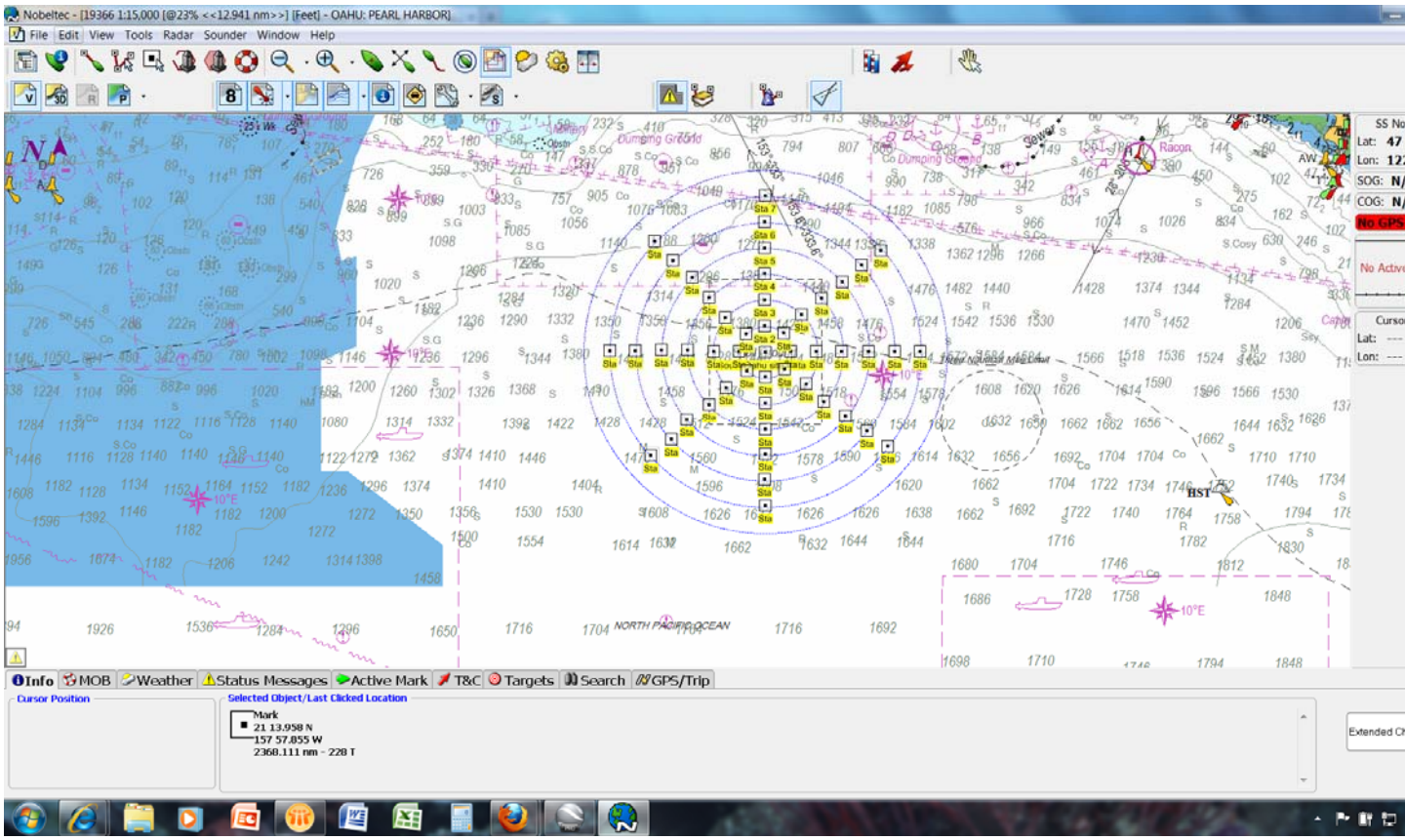
Map figures (6) - Primary areas of operations, including tentative sampling grids and sampling station coordinates

South Oahu ODMDS:





South Oahu ODMDS: tentative sampling locations



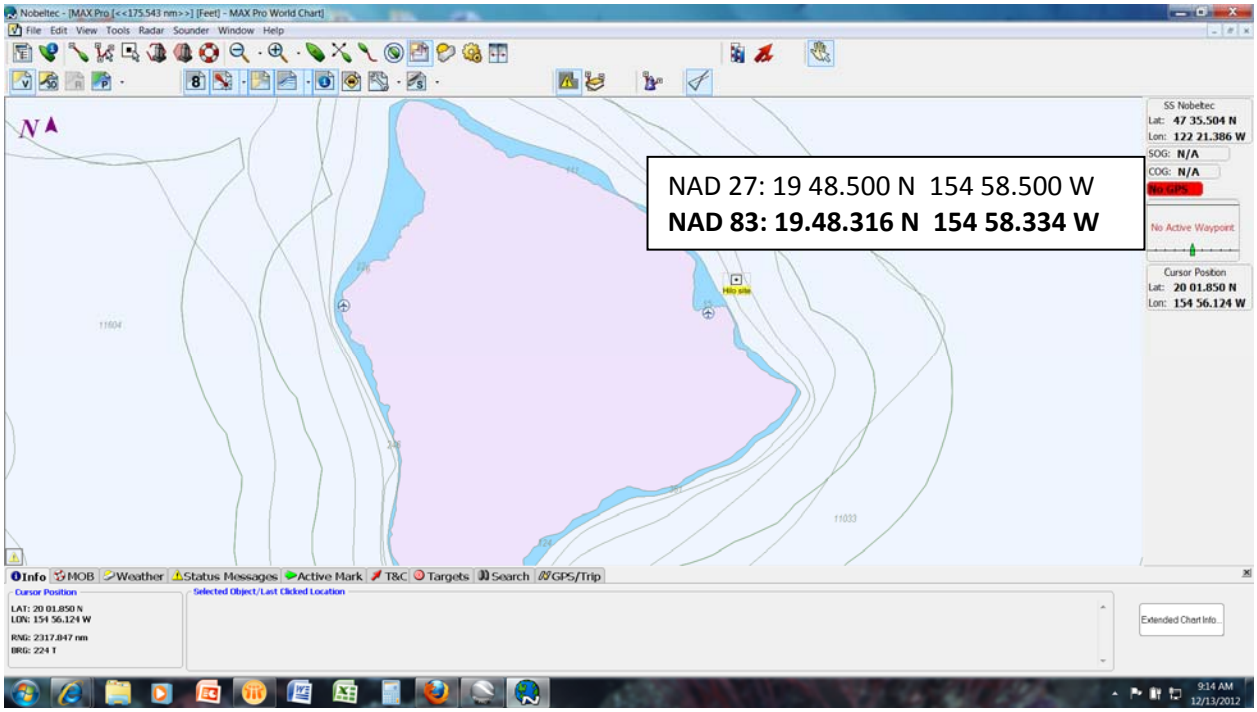
South Oahu ODMDS Sampling Station Locations - [SPI; subset for sediment sampling]

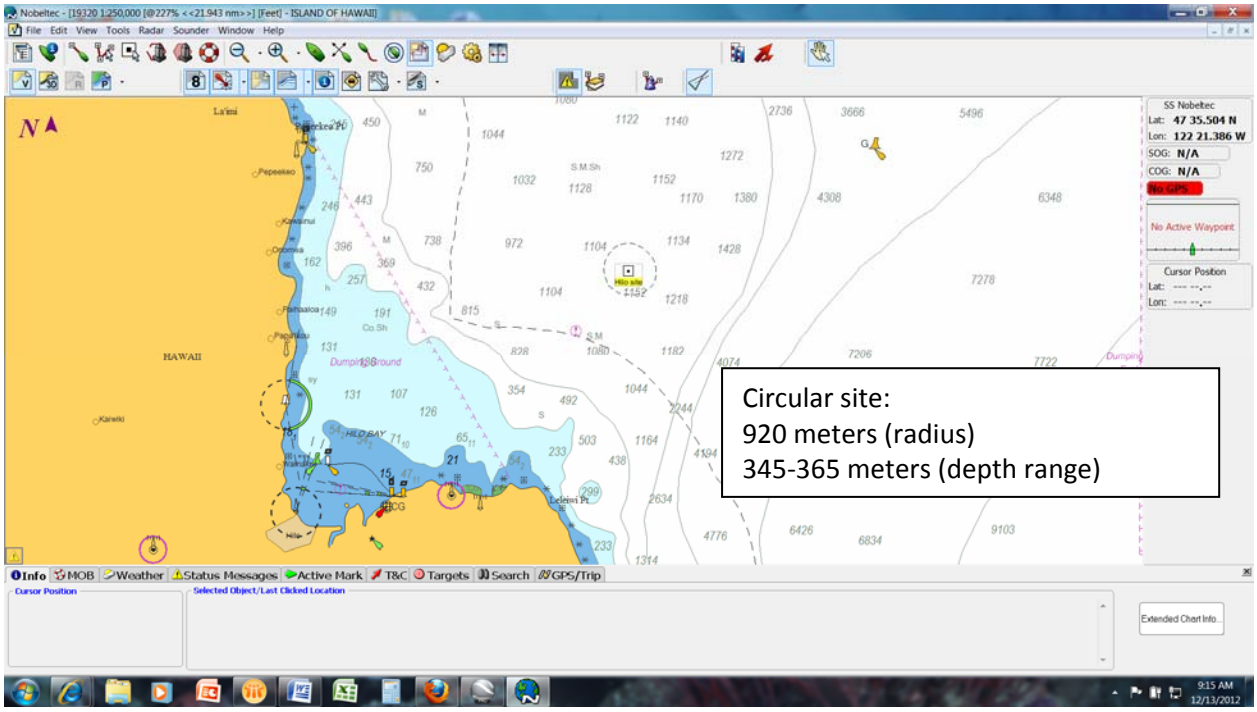
Station ID	Latitude	Longitude	Notes
C	21 14.970 N	157 56.670 W	Primary (center)
N1	21 15.220 N	157 56.670 W	Primary orthogonal
N2	21 15.470 N	157 56.670 W	Primary orthogonal
N3	21 15.720 N	157 56.670 W	Primary orthogonal
N4	21 15.965 N	157 56.670 W	Primary orthogonal
N5	21 16.215 N	157 56.670 W	Primary orthogonal
N6	21 16.470 N	157 56.670 W	Primary orthogonal
S1	21 14.720 N	157 56.670 W	Primary orthogonal
S2	21 14.465 N	157 56.670 W	Primary orthogonal

S3	21 14.220 N	157 56.670 W	Primary orthogonal
S4	21 13.965 N	157 56.670 W	Primary orthogonal
S5	21 13.720 N	157 56.670 W	Primary orthogonal
S6	21 13.465 N	157 56.670 W	Primary orthogonal
W1	21 14.970 N	157 56.940 W	Primary orthogonal
W2	21 14.970 N	157 57.210 W	Primary orthogonal
W3	21 14.970 N	157 57.475 W	Primary orthogonal
W4	21 14.970 N	157 57.740 W	Primary orthogonal
W5	21 14.970 N	157 58.000 W	Primary orthogonal
W6	21 14.970 N	157 58.275 W	Primary orthogonal
E1	21 14.970 N	157 56.400 W	Primary orthogonal
E2	21 14.970 N	157 56.135 W	Primary orthogonal
E3	21 14.970 N	157 55.870 W	Primary orthogonal
E4	21 14.970 N	157 55.600 W	Primary orthogonal
E5	21 14.970 N	157 55.340 W	Primary orthogonal
E6	21 14.970 N	157 55.070 W	Primary orthogonal
NW1	21 15.140 N	157 56.865 W	Secondary orthogonal
NW2	21 15.300 N	157 57.070 W	Secondary orthogonal
NW3	21 15.470 N	157 57.270 W	Secondary orthogonal
NW4	21 15.650 N	157 57.450 W	Secondary orthogonal
NW5	21 15.825 N	157 57.635 W	Secondary orthogonal
NW6	21 16.010 N	157 57.820 W	Secondary orthogonal
NE1	21 15.140 N	157 56.480 W	Secondary orthogonal
NE2	21 15.300 N	157 56.280 W	Secondary orthogonal

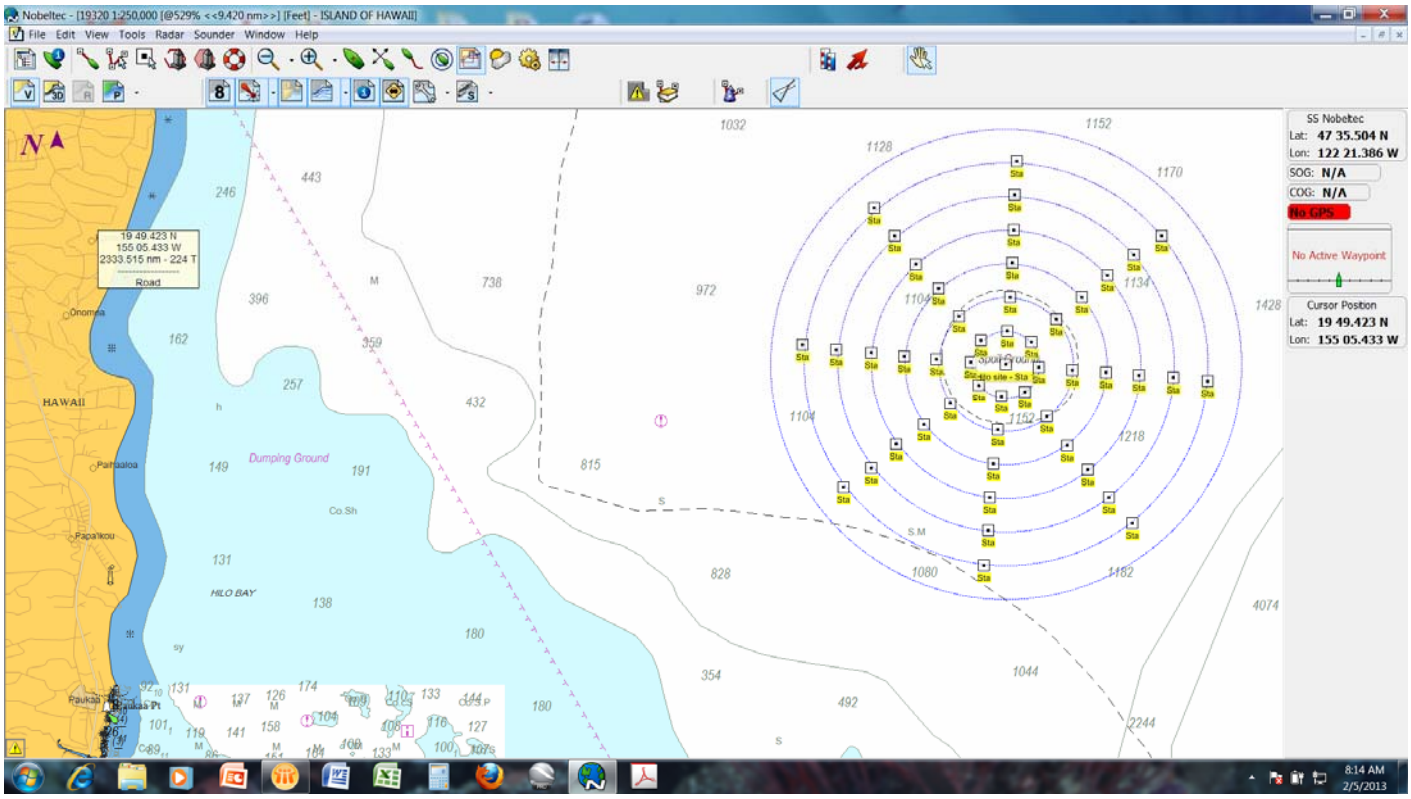
NE3	21 15.470 N	157 56.090 W	Secondary orthogonal
NE4	21 15.650 N	157 55.900 W	Secondary orthogonal
NE5	21 15.825 N	157 55.710 W	Secondary orthogonal
NE6	21 16.010 N	157 55.530 W	Secondary orthogonal
SW1	21 14.790 N	157 56.865 W	Secondary orthogonal
SW2	21 14.620 N	157 57.050 W	Secondary orthogonal
SW3	21 14.435 N	157 57.225 W	Secondary orthogonal
SW4	21 14.245 N	157 57.400 W	Secondary orthogonal
SW5	21 14.070 N	157 57.590 W	Secondary orthogonal
SW6	21 13.900 N	157 57.785 W	Secondary orthogonal
SE1	21 14.790 N	157 56.480 W	Secondary orthogonal
SE2	21 14.620 N	157 56.280 W	Secondary orthogonal
SE3	21 14.435 N	157 56.090 W	Secondary orthogonal
SE4	21 14.245 N	157 55.910 W	Secondary orthogonal
SE5	21 14.070 N	157 55.720 W	Secondary orthogonal
SE6	21 13.900 N	157 55.530 W	Secondary orthogonal

Hilo ODMDS:


NAD 27: 19 48.500 N 154 58.500 W
NAD 83: 19.48.316 N 154 58.334 W
SS Nobeltec
Lat: 47 35.504 N
Lon: 122 21.386 W
Cursor Position
Lat: 20 01.850 N
Lon: 154 56.124 W


Circular site:
920 meters (radius)
345-365 meters (depth range)
HAWAII
SS Nobeltec
Lat: 47 35.504 N
Lon: 122 21.386 W

Hilo ODMDS – tentative sampling stations (locations):



Hilo ODMDS Sampling Station Locations - [SPI; subset for sediment sampling]

Station ID	Latitude	Longitude	Notes
C	19 48.315 N	154 58.340 W	Primary (center)
N1	19 48.565 N	154 58.320 W	Secondary orthogonal
N2	19 48.815 N	154 58.295 W	Secondary orthogonal
N3	19 49.065 N	154 58.285 W	Secondary orthogonal
N4	19 49.315 N	154 58.270 W	Secondary orthogonal
N5	19 49.570 N	154 58.260 W	Secondary orthogonal
N6	19 49.820 N	154 58.245 W	Secondary orthogonal
S1	19 48.075 N	154 58.365 W	Secondary orthogonal
S2	19 47.825 N	154 58.395 W	Secondary orthogonal
S3	19 47.570 N	154 58.425 W	Secondary orthogonal

S4	19 47.325 N	154 58.450 W	Secondary orthogonal
S5	19 47.075 N	154 58.475 W	Secondary orthogonal
S6	19 46.820 N	154 58.500 W	Secondary orthogonal
W1	19 48.335 N	154 58.600 W	Secondary orthogonal
W2	19 48.355 N	154 58.870 W	Secondary orthogonal
W3	19 48.375 N	154 59.125 W	Secondary orthogonal
W4	19 48.400 N	154 59.385 W	Secondary orthogonal
W5	19 48.430 N	154 59.655 W	Secondary orthogonal
W6	19 48.460 N	154 59.920 W	Secondary orthogonal
E1	19 48.290 N	154 58.075 W	Secondary orthogonal
E2	19 48.270 N	154 57.810 W	Secondary orthogonal
E3	19 48.250 N	154 57.545 W	Secondary orthogonal
E4	19 48.230 N	154 57.285 W	Secondary orthogonal
E5	19 48.210 N	154 57.020 W	Secondary orthogonal
E6	19 48.190 N	154 56.755 W	Secondary orthogonal
NW1	19 48.490 N	154 58.530 W	Primary orthogonal
NW2	19 48.675 N	154 58.700 W	Primary orthogonal
NW3	19 48.880 N	154 58.860 W	Primary orthogonal
NW4	19 49.060 N	154 59.040 W	Primary orthogonal
NW5	19 49.265 N	154 59.200 W	Primary orthogonal
NW6	19 49.470 N	154 59.365 W	Primary orthogonal
NE1	19 48.480 N	154 58.130 W	Primary orthogonal
NE2	19 48.650 N	154 57.935 W	Primary orthogonal
NE3	19 48.815 N	154 57.735 W	Primary orthogonal

NE4	19 48.975 N	154 57.535 W	Primary orthogonal
NE5	19 49.130 N	154 57.330 W	Primary orthogonal
NE6	19 49.275 N	154 57.110 W	Primary orthogonal
SW1	19 48.155 N	154 58.540 W	Primary orthogonal
SW2	19 48.015 N	154 58.760 W	Primary orthogonal
SW3	19 47.865 N	154 58.970 W	Primary orthogonal
SW4	19 47.720 N	154 59.185 W	Primary orthogonal
SW5	19 47.565 N	154 59.385 W	Primary orthogonal
SW6	19 47.415 N	154 59.600 W	Primary orthogonal
SE1	19 48.110 N	154 58.180 W	Primary orthogonal
SE2	19 47.925 N	154 58.010 W	Primary orthogonal
SE3	19 47.715 N	154 57.850 W	Primary orthogonal
SE4	19 47.530 N	154 57.690 W	Primary orthogonal
SE5	19 47.325 N	154 57.520 W	Primary orthogonal
SE6	19 47.135 N	154 57.340 W	Primary orthogonal