

BEACH SAMPLING PROTOCOL
(CWBMON009)

State of Hawaii
Department of Health
Environmental Management Division
Clean Water Branch
Monitoring and Analysis Section

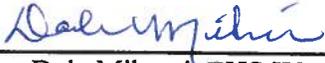
Revision 0

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ATTACHMENTS

- A. Beach Monitoring Checklist
- B. Chain of Custody/Data Sheet Instructions
- C. Non-Potable Water Microbiology Chain of Custody (Data Sheet)
- D. Certificate of Training form

BEACH SAMPLING PROTOCOL

1. SCOPE AND APPLICATION

- 1.1 This standard operating procedure (SOP) describes the methods used by the Clean Water Branch (CWB) Monitoring and Analysis Section for beach monitoring. It describes the preparation, collection, and handling of water samples for *Enterococcus* and *Clostridium perfringens* analyses, and references procedures for associated water quality monitoring. The purpose of this sampling is to determine the public health conditions of the beach bathing water at the time of sampling.
- 1.2 This procedure may also be used on a case-by-case basis for other special samples as determined by the Monitoring and Analysis Section Supervisor. Minor deviations from this procedure are acceptable with the approval of the Monitoring and Analysis Section Supervisor or senior Environmental Health Specialists (EHSs). All deviations identified prior to sampling will be documented in the Quality Assurance Project Plan (QAPP). Any deviations occurring during sampling will be documented on the field data sheets.

2. SUMMARY OF METHOD

- 2.1 Water samples are collected by wading knee-deep into the water and collecting a water sample from below the water surface by hand. *In situ* measurements are made using the Hydrolab Quanta multi-parameter instrument and the Hach 2100P turbidimeter. *In situ* parameters include temperature (°C), salinity (PPT), dissolved oxygen (DO) (mg/L and % saturation), pH, and turbidity (NTU). Sample collection and *in situ* data are recorded on chain of custody/data sheets.
- 2.2 Following water sample collection, the sample containers are transported, on ice, to the State Laboratory Microbiology Section (or private labs for remote sampling locations) for *Enterococcus* and *Clostridium perfringens* analyses. The chain of custody/data sheets forms are completed and accompany the samples to the laboratory. The microbiology data are used to determine whether a beach is safe ('Compliant') or not safe (on 'Alert') for swimming and other water contact activities.

3. DEFINITIONS

- 3.1 °C (degrees Celsius) – unit of temperature measurement
- 3.2 Clean Water Branch (CWB)
- 3.3 *Clostridium perfringens* – *Clostridium perfringens* is an anaerobic bacterium, found in the intestinal tract of both humans and animals. *C. perfringens* spores are used as a tracer of fecal pollution because its presence is a good indicator of

recent or past fecal contamination in water and spores survive well beyond the typical life-span of other fecal bacteria. There are no EPA health-based ambient water quality criteria for *C. perfringens*.

- 3.4 Dissolved Oxygen (DO)
- 3.5 *Enterococcus* – This aerobic microbe is the U.S. EPA approved indicator used to determine the extent of human-waste contamination of marine water. *Enterococcus* includes *Enterococcus faecalis*, *E. faecium*, *E. avium*, and their variants.
- 3.6 Environmental Health Specialist (EHS) – Clean Water Branch staff responsible for taking *in situ* measurements using the Hydrolab Quanta.
- 3.7 global positioning system (GPS)
- 3.8 milligrams per liter (mg/L) – unit of dissolved oxygen measurement
- 3.9 percent saturation (%) – unit of dissolved oxygen measurement
- 3.10 Material Safety Data Sheets (MSDS) – Written information provided by vendors concerning a chemical's toxicity, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions.
- 3.11 parts per thousand (PPT) – unit of salinity measurement
- 3.12 nephelometric turbidity units (NTU) – unit of turbidity measurement

4. HEALTH AND SAFETY WARNINGS

- 4.1 Beach sampling is normally conducted in populated, easily accessible, and relatively safe areas. Consequently, a single sampler should be able to collect these samples by him/herself. It is left to the judgment of the sampler to determine at the time of sampling whether hazardous conditions exist and the severity of those dangers. No sample should be taken if the sampler believes they may be injured or killed by attempting to take the sample. It is preferable that the sampler will have received first aid training. A safety kit should be taken on the sampling run.
- 4.2 Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets (MSDS) and become familiar with all safety procedures before handling any chemicals. The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. A reference file of Material Safety Data Sheets (MSDS) should be made available to all personnel involved in the chemical analysis.

- 4.3 Although marine waters being sampled are generally safe for handling, personal protective equipment such as gloves, boots, waders, etc. are available for use by monitoring personnel, should the need arise. It is the responsibility of the individual sampler to assess the hazardousness of taking each sample, and using the appropriate protective equipment as needed. After sampling is complete, the sampler should wash her/his hands, or other skin exposed to the marine water, with soap and water or antiseptic hand cleaner.

5. CAUTIONS

- 5.1 Degradation of the water samples may be caused by improper sampling shipping techniques (>4 °C) or exceeding the maximum holding time (6 hours).

6. INTERFERENCES

- 6.1 Microbial contamination introduced via improper handling of the sampling containers could bias the microbiology sample results. Pre-sterilized 500 ml Nalgene sampling bottles should be used for sample collection, and the EHS should be careful not to contaminate them by touching the inside of the bottle, the cap, or the neck of the bottle prior to sample collection. Sample bottles should be capped immediately after sample collection.
- 6.2 Proper sample collection technique is also important in minimizing interferences. The EHS should be careful not to stand up-current from the sample bottle while sampling. Samples should not be collected from highly turbid water, which may result from rough waters or sediment disturbed by the EHS. These problems can be minimized by wading carefully to the sampling location and waiting for sediment to settle. When collecting the sample directly from the ocean is not practicable (*e.g.*, the water is too rough), a stainless steel bucket (previously rinsed with sample water) may be filled with sample water, the sediment allowed to settle, and the water sample collected from the bucket.

7. PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

- 7.1 Samplers are EHSs from the CWB Monitoring and Analysis Section, and personnel that they directly supervise. (See EHS Classification Specifications for EHS qualifications.) All personnel who perform activities with this SOP must have the proper training. At a minimum, this training should involve reading this SOP in its entirety. Next, the staff member being trained should observe sample collection by an experienced staff member. Then the trainee should demonstrate proper sample collection techniques while being observed. Prior to a staff member's independent performance of a procedure, a quantitative 'test' should be conducted to ensure that the trainee results are comparable to those of an experienced staff member. Documentation of this training should be provided to the CWB QAC. The CWB must ensure, through assessment, that similar training requirements are implemented by any organization that supplies water quality

data for use in CWB projects.

8. EQUIPMENT AND SUPPLIES

- 8.1 Non-Potable Water Microbiology Chain of Custody (Data Sheet) (Attachment C)
- 8.2 Beach Monitoring Checklist (Attachment A)
- 8.3 GPS unit (SOP CWBMON005) – for new sampling locations only
- 8.4 Digital camera (SOP CWBMON006) – for new sampling locations only

9. PROCEDURE

9.1 Preparation

- 9.1.1 Most of the significant beach sites have been identified and monitored in the past. New sites are established periodically based on new developments, public input and/or problems. For new sites:
 - a. In general, areas that require access through private property are not sampled. Sampling sites should be easily accessible to the general public.
 - b. New sites will be documented with GPS readings (CWBMON005), maps of the exact location, and pictures (CWBMON006). Sites should be assigned a Storet number.
- 9.1.2 Gather equipment and supplies needed and review Beach Monitoring Checklist.
- 9.1.3 Check the Hydrolab Quanta and Hach 2100P meters at the start of each day prior to use in the field as described in the SOPs for the Hydrolab Quanta (CWBMON003) and Hach (CWBMON011) instruments.
- 9.1.4 Notify the State Laboratory Division (SLD) Microbiology Section in advance of any changes to the sampling schedule or to the number of samples that will be brought in for analysis.
- 9.1.5 Print labels for sample bottles
 - 9.1.5.1 Sample labels are pre-printed with the following information: station number, sample location, sample ID (which consists of a 10 digit alpha numeric character string denoting the sampler's initials, sample collection date (MMDDYY) and a two digit sample serial number denoting the order of sample collection). This information

is also stored in a bar code printed on the label. A second label specifying the requested analyte is also pre-printed.



Figure 1. Example CWB Sample Identification Label

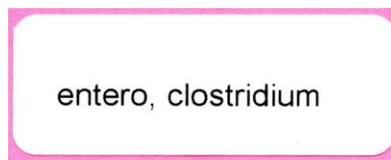


Figure 2. Example CWB Analyte label

9.2 Sample Collection

9.2.1 Attach the appropriate pre-printed labels to the sample bottle.

a. For each field sample, minimum sample labeling requirements include the the station name or ID, and the unique sample ID number (No.). The unique sample ID number contains the sampler's initials, the collection date and the sample number in the collection series:

DM02191101

DM = Dale Mikami

021911 = February 19, 2011

01 = First sample collected for the day

b. Sample labeling is discussed further in the CWB QAPrgP.

c. Temperature control blanks are not assigned a unique field sample identification number, but should be labeled as TCB (temperature control beginning) or TCE (temperature control end).

9.2.2 Fill in the Data Sheet with the Sample Number, Station Number, Location, Sampler's Initials, Collection Date and Time. This information should correspond to the printed sample labels.

9.2.3 Wade knee-deep into the water. Uncap container and submerge the bottle neck-first into the water. The container should be submerged to 0.3m (about elbow depth). Avoid touching rocks or other solid objects with the sample container. Face the opening of the container toward the prevailing

current and allow it to fill with water. If there is no current, create a current artificially by pushing the bottle forward horizontally in the direction away from the hand. Remove the container from the water column. Pour off some of the sample to allow for ample air space in the container (at least ½ inch) to facilitate mixing by shaking. Replace the cap immediately (from Bordner, et al., 1978).

a. Collect lab samples directly from the ocean if possible. Make sure not to sample water that has been disturbed or contaminated, especially by the EHS or sampling equipment. If the water is turbid or very rough, collect the sample using a stainless steel bucket and pour into the collection bottles. If a collecting container is used, rinse the container with sample water before use.

b. The required sample volume is marked on the 500 mL sample bottle

c. At the first site of the day, collect site water as a temperature control blank in the 500 mL Nalgene bottle labeled TCB (temperature control beginning). At the last site of the day, collect a second control blank, in the 500 mL Nalgene bottle labeled TCE (temperature control end). The container for the temperature control sample should be identical to the actual sample collection container if possible.

9.2.4 Monitor the water with the Hydrolab Quanta (CWBMON003) and take a sample for the Hach 2100P Portable Turbidimeter (CWBMON011). These specific procedures are defined in the respective instrument SOPs.

9.2.5 Record the instrument readings directly onto the Chain-of-Custody Worksheet (Data Sheet) (Attachment C).

9.2.6 At the end of each sampling day, perform the post-use checks for the Hydrolab Quanta (CWBMON003) and for the Hach 2100P (CWBMON011) according to the specific instrument SOPs.

9.3 Sample Handling and Preservation

9.3.1 Immediately after collecting the samples, place the bottles in a cooler with Wet or Blue ice. Ideally samples should be cooled to approximately 4 °C but should not be frozen. Take care that sample bottles are not totally immersed in water during transit or storage.

9.3.2 Upon completion of the sampling, deliver the samples and completed Data Sheet to the State Microbiology Lab (Table 8 of the CWB QAPrgP) within the holding time of 6 hours.

9.3.3 In the field, samples are in the custody of the person collecting the samples and completing the Data Sheet.

- 9.3.4 Prior to leaving the field, the EHSs will inventory the coolers and compare the bottle IDs to those recorded on the Chain-of-Custody Worksheet.
- 9.3.5 Once the inventory is complete, the EHS will sign the Data Sheet and record the date and time when the samples were delivered.
- 9.3.6 The laboratory staff who receives the samples also signs and dates the Data Sheet upon transfer and inventory of the samples. A copy of the Data sheet will be made for the laboratory. The sampler will bring the original back to the CWB office.
- 9.3.7 As part of sample receipt procedures, the laboratory staff who receives the samples measures the water temperature of the TCB and TCE and records them on the field data sheet/chain of custody form.

9.4 Sample Analysis

- 9.4.1 All water samples collected by the CWB Monitoring and Enforcement Sections are sent to the HDOH SLD Environmental Health Analytical Services Branch (EHASB), with the exception of *Enterococcus* samples taken in the Kona region of Hawaii, which are currently sent to a private laboratory. The microbiology sample analysis techniques of the Environmental Microbiology Section are described in their Quality Assurance Plan (QAP) (HDOH, 2006).

9.5 Troubleshooting

- 9.5.1 Troubleshooting of the Hydrolab Quanta (CWBMON003) and Hach 2100P (CWBMON011) instruments are described in their respective SOPs.

9.6 Data Acquisition, Calculations, and Data Reduction

- 9.6.1 All water samples and *in situ* data collection information are recorded by hand on the chain of custody/data sheets. Calculations associated with the pre- and post-use checks performed for the Hydrolab Quanta (CWBMON003) and Hach 2100P (CWBMON011) are presented in the specific instrument SOPs. There are no calculations or data reduction techniques associated with the collection of the water samples.

10. MAINTENANCE

- 10.1 Maintenance of the Hydrolab Quanta (CWBMON003) and Hach 2100P (CWBMON011) instruments are described in their respective SOPs.

11. DATA AND RECORDS MANAGEMENT

- 11.1 Non-Potable Water Microbiology Chain of Custody (Data Sheet) – All sample

collection information, *in situ* data, and field check information are recorded on the chain of custody/data sheets. These forms accompany the microbiology samples to the laboratory, where the laboratory staff receiving the samples signs and dates the forms. A copy of the Data sheet will be made for the laboratory. The sampler will bring the original back to the CWB office.

11.2 CWB personnel shall enter their field data into the CWB Access database.

12. QUALITY CONTROL AND QUALITY ASSURANCE

- 12.1 Temperature Control Beginning and End Blanks (TCB and TCE) – Temperature control blank samples should be included in all shipments from the field to the analytical laboratories, and should be clearly labeled so that laboratory sample custodians will recognize them. The temperature of the TCB and TCE samples are measured at the laboratory after the samples are delivered. These samples are used to confirm that the water samples bracketed by the temperature blanks were transported while stored at approximately 4 °C. The TCB and TCE readings are recorded on the field data sheet/chain of custody form.
- 12.2 Field (Secondary) Checks – Pre-use and post-use Field Checks are performed before and after each run, respectively, for the Hydrolab Quanta (CWBMON003) and Hach 2100P (CWBMON011), as described in the specific instrument SOPs.
- 12.3 Field concurrent replicate samples (two samples collected from the same sample site at approximately the same time) – one split field replicate sample is collected for every 10-20 samples. Each field replicate will be treated as a separate sample. Replicate data will be used to quantify the uncertainty and variability in indicator organism density. Split field concurrent replicate samples will be given unique sample identification numbers.

13. REFERENCES

Bordner, R., J.A. Winter and P.V. Scarpino (eds.), Microbiological Methods for Monitoring the Environment, Water and Wastes, EPA-600/8-78-017. Office of Research and Development, USEPA.

Hach 2100P Turbidimeter Protocol (CWBMON011) Rev 1. 2007. State of Hawaii Department of Health Environmental Management Division Clean Water Branch Monitoring and Analysis Section. August 15, 2011.

Hydrolab Quanta Protocol (CWBMON003) Rev 1. 2007. State of Hawaii Department of Health Environmental Management Division Clean Water Branch Monitoring and Analysis Section. August 15, 2011.

HIDOH. 2006. Quality Assurance Plan for Water Microbiology. HIDOH, EHASB, Environmental Microbiology Section.

Photo Documentation of Sites Using a Digital Camera (CWBMON006) Rev 1. 2011. State of Hawaii Department of Health Environmental Management Division Clean Water Branch Monitoring and Analysis Section. May 31, 2011.

Garmin eTrex Vista GPS (CWBMON005) Rev 1. 2011. State of Hawaii Department of Health Environmental Management Division Clean Water Branch Monitoring and Analysis Section. May 31, 2011.

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**ATTACHMENT A TO
CWBMON009**

BEACH MONITORING CHECKLIST

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Beach Monitoring Check List

Equipment	Item	T
Hydrolab Quanta	Pre-Field Check completed	
	Check batter voltage (> approx 3.5v)	
Hach Turbidity Meter	Check battery voltage (>4.4 volts)	
	4 Spare AA Batteries	
	Pre- Field Check completed	
Sampling Containers	1 500 mL Nalgene bottle (sterile) per site	
	2 Temperature blank bottles, caps labeled (TCB, TCE)	
Sampling Supplies	Cooler w/ice and or Blue Ice	
	Chain of Custody Form	
	Pen and 1 extra	
Safety Equipment	First Aid Kit	
	Rubber Boots, Felt Soled Boots, Waders, Gloves	
	Fresh Water for washing, drinking water	
	Hand Soap and/or Waterless Antibacterial Hand Sanitizer	
	Paper Towels	
	Mosquito Repellant, sunscreen	
	Rain Gear	
	Leatherman Tool	
Contact	Check-out & Check- in with CWB Office	
	Contact State (and/or Kona) Laboratory (see Table 8 of the CWB QAPrgP for contact information)	

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**ATTACHMENT B TO
CWBMON009**

DATA SHEET INSTRUCTIONS

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Data Sheet Instructions:

Sampler:	Record sampler's initials.*
Date:	Record date samples are collected.*
Instrument/Probe No.:	Record the Instrument(s) used and their serial number(s)*
DO, pH, Salinity, Turbidity, and Temp:	Record date/time for calibration, secondary and post checks. Record secondary and post check values, as applicable.
Lab No.:	Leave blank.
Sample No.:	Record sample number using sampler's initials, date and consecutive numbers* (e.g. WO01020501) for routine samples and if replicate samples are collected.
Storet No.:	Record the assigned Storet number for the site.* For sites with no Storet number, leave this blank. (For special samples, record Special.)
Location:	Record the sampling location.
Time:	Record the time the sample was taken.
Temp:	Record the temperature of the water at the site (°C).
Salinity:	Record the Salinity of the water at the site (PPT).
DO:	Record the DO reading (mg/L).
DO%:	Record the DO% reading.
pH:	Record the pH reading.
Turbidity:	Record the Turbidity reading (NTU).
Comments:	Record water, atmospheric and general conditions at the sampling site. Identify items that may affect the bacteria counts.

* These items are automatically generated on the Chain of Custody Form

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**ATTACHMENT C TO
CWBMON009**

NON-POTABLE WATER MICROBIOLOGY CHAIN OF CUSTODY (DATA SHEET)

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State of Hawaii - Department of Health - Clean Water Branch - Non-Potable Water Microbiology Chain of Custody

Analysis of samples for *Enterococcus* and *C. perfringens*

Sampler:	Date:	Instrument/Probe No.:
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QA/QC Check	Cal Date	Cal Time	Sec Chk Date	Sec Chk Time	Sec Chk Val	Sec Chk Range	Zero or Neu Chk Val	Post Chk Date	Post Chk Time	Post Chk Val	Post Zero or Neu Chk Val
Salinity											
DO											
pH											
Turbidity 1											
Turbidity 2											
Turbidity 3											
Temp											

Lab No.	Sample No.	Storet No.	Location	Time	Temp °C	Sal PPT	DO mg/L	DO %	pH	Turb NTU	Comments

Relinquished by:	Date / Time:		
Received by:	Date / Time:	TC Beg (°C):	End (°C):
Comments:			

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**ATTACHMENT D TO
CWBMON009**

**Certificate of Training Form
Hawaii Department of Health
Clean Water Branch**

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CERTIFICATE OF TRAINING

SOP No.: CWBMON009
SOP Title: Beach Sampling Protocol
Trainee: _____
Instructor: _____
Date SOP Read: _____
Date(s) Field
Training
Completed: _____