MARINE WATER QUALITY ASSESSMENT METHODOLOGY
FOR THE
2016 INTEGRATED REPORT

Hawaii State Department of Health
Clean Water Branch

Honolulu, Hawaii
July 23, 2015

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LIST OF ABBREVIATIONS

§	Section
CFU	Colony Forming Units
CWA	Clean Water Act
CWB	Clean Water Branch
CWRM	Commission on Water Resources Management
DOH	Department of Health
DU	Decision Unit
EPA	Environmental Protection Agency
GM	Geometric Mean
HAR	Hawaii Administrative Rules
HRS	Hawaii Revised Statutes
HUC-12	12-unit Hydrologic Unit Codes
IR	Integrated Report
NPDES	National Pollutant Discharge Elimination System
PRC	Polluted Runoff Control
SAM	Standardized Assessment Methodology
SMA	Special Management Area
STV	Statistical Threshold Value
TBD	To Be Determined
WQ	Water Quality
WQC	Water Quality Certification
WQS	Water Quality Standards

BACKGROUND

The Hawaii State Department of Health (DOH), Clean Water Branch (CWB) supports its mission "to protect the public health of residents and tourists who recreate in and on Hawaii's coastal and inland water resources, and to protect and restore inland and coastal waters for marine life and wildlife" by implementing statewide coastal water surveillance and watershed based environmental management activities. To accomplish its mission, the DOH established narrative (basic) and numeric (specific) water quality criteria for application by DOH-CWB programs, including National Pollutant Discharge Elimination System (NPDES) permits, State Water Quality Certifications (WQCs), Water Quality Monitoring and Analysis, Polluted Runoff Control and Administrative and Civil Enforcement actions. Collectively, these interrelated DOH-CWB programs support the Clean Water Act (CWA) goal of ensuring that all navigable State waters are fishable and swimmable.

The DOH-CWB is required by the CWA Sections (§) 303(d) and 305(b) to report on the State's water quality on a two year cycle known as the Integrated Report (IR). The IR describes the overall status of water quality statewide and lists waters that do not attain or maintain applicable water quality numeric criteria. In addition to satisfying CWA requirements, the goal of the IR is to inform the public on the status of marine and inland freshwater bodies, and to serve as a planning document to guide other CWA programs.

Objective

An overall standardized assessment methodology (SAM) is being developed to establish consistency and transparency with respect to how water quality data is assessed for regulatory decision making purposes by the DOH-CWB programs. The SAM will be utilized to report on the status of overall statewide water quality (CWA §305(b)), impairment listing and delisting decisions (CWA §303(d)) reported in the 2016 IR, and guide water quality restoration activities for point and non-point sources in State receiving water bodies (State waters as defined in Hawaii Administrative Rules (HAR) §11-54-1). The DOH-CWB is developing implementation documents for their respective programs based on the branch SAM.

The Water Quality Monitoring and Analysis Section has developed an IR implementation document that first describes the challenges associated with changing scopes of assessment in previous Integrated Reports (IR) and the assessment methodology used in the 2014 IR to assess for conventional pollutants (e.g. biogeochemical and bacterial parameters identified in HAR §11-54-6 and §11-54-8) (Hawaii Department of Health 2014). Secondly, it describes the change from variable scopes of assessment to clearly defined decision units (DUs) and the application of the SAM for State marine waters (as classified in HAR §11-54-2) for IR implementation.

Development of an assessment methodology for inland waters will be completed at a later date.

2014 INTEGRATED REPORT METHODOLOGY

Scopes of Assessment

The scopes of assessment for marine waters identified in the 2014 IR are based on the classification of State marine waters and the premise that water quality in nearshore recreational waters is likely to be of different quality than waters located offshore. For the purposes of the IR, nearshore recreational waters are defined as coastal waters within 300 m of shoreline and offshore waters beyond 300 m (HAR §11-54, May 2009).

The current scopes of assessment consist of large stretches of coastline, smaller beach segments, individual sampling stations or multiple sampling stations. Previous IRs created new geocodes for separate stations located in close proximity to already existing stations rather than updating the established stations with newly collected data (Table 1). This has resulted in multiple §303(d) listings for the same station. For example, the 2014 IR shows two stations, Hanakaoo Beach Co. Park (listed in 2002 IR) and Hanakaoo Station (listed in 2004 IR), as separate impairments. The 2002 impairment was not updated with data collected during the 2004 IR assessment cycle "because the samples were gathered by different personnel, utilizing protocols and analytical equipment that was deemed different enough to warrant being treated as separate events" (Hawaii Department of Health 2004). Two other examples include West Maui stations Mala Wharf (listed prior to 2002 IR) and West Maui Coast-Mala Wharf (listed in 2004 IR), and West Maui Coast-Napili Bay (listed in 2004 IR) and Napili Bay (listed in 2012 IR) (Figure 1).

Table 1. Multiple §303(d) listings for separate stations in close proximity to DOH-CWB stations on West Maui. *Denotes DOH-CWB stations.

Maui		
Water Body Type	**Scope of Assessment**	**Geocode ID**
Coastal	Hanakaoo Beach Co. Park*	HI797917
Coastal	Hanakaoo Station	HIW00165
Coastal	Mala Wharf*	HIW00171
Coastal	West Maui Coast-Mala Wharf	HIW00123
Coastal	Napili Bay*	HI764060
Coastal	West Maui Coast-Napili Bay	HIW00078

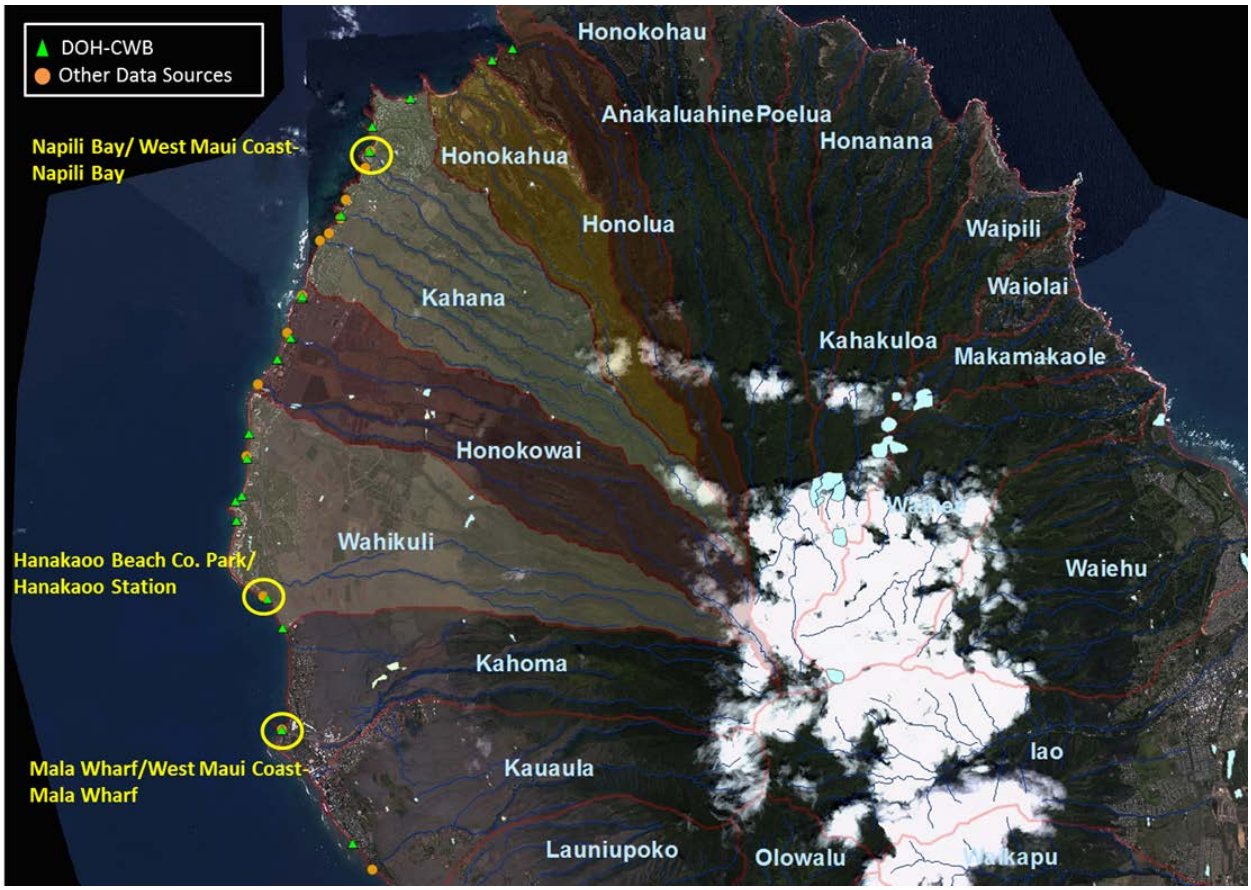

Figure 1. Multiple §303(d) listings for separate stations in close proximity to DOH-CWB stations on West Maui.

Assessment Cycle and Sample Size Requirements

The CWA requires states to provide an assessment every two years on the quality of all their waters (§305(b)) and a list of those waters that are impaired or threatened (§303(d)). The 2014 IR assessment cycle for State water recreational and ecosystem health is based on a two year reporting period. This provides a current characterization of marine water quality while allowing for trend analysis with subsequent IRs over time. Any prior impairment listings not assessed in the 2014 IR (due to unavailable data) were retained with the previous IR assessment status.

The DOH-CWB required a minimum of 10 samples (per scope of assessment) for recreational and ecosystem health assessments for the 2014 IR. Potential sources of data that were used for IR water quality assessments included watershed groups, NPDES and Special Management Area (SMA) permits, §401 WQCs and any other data sources that met the CWB minimum data submittal requirements (http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/public-notices-and-updates/).

Recreational Health WQ Assessment

Attainment of water quality criteria for recreational health in the 2014 IR was based on water quality criteria in HAR §11-54-8 (May 2009). A monthly (25-30 days) geometric mean (GM) for enterococcus was calculated using at least 5 samples and compared to Hawaii's water quality criteria GM for enterococcus (HAR §11-54-8(b)). Less frequently collected data (< 5 samples within 25-30 days) were allowed to exceed 104 CFU/100 mL in 10% of the entire dataset collected over the two year period (Table 2). Data collected at multiple depths (surface, middle, depth) were considered individual samples when calculating a monthly (25-30 days) GM. For the purposes of the IR, data collected in State receiving waters were divided into separate assessment units (nearshore marine recreational, open coastal marine and oceanic) based on water body types described in the WQS and the premise that water quality in nearshore waters is likely to be different than waters located offshore (Figure 2, Table 3).

Table 2. Enterococci WQ criteria attainment/non-attainment based on sample number/frequency.

Sample Number/Frequency	WQ Criteria Attained	WQ Criteria Not Attained (Impaired)
≥ 5 samples within 25-30 days	GM ≤ 35 CFU/100 mL	GM > 35 CFU/100 mL
< 5 samples within 25-30 days	10% or less of entire dataset collected over 2 year period ≤ 104 CFU/100 mL	More than 10% of total samples > 104 CFU/100 mL

Ecosystem Health WQ Assessment

Attainment of water quality goals for ecosystem health in the IR was determined by comparing nutrient concentrations and biogeochemical parameters to the numeric marine water quality criteria specified in HAR §11-54-6. Numeric nutrient criteria vary depending on marine water body type, whereas recreational water quality criteria remain the same for all marine waters. Assessment units for ecosystem health in State receiving waters were the same as recreational health assessment units (Figure 2, Table 3). In contrast to the monthly GM used to assess recreational health, ecosystem health assessment was based on one GM calculated over a two year assessment cycle. For marine waters where transect data were available at multiple depths, data were grouped according to distance from shoreline and combined for assessment decisions.

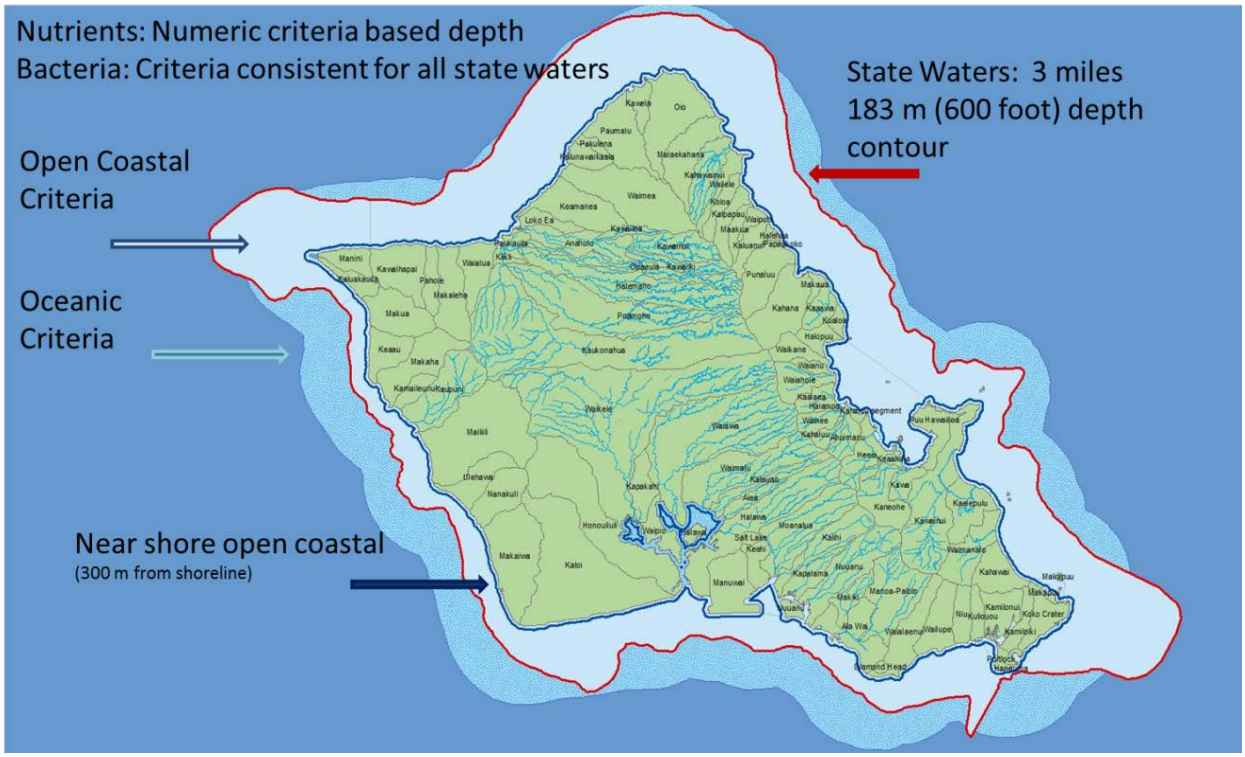

Figure 2. Marine water classification and numeric water quality criteria.

Table 3. State water classification and numeric water quality criteria for marine waters (HAR Chapter 11-54, May 2009).

State Water Classification	Description	Recreational WQ Criteria	Nutrient WQ Criteria
Estuaries	As defined in §11-54-2	HAR §11-54-8	Estuary, HAR §11-54-5.2
Embayments	As defined in §11-54-6	HAR §11-54-8	Embayment, HAR §11-54-6 (a)
Nearshore Marine Recreational Waters	Shoreline to 300 m offshore	HAR §11-54-8	Open Coastal, HAR §11-54-6 (b)
Open Coastal Marine Waters	300 m offshore to 183 m (600 ft) depth contour	HAR §11-54-8	Open Coastal, HAR §11-54-6 (b)
Oceanic Waters	183 m (600 ft) depth contour to 3 miles offshore	HAR §11-54-8	Oceanic, HAR §11-54-6 (c)

STANDARDIZED ASSESSMENT METHODOLOGY

The SAM (in progress) defines marine DUs, minimum sample size and collection frequency required for water quality assessments in State receiving waters for use by multiple DOH-CWB programs. The DOH-CWB has defined specific watershed DUs based on a modified version of the 580 watersheds delineated by the State of Hawaii, Department of Land and Natural Resources, Commission on Water Resources Management (CWRM), henceforth referred to as CWB watershed DUs. Water quality assessments using CWB watershed DUs consider the influence of watershed characteristics (e.g. land use, precipitation, and land-cover) on water quality downstream and in coastal areas. The largest DUs will initially be defined for marine waters at the State watershed scale while allowing for smaller DUs to be established within the larger framework when available data exists or for pollutant source tracking (Table 4). Using standardized DUs provide DOH-CWB programs with fundamental information to the planning, prioritizing, and implementation of regulatory and watershed protection activities.

The SAM requires a minimum sample size for water quality assessments (IR assessments, NPDES permit conditions and Polluted Runoff Control (PRC) implementation projects). Frequency of sample collection varies among the DOH-CWB programs however, sampling events should be representative of seasonal variation throughout the monitoring program where applicable. The watershed DU boundaries in combination with minimum sample size requirements will create a robust, consistent dataset that can utilize multiple sources of data. This will align programmatic goals necessary for statewide surface water quality monitoring while still providing flexibility for individual program needs such as variable assessment cycles (reporting period).

2016 INTEGRATED REPORT METHODOLOGY

The transition from the 2014 IR assessment methodology to the standardized methodology proposed for the 2016 IR a) establishes easily identifiable and uniform DUs (i.e. CWB watersheds) reducing the number of multiple §303(d) listings and b) provides the opportunity to assess newly available data from additional sampling stations without creating a new scope of assessment. Unlike previous IRs where multiple scopes of assessment characterized the same waterbody, the larger watershed DU is intended to provide the overall water quality status and any impairments to the waterbody per CWA requirements. These DUs also provide a geographical reference for existing IR scopes of assessment by identifying the associated CWB watershed (Figures 3 and 4). To maintain the integrity of previous IR assessments the scopes of assessment will become nested within the larger watershed DU (Table 4). The purpose of the nested assessments will provide “hot spots” for pollutant source tracking.

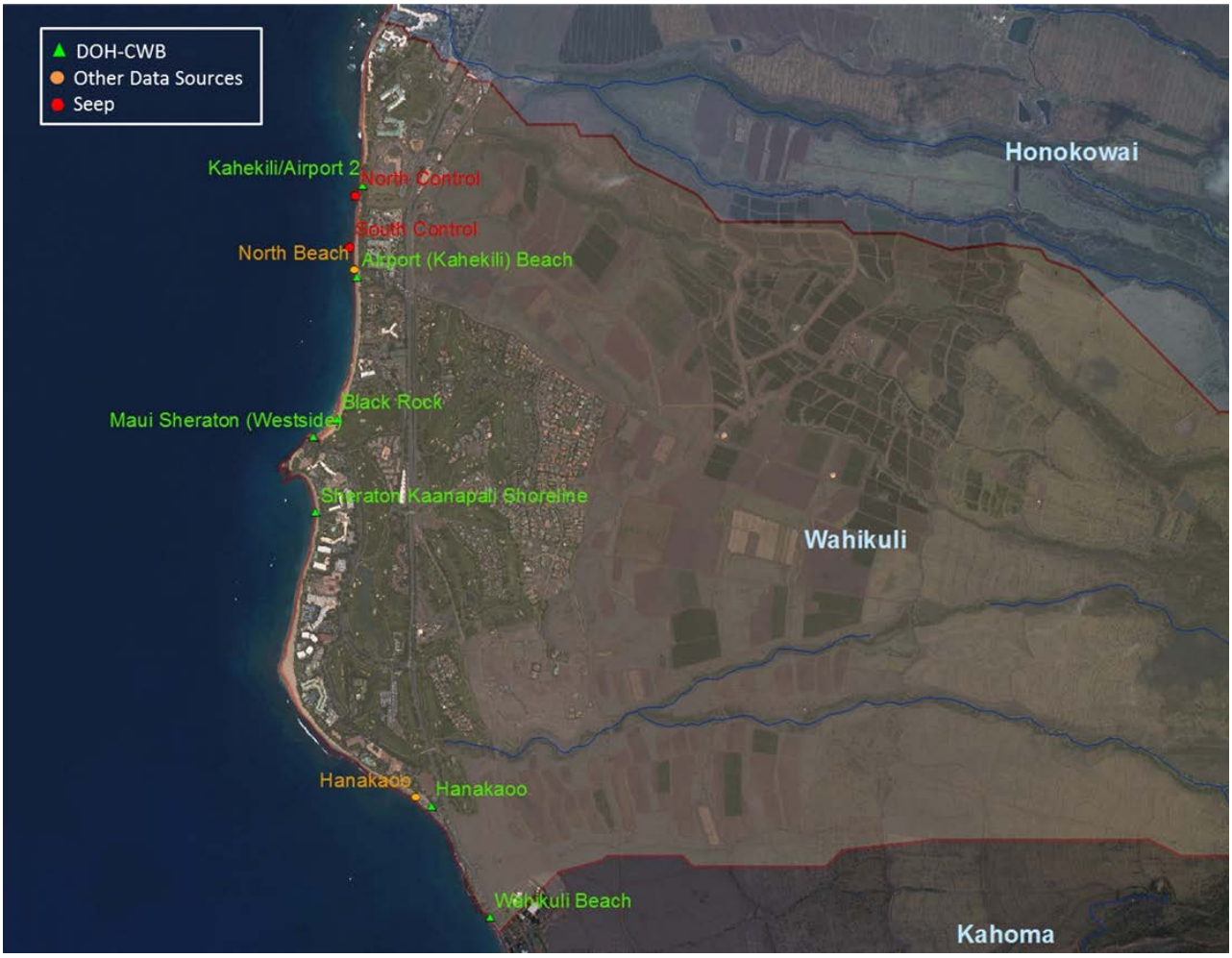

Figure 3. Current DOH-CWB stations and other data sources nested within the Wahikuli watershed DU on West Maui.

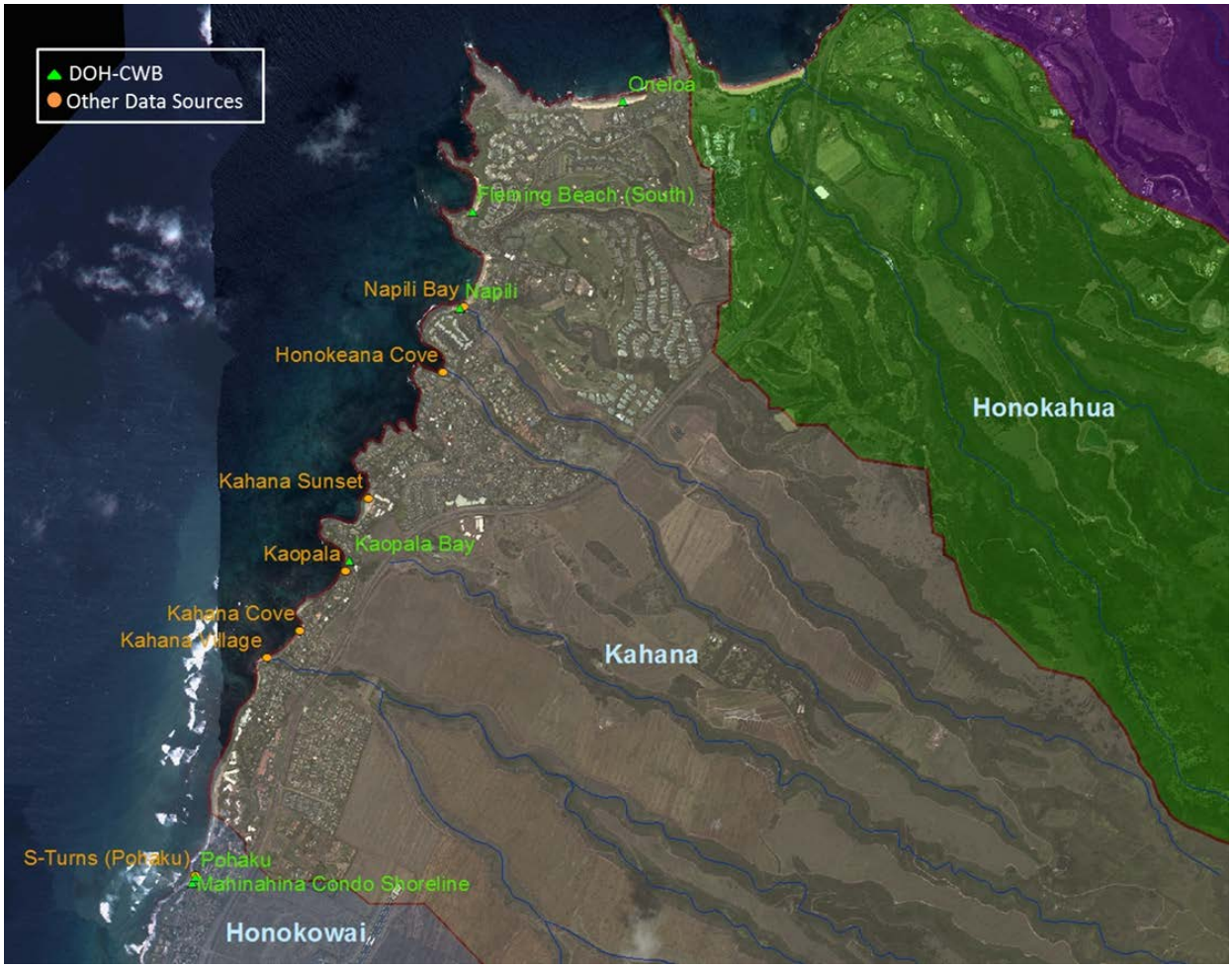

Figure 4. Current DOH-CWB stations and other data sources nested within the Kahana watershed DU on West Maui.

Table 4. Example of CWB watershed DUs (Wahikuli and Kahana) with previous IR scopes of assessment nested within their respective watershed on West Maui. Integrated Report [1]scopes of assessment consist of DOH-CWB* stations and other data sources**.

Maui														
HUC-12 (sub-watershed)	**CWB Watershed Decision Unit With Nested IR Scopes of Assessment**	**Geocode**	**Water Body Type**	**Wet/Dry Criteria**	**Enterococci**	**TN**	**NO_3+NO_2**	**NH_4**	**TP**	**Turbidity**	**Chl *a***	**Other Pollutants**	**Category**	**TMDL Priority**
Kahoma Stream	***Wahikuli Watershed***	***TBD***	***NA***	***Dry***	***A***	***A***	***A***	***A***	***A***	***N***	***A***		***2, 5***	***L***
	[1]Hanakaoo Beach Park Co. Hanakaoo*	HI797917	C	Dry	A	A	N	N	N	N	N		2, 5	M
	[1]Hanakaoo Station Hanakaoo**	HIW00165	C	Dry	-	-	N	-	-	N	-		3,5	M
	[1]Ka'anapali (Kahekili Beach) Airport (Kahekili) Beach* Kahekili/Airport 2* Control Seeps* Black Rock*	HI643627	C	***Wet***	A	A	***A***	***A***	A	N	A		2, 5	M
	[1]Ka'anapali (Sheraton Ka'anapali Shoreline)*	HIW00022	C	Dry	A	-	-	-	-	N	N		2, 3, 5	M
	Maui Sheraton (Westside)*	NA	C		-	-	-	-	-	-	-		3	
	North Beach**	NA	C		-	-	-	-	-	-	-		3	
	[1]Wahikuli State Wayside Park Wahikuli Beach*	HI169380	C	Dry	A	-	-	-	-	N	N		2, 3, 5	M
	[1]West Maui-Wahikuli Watershed**	HIW00209	C	Dry	-	-	-	-	-	-	-		3	

Decision Codes: - = no new data or insufficient data, **A** = attained, **A_T** = attained (TMDL approved for parameter), **N** = not attained, **N_T** = not attained (TMDL approved for parameter), **V** = visual listing from 2001-2004, **Y** = previous listing from 1998 or earlier,; **Category: 1** = all uses attained, **2** = some uses attained, **3** = no new data or not enough new data to evaluate, **4** = at least one use not attained, but no TMDL needed, **4a** = TMDL approved, **5** = at least one use not attained, TMDL needed; **TMDL Priority Codes:** High (**H**), Medium (**M**), & Low (**L**) priority for initiating TMDL development within the current monitoring and assessment cycle (through October 31, 2013); **IP** = TMDL development in progress; prior assessments confirmed with new data are shaded; ***category changes are bolded, italicized, underlined & shaded***.

Maui														
HUC-12 (sub-watershed)	**CWB Watershed Decision Unit With Nested IR Scopes of Assessment**	**Geocode**	**Water Body Type**	**Wet/Dry Criteria**	**Enterococci**	**TN**	**NO_3+NO_2**	**NH_4**	**TP**	**Turbidity**	**Chl *a***	**Other Pollutants**	**Category**	**TMDL Priority**
Honokowai Stream	***Kahana Watershed***	***TBD***	***NA***	***Dry***	***A***	***-***	***-***	***-***	***-***	***N***	***-***		***2, 3, 5***	***L***
	[1]Kapalua (Fleming's) Beach Fleming Beach (South)*	HI391006	C	Dry	A	N	N	N	A	N	N		2, 5	M
	[1]West Maui Coast-Honokeana Cove Honokeana Cove**	HIW00044	C	Dry	-	N	N	-	-	N	N		3, 5	M
	[1]West Maui Coast-Kahana Cove Kahana Cove**	HIW00045	C	Dry	-	N	N	-	-	N	N		3, 5	M
	[1]West Maui Coast-Kahana Sunset Kahana Sunset**	HIW00075	C	Dry	-	-	N	-	-	N	N		3, 5	M
	[1]West Maui Coast-Kahana Village Kahana Village**	HIW00076	C	Dry	-	-	-	-	-	N	N		3, 5	M
	[1]West Maui-Kahana Watershed**	HIW00207	C	Dry	-	-	-	-	-	-	-		3	
	[1]West Maui Coast-Kaopala Bay Kaopala**	HIW00046	C	Dry	-	N	N	N	-	N	N		3, 5	M
	[1]Kahana (Mahinahina Condo Shoreline) Kaopala Bay*	HI160433	C	Dry	A	N	N	N	N	N	N		2, 5	M
	[1]Napili Bay Napili*	HI764060	C	Dry	A	A	N	N	N	-	N		2, 3, 5	L
	[1]West Maui Coast-Napili Bay Napili Bay**	HIW00078	C	Dry	-	-	N	-	-	N	N		3, 5	M
	[1]Oneloa Bay Beach Oneloa*	HI740710	C	Dry	A	-	-	-	-	-	-		2, 3	

Decision Codes: - = no new data or insufficient data, **A** = attained, **A_T** = attained (TMDL approved for parameter), **N** = not attained, **N_T** = not attained (TMDL approved for parameter), **V** = visual listing from 2001-2004, **Y** = previous listing from 1998 or earlier,; **Category: 1** = all uses attained, **2** = some uses attained, **3** = no new data or not enough new data to evaluate, **4** = at least one use not attained, but no TMDL needed, **4a** = TMDL approved, **5** = at least one use not attained, TMDL needed; **TMDL Priority Codes:** High (**H**), Medium (**M**), & Low (**L**) priority for initiating TMDL development within the current monitoring and assessment cycle (through October 31, 2013); **IP** = TMDL development in progress; prior assessments confirmed with new data are shaded; ***category changes are bolded, italicized, underlined & shaded***.

Decision Units

This section describes the implementation of the standardized assessment methodology for marine waters applicable to the 2016 IR. The IR assessments will be based on marine DUs bounded by State watershed delineations and distance from shoreline. For the purposes and consistency of the IR, nearshore recreational waters will continue to be categorized as coastal waters within 300 m of shoreline and offshore waters beyond 300 m.

Sample Size Requirements and Collection Frequency

Ecosystem health assessments are based on the biogeochemical parameters identified in HAR §11-54-6. Future assessments will require a minimum of 30 samples to be collected from State receiving waters within the CWB watershed DU for a two year assessment cycle. This means that the 30 samples will come from multiple stations located within the larger watershed DU. Sample collection frequency should minimally be representative of seasonal variation throughout the monitoring program where applicable. The GM calculation and comparison to the water quality criteria will remain consistent with the 2014 IR. Data collected in State receiving waters will be divided into separate assessment units (nearshore marine recreational, open coastal marine and oceanic) based on water body types described in the WQS and the premise that water quality in nearshore waters is likely to be different than waters located offshore.

Recreational health bacterial assessments are compared against water quality criteria described in HAR §11-54-8 (Nov 2014). Revisions to the State WQS changed enterococcus GM criteria from not exceeding 35 CFU/100 mL in not less than five samples which shall be spaced to cover a period between 25 and 30 days to not exceeding 35 CFU/100 mL over any 30 day interval. The 2014 WQS revision also replaced the 104 CFU/100 mL with the statistical threshold value (STV) of 130 CFU/100 mL, which shall not be exceeded by more than ten percent of the samples taken within the same 30 day interval in which the GM is calculated. These changes of numeric water quality criteria for recreational health in marine waters are consistent with the Environmental Protection Agency's 2012 Recreational Water Quality Criteria (US EPA Office of Water 2012). For the purposes of the 2016 IR and to maintain consistency with the 2014 IR, recreational health assessments will calculate a monthly GM. Assessment units for recreational health in State receiving waters will be the same as ecosystem health assessment units.

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