Wahikuli-Honokowai Watershed Management Plan

Volume1: Executive Summary

Healthy coral reefs are vital to our culture, way of life, and economy. Long-term coral reef monitoring has shown that coral reefs in northern Kāʻanapali have declined by as much as 50%. The West Maui region is currently targeted by Federal, State, and private entities for watershed planning efforts with the goals of reducing stressors to and improving the overall health of coral reefs, nearshore waters, and watersheds. The Honolulu District of the U.S. Army Corps of Engineers (USACE) and Hawaiʻi Department of Land and Natural Resources Division of Aquatic Resources (DLNR-DAR) are the lead government agencies for the West Maui Ridge to Reef (R2R) Initiative, covering five watersheds from Wahikuli to Honolua.

Over the past century, land use in this region has resulted in export of land-based pollutants that have impaired the water quality of nearshore ocean waters and adversely impacted the marine ecosystem. Land-based pollutants generated across large areas and from diffuse sources are commonly referred to as non-point source (NPS) pollutants. Pollutants are transported off the watersheds in both surface water and groundwater and delivered into the ocean at various rates and total loads. Two of the most problematic land-based pollutants identified by scientists are nutrients (Nitrogen and Phosphorus) and sediment.

To address the issue, the National Oceanic and Atmospheric Administration (NOAA) Coral Program has sponsored a Watershed Management Plan (WMP) for two watersheds, Wahikuli and Honokōwai, as part of the West Maui R2R Initiative. The *Wahikuli-Honokōwai Watershed Management Plan* (WHWMP) is composed of two volumes: *Volume 1: Watershed Characterization*, and *Volume 2: Strategies and Implementation*. The WHWMP will provide a template for WMPs to be developed for other West Maui watersheds. It adheres to the Environmental Protection Agency (EPA) Clean Water Act (CWA) Section 319 guidelines for watershed plan development. These guidelines require use of a holistic, watershed based approach to identify sources and sinks of NPS pollutants, and the remedial actions necessary to reduce their loads to receiving waters. The complete WHWMP characterizes the project watersheds (Volume 1); and recommends pollution control strategies, outlines implementation strategies, provides evaluation and monitoring protocols, and describes education and outreach approaches (Volume 2).

Volume 1 of the WHWMP summarizes the current and proposed future environmental conditions of Wahikuli and Honokōwai Watersheds, with an emphasis on identifying pollutant sources and types. It was developed using existing data and information, field investigations, interviews with people with historic and current knowledge of land uses and activities, and geospatial data analysis using geographic information system (GIS) software. In general, surface water and groundwater flow and quality data are limited spatially and temporally in the watersheds. As a result, calibration and validation of hydrologic models to estimate NPS pollutant concentrations in runoff and groundwater is challenging. However, sufficient qualitative information exists for making informed inferences about where and what types of pollutants are generated, and the flow paths that carry them into ocean receiving waters. General estimates of NPS pollutant loadings from major sources within the watershed have been made where possible based on available data and assumptions as noted. This information is important for targeting management recommendations.

Land in the two watersheds falls within three Land Use Districts as defined by the State of Hawai'i and progressing from mountain to sea: Conservation, Agricultural, and Urban. The Conservation District encompasses the upper most sections of the watersheds extending up to their divides at the crest of the mountains. Conservation District lands function as a reservoir, capturing high rainfall, and slowly releasing rain that soaks into its surfaces to sustain stream flows and recharge underground aquifers. The lands within the steep mountainous terrain host pristine native flora and fauna communities that are being threatened in various areas by alien plant species, illegal dirt bike use, and disturbance of ground cover by feral ungulates. This compromises the ecohydrologic services the forest provides. Management efforts to prevent damage to and restore parcels within the forested areas are carried out by the West Maui Mountains Watershed Partnership. Conservation District lands are minimally discussed in the WHWMP.

The Agricultural District occupies the middle section of the watersheds, with lands primarily used for agricultural activities. For nearly a century sugarcane and pineapple fields covered almost 40 percent of the watersheds (4,570 acres). By 2008 these crops were phased out. From 1999 until mid-2012, seed corn was actively cultivated on a portion of former sugarcane lands (approximately 300 acres planted at any given time). Today, fallow sugarcane and pineapple fields are mostly covered with a mixture of non-native grasses and shrubs. Fallow seed corn fields are becoming covered with grasses and other plants since cessation of cultivation during the summer of 2012. Coffee is currently cultivated on approximately 311 acres, in areas once used to grow sugarcane. Additional tracts of agricultural lands in the Wahikuli Watershed are currently being developed as small scale single owner coffee farms. The plant types on the fallow fields and arid landscape create conditions that make wildfires a constant threat to the area. The main NPS pollutants associated with the Agricultural District are sediment and nutrients.

Dirt roads dissecting the Agricultural District are a significant source of sediments and a primary transport route of these sediments and those derived from adjacent lands. During field observations, the dirt roads were found to be in variable condition. Some roads exhibit generally acceptable surface and structural condition, and include management practices to direct surface water runoff off the road surface. However, many road sections are highly eroded, and many management practices in disrepair, generating a disproportionate amount of sediment. Runoff generated within the Agricultural District flows along road surfaces during storm events, dislodging surface soil particles, rutting the roads, and creating channels for runoff to travel rapidly downslope into natural drainage ways. The degree to which this occurs in individual locations is a function of many factors, including road slope, contributing drainage area, and presence/operating condition of management practices. Several roads are unstable where they cross streams and gulches, with slopes actively eroding into the drainage channels and no measures in place in some areas to prevent downstream transport of sediment.

Wahikuli Watershed is estimated to contribute more sediment from its agricultural fields than Honokōwai Watershed. The Honokōwai Watershed agricultural lands are primarily covered by vegetated fallow pineapple fields, and to a lesser extent, vegetated fallow sugarcane fields. Conversely, active and fallow fields in Wahikuli Watershed have less vegetative cover compared to Honokōwai, which is the primary reason for higher erosion rates. The fallow seed corn fields are found primarily in Wahikuli Watershed. During the cultivation era, a portion of the rotated acres used to cultivate seed corn were left bare and therefore highly vulnerable to erosion, soil loss, and

sediment export. Fugitive dust was generated off of the bare plots, and has been identified as a nuisance in the past by residents located downwind.

Annual soil loss was estimated using the Revised Universal Soil Loss Equation (RUSLE2) model for active and fallow fields. Representative fields were chosen for each of the types, and calculated soil loss rates were compared to tolerable losses.[1] The results showed that seed corn fields under cultivation generate soil losses at a rate that exceeds tolerable levels by 190-480%; while pineapple, sugarcane, and coffee fields all have soil losses falling within tolerable limits. Given that general surface conditions for seed corn fields have not changed substantially since cultivation ceased, it is reasonable to assume these levels are still accurate.

The total amount of fertilizers applied per year to all the active fields is far less compared to amounts under the historic pineapple and sugarcane era. Under cultivation, seed corn fields received the lowest application of Nitrogen, Phosphorus, and Potassium of any crop, former or active. The total acreage of coffee fields in production at one time is roughly equal to the area that was planted in seed corn. However, the amount of Nitrogen is 600% higher and Phosphorus is 140% higher per year compared to seed corn. Sugarcane had the highest Nitrogen and Potassium application of all fields, and depending on the fertilizer mix used, pineapple was highest in Phosphorus applied.

During the sugarcane and pineapple era a portion of the chemicals used to increase plant growth and prevent disease on the crops was most likely transported via surface water and groundwaters into the ocean. These legacy chemicals may still be moving off the watershed via ground and surface waters. Export of chemicals off actively cultivated coffee lands is likely less than during the sugarcane and pineapple era, due to the substantial decrease in cultivated crop area. Future hydrologic studies are recommended to determine the magnitude and timing of Nitrogen, Phosphorus, and other nutrients being exported as a result of historic and active farming practices.

Two county-maintained dams are located in Honokōwai Watershed, on Honokōwai and Māhinahina Streams. The need for these water works was in part due to the acknowledgement by government, land owners, and the public that sediment and nutrients generated off the Conservation and Agricultural lands and delivered to the ocean via these streams was having an adverse impact on the coral reefs. The dams have desilting basins intended to function as sediment traps. The dams are effective in trapping coarse sediments and plant material generated off lands in the Conservation and Agricultural Districts, but their efficiency at capturing fine suspended particulates varies due to their outlet designs. With modifications to their outlets, the existing basins could be more effective in trapping fine particulates over a larger range of discharges. The majority of fallow seed corn fields, active coffee fields, and dirt access roads are in Wahikuli Watershed, which does not drain into either Honokōwai or Māhinahina Streams. In the northern half of Wahikuli Watershed most of the surface water runoff generated from the agricultural fields and roads is routed to a series of sediment detention basins that function to capture both coarse and fine sediments. The southern section of the watershed has only few sediment basins, and runoff from

[1] Subsequent to using the RUSLE2 model to estimate sediment losses from seed corn fields, cultivation of this crop ceased. As of December 2012 the fields used for seed corn are fallow and becoming covered with vegetation. The RUSLE2 model was not re-run.

the agricultural areas and roads flows freely into Wahikuli Gulch and other natural drainages. There are no large dams or detention basins within Wahikuli Watershed.

The Urban District encompasses the coastal lands primarily located between the ocean and Honoapiʻilani Highway. The area is known for its beautiful beaches, abundant sunshine, and numerous resort hotels and condominiums. Land uses that potentially generate NPS pollutants include chemicals applied to golf courses and landscaped areas, and runoff generated off impervious surfaces (e.g. roads and parking lots) that cover nearly 50 percent of developed land. Surface water runoff is the primary carrier of NPS pollutants that are by-products of land use and activities (e.g. oil drips) that fall out onto the impervious surfaces. In addition, groundwater is also suspected to be transporting pollutants to the ocean beneath the Urban District

The Maui County owned and operated Lahaina Wastewater Reclamation Facility (WWRF) treats raw sewage collected from the project area's Urban District and areas north to Kapalua and south to Lahaina. The WWRF is subject to Underground Injection Control (UIC) permits administered under the Safe Drinking Water Act (SDWA) to dispose of treated effluent waste water via injection wells. Permits are issued by EPA and Hawaiʻi Department of Health Safe Drinking Water Branch (DOH-SDWB), and require compliance and regular renewal. Both permits are currently expired, although they have been administratively extended. Since expiration of the permits the facility has operated and complied with their provisions, which includes monitoring of the treated effluent water quality (e.g. sediments, biochemical oxygen demand, and nutrients). In addition, the WWRF periodically samples treated effluent for bacteria, chemicals, heavy metals, pesticides, and other compounds designated by EPA and DOH.

The objective of the WWRF is to remove the physical, chemical, and biological contaminants and produce fluid and solid waste (sludge) that is environmentally safe for disposal or reuse. The WWRF employs primary, secondary, and tertiary effluent treatment methods to both physically and biologically remediate contaminants contained in the inflow water. The WWRF currently treats an average flow rate of 4.0 MGD (million gallons per day). During the dry season, up to 1.9 MGD of influent wastewater is treated and reclaimed to R-1 water quality standards (highest level of treatment for reclaimed water), for use as irrigation water on the golf courses and resort areas in Kāʻanapali. Four Class V UIC wells are used for final disposal of excess tertiary treated effluent. Flow rates of injected treated effluent typically range from 2.1 MGD in the dry season to 4.0 MGD during the wettest periods of the year when R-1 water is not being used.

Scientific studies have determined that the some of the treated effluent water flows underground to the ocean, where it discharges as submarine groundwater out two springs located just offshore and north of the Kahekili Beach Park. Scientists hypothesize that the effluent water transports nutrients (e.g. Nitrogen and Phosphorus) and other potential polluting substances (e.g. pharmaceuticals, fire retardant, plasticizer compound) that have negatively impacted the coral reef. Loading rates were calculated for several chemicals found in the effluent using WWRF water quality samples collected during wet and dry periods in 2011. These loading rates were compared to determine the variation in pollutant loading rates injected over the course of the year and the effect that R-1 level reclamation for land irrigation has on the rates of pollutant injection into the wells during the driest periods. Predicted future wastewater flows generated from proposed future development projects

are estimated at between 1.6 and 2.0 MGD, resulting in a 40% to 50% increase over the current average flow rate of 4.0 MGD.

The disposal of WWRF treated effluent and its connectivity to and impact on near shore ocean water quality has been the subject of several scientific studies, numerous debates, and a recent lawsuit. This report attempts to objectively present the latest available information and data. Studies on this issue and dialogue between Maui County and the regulatory agencies continue.

Many parcels within Wahikuli and Honokōwai Watersheds have been identified for future development, incorporating single-family, multi-family, and timeshare residential developments. Gradual changes in land use from Agricultural to Urban will increase the amount and extent of impervious surfaces across these areas. Urbanization will introduce new NPS pollutants common to those found in developed landscapes and increase the volume of storm water runoff. Low impact development practices built into the designs of future developments can mitigate changes to the hydrologic regime due to increases in impervious areas.

Volume 1: Watershed Characterization provides a comprehensive though not exhaustive inventory of specific areas of concern and hotspots of NPS pollutant sources identified above within the project area by district (Section 6). In *Volume 2: Strategies and Implementation*, strategies for management of the NPS pollutants that adversely impact water quality and the coral reef ecosystem are presented. The *Implementation Strategy* section discusses elements required to implement a watershed management plan, financial considerations, and necessary technical resources. The *Pollution Control Strategies* section identifies projects and management practices recommended to address identified sources and types of NPS pollutants in Wahikuli and Honokōwai Watersheds. Reduction of pollutant loads is a function of both the types and number of management practices installed. The *Evaluation and Monitoring* section provides programmatic evaluation criteria and describes the types of monitoring necessary to track management practices. This qualitative and quantitative information helps determine their effectiveness and apply the findings to other watersheds. The *Education and Outreach* section provides details on current and planned activities to engage the local community in efforts to reduce NPS pollution in the West Maui Watersheds.

This WHWMP provides a framework for addressing NPS pollutant control in Wahikuli and Honokōwai Watersheds. Implementation of the recommendations is expected to reduce generation and transport of land-based pollutants, resulting in improved water quality and coral reef ecosystem health. The WHWMP provides a framework that can be used as a template for other watersheds within West Maui.