

Ala Wai Watershed Analysis



Final Report

Prepared By:
Townscape, Inc. and
Eugene P. Dashiell, AICP
in cooperation with Oceanit

Prepared For:
Department of Land and Natural Resources and
U.S. Army Corps of Engineers

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*Cover Photo: Aerial view of the Ala Wai Canal.
Source: USGS website at
<http://www.water.usgs.gov/pubs/FS/FS-012-99>*

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- A Advisory Groups
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- C Findings and Analysis
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LIST OF ACRONYMS

ASG	Agency Study Group
AWWA	Ala Wai Watershed Association
BMP	Best Management Practice
BWS	Honolulu Board of Water Supply
C&C	City and County of Honolulu
cfs	Cubic Feet per Second
COE	US Army Corps of Engineers
crm	Concrete Rubble Masonry
CWRM	DLNR Commission on Water Resource Management
DAR	DLNR Division of Aquatic Resources
DBEDT	HI Department of Business, Economic Development and Tourism
DDC	C&C Department of Design and Construction
DFM	C&C Department of Facility Maintenance
DLNR	HI Department of Land and Natural Resources
DOBOR	DLNR Division of Boating and Ocean Resources
DOFAW	DLNR Division of Forestry and Wildlife
DOH	HI Department of Health
DOT	HI Department of Transportation
DOWALD	DLNR Division of Water and Land Development
DPP	C&C Department of Planning and Permitting
DPR	C&C Department of Parks and Recreation
DTS	C&S Department of Transportation Services
ENV	C&C Department of Environmental Services
EPA	US Environmental Protection Agency
FIRM	Federal Insurance Rate Map
HI	State of Hawai'i
HRS	Hawaii Revised Statutes
IC	Impervious Cover
KMWP	Ko'olau Mountains Watershed Partnership
LUST	Leaking Underground Storage Tank
mgd	Millions of gallons per day
MPDC	Mānoa-Pālolo Drainage Canal
msl	Mean sea level
NPDES	National Pollutant Discharge Elimination System
NRCS	US Department of Agriculture Natural Resource Conservation Service
OEQC	HI Office of Environmental Quality Control
OP	DBEDT Office of Planning
ROH	Revised Ordinances of Honolulu
SOODMDS	South O'ahu Ocean Dredge Material Disposal Site
TAG	Technical Advisory Group
TMDL	Total Maximum Daily Load
UH	University of Hawai'i
UHM	UH Mānoa
US	United States
USFWS	US Fish and Wildlife Services
WQLS	Water Quality Limited Segment
WQS	Water Quality Standards

EXECUTIVE SUMMARY

Analysis Objective: To assess the condition of the Ala Wai watershed through a review of existing data, reports, and studies, and to describe recommended actions that will improve watershed health.

Analysis Sponsors: This analysis was jointly sponsored by:

- State of Hawai‘i Department of Land and Natural Resources
- U.S. Army Corps of Engineers

Analysis Team: Oceanit - Prime Contractor
Townscape, Inc. – Principal Consultant
Eugene P. Dashiell, AICP - Subconsultant

Study Area: The Ala Wai Watershed is comprised of an approximately 12,033-acre area that includes the sub-watersheds of Makiki, Mānoa, and Pālolo, and extends from the top of the Ko‘olau Mountains to the near-shore waters of Waikīkī and Māmala Bay.

Methodology: Principal elements of the analysis included the collection and review of existing data, the identification of problems and issues, and the description of recommended actions. Data collection involved assembling all of the available data on the study area and consulting with agencies and organizations involved in development and management of the watershed. Review of the data resulted in the identification of issues and problems pertaining to the Ala Wai watershed and recommendations for action. Recommendations were substantiated through consultations with knowledgeable agencies and organizations. Additionally, agency representatives and the Ala Wai Watershed Analysis (Analysis) team conceptualized further actions and supplemented earlier recommendations based on their expertise and observations made during the course of the analysis.

Recommended Actions:

Project No. WATER QUALITY

- 01 Ala Wai Watershed Monitoring Program
- 02 Ala Wai Watershed Nutrient Reduction Program
- 03 Ala Wai Watershed Bacteria Reduction Program
- 04 Ala Wai Watershed Household Hazardous Waste Reduction Program
- 05 Ala Wai Canal Water Circulation Project
- 06 Ala Wai Harbor Waste Reduction Program
- 07 Conservation District Public Access Plan
- 08 Urban District Public Access Plan

EROSION AND SEDIMENT CONTROL

- 09 Ala Wai Watershed Erosion and Sedimentation Reduction Project
- 10 Ala Wai Watershed Contaminated Sediment Reduction Program
- 11 Sediment Disposal Study

FLOOD CONTROL

- 12 Urban District Storm Water Runoff Master Plan
- 13 Ala Wai Canal Flood Control Project
- 14 Makiki Flood Control Project
- 15 Mānoa Flood Control Project
- 16 Pālolo Flood Control Project

PUBLIC HEALTH AND SAFETY

- 17 Streamside Dumping Prevention and Cleanup Program
- 18 Litter Reduction Program
- 19 Ala Wai Canal Health Awareness Program
- 20 Ala Wai Canal Maintenance Program

BIOTIC ENVIRONMENT

- 21 Ala Wai Watershed Aquatic Habitat Project
- 22 Ala Wai Watershed Bioassessment Study
- 23 Forest Ecosystem Restoration Master Plan

OVERALL WATERSHED

- 24 Urban Stream Corridor Preservation Project
- 25 Ala Wai Research Watershed Partnership
- 26 Ala Wai Watershed Public Education Program
- 27 Ala Wai Wetland Restoration Project
- 28 Ala Wai Watershed Partnership

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1 Introduction

The Ala Wai watershed is located in the south, central sector of the island of O‘ahu and includes the Makiki, Mānoa, and Pālolo drainages, as well as Waikīkī (Figure 1). Since the development of the Ala Wai Canal in the 1920’s to drain the wetlands of Waikīkī, the Canal’s water quality has deteriorated to where it is aesthetically objectionable and may also pose some health risk to the public. This watershed analysis was conducted to address these conditions.

Many studies have focused only on the Ala Wai Canal due to its highly visible problems with water quality. However, there is an inherent interconnectedness between land use and natural resources that may be exemplified by the effect that upstream actions, such as erosion or pollution, have on downstream waters, such as the Ala Wai Canal. Therefore, this analysis included the entire watershed, from the mountain tops to the near-shore waters, as the unit of study.

1.1 Purpose and Objectives

The purpose of the Ala Wai Watershed Analysis was to review and evaluate existing data that identify water resource problems, studies, and solutions in the watershed. Through these data sources, the Analysis assessed the condition of the Ala Wai watershed and described recommended actions to improve watershed health. Some

specific issues that were considered include water supply, flood control, and ecosystem degradation.

While not a plan, this Analysis included several characteristics of the planning process such as a review of existing information, consultation with agencies, problem identification, and conceptualization of recommended actions to address those problems. This process was mindful of the fact that this is a highly urbanized watershed and sought to create a balance between urban uses and watershed protection.

1.2 Description of the Study

The U.S. Army Corps of Engineers (COE), together with the State of Hawai‘i (HI) Department of Land and Natural Resources (DLNR) as the local sponsor, is currently conducting a Feasibility Study for the Ala Wai Canal project, which is a multiple purpose project being investigated under Section 209 of the Flood Control Act of 1962. The Feasibility Study will investigate and evaluate solutions to environmental degradation and flood control problems throughout the Makiki, Mānoa, and Pālolo drainages, including the Ala Wai Canal and Waikīkī. This Ala Wai Watershed Analysis is a component of the COE Ala Wai Canal Feasibility Study.

1 - Introduction

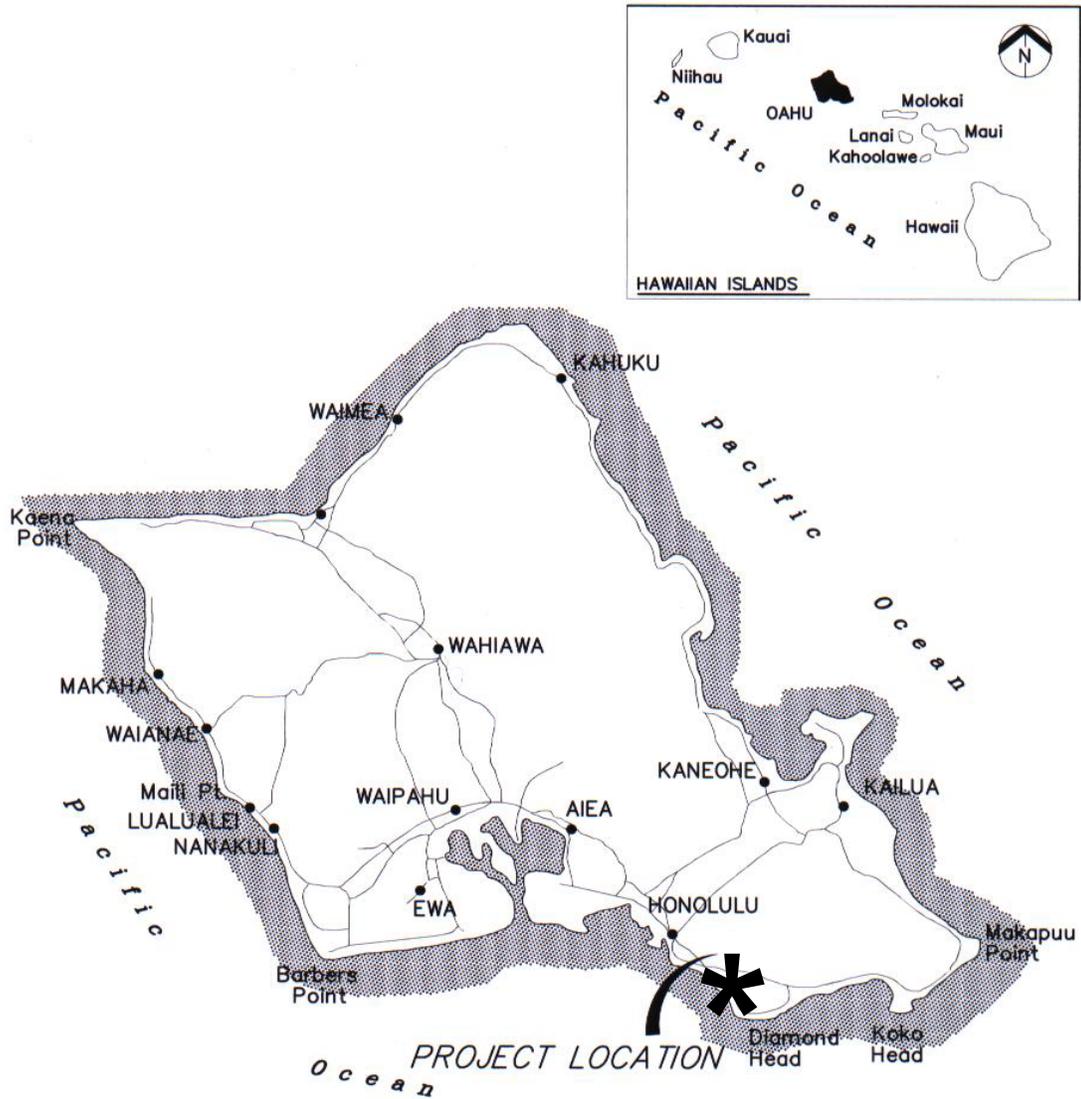
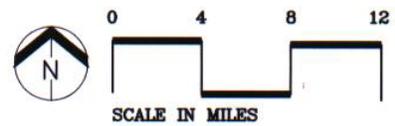


Figure 1
LOCATION MAP

ALA WAI WATERSHED ANALYSIS

For: the U.S. Army Corps of Engineers and
the State Department of Land and Natural Resources

By: Townscape, Inc.
July 2003



2 Methodology

This study involved data collection; problem and issue identification, including the identification of data gaps; and conceptualization and description of potential watershed restoration projects. Guiding principles were developed to provide a context for project development, and are described in Section 2.4.

2.1 Data Collection

The Ala Wai watershed is a high profile area due to its proximity to the urban core of Honolulu, its heavy use as a recreational venue, and its many water quality issues. Therefore, many studies and research projects have been conducted on its properties and perceived problems over the past few decades. The study team collected data from three main sources: existing literature, an agency study group, and meetings with key agencies and organizations.

2.1.1 Literature Review

The primary sources of data were the 162 documents that were collected from various agencies, organizations, and libraries. These reports either provided information on specific topics within the Ala Wai watershed, or on watershed issues in general.

Some of the documents proved to be very valuable in detailing the characteristics of the watershed and its problems, while others were more general or summarized previous

work. This analysis provides abstracts of those reports that provided information essential to understanding the issues and dynamics of the Ala Wai watershed. A complete list of the literature collected and abstracts of selected documents may be found in Appendix D.

2.1.2 Advisory Groups

To supplement the literature review, a group of experts on watershed issues was asked to provide technical assistance to the project. The Technical Advisory Group (TAG) was formed in the early stages of the Feasibility Study and included government organizations such as the HI DLNR, Department of Health (DOH), and University of Hawai'i (UH), and the City and County of Honolulu (C&C) Department of Parks and Recreation (DPR).

As the Ala Wai Watershed Analysis portion of the Feasibility Study progressed, the study team determined that it would be beneficial to expand the original TAG. This group was renamed the Agency Study Group (ASG) and added such agencies as the C&C Board of Water Supply (BWS), C&C Department of Environmental Services (ENV), HI Department of Transportation (DOT), and United States Fish and Wildlife Service (USFWS). After most of the literature was reviewed and the initial projects were identified, the ASG provided advice on the value and scope of the watershed analysis. Members of the ASG also identified other contacts that could

provide more information on specific projects. A list of TAG and ASG members may be found in Appendix A.

2.1.3 Meetings with Key Agencies and Organizations

The study team met with individuals and organizations that were implementing watershed projects and research. The intent of these meetings was to determine if past concerns were still valid, to identify new issues that had arisen since the literature was published, and to understand the status of current watershed efforts and programs.

The meetings produced interesting insights into the current status of issues in the Ala Wai watershed. Most of the problems previously stated in the literature still persist, although a few were being addressed by agency and independent efforts. A list of the individuals and organizations that were consulted may be found in Appendix A.

2.2 Problem and Issue Identification

Most of the problems and issues of concern in the Ala Wai watershed were discussed in the literature. Additional issues were identified as a result of the meetings held with the ASG, individuals, and organizations. These meetings generally resulted in confirmation of the literature and additional detail on previously known problems and data gaps, rather than the identification of new issues.

2.3 Project Descriptions

Most of the recommended actions came directly from the literature, as there were many studies conducted previously to determine the feasibility of various concepts for watershed restoration. Further recommendations, especially those concerning additional research, were developed from interviews with those currently working on watershed-related issues. The ASG also provided some guidance on the direction that some of the projects should take. A comprehensive summary of the issues, data gaps, and recommended actions identified may be found in Appendix C.

2.4 Guiding Principles

The study team developed “Guiding Principles” to ensure project consistency and compatibility. These principles were generally derived from knowledge of watersheds on the national level, and tailored to meet the specific needs of Hawaii’s unique watersheds.

2.4.1 Adhere to *Ahupua‘a* Land Management Principles

Ahupua‘a were traditional Hawaiian land management units that typically ran between valley ridges from the mountaintop to the ocean, including the reef beyond. All resources within this boundary were the responsibility of those that lived within the particular *ahupua‘a*. The ancient Hawaiians recognized the influence of the land on the coastal waters, and the interrelationship between waters of adjacent *ahupua‘a*.

The Hawai'i State Legislature passed Act 152 in the year 2000, creating a Watershed Protection Board within the DLNR for the purpose of developing a watershed protection master plan. The Watershed Protection Board recommended the *ahupua'a* as the focus of watershed planning. Some *ahupua'a* principles that may be transferred to watershed planning and management include access to a complete resource base, reverence for water, respect for all living things, coordination and cooperation, protocol and respect, intergenerational learning, *'ohana* among people, and the connection between people and the land.

2.4.2 Expand the Body of Knowledge on Watershed Protection and Management in Hawai'i

There is much to be learned about watershed functions, and while significant research is being done on the national level, Hawaii's watersheds are unique and may not benefit from data developed in other locales. This is in part due to natural differences between geography and climate: Hawaiian watersheds tend to be steep and much shorter than their mainland counterparts, and the sub-tropical climate contrasts with the temperate climate of most of the United States (US).

Watershed relationships and functions are difficult to assess because of the interconnectedness of components, the constant evolution of conditions, and the high cost involved in data collection. This type of information however, is necessary for making sound management decisions.

Efforts to increase the understanding of the dynamics, physical properties, and inter-relationships of Hawaiian watersheds should be promoted to allow for better management practices.

2.4.3 Protect and Enhance Groundwater Resources

Recharge of groundwater resources is believed to have decreased in recent times due to the reduction of irrigated agriculture and the spread of non-native vegetation that is not conducive to infiltration as compared to native vegetation. Impervious (ground) cover (IC) in the watershed has also been shown nationally to reduce stream quality by funneling water into storm drain systems instead of percolating into the ground. Decreased percolation reduces groundwater recharge and its contribution to stream flow, and increases flood peaks and frequency during heavy rains. Components of IC include roads, driveways, parking lots, buildings, sidewalks, and other surfaces that do not allow for groundwater infiltration.

The Center for Watershed Protection is a national non-profit organization that provides technical expertise on watershed management. The Center categorizes watersheds based on the amount of IC they contain. A watershed with less than 10% IC is rated "sensitive," and is considered high quality. Watersheds with between 10-25% IC are "impacted," and a watershed with more than 25% IC is "non-supporting," meaning that it cannot support the full range of designated uses. Based on general estimations of the existing IC makai of the Conservation District, the Ala Wai

watershed falls within the non-supporting category.

Groundwater protection measures, such as native forest regeneration, alien species removal, and impervious cover reduction, should be incorporated into management practices where possible.

2.4.4 Expand the Function of Stream and Channel Modifications

Stream channel modifications have traditionally been designed for flood control or bank stabilization to minimize property loss. While these designs tend to solve local drainage and flood problems, they generally do not provide other features such as ecosystem structure and function.¹ Recent methods and technologies have shown promise in accommodating additional ecosystem functions, in addition to accommodating other purposes such as flood control or bank stabilization. New or renovated modifications should attempt to accommodate natural ecosystem functions such as serving as native species habitat.

2.4.5 Improve Native Species Habitat

Some native species have been found to be good indicators of watershed health. Because aquatic species such as *o'opu*, native freshwater gobies, tend to be sensitive to environmental changes, their continued presence suggests a stream's level of naturalness. Native plant species are also theorized to be superior to alien species in terms of soil stabilization and water infiltration.

¹ U.S. Fish and Wildlife Service. (1978). *Stream Channel Modification in Hawaii*.

Native species habitat has been degraded by human modifications to the environment that range from the introduction of alien species that out-compete or prey upon natives, to the input of pollution to the system, to outright destruction of habitat. Improvement of native species habitat is seen as a step towards restoring the original functions of the watershed.

2.4.6 Increase Stewardship of the Watershed

The channelization of streams has led to a disconnect between people and the natural environment that has in turn led to neglect. Ala Wai watershed residents and users need to reconnect with the natural environment in order to foster a sense of responsibility and guardianship over watershed resources. Awareness and accessibility to information and the natural environment itself are integral parts of increasing stewardship.²

² State of Hawaii Department of Health. (1998). *Ala Wai Canal Watershed Water Quality Improvement Project Management and Implementation Plan Volume I*.