

Honolulu Board of Water Supply East Honolulu Watershed Management Plan

Mayor Rick Blangiardi

East Honolulu Watershed Management Plan (EHWMP)

Commission on Water Resources Management
November 19, 2024

Presentation Agenda

1. EHWMP Overview & Planning Process
2. Community Involvement
3. EHWMP Public Review & Final Draft
4. Adoption Process
5. Q&A

EHWMP Planning Process

EHSCP/WMP Nexus

EHSCP	NEXUS	EHWMP
Develops the vision, responsibility, and goals for the planning process. Includes City Council approval, and provides the framework for the planning process.	Establishes the vision, responsibility, and goals for the planning process. Includes City Council approval, and provides the framework for the planning process.	Establishes the vision, responsibility, and goals for the planning process. Includes City Council approval, and provides the framework for the planning process.



EHWMP Goal & Objectives

GOAL

Develop a holistic WMP that will provide a balance between: 1) the preservation, restoration, and management of O'ahu's watersheds; and 2) sustainable ground water and surface water use and development to serve present users and future generations.

OBJECTIVES

Promote sustainable watersheds

Protect and enhance water quality and quantity

Protect Native Hawaiian rights and traditional and customary practices

Facilitate public participation, education, and project implementation

Meet water demands at reasonable costs

OWMP Framework

STATE WATER CODE

HAWAII WATER PLAN

- Statewide Framework to Update HWP
- Water Resource Protection Plan
- Water Quality Plan
- State Water Projects Plan
- Agricultural Water Use and Development Plan
- County Water Use and Development Plans

O'AHU GENERAL PLAN

8 Development Plan (DP)/ Sustainable Communities Plan (SCP)

Legal/ Regulatory/Policy Guidance

- Act 152: Watershed Protection
- Waiāhole Ditch Decision
- Ch 30, ROH Water Management
- BWS Mission Ka Wai Ola
- Mayor's Climate Change & Sea Level Rise Directive 2018
- Ola O'ahu Resilience Strategy

O'AHU WATER MANAGEMENT PLAN (BY DP/SCP DISTRICT)

Wai'anae

Ko'olau
Loa

Ko'olau
Poko

North
Shore

'Ewa

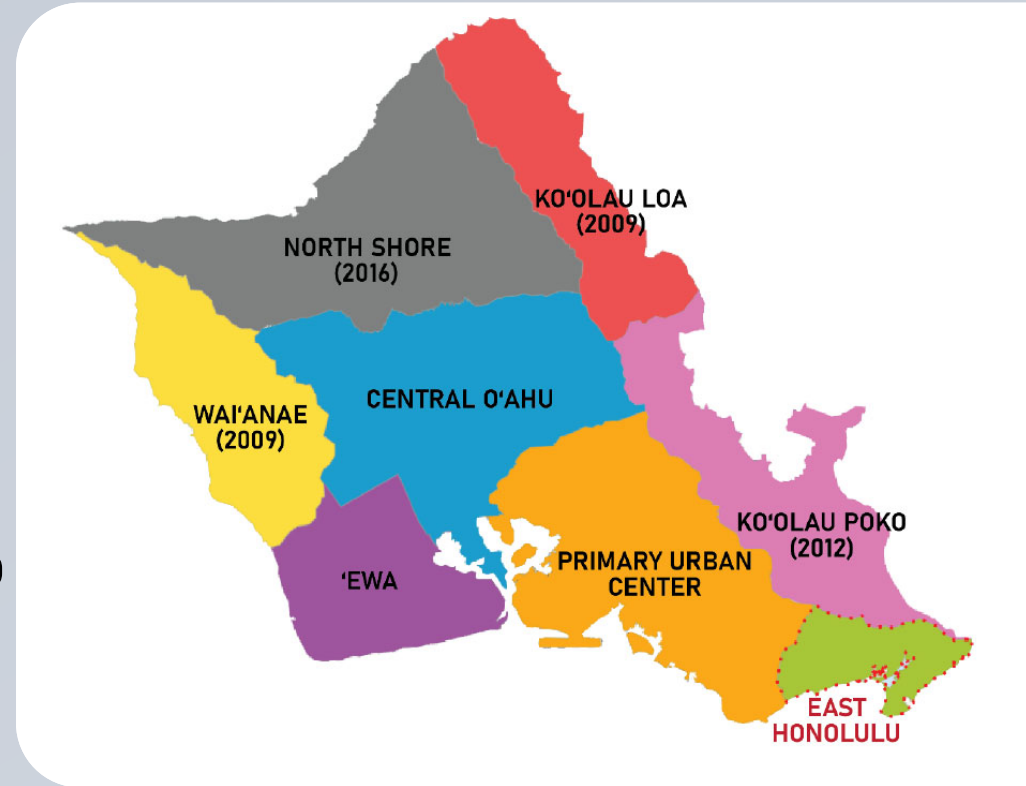
Central
O'ahu

PUC

EAST
HONOLULU

OWMP Status

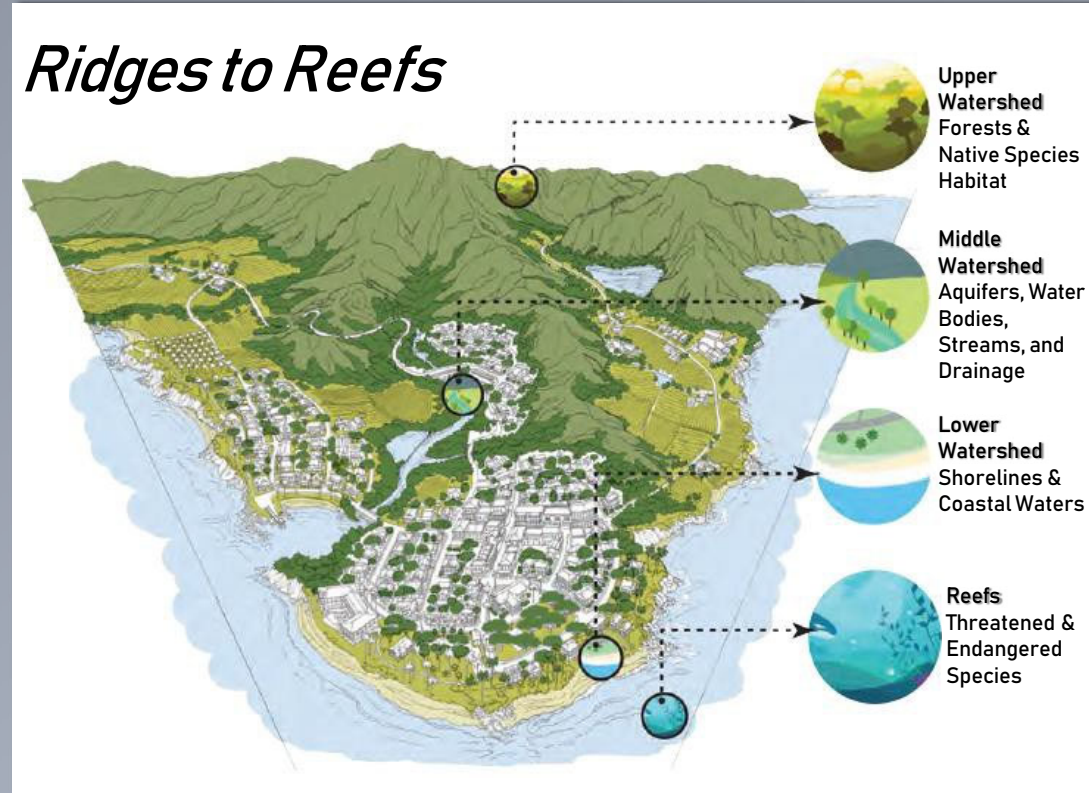
- Wai'anae, Ko'olau Loa, Ko'olau Poko, and North Shore WMPs have been adopted (Wai'anae currently being updated)
- 'Ewa, Primary Urban Center, Central O'ahu, are being revised to address climate change
- East Honolulu in final adoption



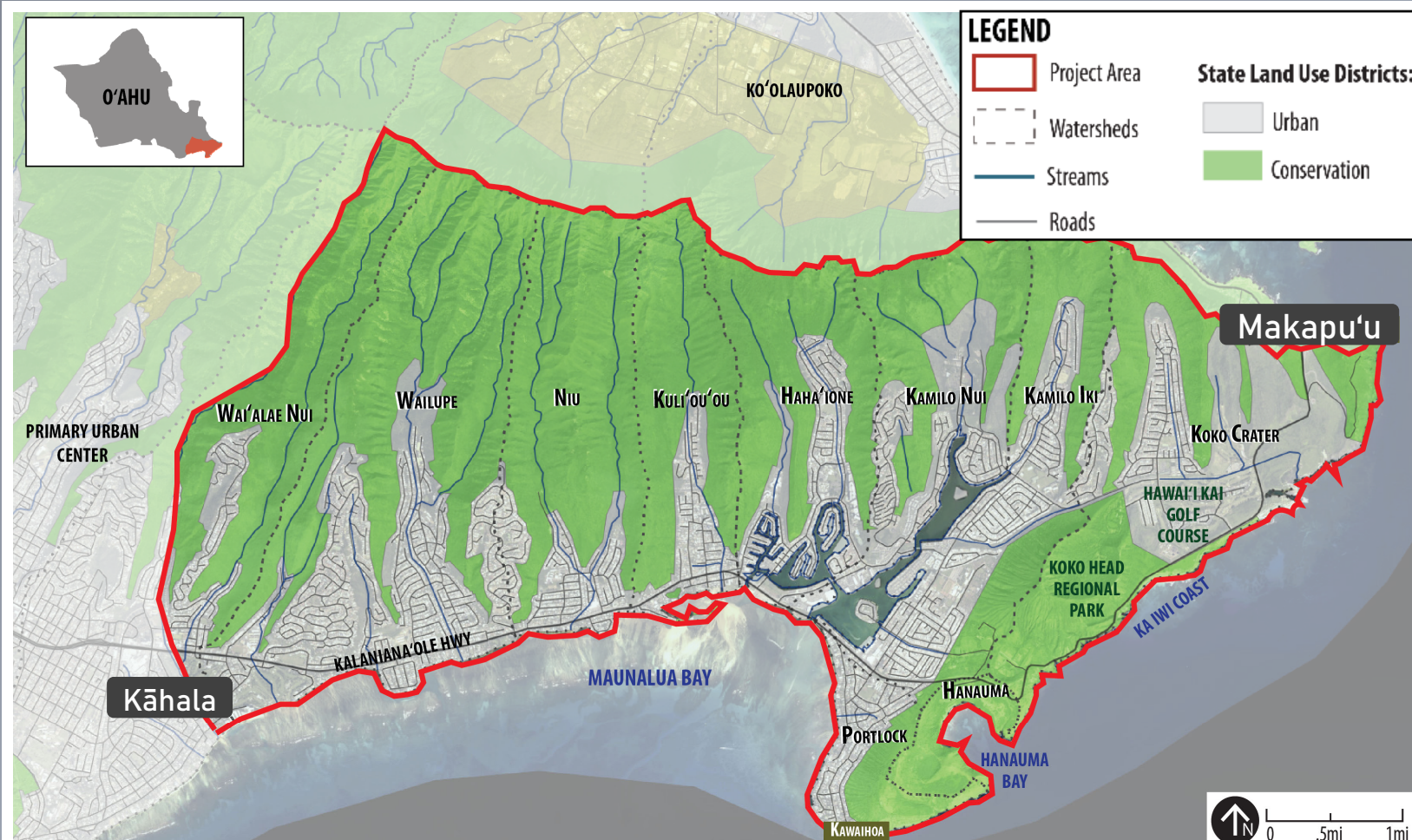
Ahupua'a Model

Planning concept based on Native Hawaiian ahupua'a model (systems-thinking), emphasizing:

- Watershed health
- Holistic resource management
- Self-sufficient and sustainable communities
- Inter-relationship of mauka and makai resources
- Stewardship and kuleana of land, water, people & culture



East Honolulu Planning District Kāhala to Makapu'u



EHWMP Planning Process

Research & Identify Key Water Resource Issues



Preliminary Watershed Analysis &
Water Demand Forecasting



Water Supply Options & Watershed
Management Policies, Projects & Strategies



Agency Review & Public Review Draft EHWMP



We Are
Here

Final Draft EHWMP & Adoption Process

Community
Meeting #1

Community
Meeting #2

Community
Meeting #3

Community
Meeting #4

Stakeholder Consultations

EHWMP Schedule



	2019				2020				2021				2022				2023				2024			
Year Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Stakeholder Consultation	★																							
Watershed Profile																								
Water Demand Analysis			★																					
Projects & Strategies								★																
Implementation Plan																								
Agency Review & Public Review Drafts																			★					
Final EHWMP & Approvals Process																								★

We are here
↓

East Honolulu Stakeholder Outreach as of October 2024

26 Stakeholder Consultations



12 Neighborhood Board Presentations



5 Community Meetings



5 City Council Hearings

Community Organizations:

- Kaiwi Maunalua Watershed Hui
- Livable Hawai'i Kai Hui
- Aloha 'Āina O Kamilo Nui
- Mālama Maunalua Bay
- Hui o Ko'olaupoko
- UH Sea Grant
- Ka Iwi Coast Coalition
- Maunalua Fishpond Heritage Center
- Roth Ecological
- Sierra Club
- WAI
- Kamehameha Schools
- Kamilo Nui Farmers

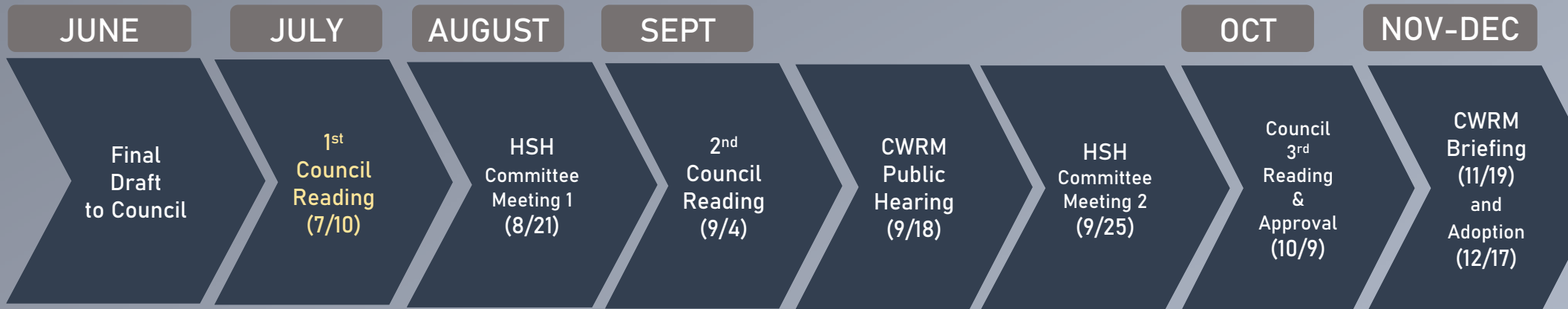
Agencies:

- CCH Office of Climate Change, Sustainability & Resiliency
- CCH Dept. of Facilities Maintenance
- DLNR Division of Forestry & Wildlife
- DLNR Nā Ala Hele Program
- Ko'olau Mountains Watershed Partnership
- DLNR Commission on Water Resource Management

Neighborhood Boards / Elected Officials:

- Hawai'i Kai (NB District #1)
- Kuli'ou'ou-Kalani Iki (NB District 2)
- Wai'alaie-Kāhala (NB District #3)
- Stanley Chang (Senate District #9)
- Gene Ward (Senate District #17)
- Mark Hashem (Rep. District #18)
- City Councilmember Tommy Waters

Adoption Timeline (2024)



Bill 038(24), FD1

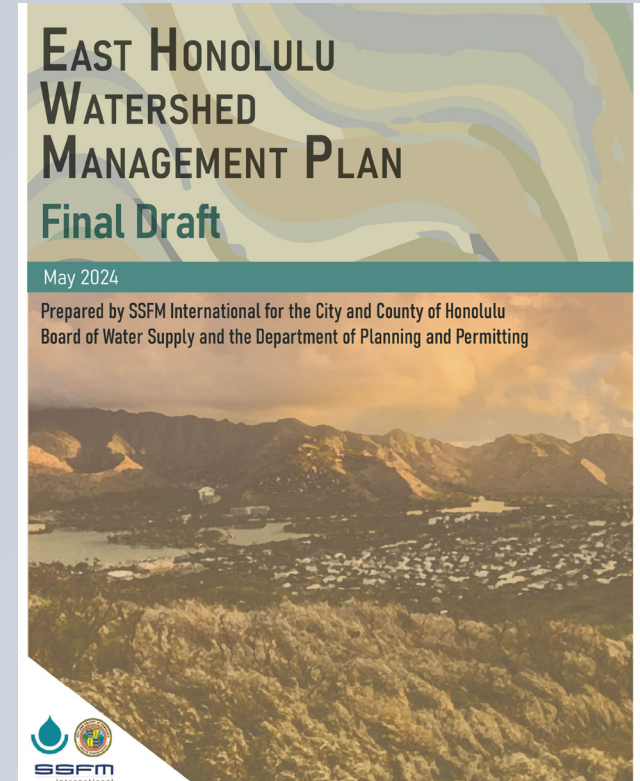


EHWMP Overview



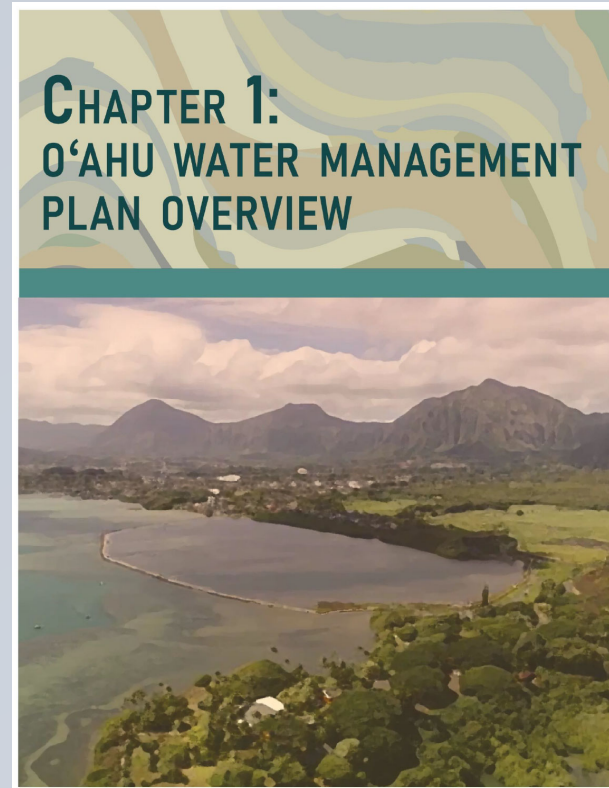
Elements of the EHWMP

- Ch. 1: O'ahu-Wide Overview
- Ch. 2: East Honolulu Watershed Profile
- Ch. 3: East Honolulu Water Demand/Supply
- Ch. 4: Policies, Projects & Strategies
- Ch. 5: Implementation



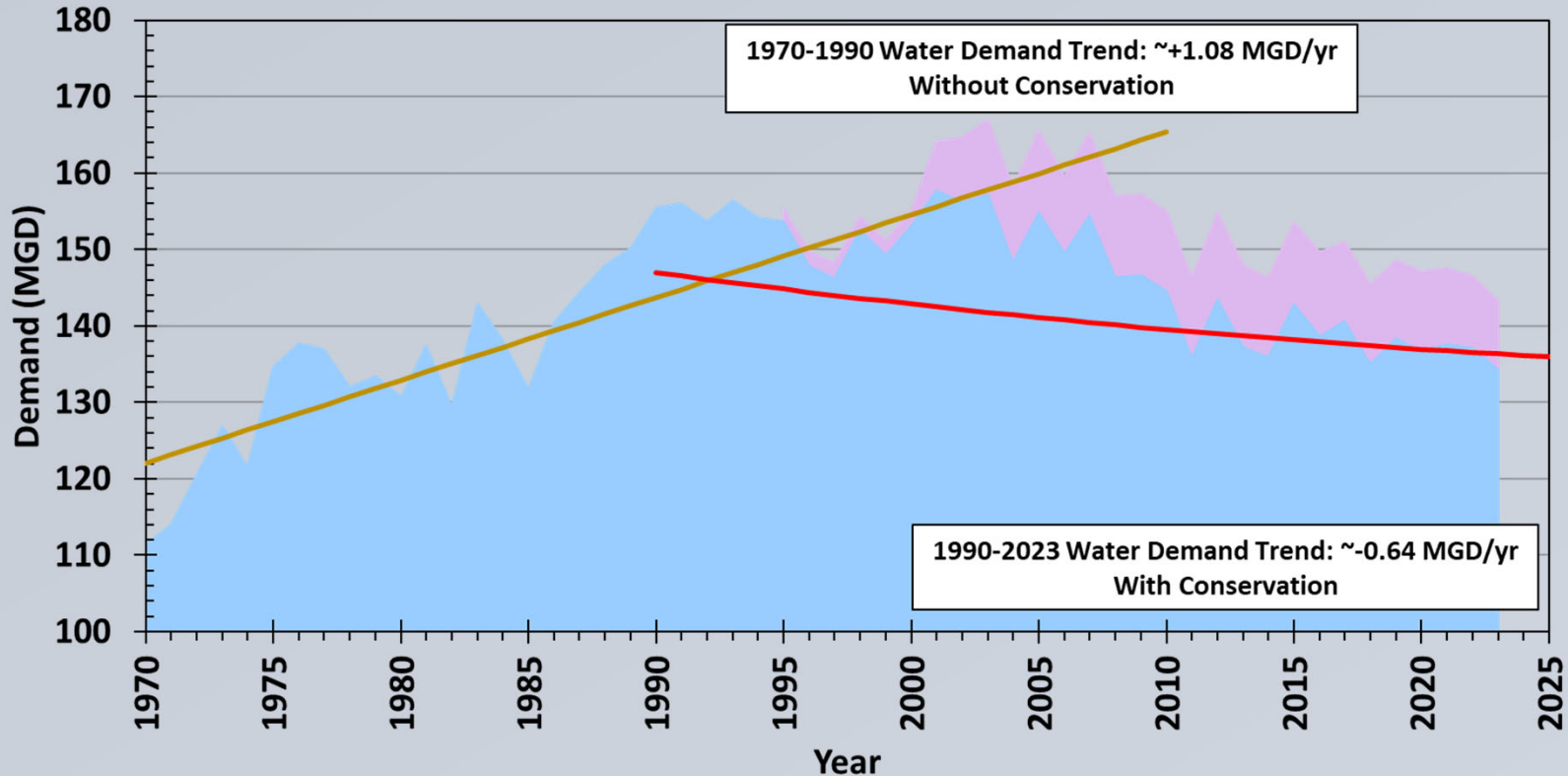
Elements of Chapter 1

- Authority and Purpose
- O'ahu Water Mgt Plan Framework (islandwide)
 - Integrated plans, goals & objectives
- O'ahu Water Use and Development Plan Update
 - Demand forecasts, supply availability, conservation, existing & planned sources, alternatives & transfers
 - Uncertainties & Contingencies
- Plan Implementation
 - Reasonable & beneficial uses, water allocation, adequate facilities reviews, CIP investment



BWS Water Demand Trends

BWS Water Demand 1970 - 2023



Non-Potable (1995-2023) Potable Demand (1970-2023) W/O Cons (1970 - 1990) Trendline W/ Cons (1990 - 2023) Trendline

Elements of Chapter 1 (Cont.)

Uncertainties & Contingencies

- Estimating & recovering sustainable yield
- Climate Change & drought impacts to SY
- Contamination
- Groundwater dependent ecosystems
- IIFS, drought impacts to stream flows, diversions & use
- Urban & Agriculture demands

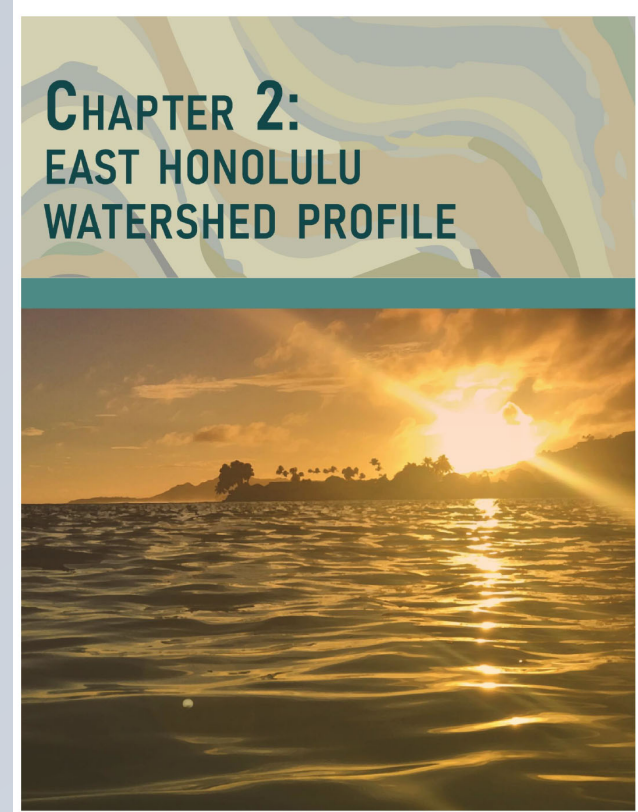


CHAPTER 1: O'AHU WATER MANAGEMENT PLAN OVERVIEW



Elements of Chapter 2

- Methodology
- Physical Setting
- Ground Water & Surface Water
- Terrestrial Ecosystems
- Climate Change & Sea Level Rise
- Traditional Practices & Cultural Resources
- Socio-Economic Conditions
- Land Use
- Infrastructure and Utilities
- Relevant Plans
- **Summary of Critical Water Resource Issues**



East Honolulu Water Resource Issues & Concerns

Climate Change

Sea Level Rise

Nearshore
Water Quality

Water
Conservation
Efforts

Maintaining
Traditional &
Customary
Practices

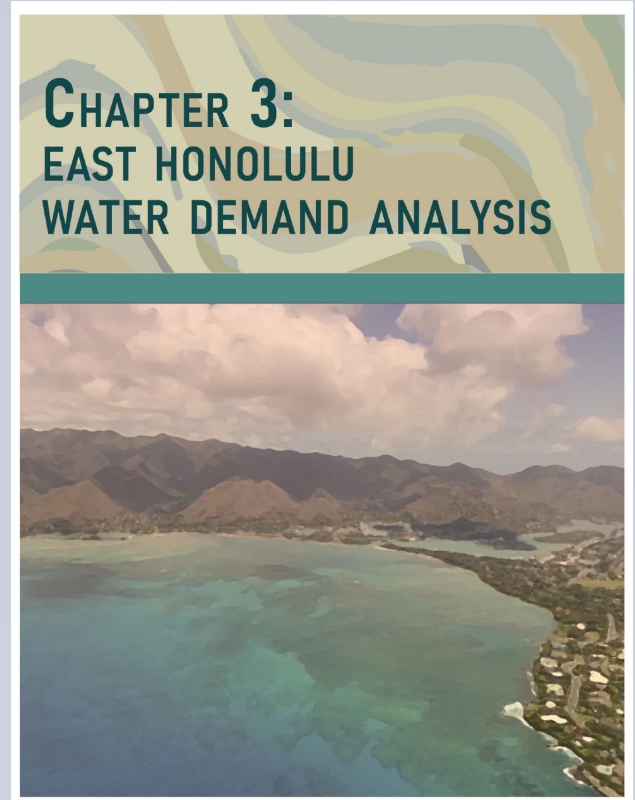
Flooding &
Drainage

Access to
Mauka &
Makai Areas

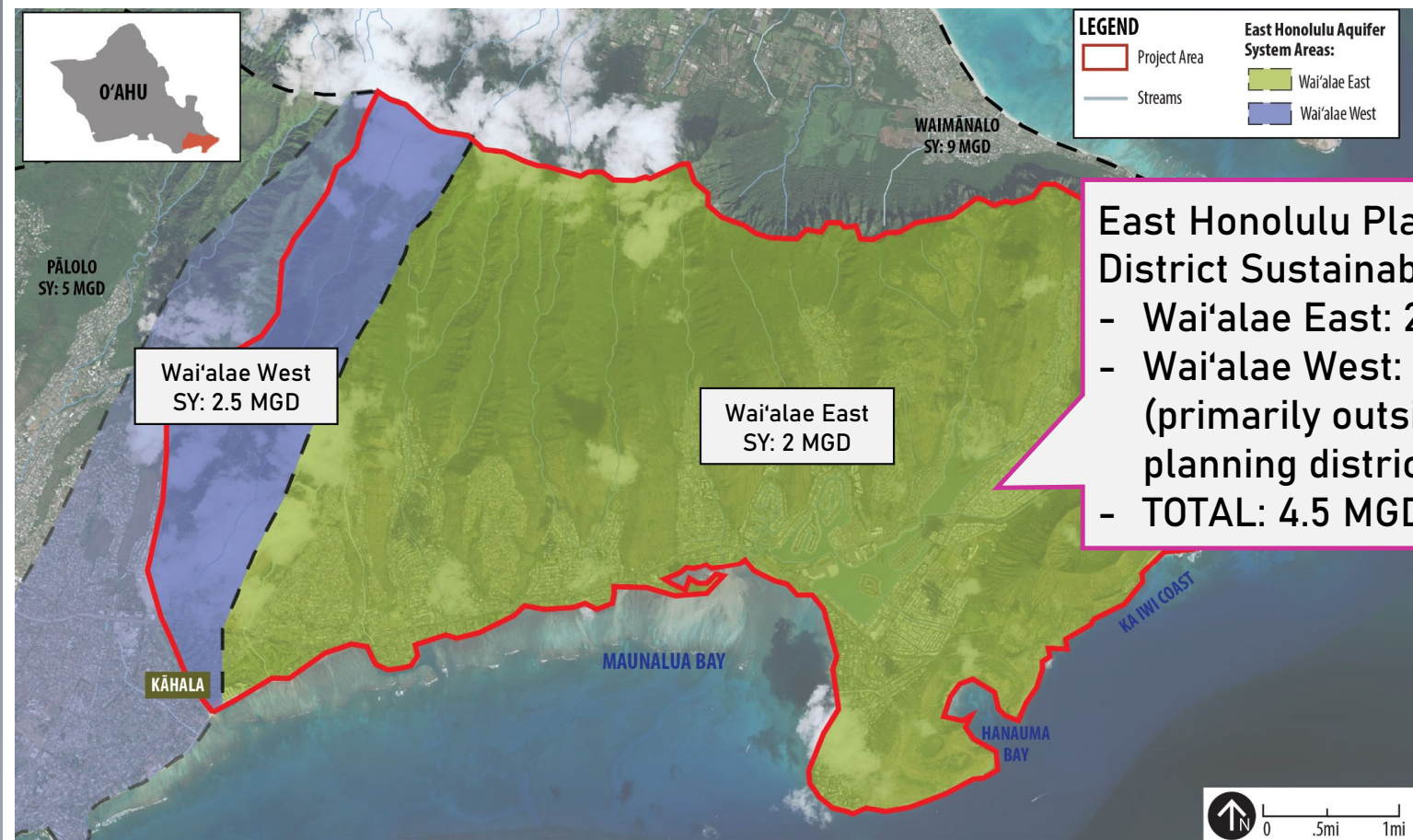
Wildfires

Elements of Chapter 3

- Existing water availability and supply; water demand; water uses
- Future water demand and supply
- Implications for future water supply planning



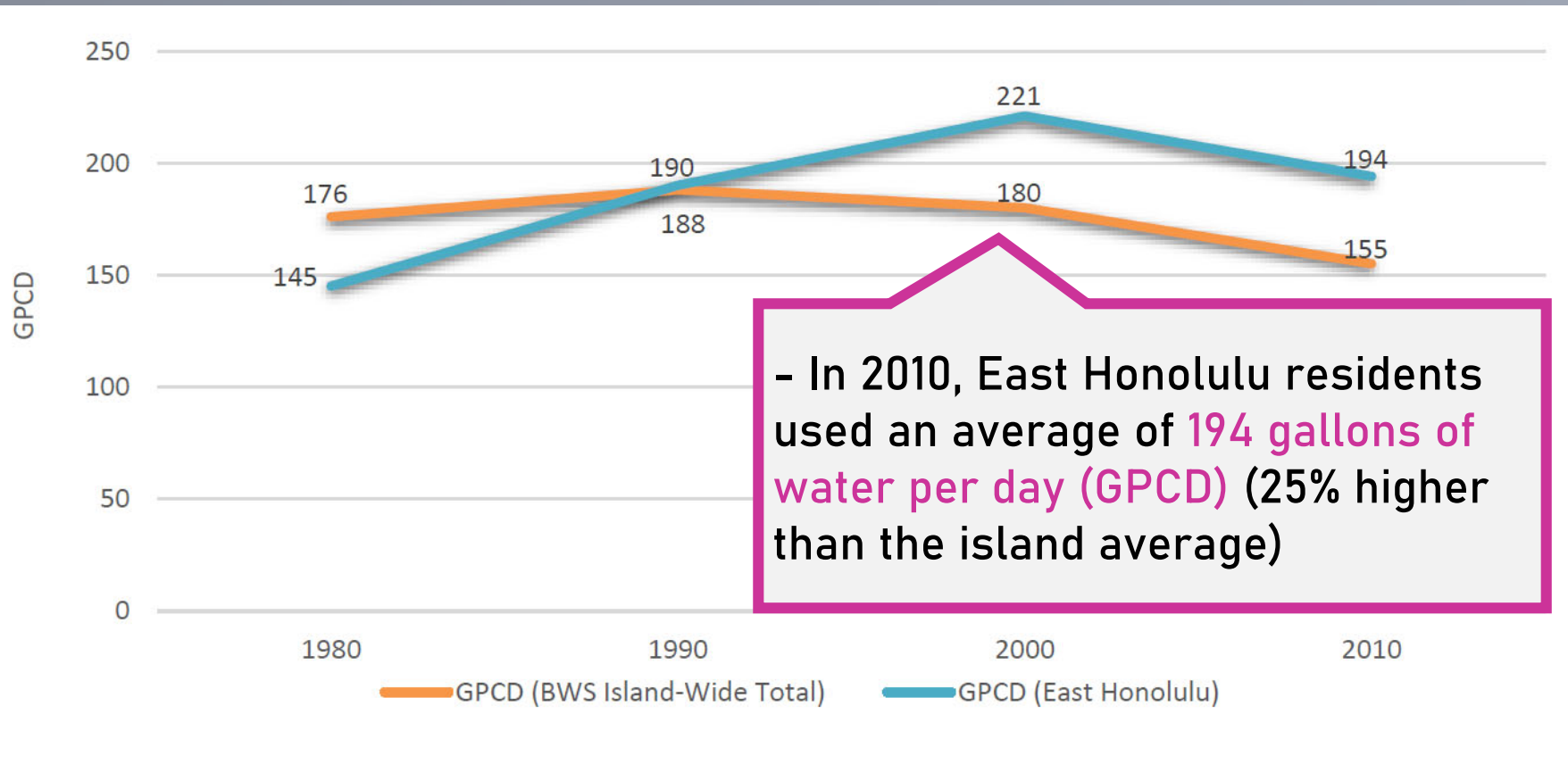
East Honolulu Groundwater System Areas



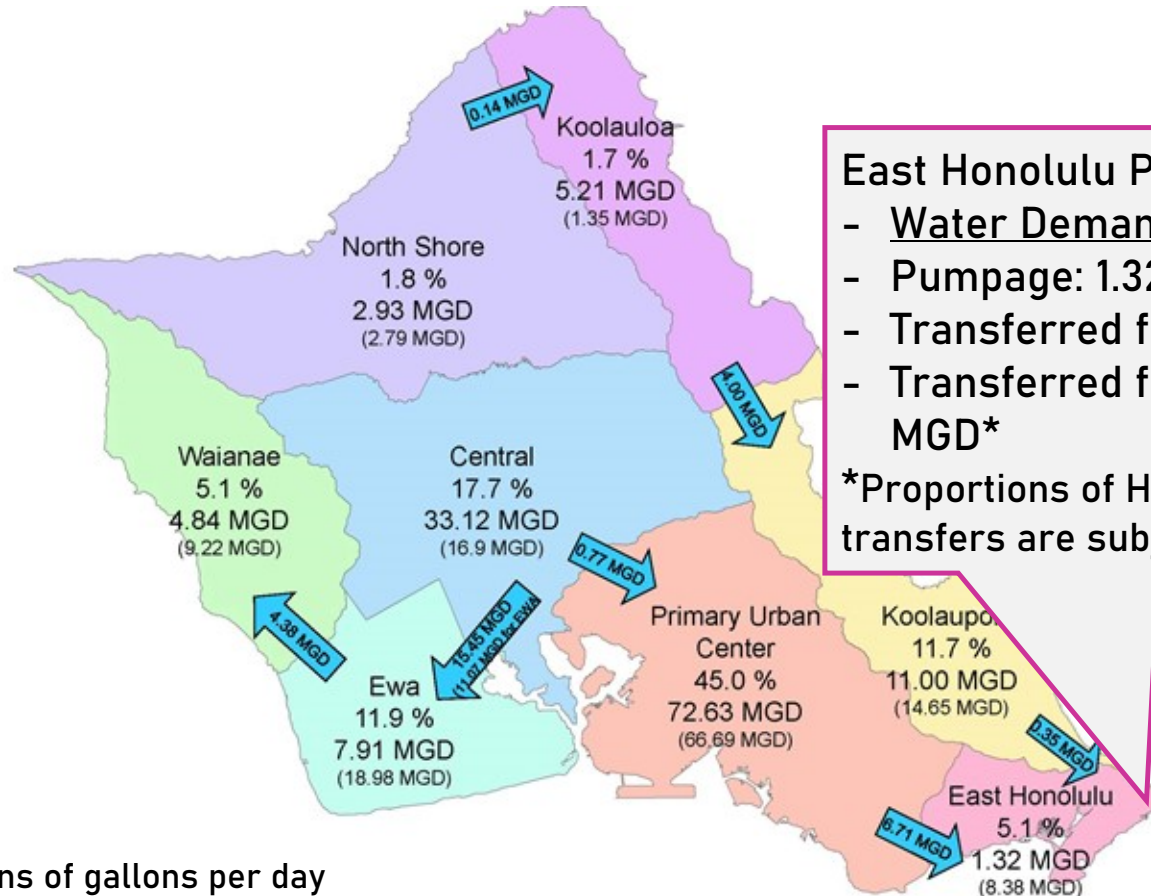
East Honolulu Planning District Sustainable Yield:

- Wai'alaie East: 2 MGD
- Wai'alaie West: 2.5 MGD (primarily outside of the planning district)
- TOTAL: 4.5 MGD

Historical Projected Per Capita Water Demand



BWS Water Transfer Map (2013-2017 average)



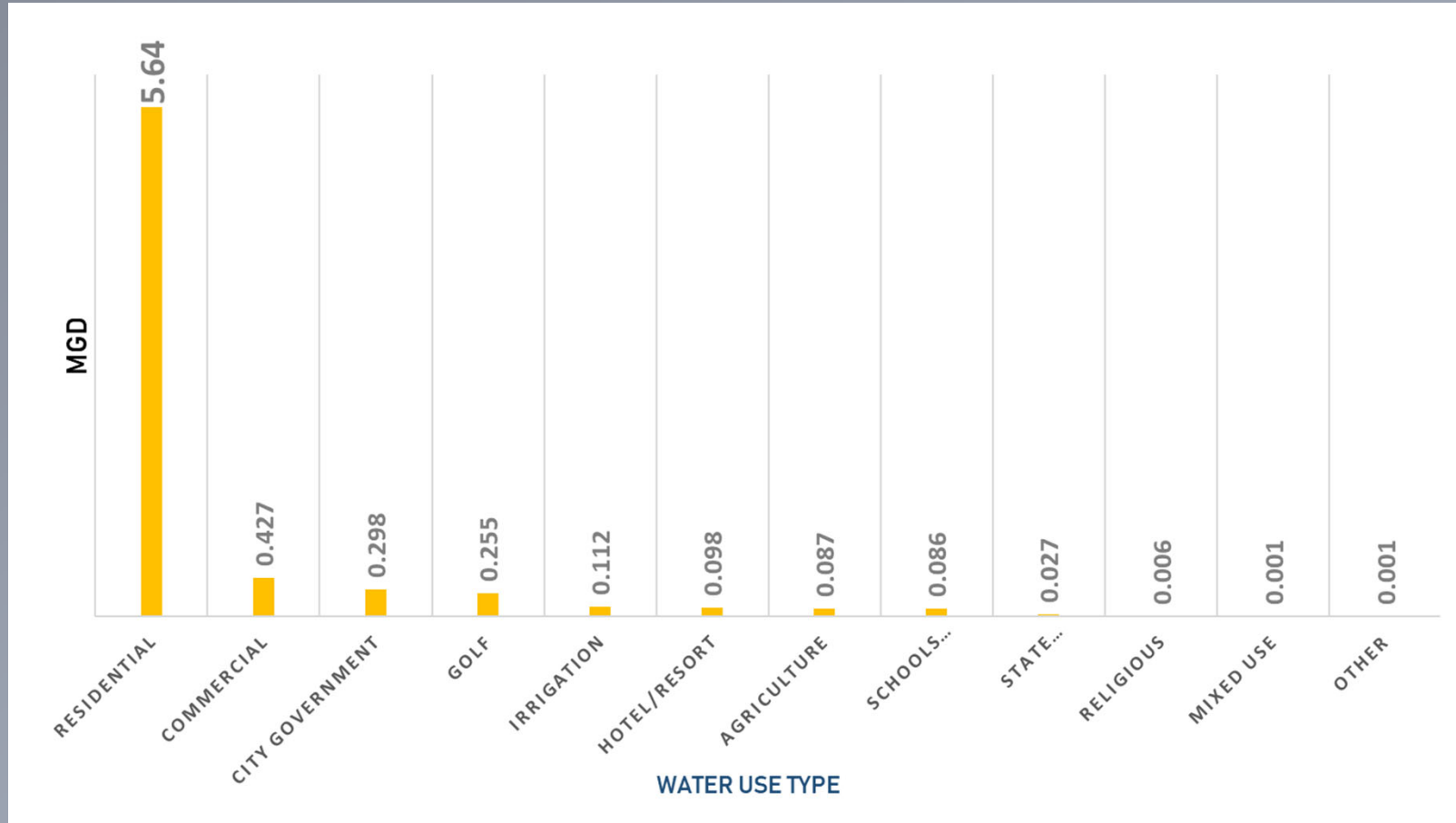
East Honolulu Planning District:

- Water Demand: 8.38 MGD
- Pumpage: 1.32 MGD
- Transferred from PUC: 6.71 MGD*
- Transferred from Windward: 0.35 MGD*

*Proportions of Honolulu and Windward transfers are subject to change

mgd= millions of gallons per day

BWS Potable Water Demand by Use Type (2013-2017 Average in MGD)



East Honolulu Future Water Demand Projections

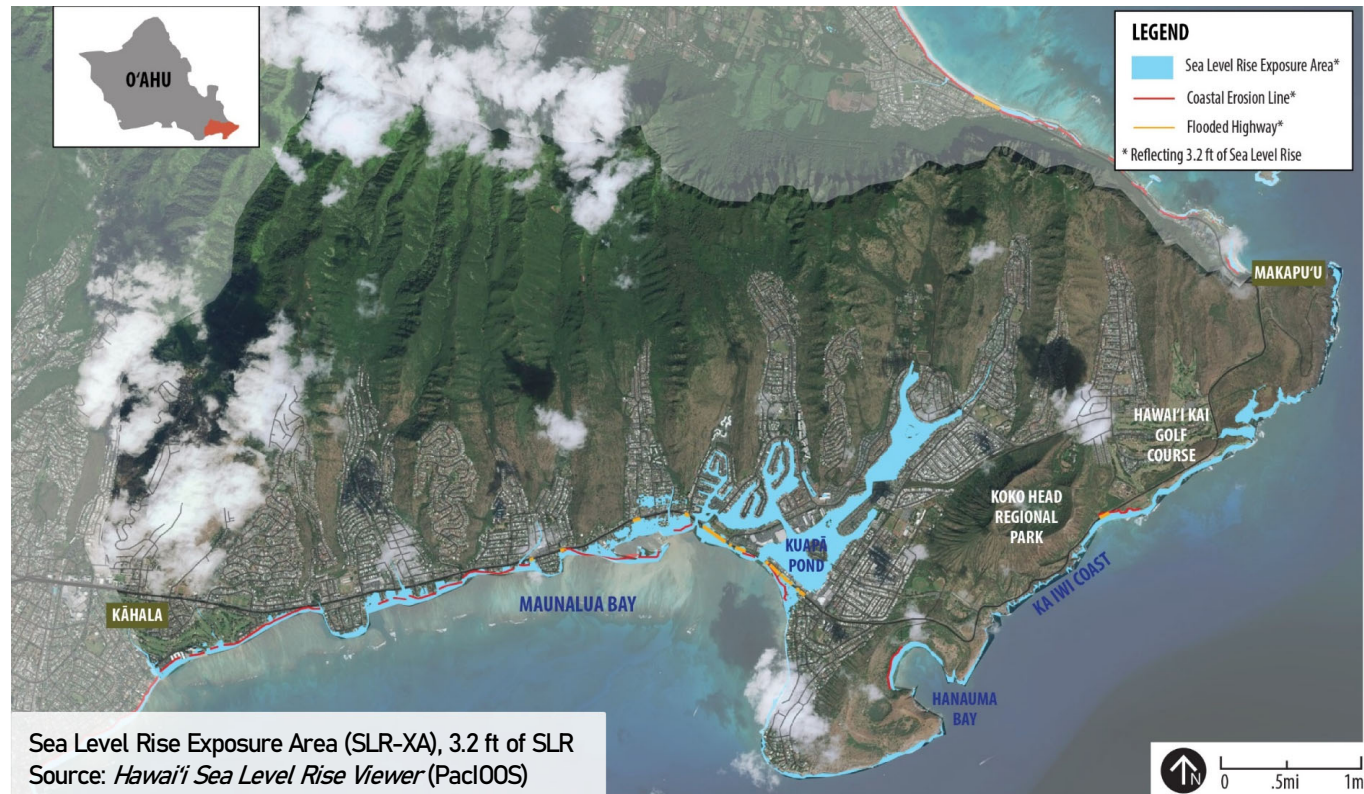
Three Scenarios for the Year 2040

- Low Demand (most probable)
- Mid Demand
- High Demand

One Scenario for the Year 2100

- “Ultimate” Demand
 - “Dry” Rainfall Scenario
 - “Wet” Rainfall Scenario

Sea Level Rise Impacts

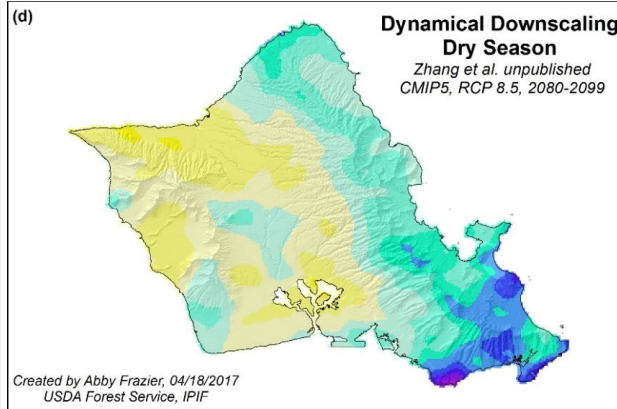
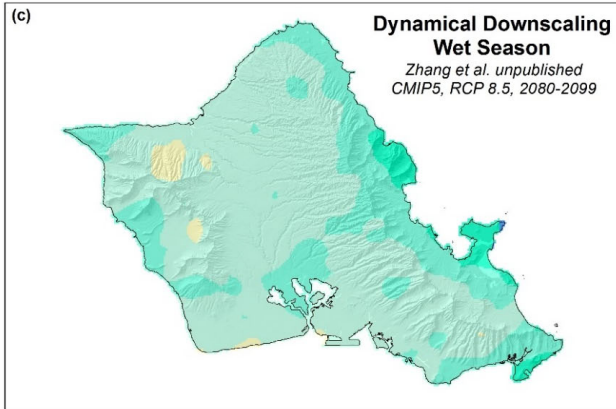
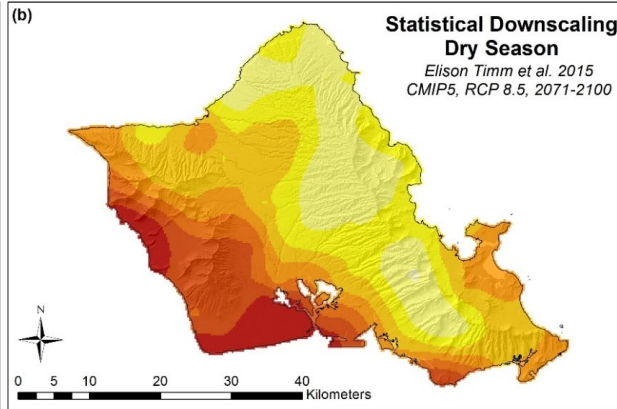
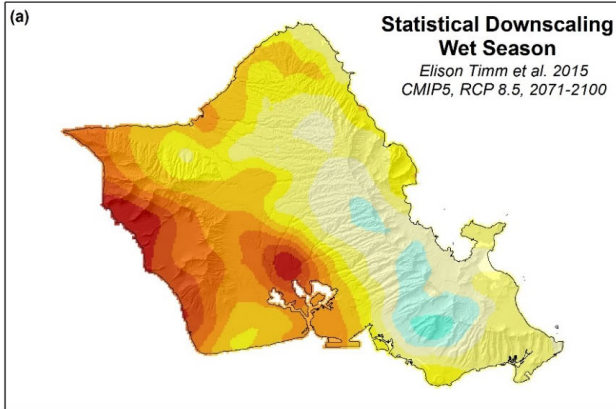


Ultimate Demand Scenarios accounts for 3.2 ft or more of sea level rise

Ultimate Rainfall Scenarios

Drier = "Worst Case"

Wetter = "Best Case"



The Ultimate Scenarios accounts for differences in the "Dry" and "Wet" rainfall scenarios—the dry scenario incorporates increased irrigation demand

Water Source Adequacy

2040

- Low (“Most Probable”) Demand Scenario – existing water supply is adequate
- Mid- and High-Demand Scenarios – would require additional water resources / improved water efficiency

2100 Ultimate

- Wet Scenario – adequate water supply (anticipated)
- Dry Scenario – would require improved water efficiency

East Honolulu's Shared Water Kuleana

Issues

East Honolulu relies on Honolulu and Windward water sources

Water transfers can be impacted by drought and contamination, etc.

Ko'olau Poko has dike aquifers which are more vulnerable to drought

Transfers can be detrimental to Windward's streams and cultural uses

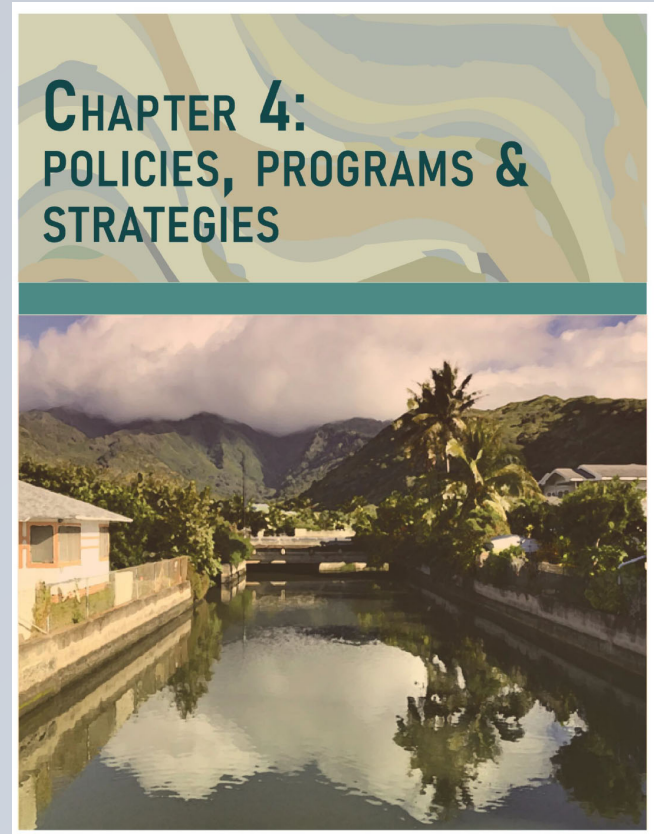


Kuleana

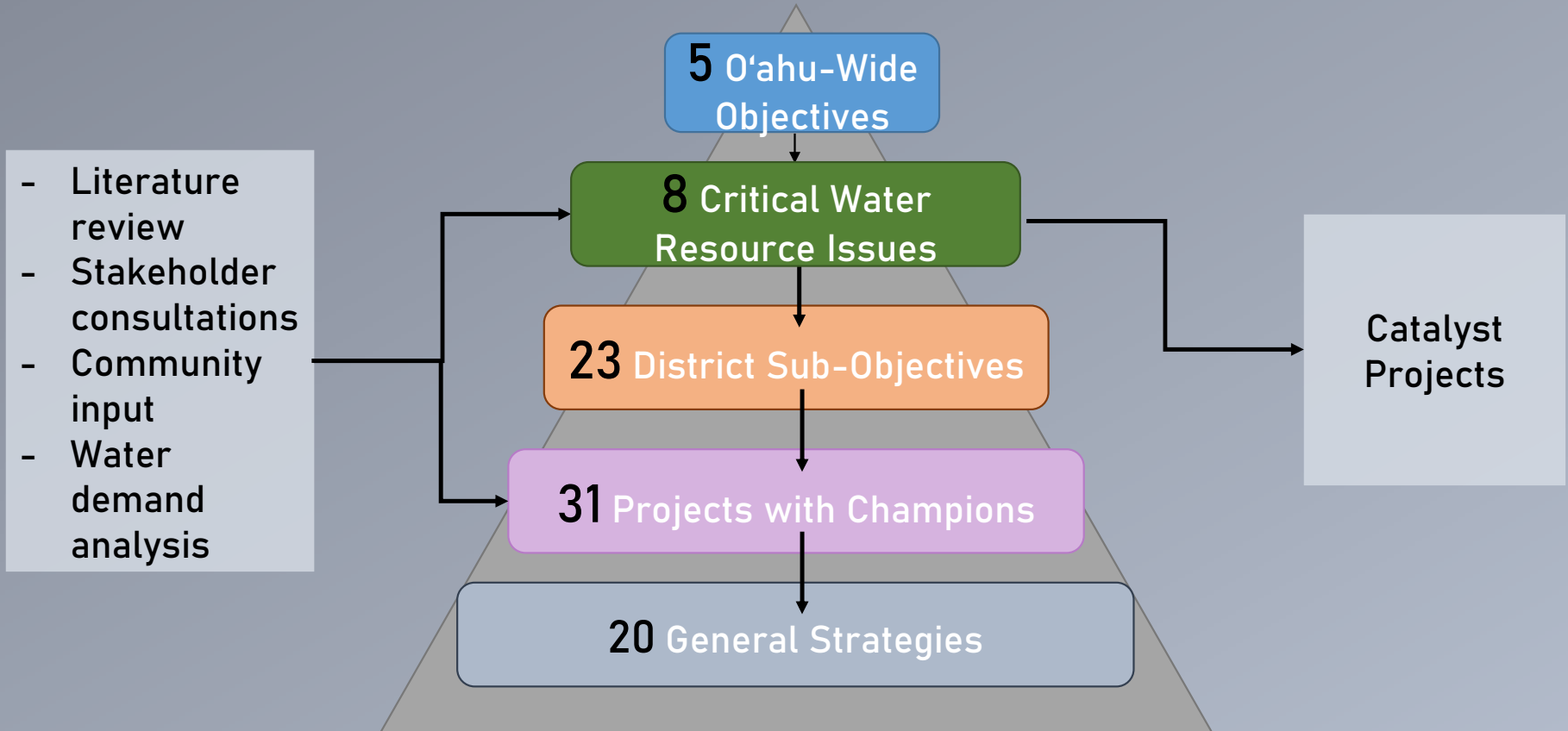
Responsibly to use transferred water efficiently

Elements of Chapter 4

- EHWMP Goals, Objectives, and Sub-Objectives
- Project Descriptions
- Program & Strategy Descriptions



Relationship: Watershed Issues, Policies, Projects & Strategies



Example of Issues – Policies – Projects Relationship

District Issues & Values	District Sub-Objective	Projects with Champions	General Strategies
OBJECTIVE #2: PROTECT AND ENHANCE WATER QUALITY AND QUANTITY		(O'ahu-Wide Objective)	
<p>Issue: Irrigation is a large contributor to water demand for single-family home development, particularly in East Honolulu, which has a relatively dry climate.</p>	<p>2.1: Encourage the use of xeriscaping and other low impact development strategies to reduce irrigation water demand from current aquifer sources and mitigate flooding impacts, with a focus on <u>large landscaped</u> areas such as parks, schools, golf courses, roadway landscaping, farms and large residential lots.</p>	<p>#17: Low Impact Design and Green Infrastructure Standards and Guidelines #30: Develop R-1 Recycled Water for Irrigation Users in Hawai'i Kai</p>	<p>L: Agricultural Water Use Plans I: Golf Course Xeriscaping and Water Efficiency Plan M: Grey Water Reuse Plan</p>
<p>Value: Water quality of Maunalua Bay was one of the most discussed water resource issues among residents.</p> <p>Issue: Maunalua Bay is considered an impaired water body; stormwater contributes to the degraded quality of the Bay.</p>	<p>2.2: Improve the water quality of Maunalua Bay by capturing and infiltrating stormwater runoff and reducing the transfer of sediment and other pollutants from mauka areas to the Bay.</p>	<p>#2: Wailupe Stream Restoration #3: Kuli'ou'ou Watershed Retention and Infiltration Retrofit #4: Kamilo Nui Watershed Kipuka Reforestation #5: Kamilo Nui Watershed Sustainable Agriculture Pilot Project #6: Kamilo Nui Watershed Kuapā Pond Restoration #11: Restoration of Upper Niu and Wailupe Watersheds #12: Mālama Maunalua Programs #16: DFM Community Programs #17: Low Impact Design and Green Infrastructure Standards and Guidelines #18: Stormwater Utility O'ahu #19: Watershed Boulder Basins and Detention Basins #20: Drainage System Upgrades #26: Drainage and Stormwater Master Plans #29: One Water Collaboration for Climate Resilience #31: Ka Lapa O Maua (Paikō Ridge) Preservation</p>	<p>A: Southern Ko'olau Mountains Native Species Reforestation D: Coordinated Pig Hunting Program C: Stream Debris Educational Program E: Trail Education Program F: Trail Erosion Mitigation G: Kuli'ou'ou Ridge Trail Entrance Improvements</p>

Example of District Sub-Objectives

1: Promote Sustainable Watersheds

1.1: Increase native reforestation and implement measures to slow the spread of invasive species and ungulates...

1.2: Implement preventative measures that reduce wildfire risks

1.5 Conserve natural shorelines to protect beaches and coastal ecosystems....

2: Protect and Enhance Water Quality and Quantity

2.1: Encourage the use of xeriscaping and other low impact development...

2.2: Improve the water quality of Maunalua Bay by capturing stormwater runoff...

2.5: Reduce ground water contamination through cesspool conversion...

3: Protect Native Hawaiian Rights and Traditional and Customary Practices

3.1: Restore fishponds and springs for cultural and educational use

3.3: Improve public shoreline access...

4: Facilitate Public Participation, Education and Project Implementation

4.2: Provide educational opportunities to learn about protecting and preserving water resources

4.3: Collaborate among government agencies, landowners, and other stakeholders to implement mutually beneficial projects....

5: Meet Public Water Demands at a Reasonable Cost

5.2: Adapt and plan for drought...

5.3: Implement conservation measures to improve water efficiency...

EHWMP Projects with Champions

- #1 Kalauha'īha'ī Fishpond and Kānewai Spring Restoration
- #2 Wailupe Stream Restoration
- #3 Kuli'ou'ou Watershed Retrofit
- #4 Kamilo Nui Watershed Kipuka Reforestation
- #5 Kamilo Nui Watershed Sustainable Agriculture Pilot Project
- #6 Kamilo Nui Watershed Kuapā Pond Restoration
- #7 Keawāwa Wetland & Hawea Heiau Restoration
- #8 Ka Iwi Coast Mauka Lands Preservation
- #9 Restoration of Upper Niu and Wailupe Watersheds
- #10 Maunalua Kaiwi Watershed Hui
- #11 Maunalua Watershed Talk Stories
- #12 Mālama Maunalua Programs
- #13 Coral Assisted Evolution Project
- #14 Community Cleanups and Water Quality App
- #15 Work-4-Water Initiative
- #16 DFM Community Programs

- #17 Low Impact Design and Green Infrastructure Standards and Guidelines
- #18 Stormwater Utility O'ahu
- #19 Watershed Boulder Basins and Detention Basins
- #20 Drainage System Upgrades
- #21 Implement Mayor's Directive on Climate Change and Sea Level Rise
- #22 Climate Change Sustainable Yield Scenarios
- #23 Infrastructure Planning in the Sea Level Rise Exposure Area
- #24 O'ahu Climate Adaptation Strategy
- #25 Wastewater Long Range Master Plans
- #26 Drainage and Stormwater Master Plans
- #27 BWS Long Range Water Master Plan and Infrastructure Renewal and Replacement Program
- #28 BWS Water Conservation Incentives Program
- #29 One Water Collaboration for Climate Resilience
- #30 R-1 Recycled Water for Irrigation in Hawai'i Kai
- #31 Ka Lapa O Maua (Paikō Ridge) Preservation

EHWMP General Strategies & Programs

A: Southern Ko'olau Mountains Native Species Reforestation Program

B: Stream Restoration, Dechannelization & Maintenance

C: Stream Debris Educational Program

D: Coordinated Pig Hunting Program

E: Trail Educational Program

F: Trail Erosion Mitigation

G: Kuli'ou'ou Ridge Trail Entrance Improvements

H: Firebreak Program

I: Golf Course Xeriscaping and Water Efficiency Plan

J: Lateral Shoreline Access Plan

K: Awāwāmalu Access Improvements

L: Agricultural Water Use Plans

M: Grey Water Reuse Plan

N: Climate Adaptation Neighborhood Plans

O: Climate Change and Resilience Education

P: Restoration of Freshwater Spring Flows to Nearshore Coastal Waters

Q: Strengthen Building Codes and Standards for Building Resilience

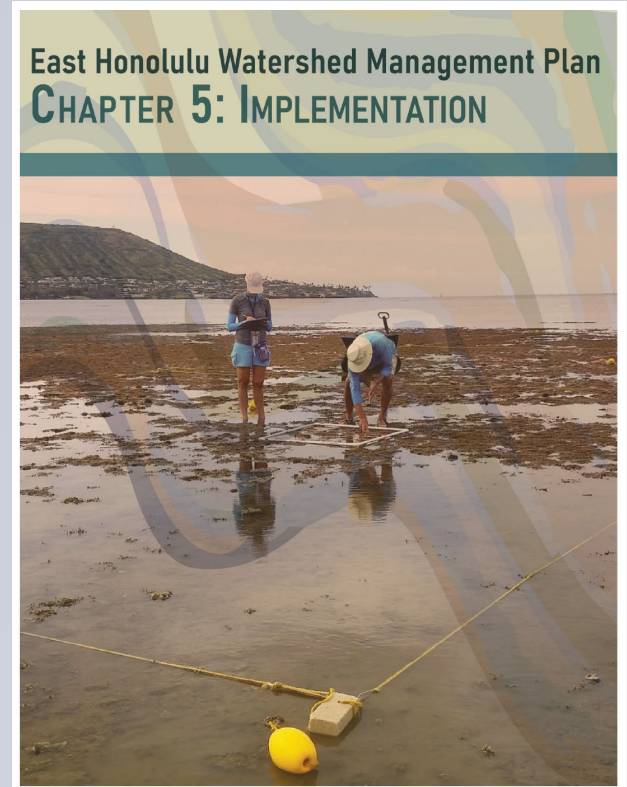
R: Build Back Better and Smarter

S: Restrictions on Shoreline Armoring

T: Redevelopment District

Elements of Chapter 5

- **Water Use and Development Plan**
- **Priority Watersheds and Catalyst Projects**
- **Implementation Entities**
- **Funding**



Catalyst Projects

What are catalyst projects?

- A high priority project that will provide energy, connectivity, information, and inspiration for other projects and programs

What are priority watersheds?

- Watersheds that require special protection or enhancement of water quality and/or provide special opportunities for implementing important watershed management actions

EHWMP Catalyst Projects

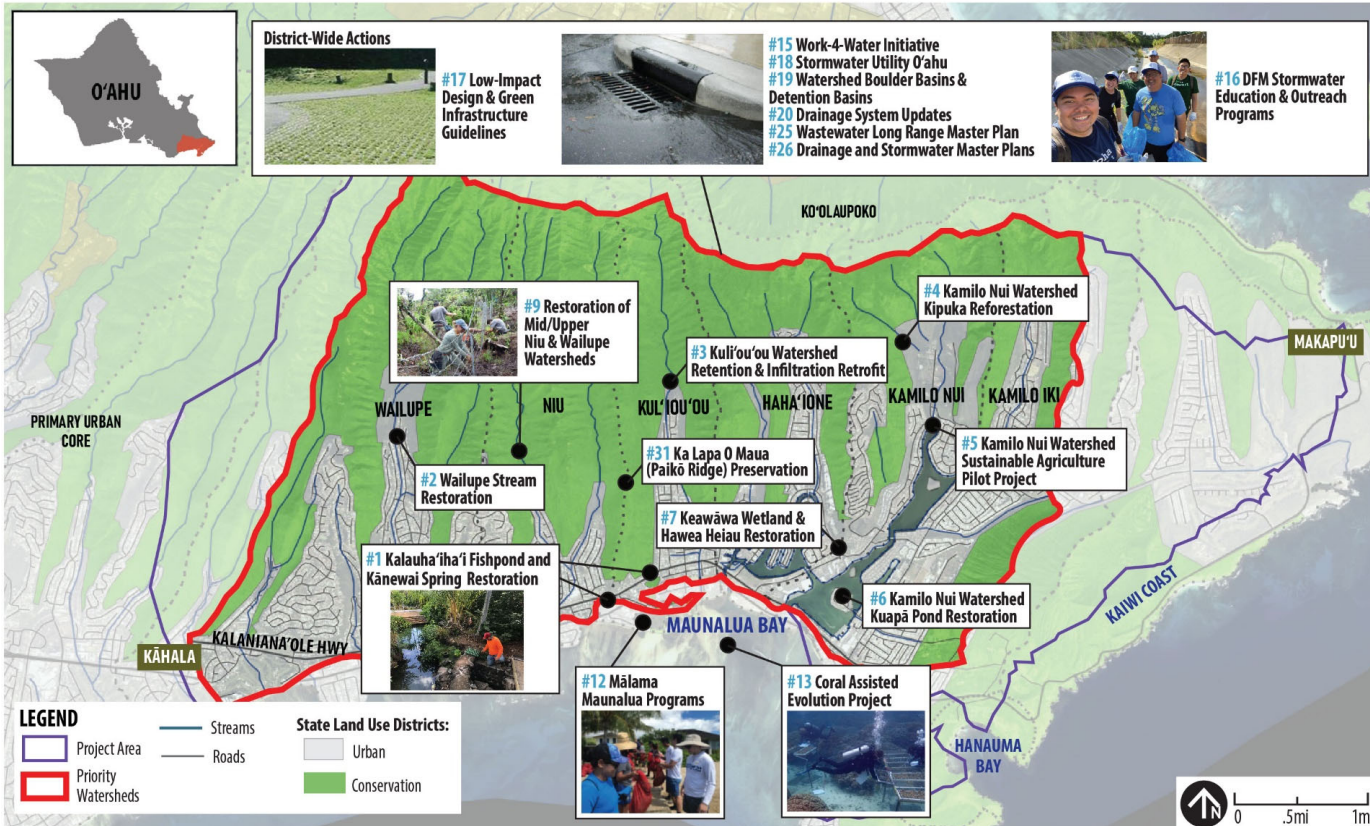
- **Catalyst Project #1:** Improve water quality in Maunaloa Bay
 - Priority watersheds for implementation: 1) Wailupe 2) Niu 3) Kuli'ou'ou 4) Haha'ione 5) Kamilo Nui and 6) Kamilo Iki
- **Catalyst Project #2:** Increase water efficiency in East Honolulu
 - District-wide implementation

Catalyst Project #1: Improve water quality in Maunalua Bay

Goals:

- #1: Reduce the amount of invasive algae found in the Bay.
- #2: Increase the amount of healthy, living coral reef in the Bay.
- #3: Decrease the amount of impervious surfaces within the priority watersheds.
- #4: Decrease the number of cesspools located within the priority watersheds.
- #5: Increase the amount of fresh water that enters the Bay through stormwater retention and water conservation.
- #6: Decrease the amount of stormwater runoff, erosion, and debris that enter the Bay.

Catalyst Project #1: Priority Watersheds & Key Actions



- Key actions within these watersheds are being prioritized as they represent the highest pollution reduction benefits
- Most site-specific actions have been previously identified by the Kaiwi- Maunaloa Watershed Hui

Catalyst Project #2: Increase water efficiency in East Honolulu

Goals:

- #1: Maintain East Honolulu's per capita water demand at 170 gallons per person per day (GPCD) through 2040.
- #2: Reduce per capita water demand to 130 GPCD by 2100.

Catalyst Project #2: Increase water efficiency in East Honolulu

District-Wide Key Actions:

Water Distributor

- BWS Infrastructure Renewal and Replacement Program (Project #27)

Water Users

- BWS Water Conservation Incentives Program (Project #28)
- Developing R-1 Recycled Water for Irrigation Users in Hawai'i Kai (Project #30)

Example Action Plan for Catalyst Projects

Project with Champion or Strategy	Goals & Alignment with Improving Water Quality in Maunalua Bay	Existing or Potential Champions & Partners	Status	Estimated Project Costs	Target Implementation
Project #26: Drainage and Stormwater Master Plans	<p><u>Project Goal:</u> Implement DFM's <i>Stormwater Management Program Plan</i>, which increases resilience of the drainage system in accordance with the Mayor's Climate Change and sea level rise Directive 18-02.</p> <p><u>Catalyst Project Alignment:</u> Drainage system improvements are needed to slow, capture, and filter stormwater runoff that enters Maunalua Bay.</p>	CCH Department of Design and Construction (DDC) and DFM	<p><u>To Date:</u> The Storm Water Management Program Plan was finalized by DFM in September 2021.</p> <p><u>Next Steps:</u> DFM to work with DCC and other partner agencies to implement the <i>Stormwater Management Program Plan</i>.</p>	Unknown.	Ongoing Effort
SHORT-TERM (2-5 YEARS TARGET IMPLEMENTATION)					
Project #4: Kamilo Nui Watershed Kipuka Reforestation	<p><u>Project Goal:</u> Reforest the area near Kamilo Nui Farm with kipuka, to reseed and repopulate native plants in Kamilo Nui Valley.</p> <p><u>Catalyst Project Alignment:</u> Enhanced vegetation cover and diversity surrounding Kuli'ou'ou Stream and Paikō lagoon will help prevent erosion and reduce stormwater entering Maunalua Bay.</p>	Maunalua Watershed Hui	<p><u>To Date:</u> Field observations have been completed and stakeholders / potential contractors have identified by the Hui.</p> <p><u>Next Steps:</u> The Hui to determine the number and size of kipuka areas, establish an agreement with the affected landowner(s), identify and obtain any required permits, and acquire funding for implementation.</p>	Cost will be dependent upon the number and size of kipuka areas, as well as the agreement reached with the landowner(s).	2025

EHWMP Public Review & Adoption



Engagement for Public Review Draft (July–October 2023)

- Neighborhood Board Announcements/Presentations
- Posting of draft plan and public comment period on BWS website and social media
- E-mail blasts to project mailing list
- Transmittal of plan to County and State agencies
- Community Meeting #4
- Two-month public comment period

How Public Input was Incorporated into the EHWMP Final Draft

PUBLIC REVIEW DRAFT – JANUARY 2024 (43 comments tabulated):

- Updated data, project information, and references where appropriate
 - Preliminary census data incorporated into water demand analysis
- Referenced additional community watershed projects provided by the Maunaloa Ka Iwi Watershed Hui
- Updated place name references where appropriate
- Emphasized that Ka Pa'akai Analysis for projects was preliminary and may require further study



FINAL DRAFT TO COUNCIL – MAY 2024 (28 comments tabulated):

- Revisions to ahupua'a maps and boundaries to match updated State GIS ahupua'a layer
- Incorporated updates to Mālama Maunaloa priority project
- Added references to Kamilo Nui Firewise
- Added project champions to project list
- Updated place name and organization names throughout
- Corrected tables/figures as applicable
- Added Paiko Ridge Preservation as Project #31

Neighborhood Board Presentations & Endorsement of Final Draft (Feb-May 2024)

- **Hawai'i Kai Neighborhood Board No. 1:**
 - February 2024: Unanimous endorsement
- **Kuli'ou'ou-Kalani Iki Neighborhood Board No. 2:**
 - May 2024: 7 votes in favor, 2 against
- **Wai'alaie-Kāhala Neighborhood Board No. 3:**
 - May 2024: 4 votes in favor, 4 abstained

Council Hearings and Adoption (Aug–Oct 2024)

- Three Council readings, two Committee meetings (Housing, Sustainability, Health); ordinance passed unanimously on 10/9
- Testimony received:
 - Generally supportive
 - Amendments submitted based on two pieces of testimony requesting revisions:
 - Small text edits
 - Changes for one of the “projects with champions” descriptions (#1) and two associated figures
 - Correction to ahupua‘a description (based on changes to previous draft)

See Council records and adopted Ordinance here:



CWRM Public Hearing (9/18/24)

- Supportive testimony provided:
 - Elizabeth Reilly, Livable Hawai'i Kai Hui, Hawai'i Kai Neighborhood Board
 - Jeanne Ohta, Kuli'ou'ou Neighborhood Board
- Questions addressed from CWRM Staff

Project Contact Information



Honolulu Board of Water Supply

Barry Usagawa
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busagawa@hbws.org



Melissa May
808-628-5861
mmay@ssfm.com

For more information, please visit:
<http://www.boardofwatersupply.com/water-resources/watershedmanagement-plan/east-honolulu>

Community Meetings

Community Meeting #1
MARCH 2019
(In-Person)

~ 45 attendees

Community Meeting #2
NOVEMBER 2019
(In-Person)

~ 20 attendees

Community Meeting #3
WINTER 2021
(Virtual Open House and Q/A Sessions)

~ 190 participants

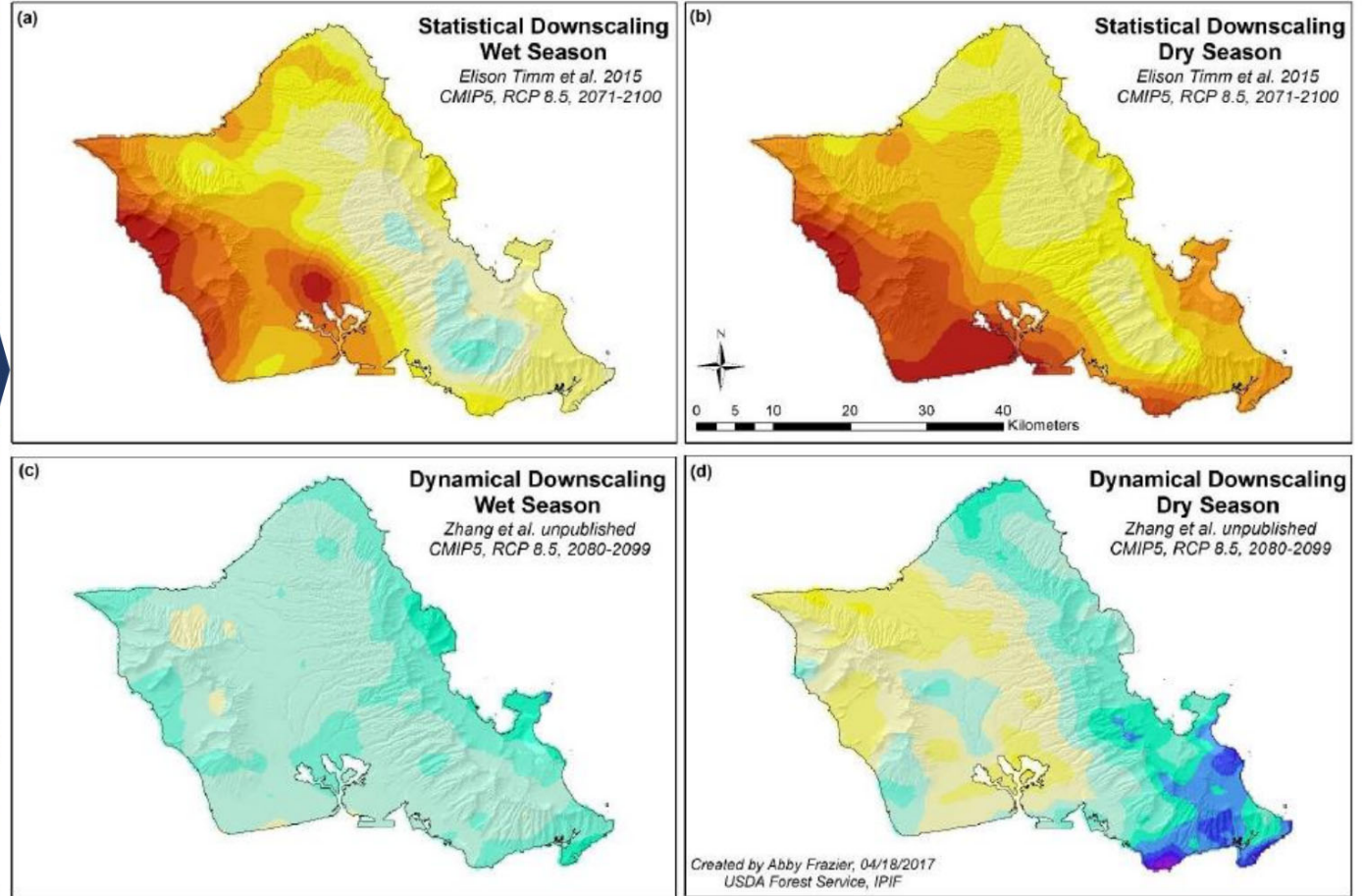
Community Meeting #4
AUGUST 2023
(Virtual)

~ 20 attendees

+ 4 SMALL GROUP MEETINGS
with members of the Kaiwi Maunalua Watershed Hui
and Kamilo Nui Farmers (~10-15 attendees / meeting)

+ TODAY – CWRM PUBLIC HEARING

Issue:
Climate Change
Areas of Concern:
 - Amount of rainfall & impacts on drinking water supply
 - More frequent & intense storms



Percent Change	-90% to -70%	-60% to -50%	-40% to -30%	-20% to -10%	0% to 10%	20% to 30%	40% to 50%	60% to 70%
End of Century	-70% to -60%	-50% to -40%	-30% to -20%	-10% to 0%	10% to 20%	30% to 40%	50% to 60%	70% to 90%

2100 O'ahu Rainfall Scenarios

Source: Zhang et al. (unpublished)

3.2ft Sea Level Rise Exposure Area

Issue:

Sea Level Rise

Areas of Concern:

- Coastal areas (mostly makai of the highway)
- Areas near Kuapā Pond
- Saltwater intrusion



Issue:

Nearshore Water Quality Areas of Concern:

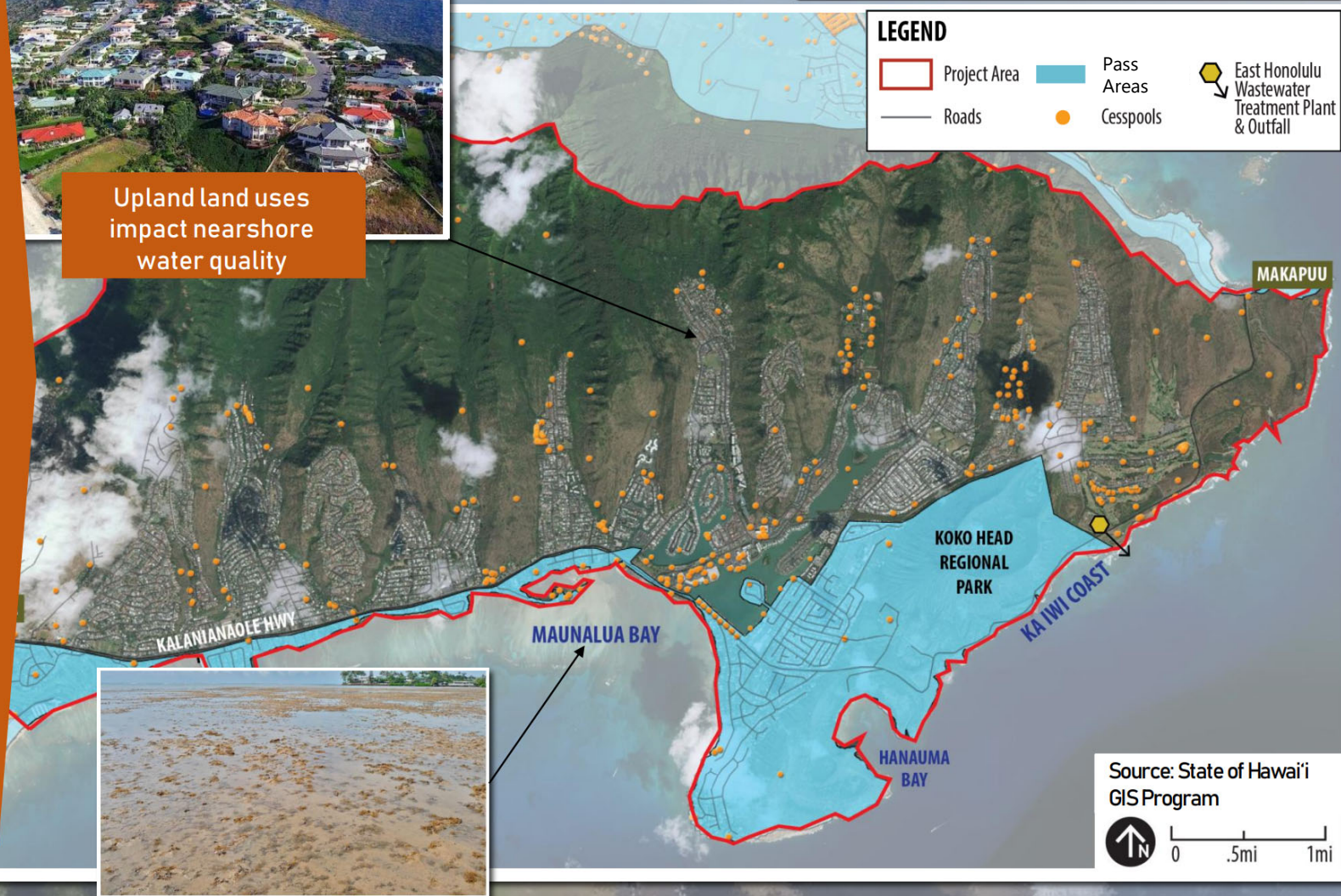
- Erosion from upland areas
- Runoff from development
- Sewage spills & cesspools
- Invasive species



Upland land uses impact nearshore water quality



East Honolulu Wastewater



Issue:

Water Conservation Efforts

Areas of Concern:

- Wai'alaie & Hawai'i Kai Golf Courses
- Large single family home development
- Commercial development
- Agricultural uses



Ahupua'a & Cultural Sites

Issue:

Maintaining Traditional & Customary Practices

Areas of Attention:

- Kalauha'iha'i Fishpond
- Kānewai Spring
- Hāwea Heiau & Keawāwa Wetland
- Kuapā Pond
- Maunalua Bay
- Ka Iwi Coast



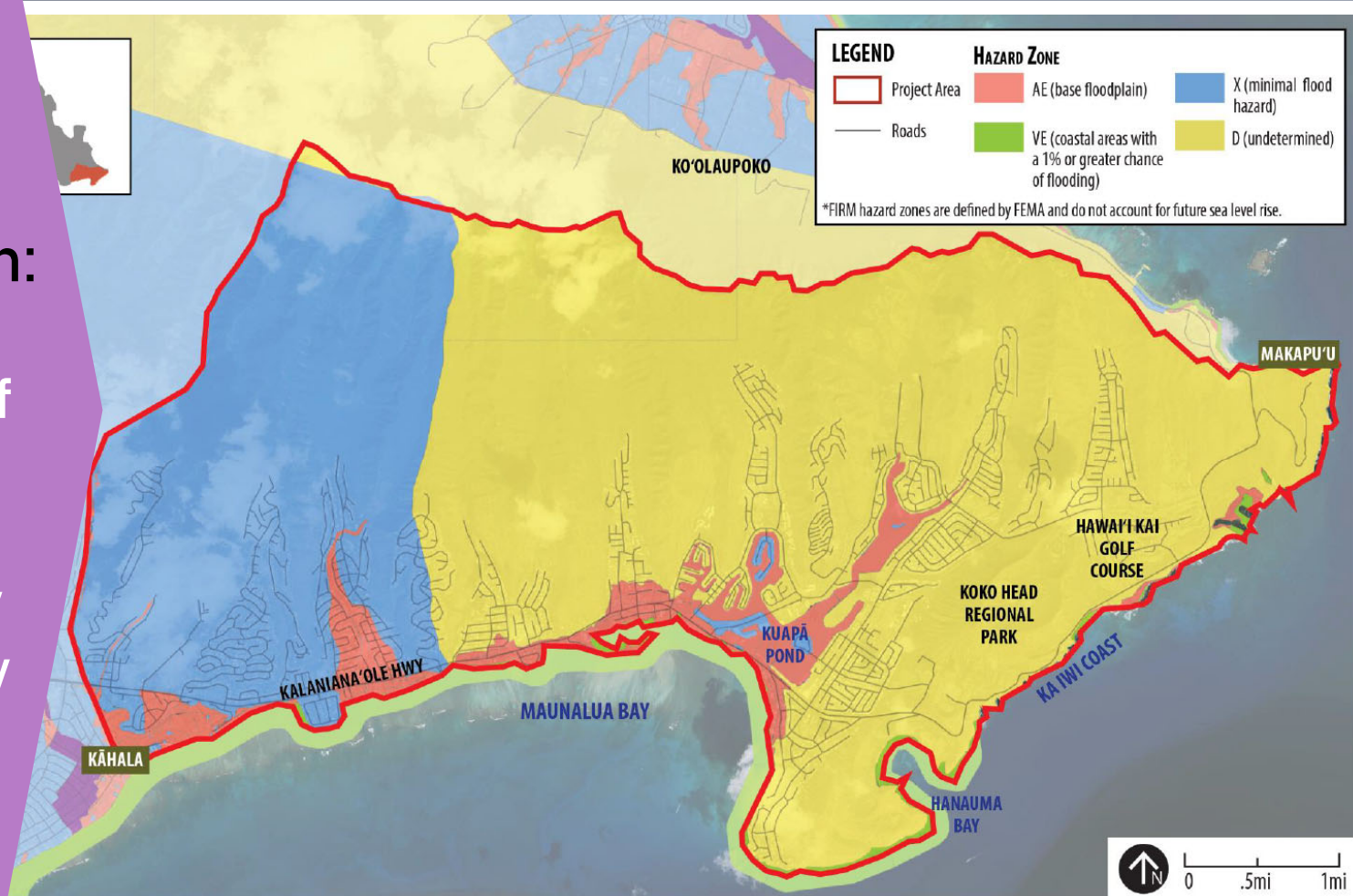
Flood Zones

Issue:

Flooding & Drainage

Areas of Concern:

- Coastal areas (mostly makai of the highway)
- Waiupe Valley
- Kuli'ou'ou Valley
- Kamilo Iki Valley
- Kalaniana'ole Highway



Issue:

Access to Mauka & Makai Areas

Areas of Concern:

- Upland trail management
- Erosion
- Invasive species
- Ungulates control
- Shoreline access



Kamilo Iki Ridge Trail



Kuli'ou'ou
Ridge Trail
Stairs



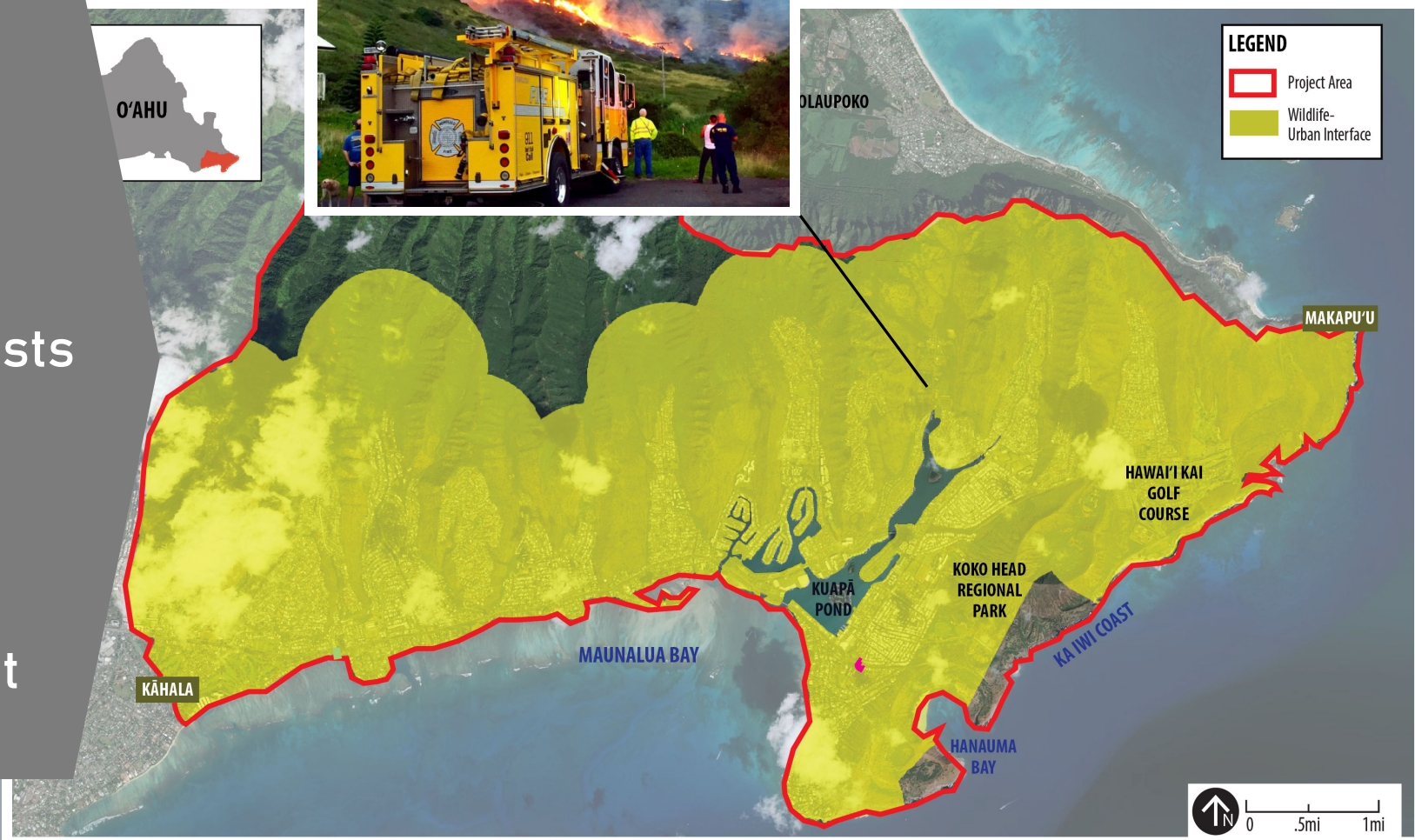
Wailupe Beach Access

Issue:
Wildfires
Areas of Concern:

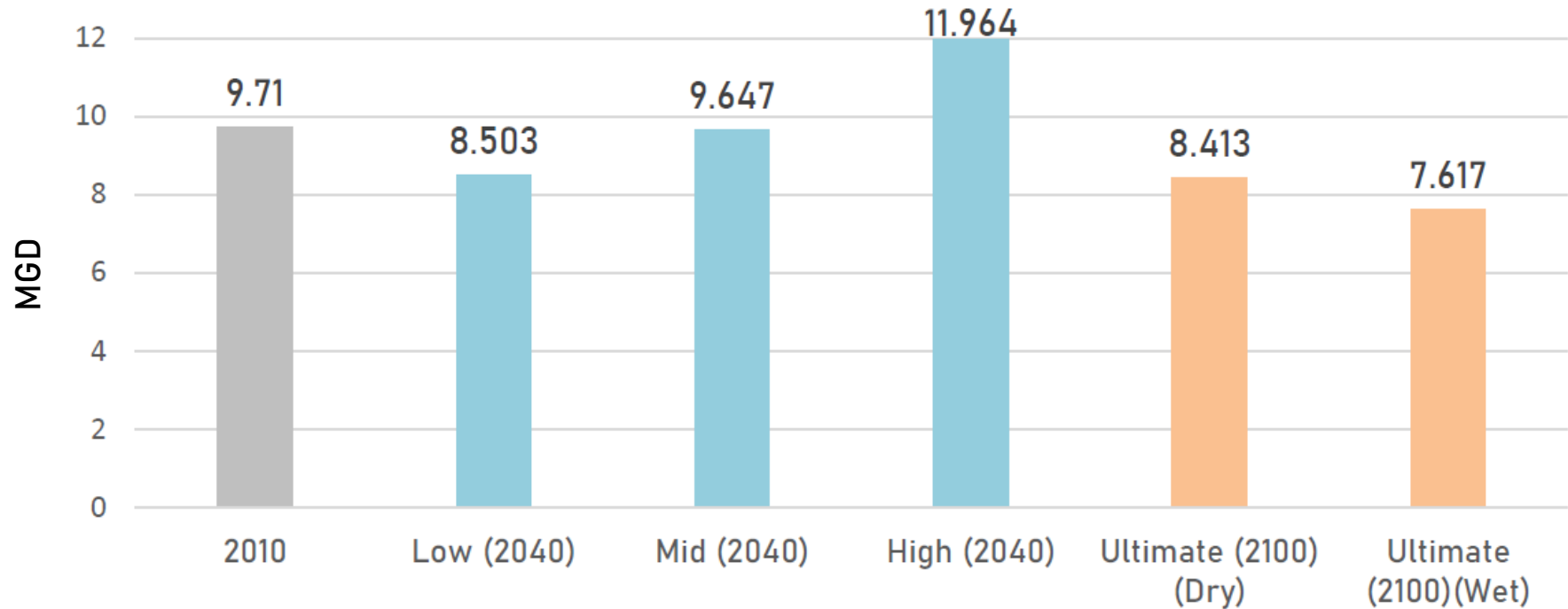
- Upland forests
- Kamilo Nui Valley (Mariner's Ridge)
- Ka Iwi Coast



Wildland-Urban Interface

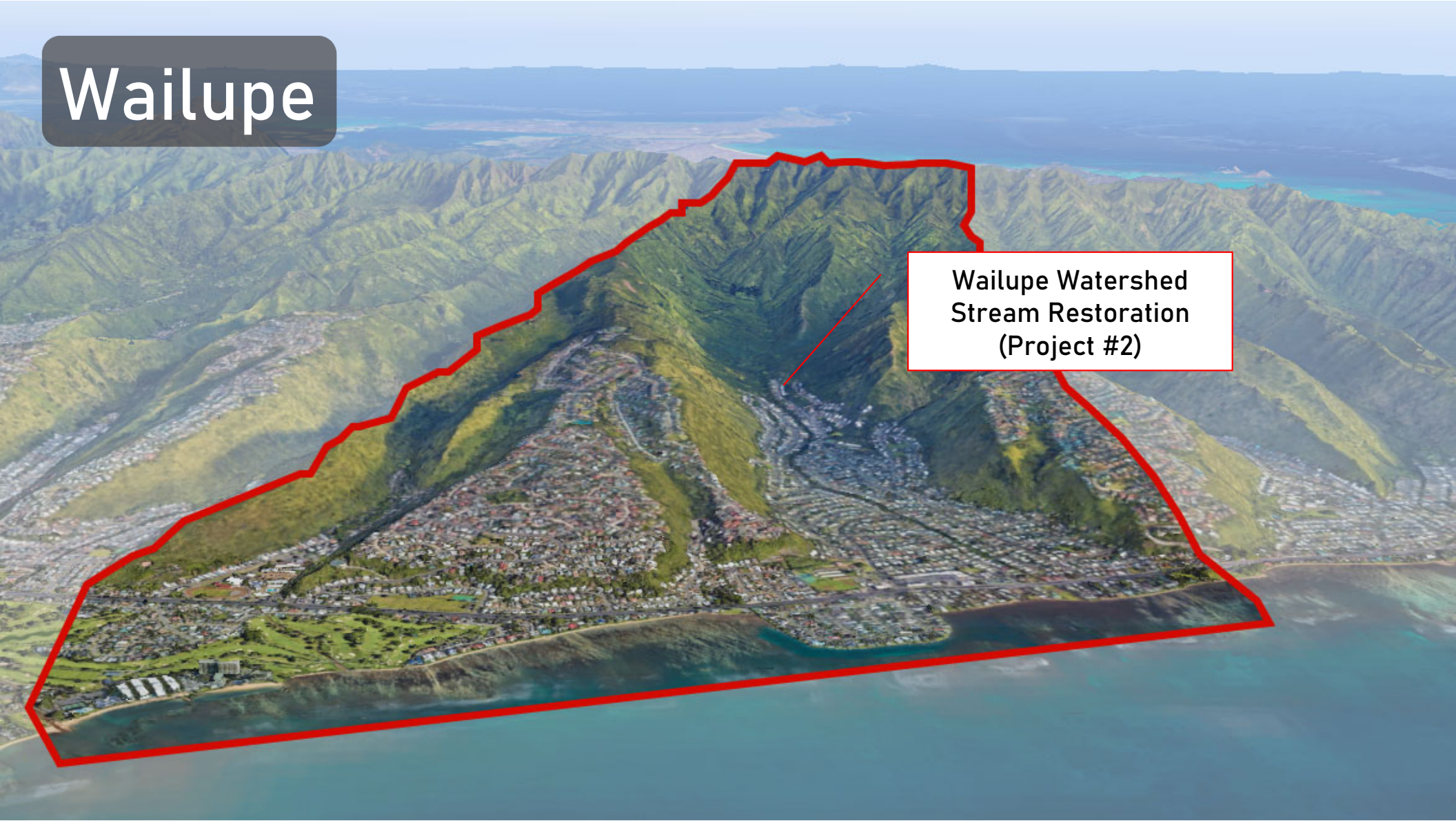


Total Future Water Demand by Scenario (MGD)



Wailupe

Wailupe Watershed
Stream Restoration
(Project #2)



Watershed fencing
(Project #9)

Invasive species removal
+ native outplanting
(Project #9)

Invasive algae removal
(Project #12)

Kuli'ou'ou

Ka Lapa O Maua (Paikō
Ridge) Preservation
(Project #31)

Kuli'ou'ou Watershed
Retention & Infiltration
Retrofit (Project #3)

Kalauha'iha'i Fishpond and
Kanewai Spring Restoration
(Project #1)



Hahaione

Keawāwa Wetland & Hawea Heiau
Restoration (Project #7)



Kamilo Nui + Kamilo Iki

Kipuka Reforestation (Project #4)

Sustainable Agriculture Pilot Project
(Project #5)

Kuapā Pond Restoration
(Project #6)