

An aerial photograph of a coastal city, likely Honolulu, Hawaii. The foreground shows the turquoise ocean meeting a sandy beach. The middle ground is a dense urban area with buildings and roads. In the background, there are rolling hills and mountains under a sky with scattered white clouds. The text is overlaid on this image.

# **'EWA WATERSHED MANAGEMENT PLAN**

**COMMUNITY MEETING #2**

**November 19, 2014**

**Honolulu Board of Water Supply  
Department of Planning and Permitting**

# Agenda

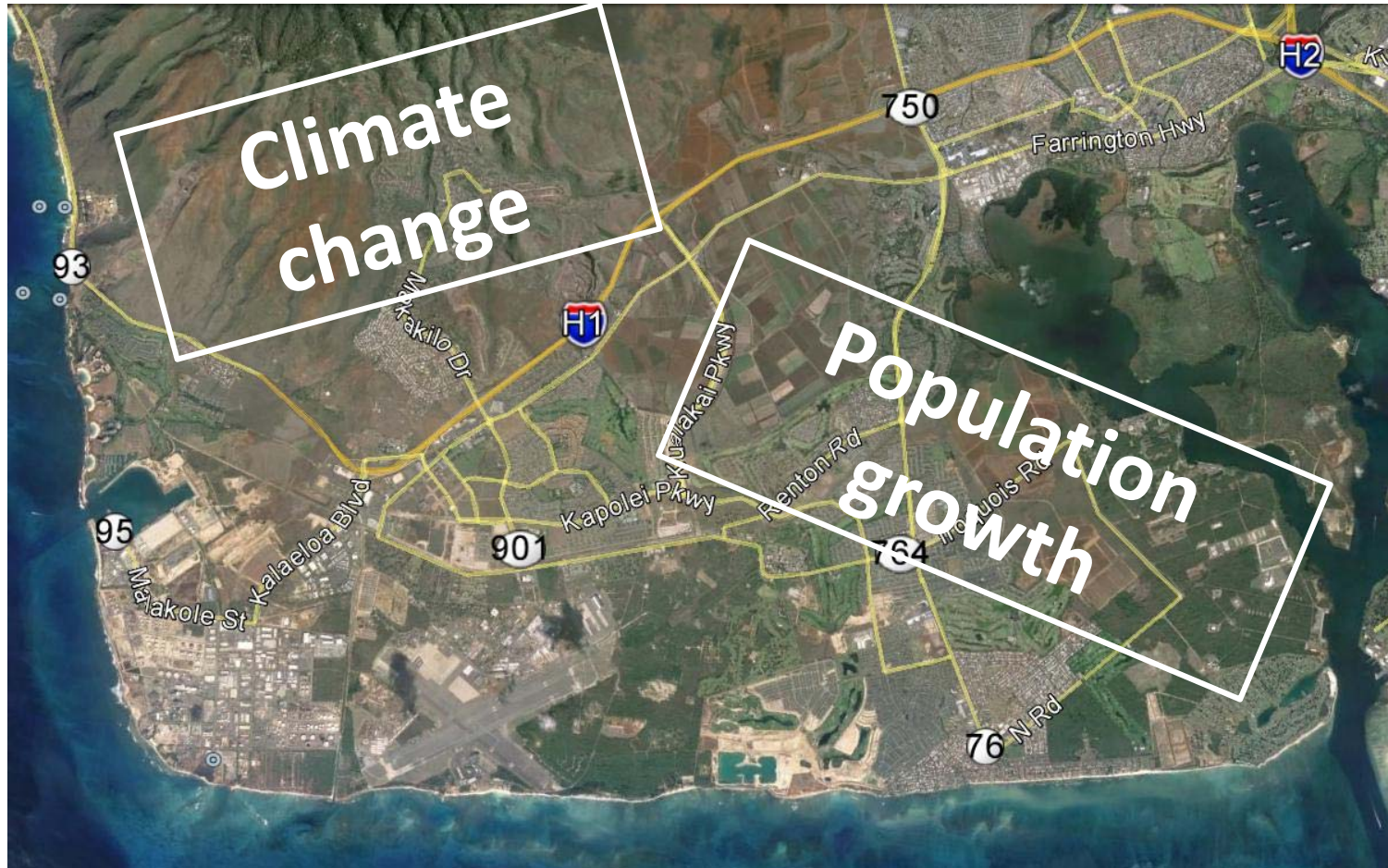
---

- Introduction
- ‘Ewa Water Resources
- ‘Ewa Water Systems
- ‘Ewa Water Demand
- ‘Ewa WMP Objectives and Sub-Objectives
- Potential Water Supply Options for ‘Ewa
- ‘Ewa WMP: Next Steps



# Introduction: 'Ewa's Water Story

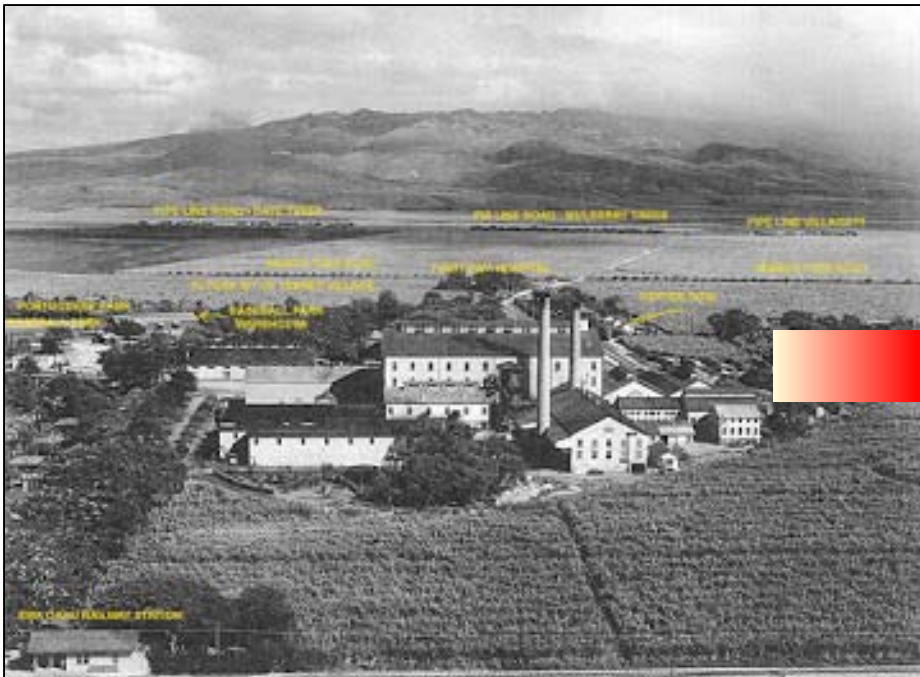
'Ewa, like all regions, has water challenges...



# Introduction: 'Ewa's Water Story

...but 'Ewa has a special water history...

...and an opportunity for a model water future...



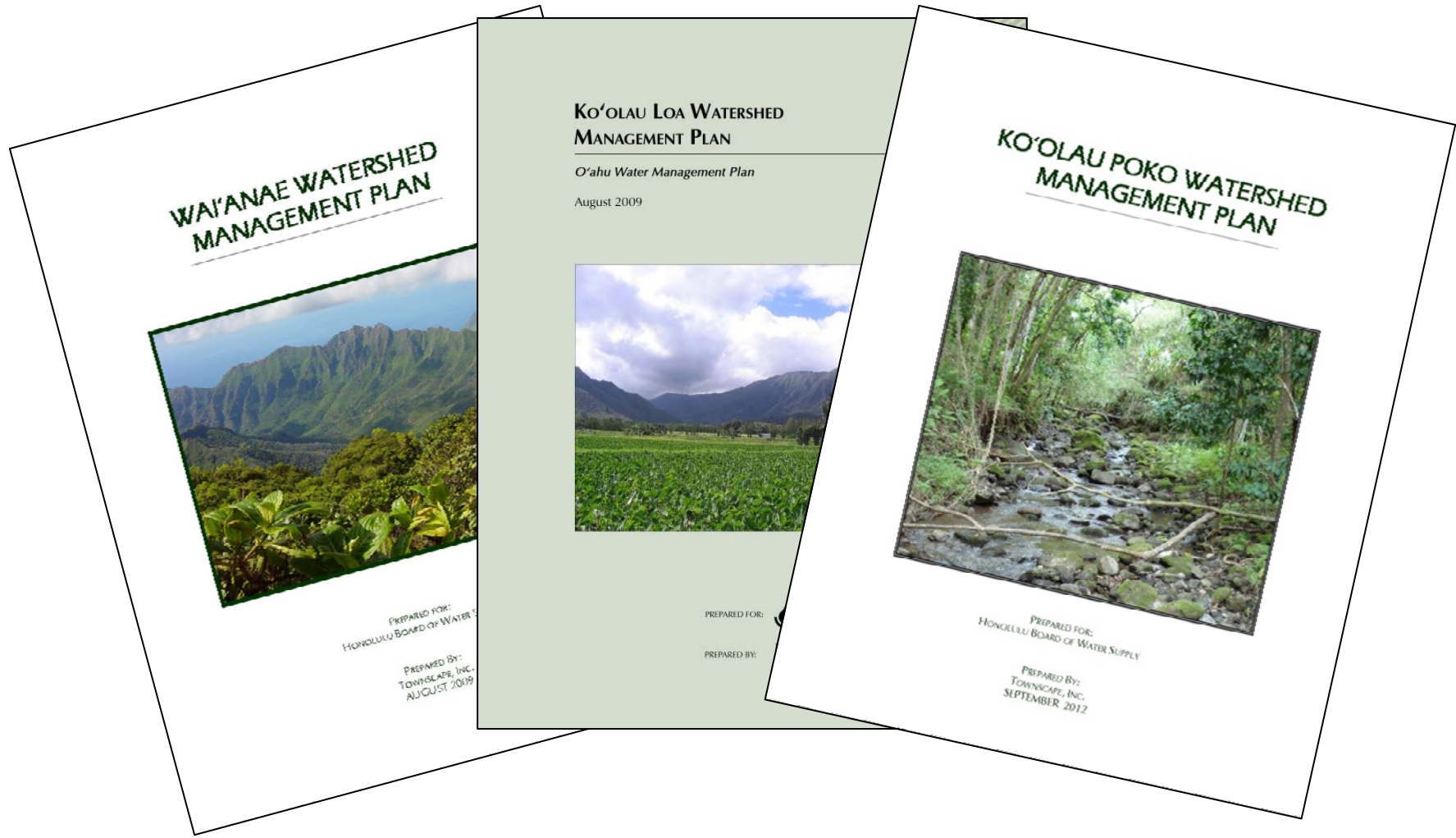
# Introduction: 'Ewa's Water Story

---

...so how will the 'Ewa community respond?



# Introduction: Watershed Management Plans



# Introduction: Watershed Management Plans

---

## THE PUBLIC TRUST

“The State has an obligation to protect, control and regulate the use of Hawaii’s water resources for the benefit of its people.”

-State Constitution, Article XI, Section 7 (1978)

There are four identified public trust purposes, as determined by the Hawai‘i Supreme Court:

- 1) resource protection;
- 2) domestic water use;
- 3) Native Hawaiian traditional and customary rights; and
- 4) Department of Hawaiian Home Lands (DHHL) reservations.

# Introduction: Watershed Management Plans

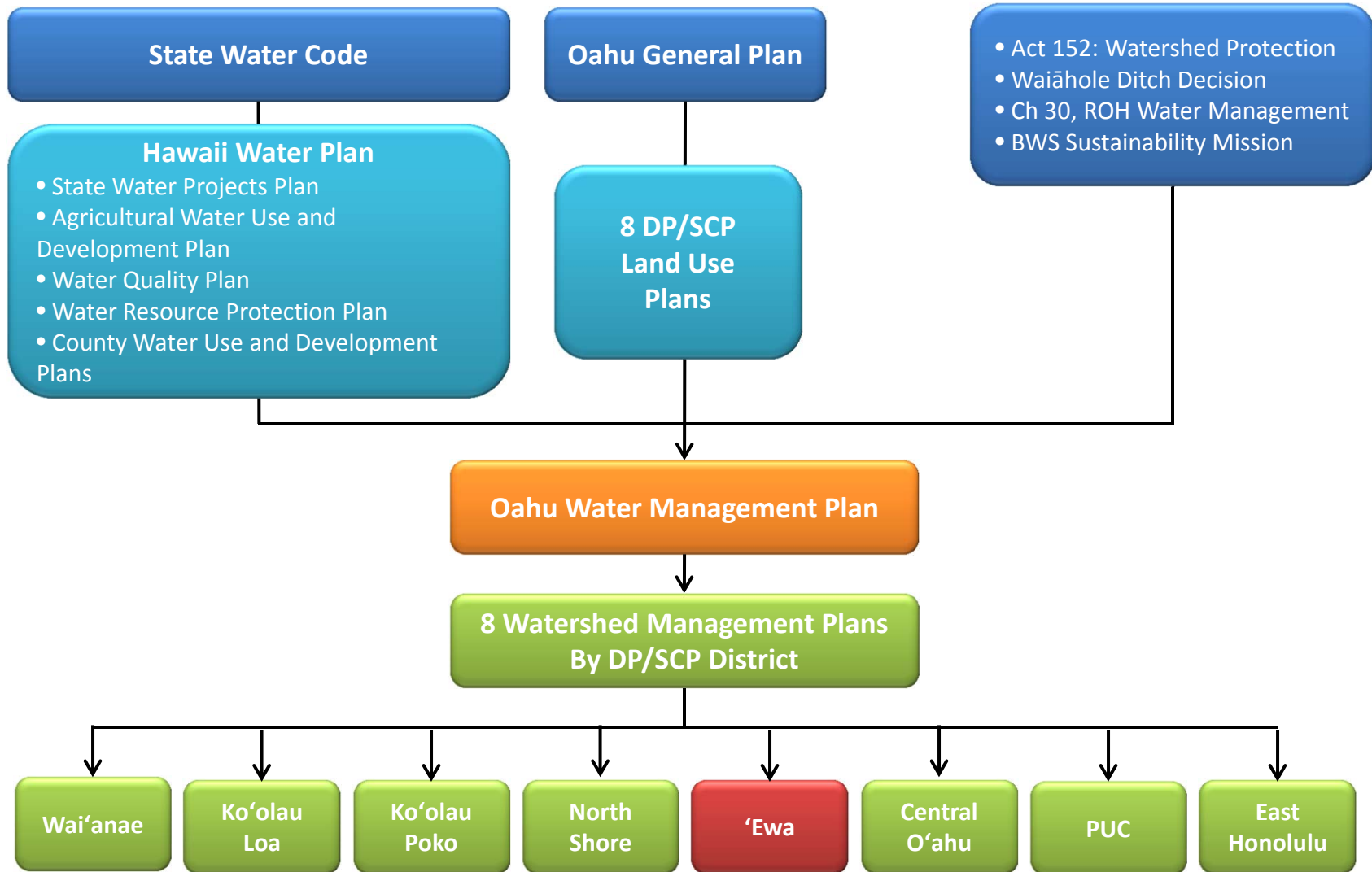
---

- County “Water Use and Development Plans” are required by the State Water Code
- “O‘ahu Water Management Plan” is required by Revised Ordinances of Honolulu Chapter 30
- Honolulu Plans are district specific and called “Watershed Management Plans” (WMPs).
- Guidance is provided by the Hawai‘i Water Plan and the City’s ‘Ewa Development Plan.
- District-level water and land use plans allow for community-specific actions and strategies
- WMPs require approval by BWS, DPP, City Council, and CWRM





# Introduction: Watershed Management Plans



# Introduction: WMP Goal

---

To formulate an **environmentally holistic, community based, and economically viable** watershed management plan that will provide a balance between:

1. The protection, preservation, and management of O‘ahu’s watersheds
2. Sustainable ground and surface water use and development to serve present users and future generations.

# Introduction: WMP Objectives

---

1. Promote sustainable watersheds;
2. Protect and enhance water quality and quantity;
3. Protect Native Hawaiian rights and traditional and customary practices;
4. Facilitate public participation, education, and project implementation; and
5. Meet future water demands at reasonable costs.

# Introduction: 1<sup>st</sup> Community Meeting

---

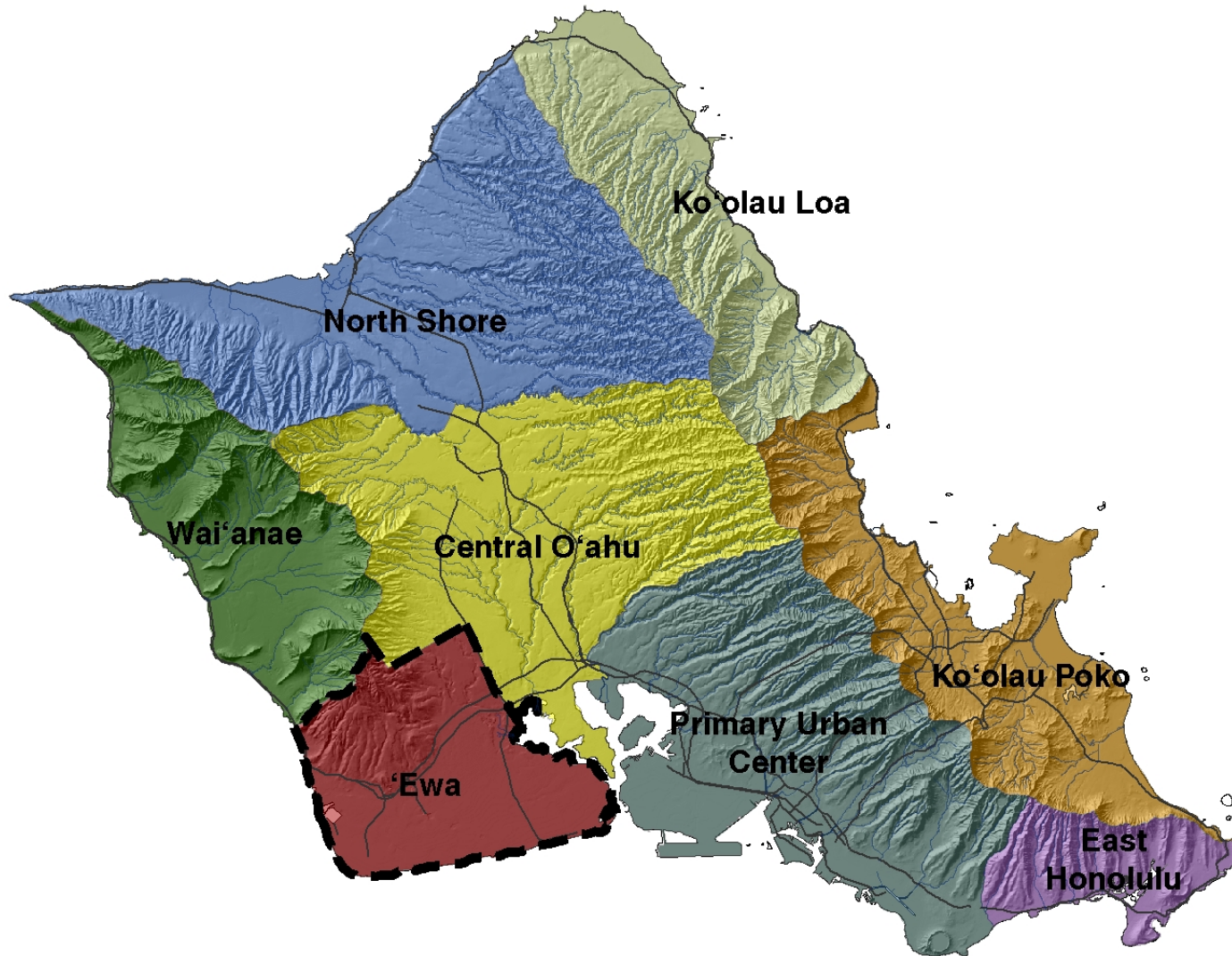
- May 2013
- Purposes:
  - Share preliminary research on 'Ewa
  - Discuss water resource Issues
  - Start the discussion on water demand and supply
- Meeting notes and slideshow on-line at:  
<http://www.hbws.org/cssweb/display.cfm?sid=125018>

# Introduction: 1<sup>st</sup> Community Meeting

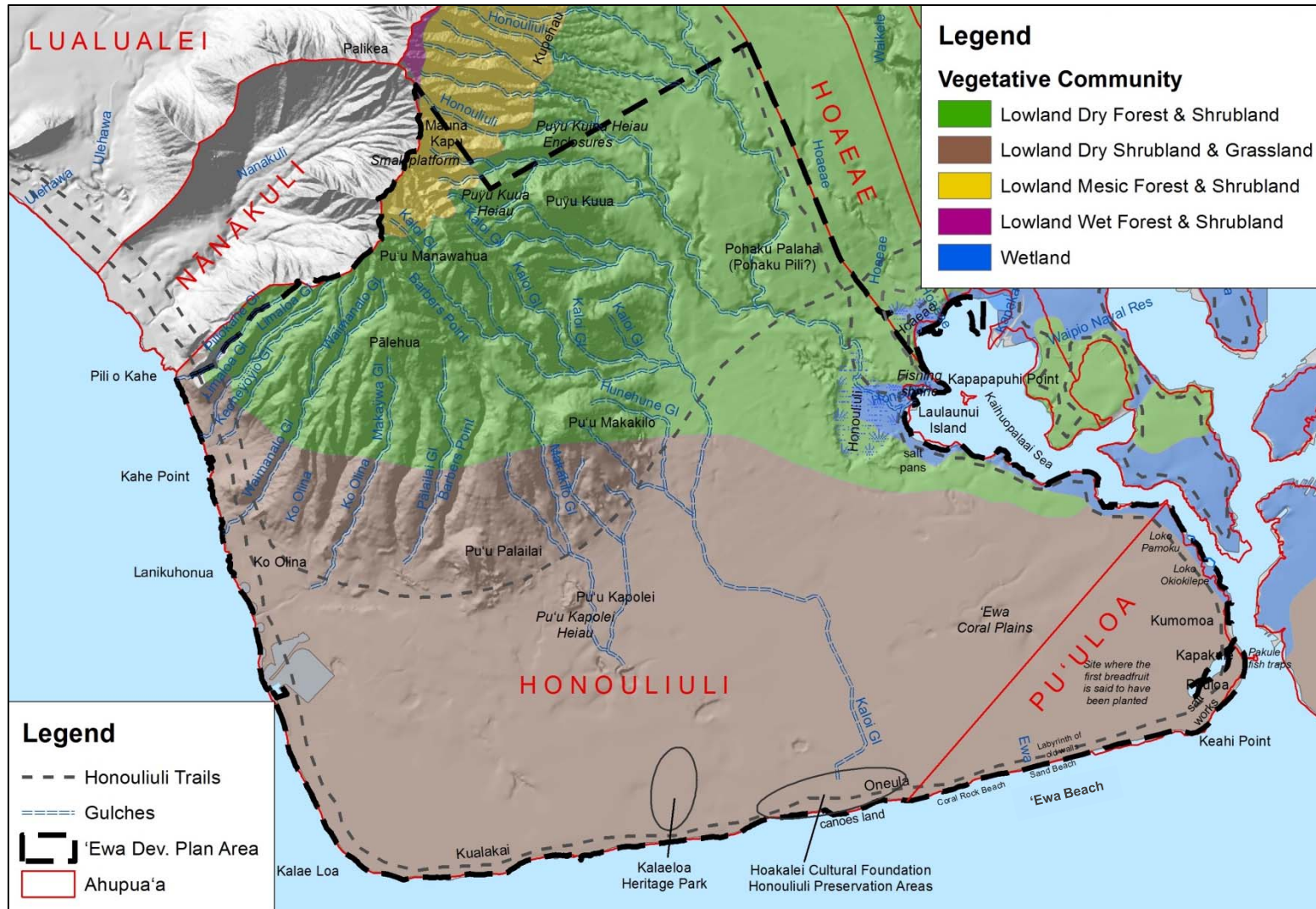
---

- Issues and questions raised:
  - Protect traditional and customary practices
  - Desalinated water: what will it be used for?
  - What is the state of the BWS water system in 'Ewa?
  - Non-BWS water systems need to be accounted for
  - Is there enough water for planned development?
  - Is our drinking water safe?
  - What are the flooding issues?
  - Education and community engagement is important
  - Land use and water planning needs to be integrated

# Introduction: The 'Ewa District

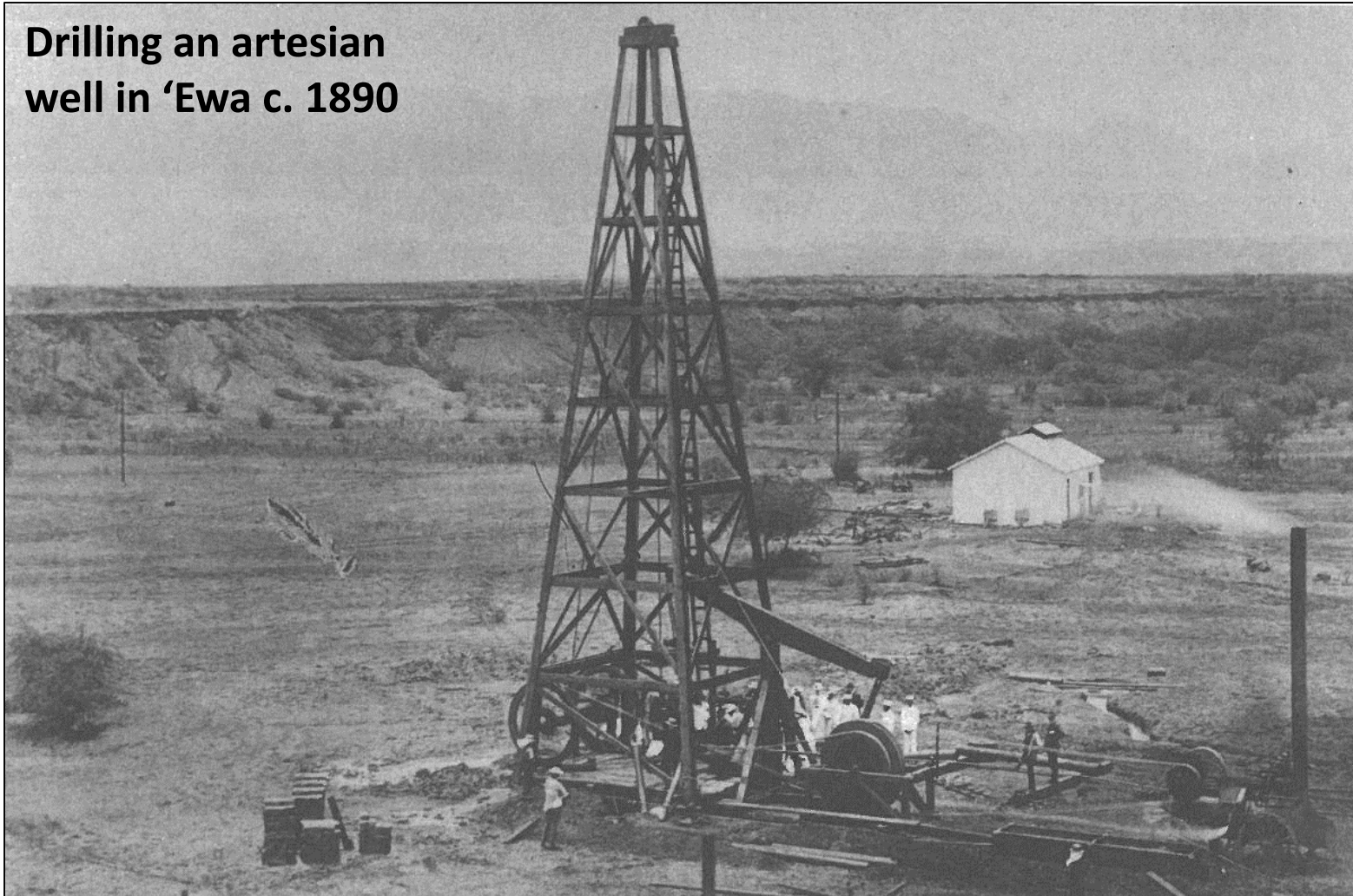


# Introduction: 'Ewa History



# Introduction: 'Ewa's Sugar History

**Drilling an artesian well in 'Ewa c. 1890**

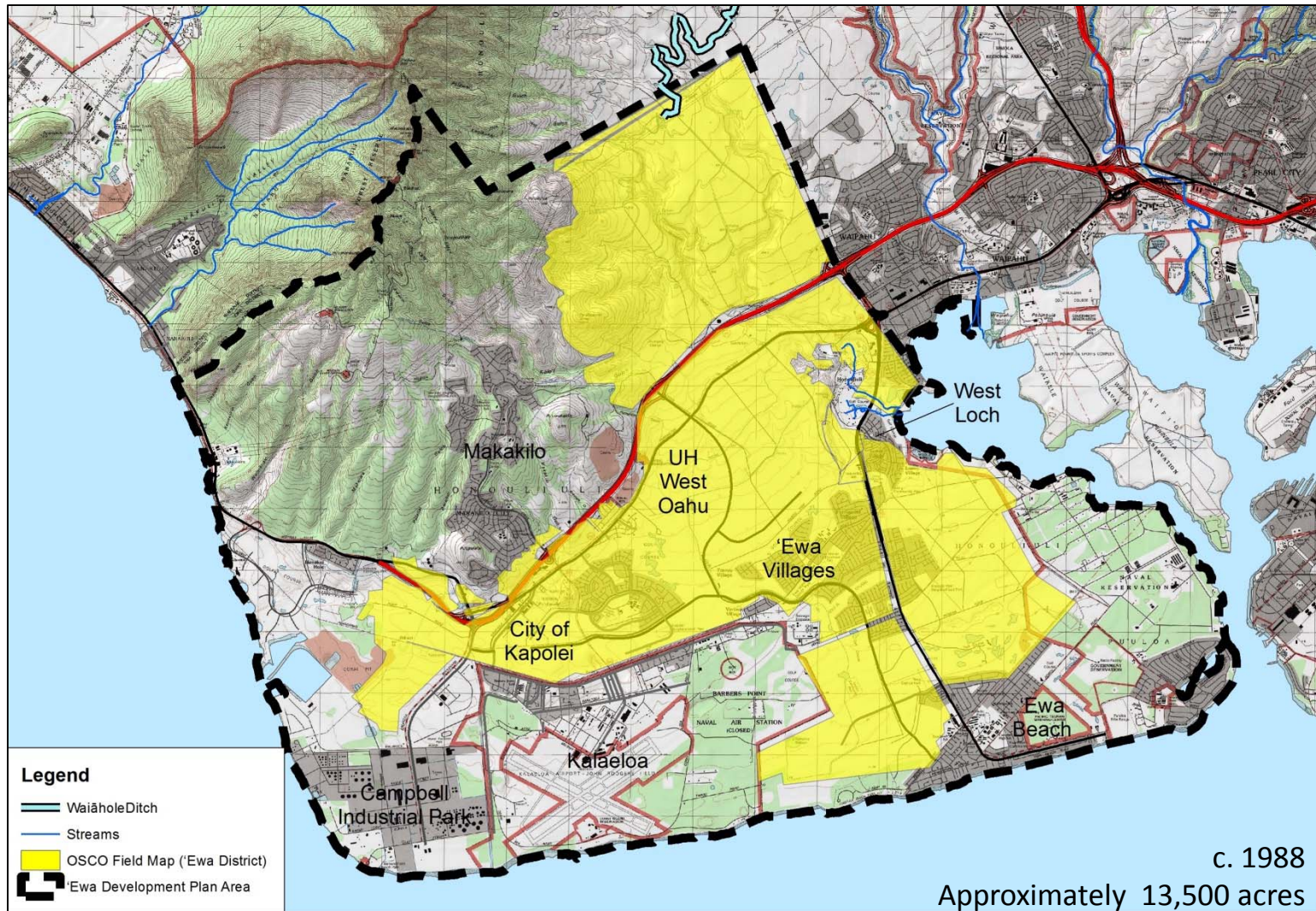


Source: Wilcox, Carol. 1996. "Sugar Water: Hawaii's Plantation Ditches"

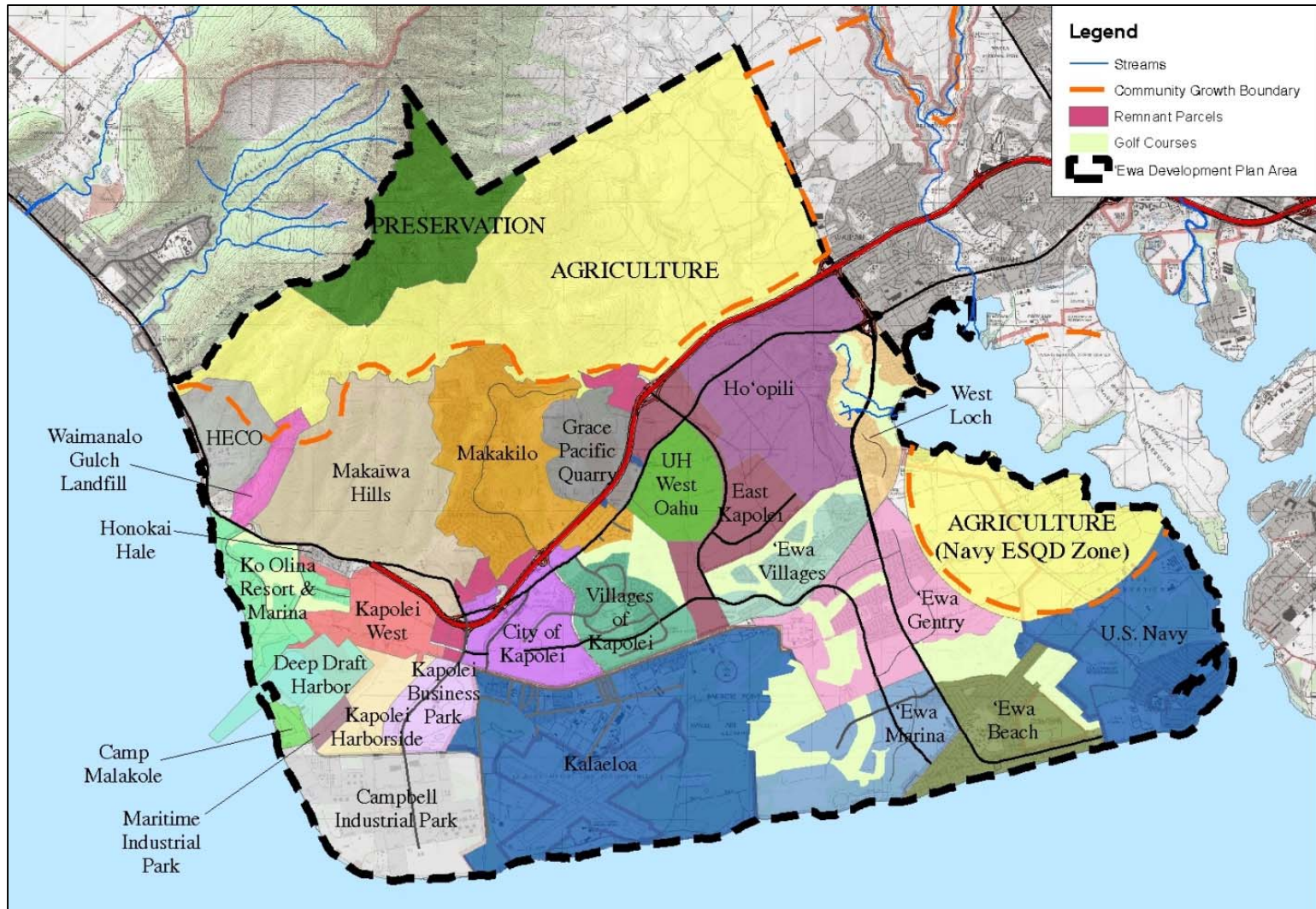




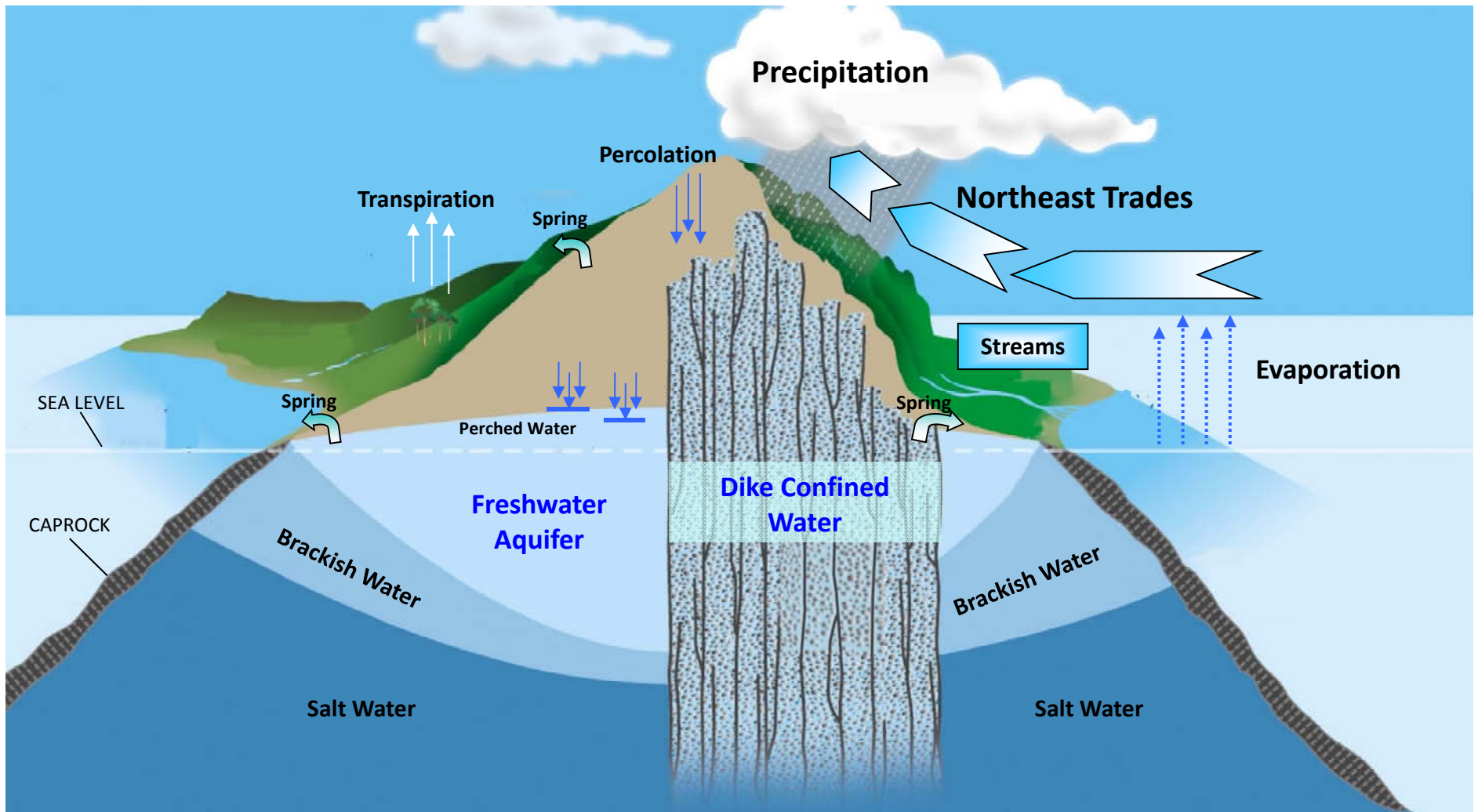
# Introduction: 'Ewa's Sugar History



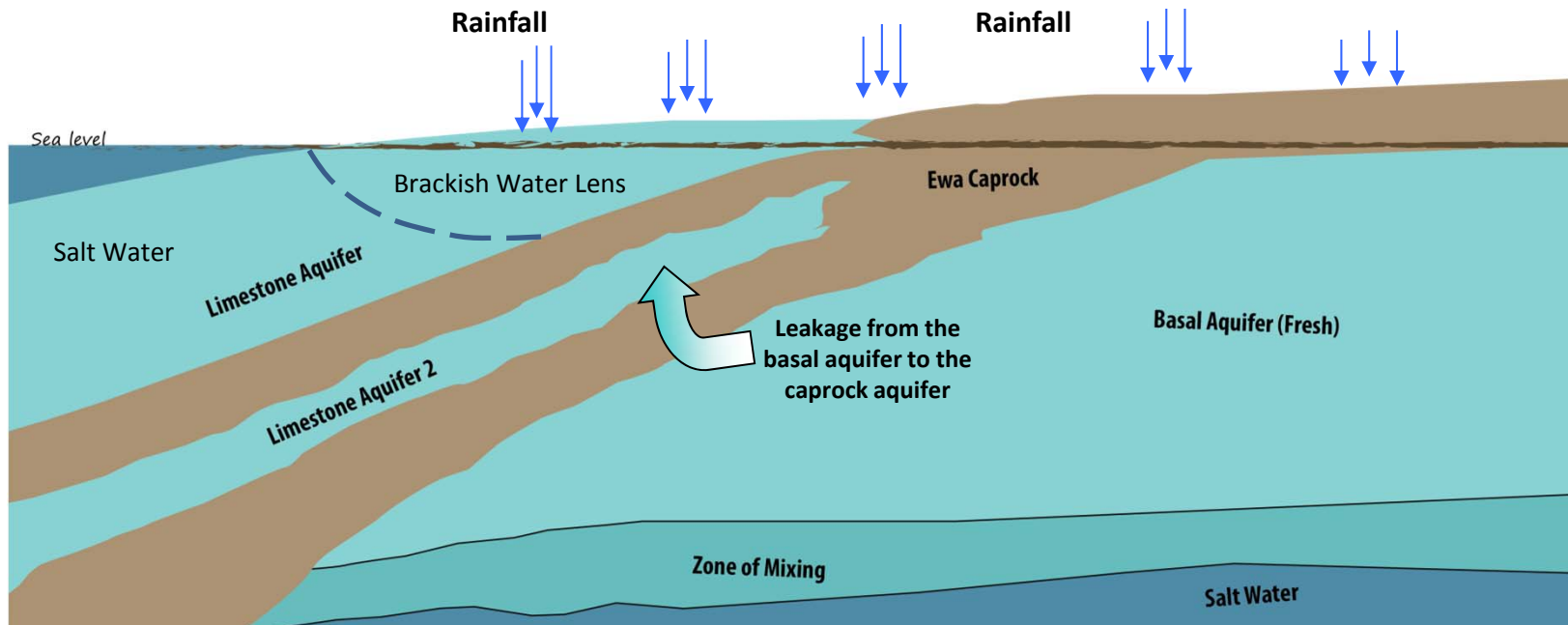
# Introduction: Full Buildout of Master Plans



# 'Ewa Water Resources: Hydrologic Cycle

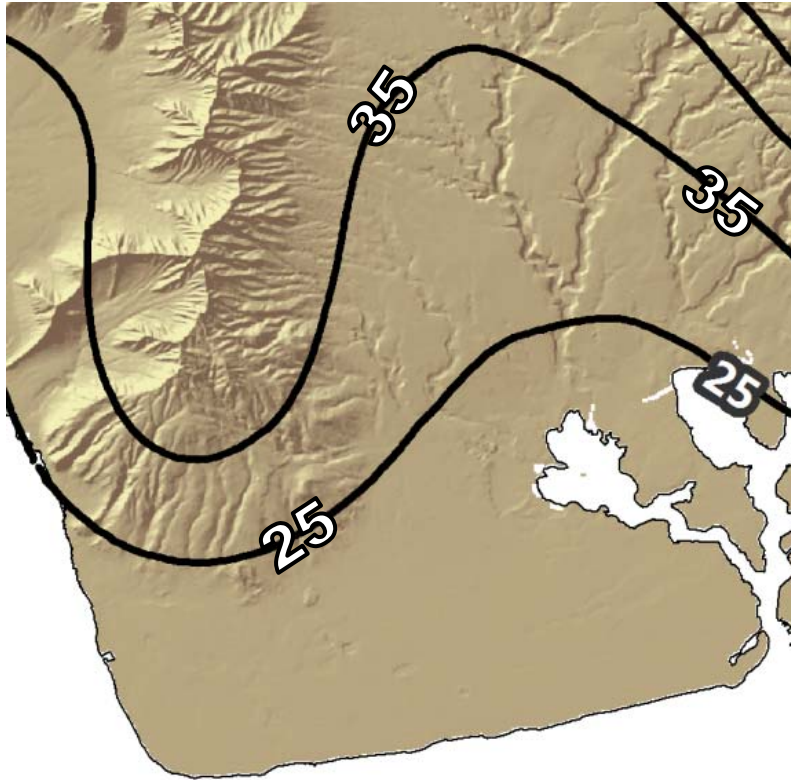


# 'Ewa Water Resources: Geology



- Impermeable caprock holds the fresh basal water inland.
- Caprock also holds water from rainfall and leakage from the basal aquifer in its limestone layers

# 'Ewa Water Resources: Climate



**Mean Annual Rainfall  
Island of O'ahu**

*2011 Rainfall Atlas of Hawai'i  
Department of Geography  
University of Hawai'i at Mānoa*

- Low rainfall
  - Average annual rainfall = 20" - 40"
  - Average annual rainfall on O'ahu = 20" – 300"
  - Average annual rainfall for the State = 10" – 440"
- Within the district, rainfall decreases when going mauka to makai
- Average temperatures: 60° to 91°

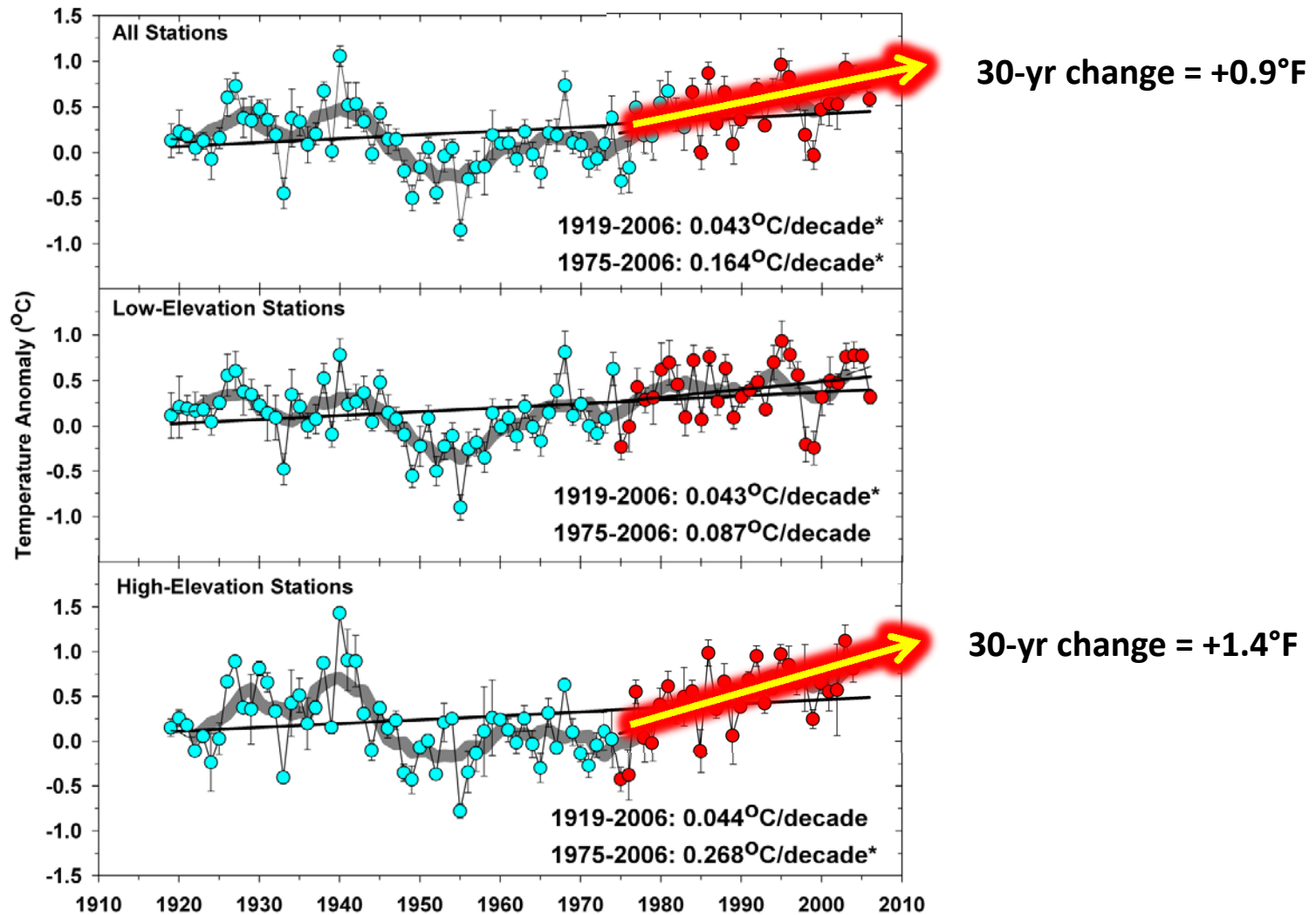
# 'Ewa Water Resources: Climate Change

- Rainfall (-15% over the past 20 years) and stream discharge have decreased<sup>1</sup>
- Air temperature is increasing  
(0.3°F/decade over the past 30 years)<sup>1</sup>
- Rainstorm intensity has increased (+12%, 1958-2007)<sup>1</sup>
- Sea surface temperature is rising  
(0.22°F/decade over the past 30 years)<sup>2</sup>
- Ocean has grown more acidic
- Sea level is rising

1 Fletcher, Chip. 2010. Hawai'i's Changing Climate Briefing Sheet. School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa. Center for Island Climate Adaptation and Policy.

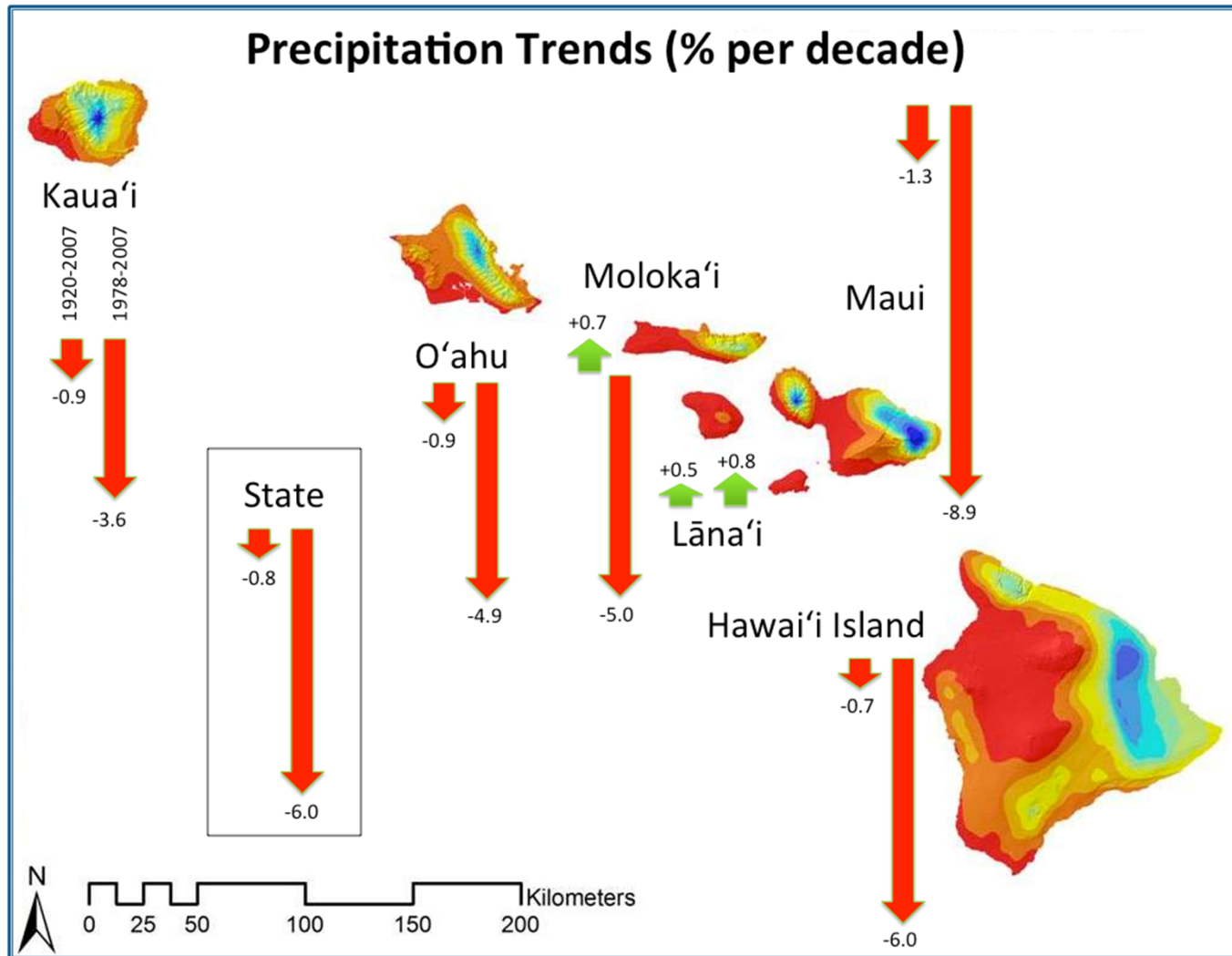
2 Keener, V.W., J.L. Marra, M.L. Finucane, D. Spooner, M.H. Smith. 2012. Pacific Islands: Indicators and Impacts. Report for the 2012 Pacific Islands Regional Climate Assessment. Washington, D.C: Island Press.

# 'Ewa Water Resources: Climate Change



Giambelluca, T.W., Diaz, H. F., and Luke, M.S.A. 2008. Secular temperature changes in Hawaii'. *Geophysical Research Letters*, Vol. 35, L12702, doi;10.1029/2008GL034377.

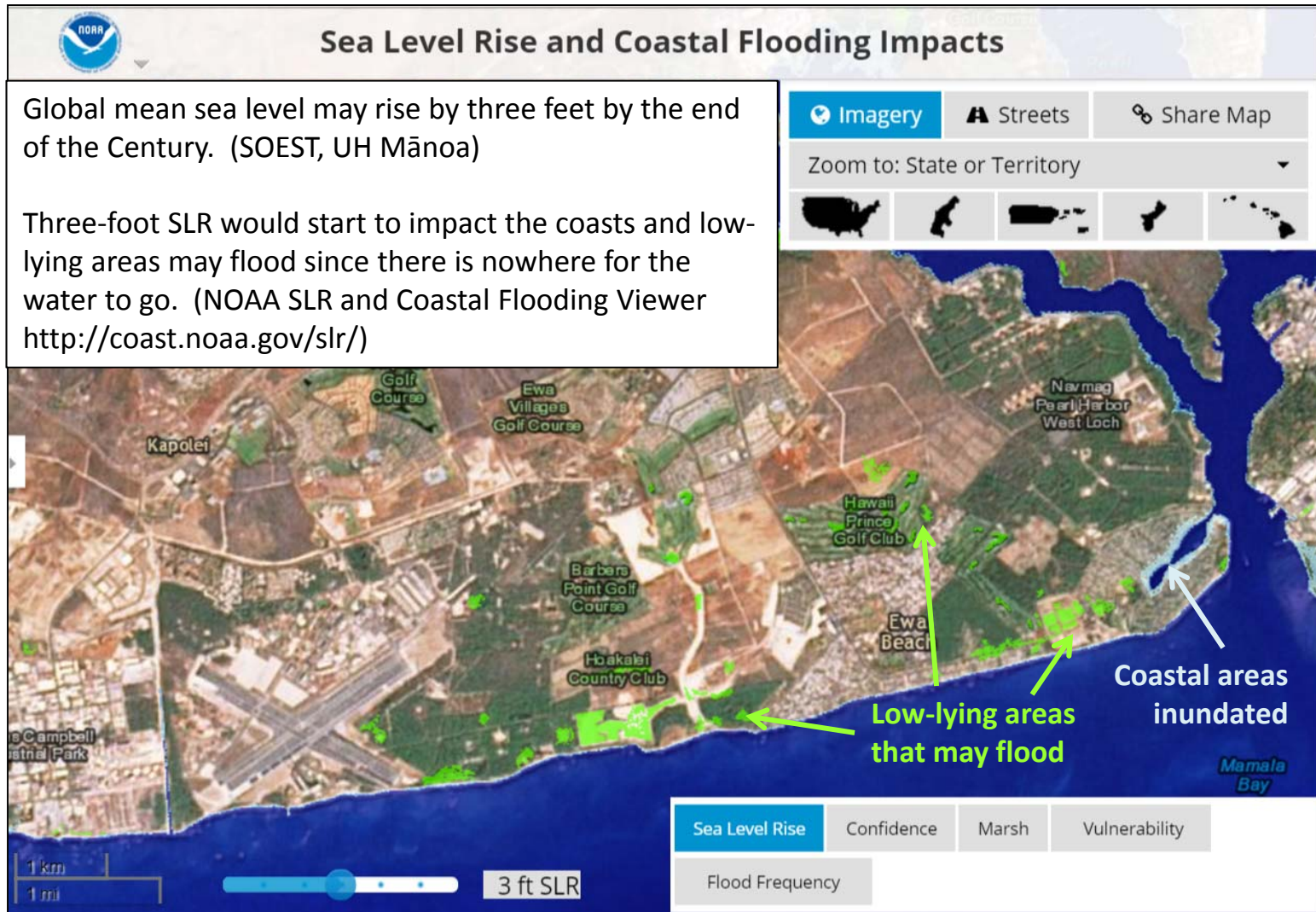
# 'Ewa Water Resources: Climate Change



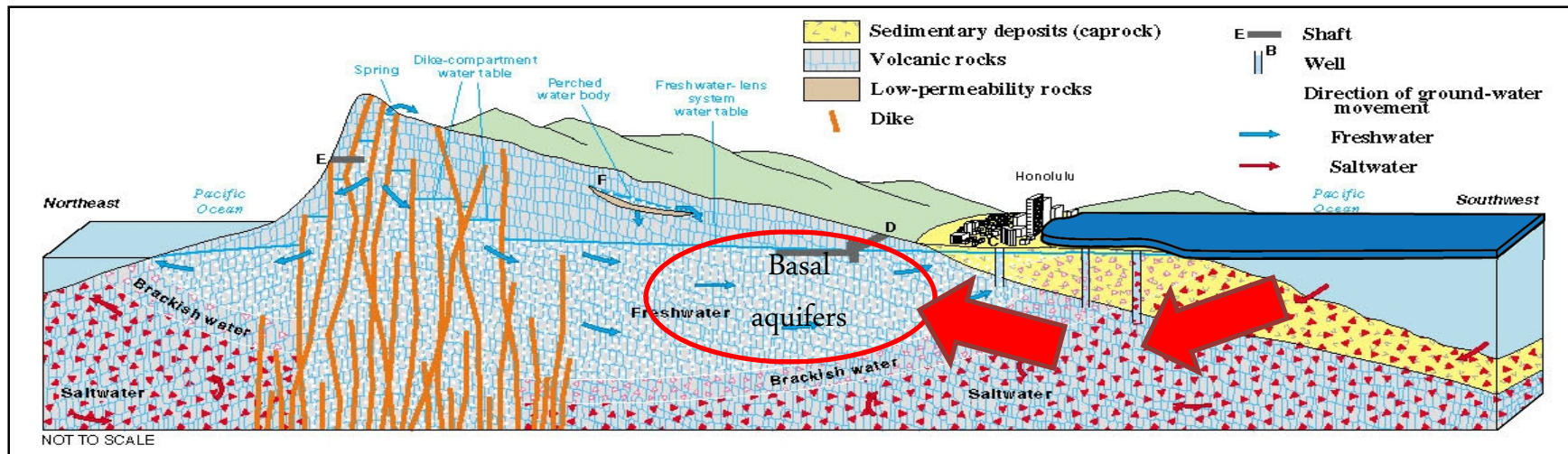
Giambelluca, et. al. 2011. Regional Climate Trends in Hawaii. *American Geophysical Union Fall Meeting*. Abstract GC21B-0898.



# 'Ewa Water Resources: Climate Change



# 'Ewa Water Resources: Geology



- As sea level rises, salt water pushes the basal aquifer inland



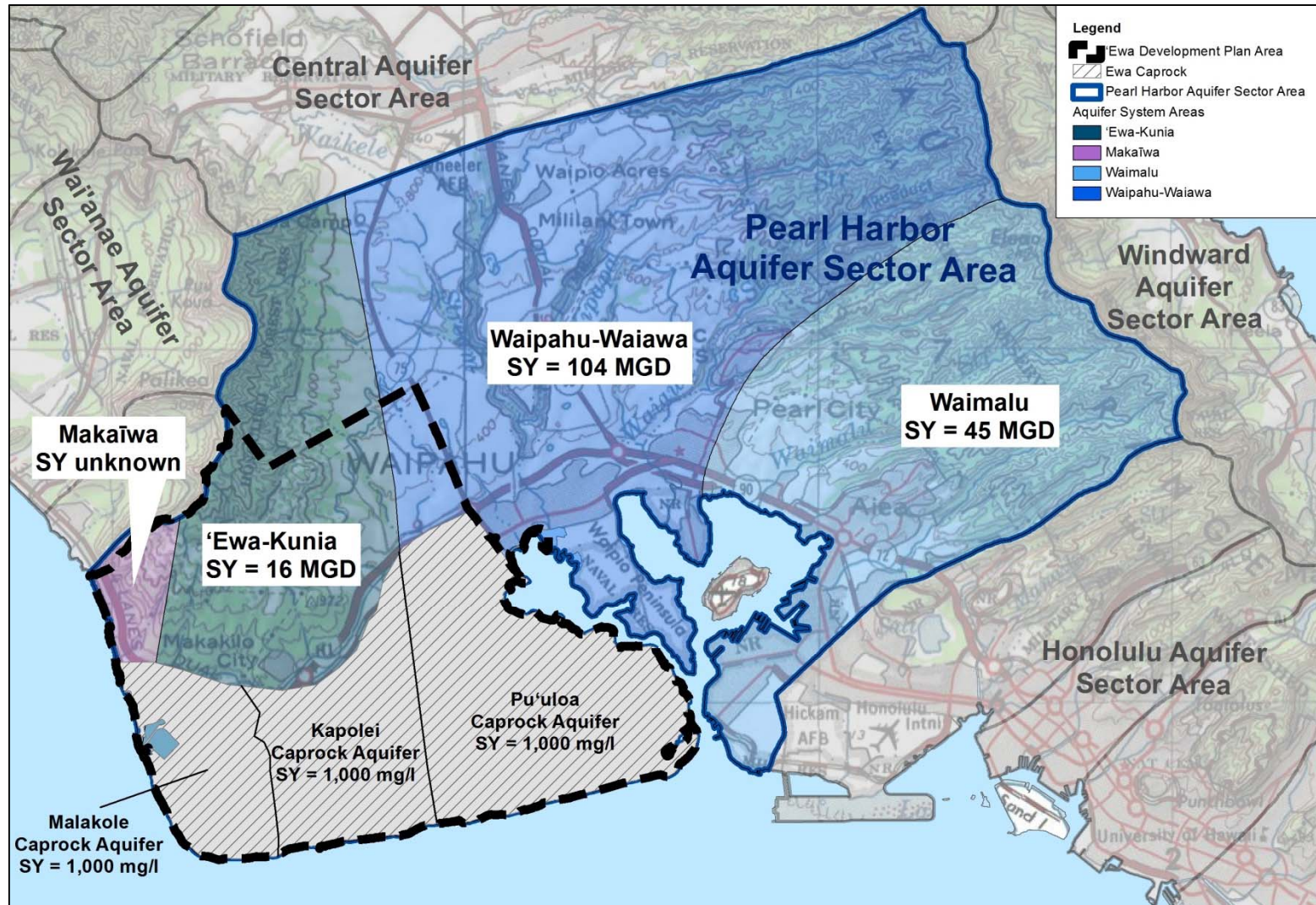
# 'Ewa Water Resources: Ground Water

---

- Sustainable Yield (SY): the maximum rate at which water may be withdrawn without impairing the utility or quality of the water source as determined by CWRM.
- Ground Water Management Area: special areas where additional regulation is required
  - The Pearl Harbor Aquifer Sector Area is a Ground Water Management Area.
  - A CWRM water use permit is required for all ground water uses.

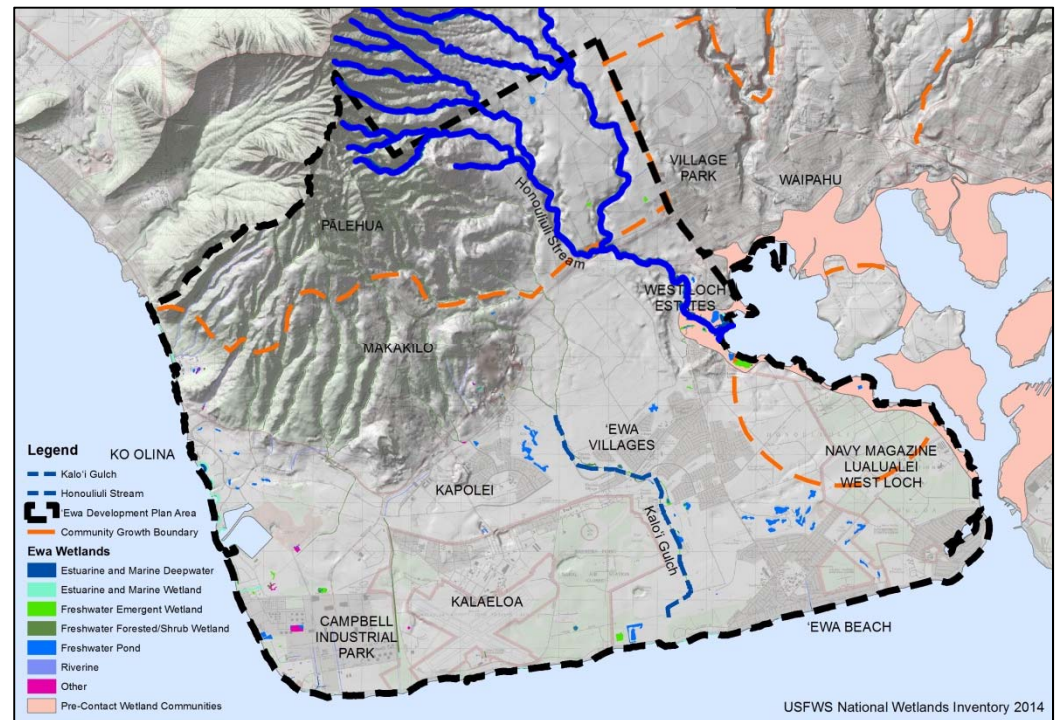


# 'Ewa Water Resources: Ground Water

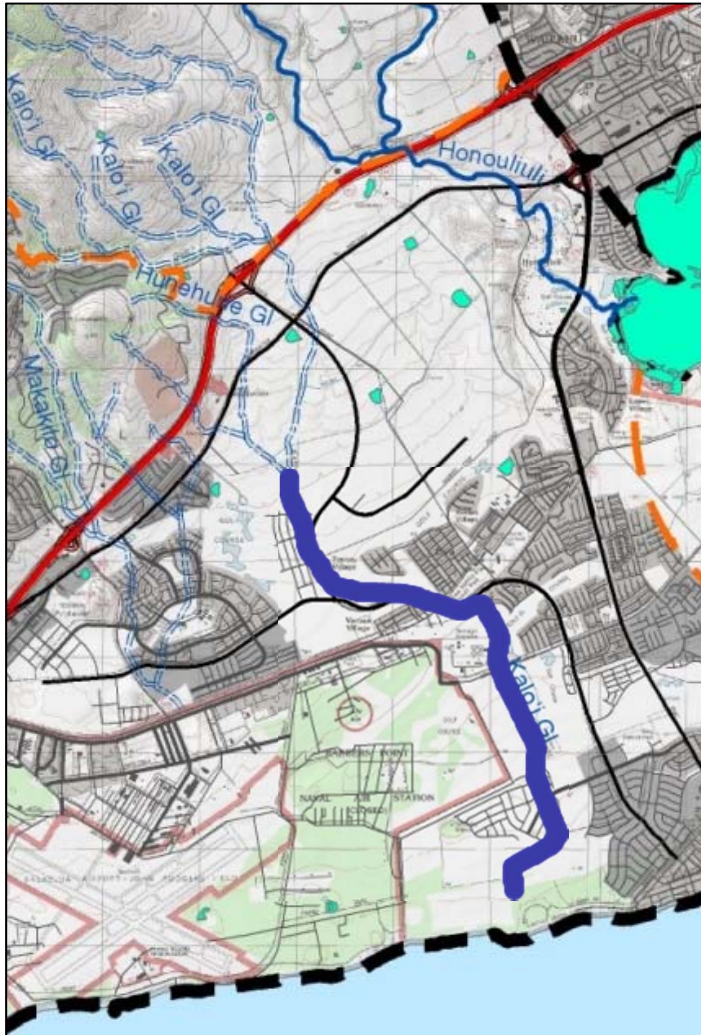


# 'Ewa Water Resources: Surface Water

- One (1) perennial Stream
- 16 dry streams or gulches
- Wetlands in the Honouliuli and Kalaeloa units of the Pearl Harbor National Wildlife Refuge



# 'Ewa Water Resources: Drainage and Flooding



Renton Road, 1996

<http://archives.starbulletin.com/96/11/06/news/story2.html>



# 'Ewa Water Resources: Implications

---

- Ground water must be managed wisely
  - The availability of ground water in the 'Ewa district is limited and protected by City, State, and federal regulation.
  - Ground water quality is susceptible to impacts from surrounding land uses.
- Surface water should be maintained for ecological and cultural purposes
  - There are few surface water resources that are capable of supplying water for human use.
  - Surface water resources are of both ecological and cultural significance.

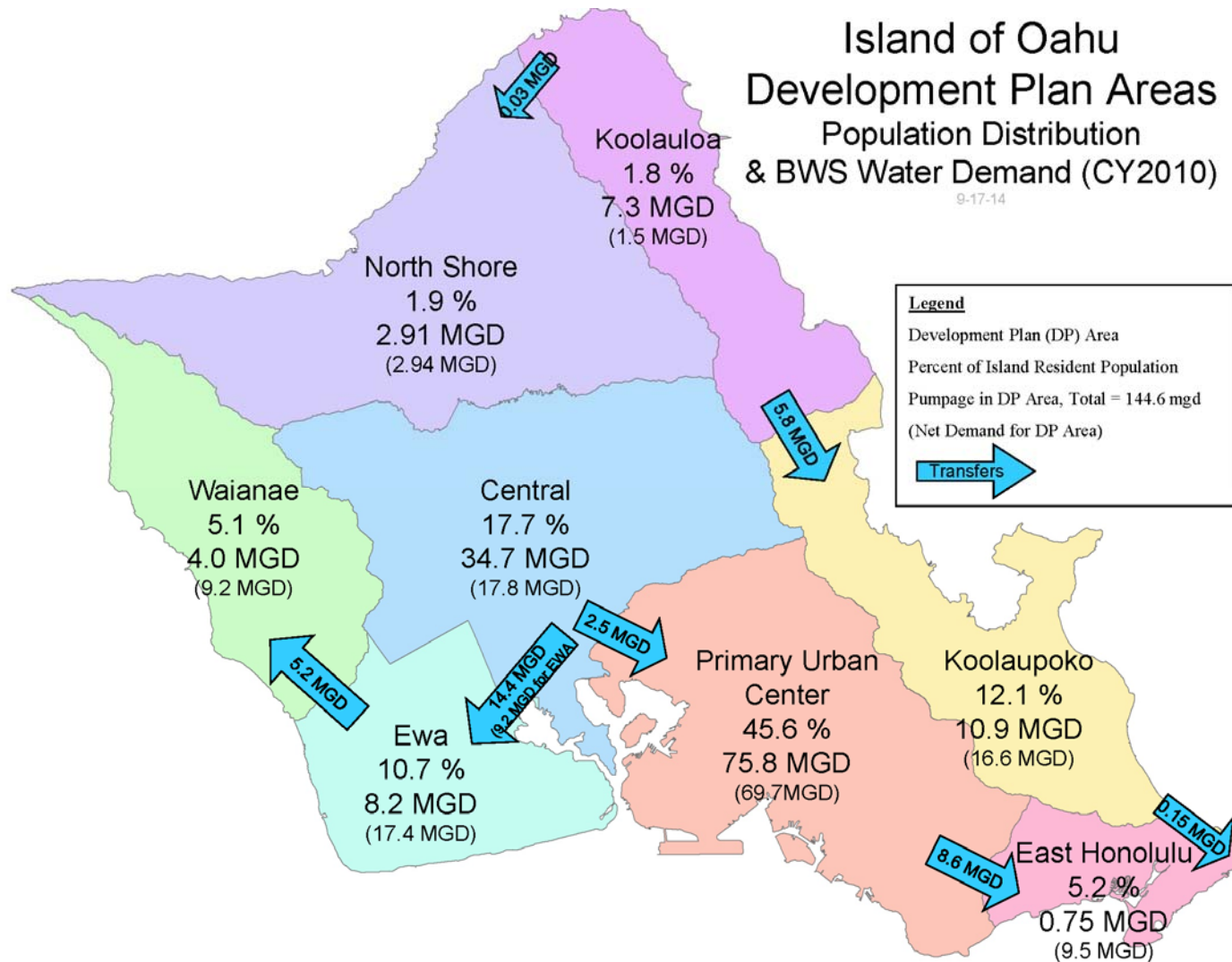
# ‘Ewa Water Systems: System Owners

- City and County of Honolulu
  - Honolulu BWS
- State of Hawai‘i
  - Agribusiness Development Corporation (ADC)
  - Hawai‘i Housing Finance and Development Corporation (HHFDC)
- Federal
  - Kalaelo Water System
  - U.S. Navy
  - USFWS
- Private
  - Individual non-potable wells

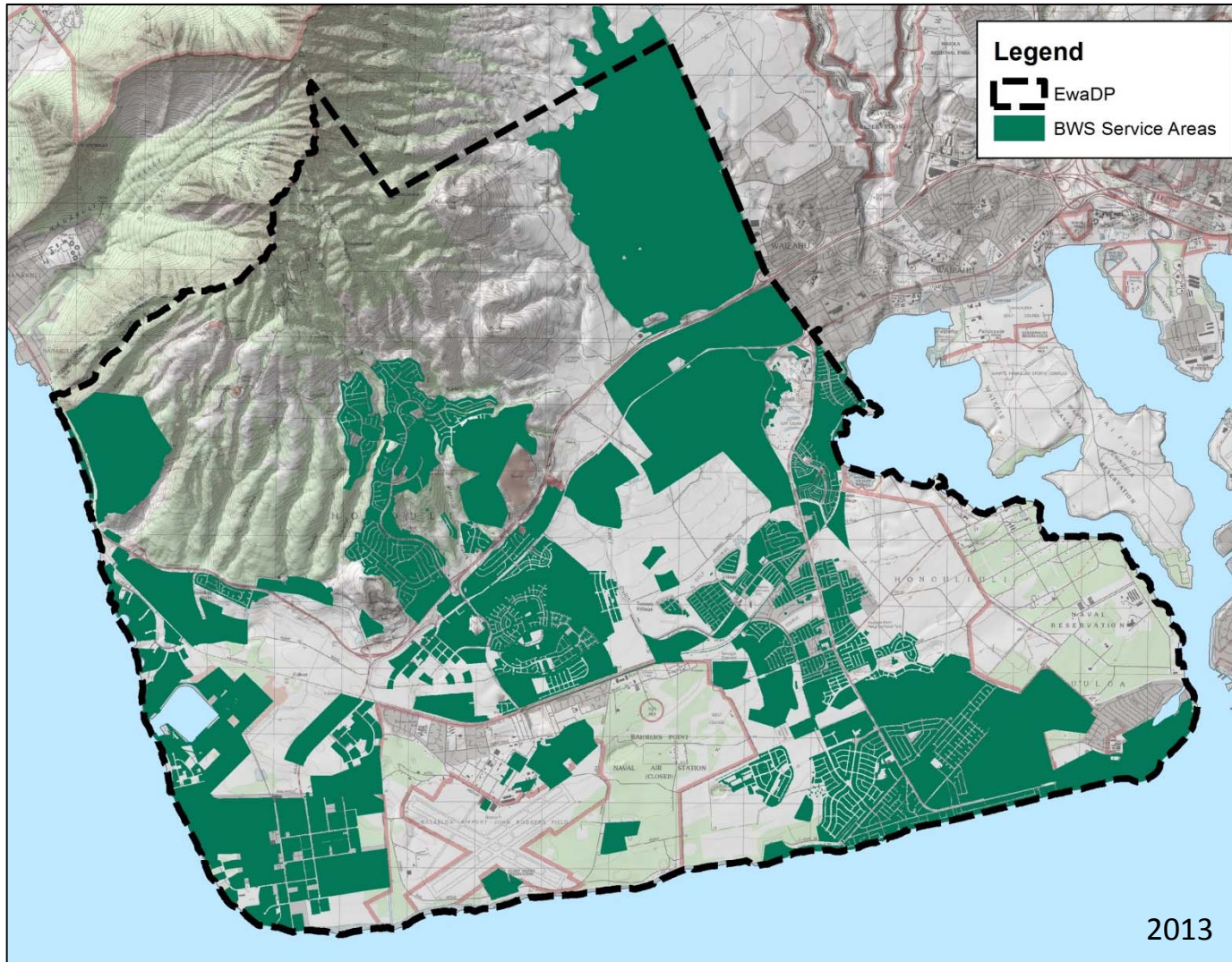




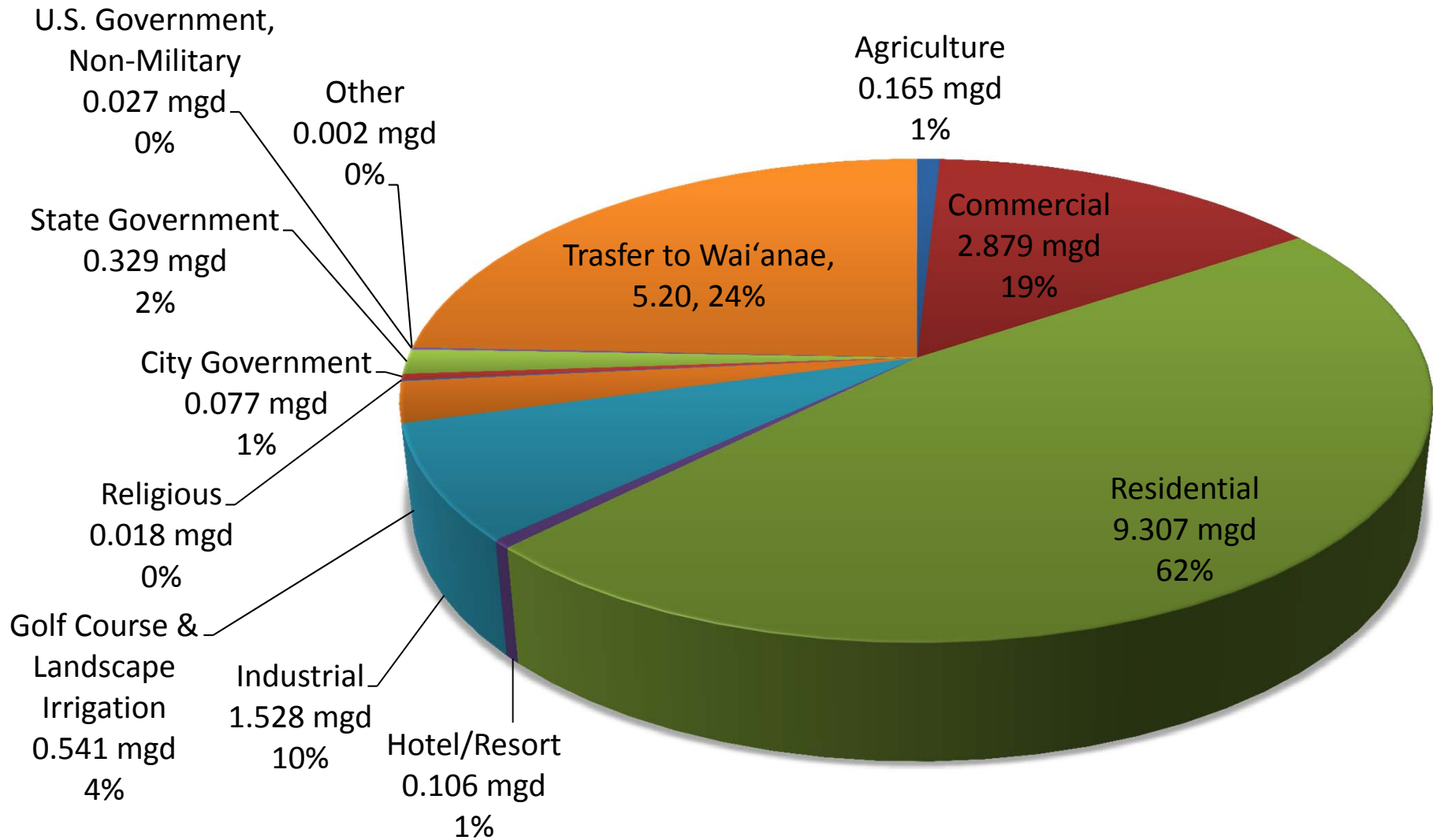
# 'Ewa Water Systems: Honolulu BWS



# 'Ewa Water Systems: Honolulu BWS



# 'Ewa Water Systems: Honolulu BWS (2010)



# 'Ewa Water Systems: Recycled Water

## Honouliuli Water Recycling Facility

- BWS purchased facility in 2000 from US Filter
- R-1 Quality Water (10 mgd capacity)
  - Landscape irrigation
  - Golf Course Irrigation
  - Dust Control
  - Honouliuli WWTP
- R-O Quality Water (2 mgd capacity)
  - Refineries
  - Power Plants



The Honouliuli Water Reclamation Facility produces both R-1 and R-O recycled water. The Honolulu Board of Water Supply has integrated recycled water into its overall water conservation plan.

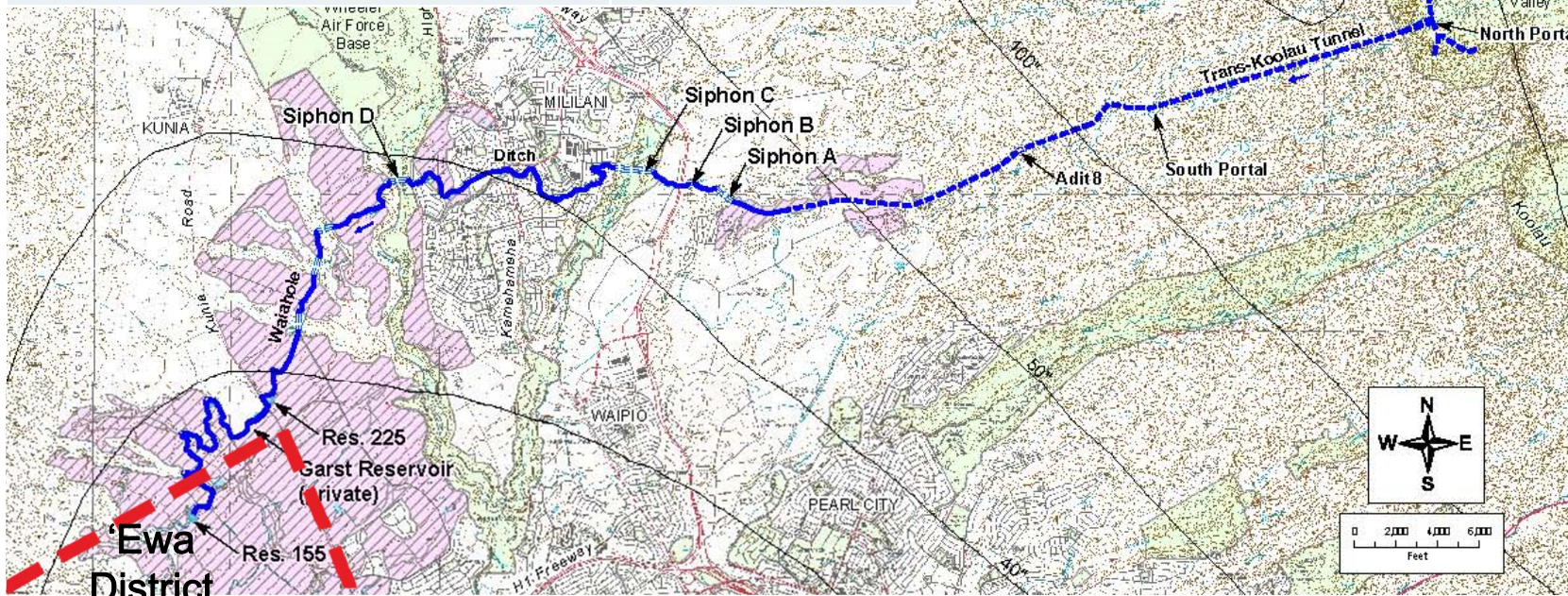
Source: Hawaii Water Reuse Survey and Report (2005)

# 'Ewa Water Systems: Recycled Water



# 'Ewa Water Systems: Waiāhole Ditch

USE	ALLOCATION (2010, mgd)
Water Returned to Windward Streams	12.0
Permitted Offstream Uses (mostly in Central O'ahu)	12.991
Unallocated Water	2.009
<b>TOTAL</b>	<b>27.0</b>



Source: State Department of Agriculture

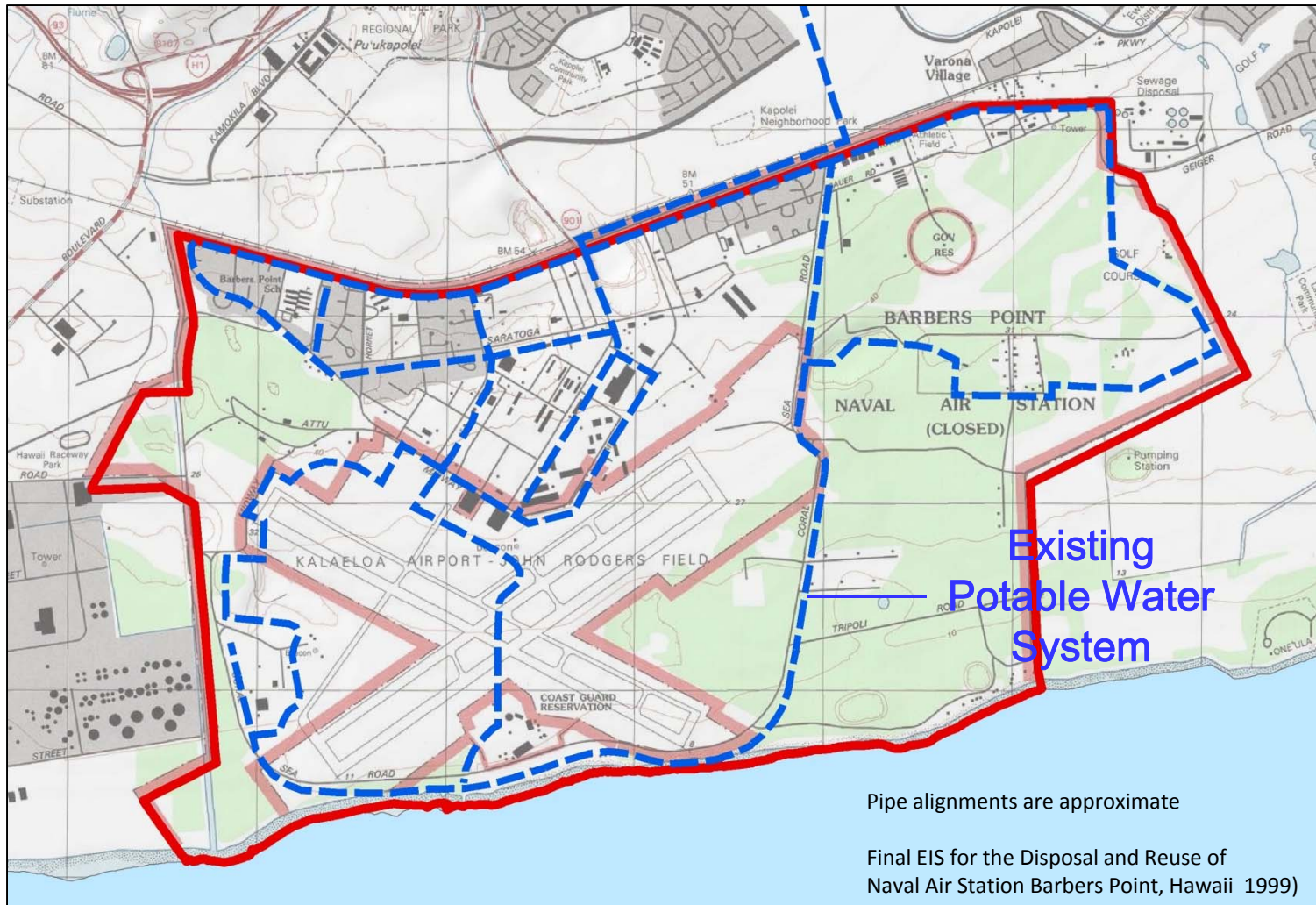
# 'Ewa Water Systems: Other State Systems

---

- HHFDC (non-potable)
  - Landscape Irrigation (0.34 mgd) (2010)



# 'Ewa Water Systems: Kalaeloa Water System





# 'Ewa Water Systems: Kalaeloa Water System

---

- Current Owner: US Navy
- Probable Future Owner: Pural Water Specialty Co.
- Source: Barber's Point Shaft
  - Water Use Permit Amount: 2.337 mgd
  - 2010 Pumpage: 1.31 mgd
- Uses
  - Residential
  - Other non-residential
  - Irrigation/non-potable
- HCDA
  - Oversees the redevelopment of Kalaeloa
  - Approves infrastructure plans within the Kalaeloa Community Development District

# 'Ewa Water Systems: Federal Non-Potable Wells

---

- U.S. Navy
  - 2010 Withdrawal: 0.19 mgd
  - Use: Agriculture
- USFWS
  - 2010 Withdrawal: 0.08 mgd
  - Use: Irrigation at the Pearl Harbor NWR

## 'Ewa Water Systems: Private Non-Potable Wells

---

- Agriculture
  - 2010 Withdrawal: 3.20 mgd
- Industrial
  - 2010 Withdrawal: 2.99 mgd
- Irrigation (golf course)
  - 2010 Withdrawal: 3.38 mgd
- Irrigation (other landscape)
  - 2010 Withdrawal: 0.66 mgd

# 'Ewa Water Systems: Opportunities

- Of all O'ahu Districts, 'Ewa has the greatest opportunity for diversification of water sources
- 'Ewa has master planned its growth for decades with recycled water and dual plumbing



# 'Ewa Water Demand: Uses

- Domestic Residential
- Domestic Non-Residential
- Agriculture
- Irrigation
- Industrial

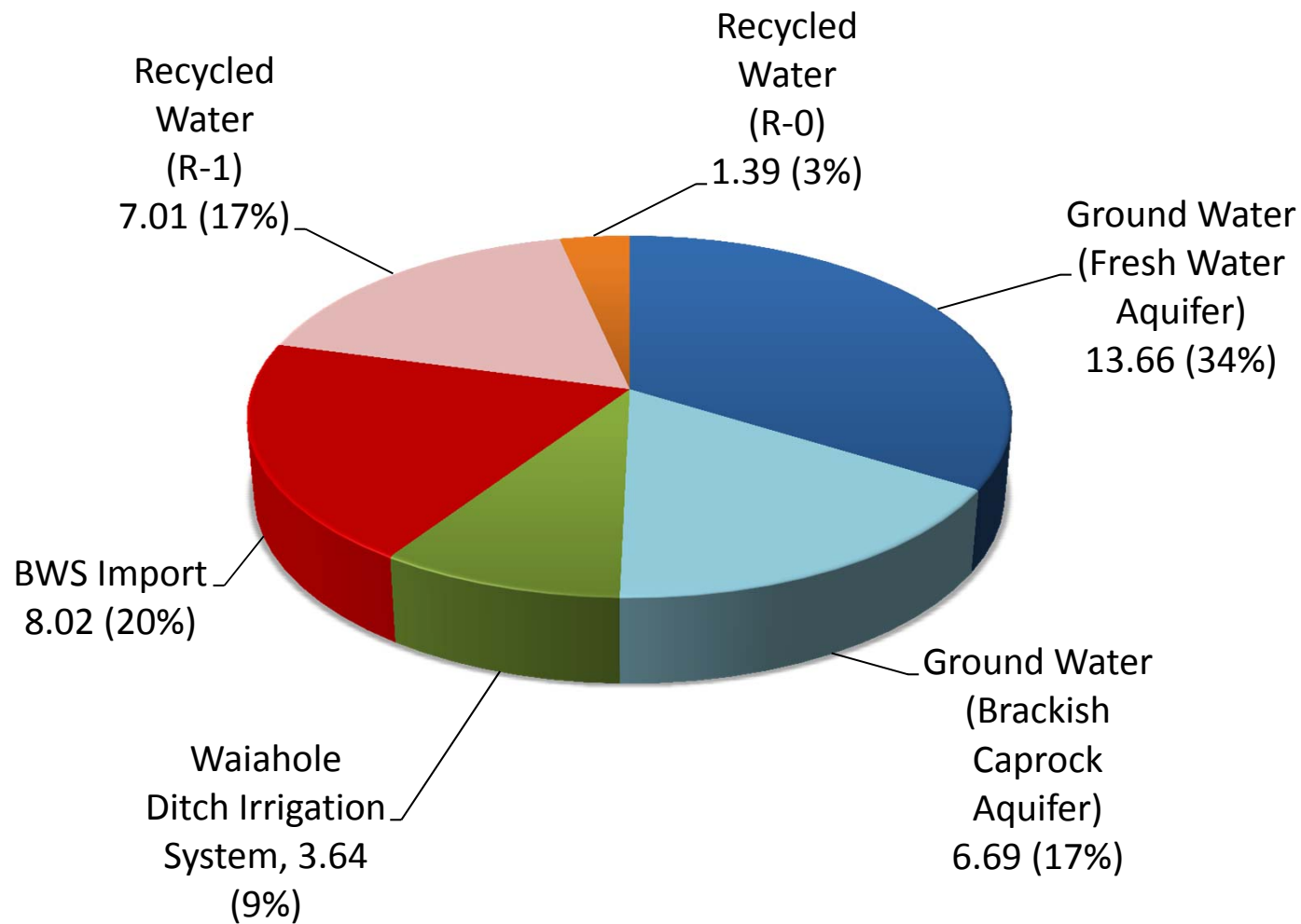


# 'Ewa Water Demand: Existing (2010)

Water Use Category	Water Demand (CY 2010, mgd)
Domestic Residential	14.59
Domestic Non-Residential	3.72
Industrial <sup>1, 2</sup>	7.24
Agriculture	4.01
Irrigation <sup>2</sup>	9.20
Other	0.00
<b>TOTAL</b>	<b>40.41</b>

- 1 Industrial water demands do not include demands for salt water.*
- 2 Industrial and irrigation demands include demands for recycled water.*

# 'Ewa Water Demand: Existing (2010)



# 'Ewa Water Demand: Projections

---

## Why project future water demand?

- To determine how much water may be needed in the future
- To indicate when increased demands might require infrastructure upgrades
- To provide guidance for responsible land and water use decisions





# 'Ewa Water Demand: Projection Methodology

## Per Capita Method

Determine the average water use per person by dividing the current water demand by the current population served by that water system.

$$\frac{\text{Water Demand}}{\text{Person}} = \frac{\text{Total BWS Water Demand}}{\text{Total BWS-Served Population}} = \text{Per capita demand}$$

Apply the per person water demand to the projected population.

$$\text{People served by BWS in CY 2035} \times \text{Per capita demand} = \text{BWS water demand in CY 2035}$$

# 'Ewa Water Demand: Projection Methodology

---

## End Use Inventory Method

Land use based. Estimates water demand by type of land use:  
e.g. agriculture, other landscape irrigation, etc.

$$\begin{array}{ccccc} \text{Acres of} & & \text{Per acre water} & & \text{Total water demand} \\ \text{land use} & \times & \text{demand factor} & = & \text{for that particular} \\ & & & & \text{land use} \end{array}$$

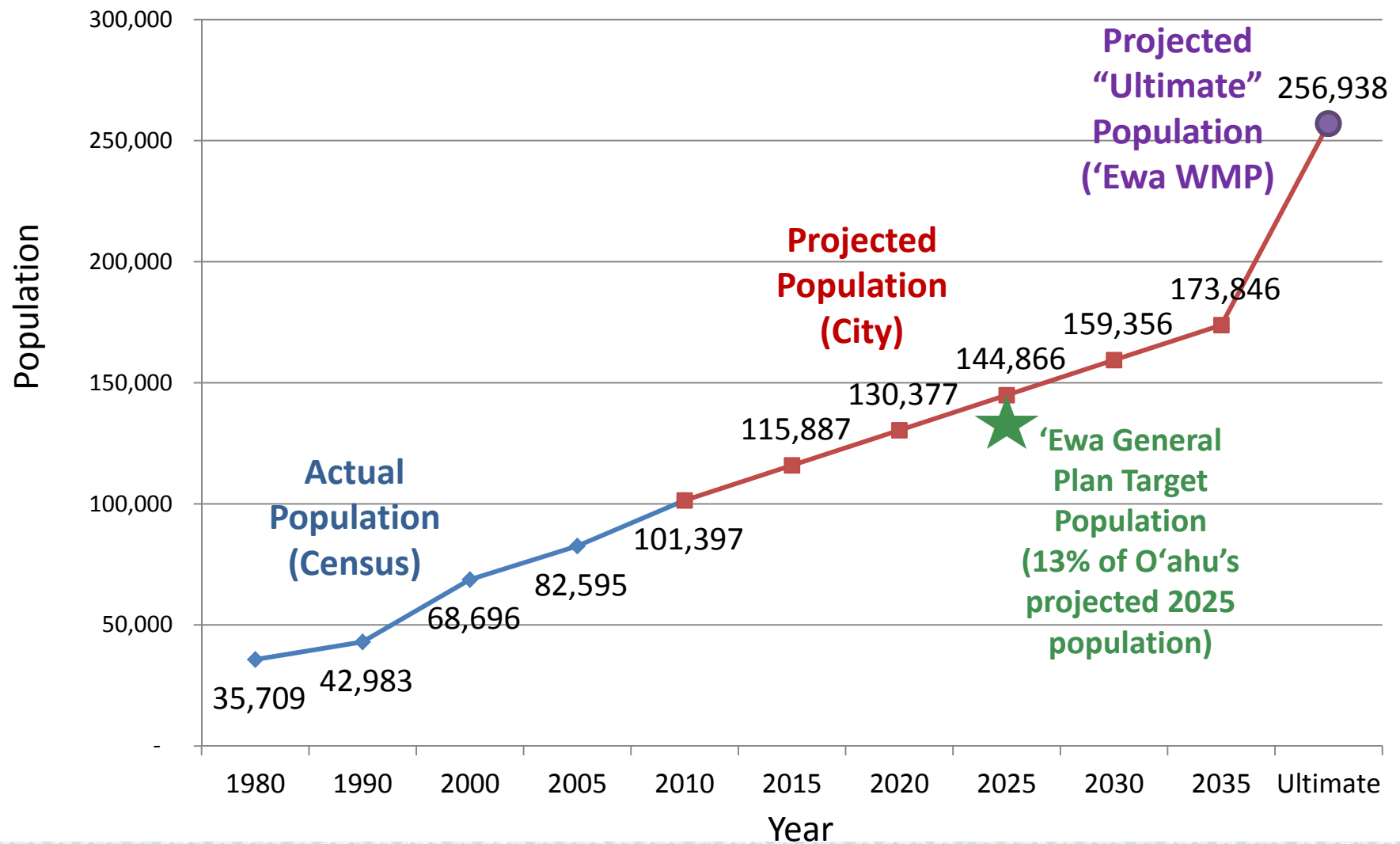
Apply the per unit water demand to the projected increase of the water use sector.

# 'Ewa Water Demand: Projection Guidelines

---

- The Statewide Framework for Updating the Hawai'i Water Plan (Statewide Framework)
- Project for all water producers: BWS, Federal, State, and Private
- Develop “a range of forecasts” – three scenarios
  - (1) Low - growth
  - (2) Mid – growth (City projections based on policy)
  - (3) High – growth

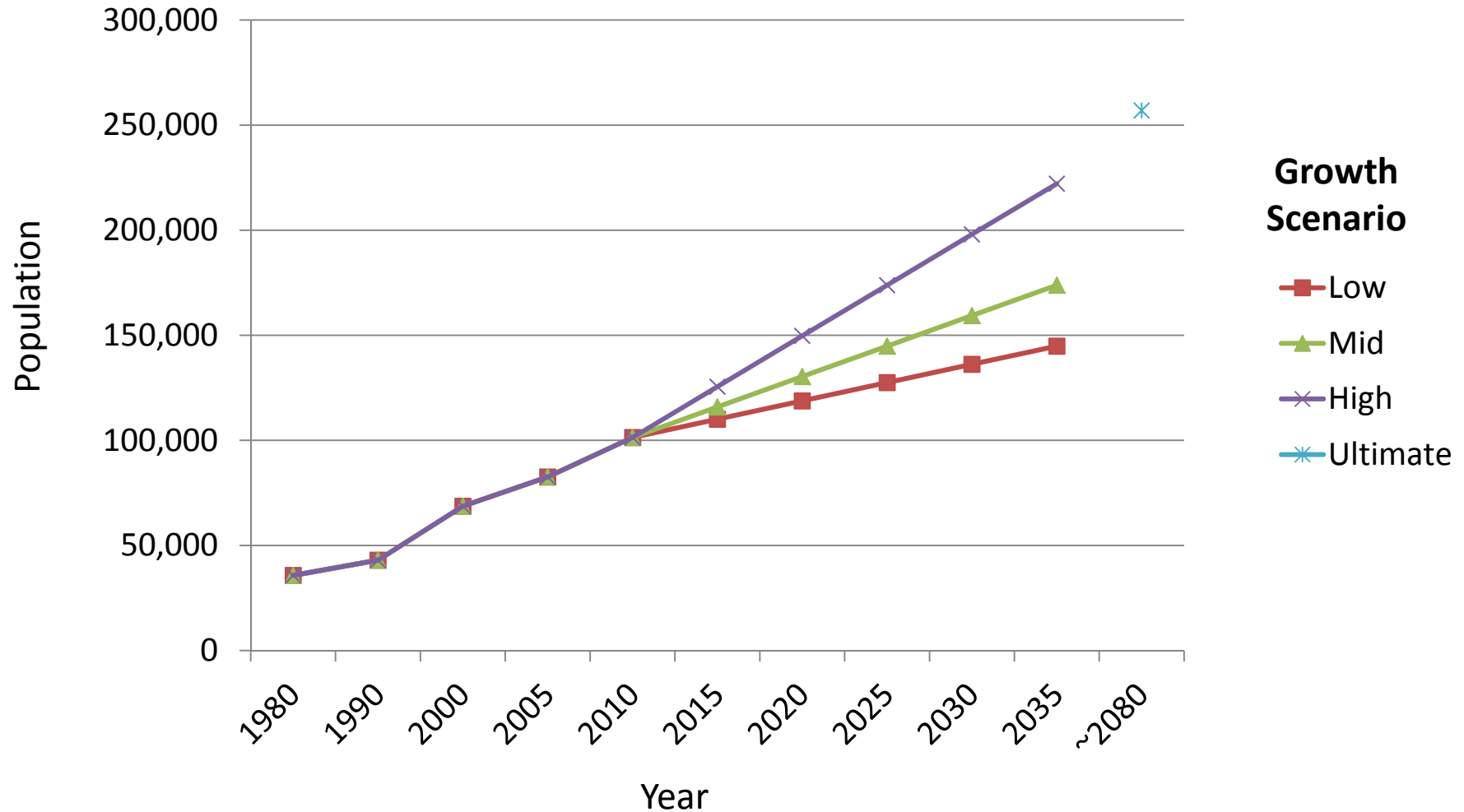
# 'Ewa Water Demand: Projected Population



# 'Ewa Water Demand: Projection Scenarios

Scenario	Description	Population Increase 2010 - 2035
Low-Growth	'Ewa does not develop into the Secondary Urban Center and O'ahu residents continue to work and reside in the Primary Urban Center.	+ 43,469 people
Mid-Growth	City population projections based on the General Plan and 'Ewa Development Plan recognize that Kapolei becomes the Secondary Urban Center of O'ahu.	+ 72,449 people
High-Growth	The Second City of Kapolei has come into its own. 'Ewa is a successful job center and Kalaeloa is being developed.	+ 120,748 people
Ultimate-Growth	Kapolei and Kalaeloa rival Downtown Honolulu as job centers and all planned residential units have been developed.	+ 155,541 people (2010 - ~2080)

# 'Ewa Water Demand: Population Projections

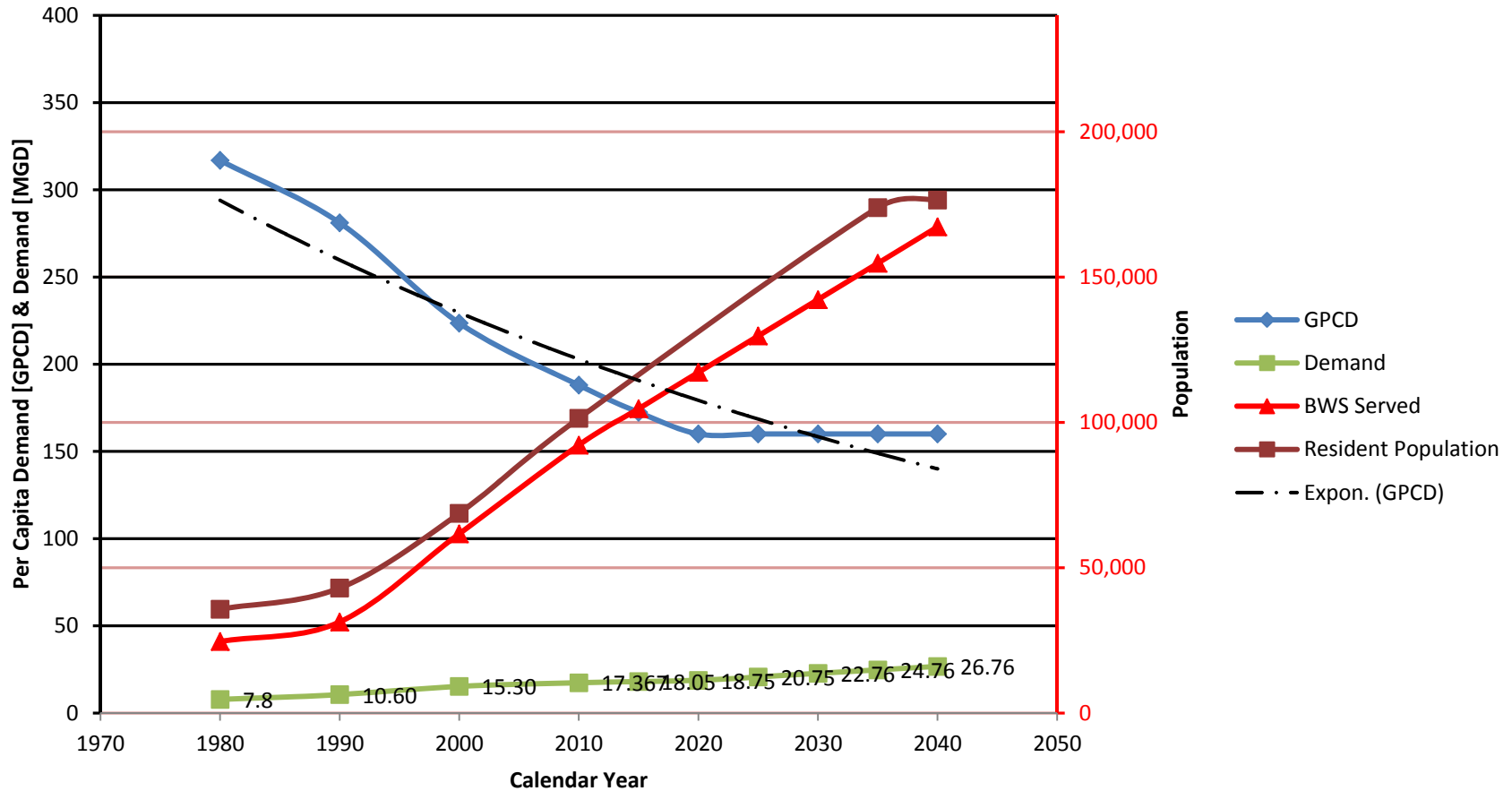


# Water Demand Projections: BWS Potable

Ewa GPCD Trend

$$y = 1E+13e^{-0.012x}$$

$$R^2 = 0.8876$$



# Water Demand Projections: BWS Potable

---

Scenario	2035 BWS Served Population (mgd)	Projected Water Demand (mgd)
Existing (2010)	92,174	16.2
Low (2035)	128,964	22.2
Mid (2035)	154,741	26.4
High (2035)	197,732	33.4
Ultimate (~2080)	228,701	38.1



# Water Demand Projections: Kalaeloa Water System

Scenario	Basis	Water Demand (mgd)
Existing (2010)	Reported Water Use	1.31
Low (2035)	Phase I of the Kalaeloa Master Plan (KMP, 2006) has been implemented by the year 2035.	1.40
Mid (2035)	Phases I and II of the KMP have been implemented by the year 2035.	2.55
High (2035)	Phases I, II, and III of the KMP have been implemented by the year 2035.	3.29
Ultimate (~2080)	Phases I, II, III, and IV of the KMP have been implemented by the year 2035.	4.21

# Water Demand Projections: Agriculture

Scenario	Basis	Acres	Water Demand (mgd)
Existing (2010)		3,539	7.04
Low (2035)	UH West O‘ahu and DHHL East Kapolei have displaced some existing agriculture within the Community Growth Boundary.	3,057 <i>-481 acres from 2010</i>	5.40
Mid (2035)	All ag lands within the Community Growth Boundary have been converted to urban uses, except for Ho‘opili’s ag component.	2,859 <i>-680 acres from 2010</i>	4.72
High (2035)	Same as mid-growth scenario, but additional ag lands in US Navy ESQD zone are fully cultivated.	2,960 <i>-579 acres from 2010</i>	5.07
Ultimate (~2080)	Same as mid-growth scenario, but additional ag lands at UH West O‘ahu’s mauka campus are fully cultivated.	3,408 <i>-131 acres from 2010</i>	6.06

# Water Demand Projections: Industrial

Scenario	Basis	Acres	Water Demand (mgd)
Existing (2010)		1,686	7.24
Low (2035)	Portions of Kenai Industrial Park, Kalaeloa Barbers Point Deep Draft Harbor, Kapolei Harborside, and Kalaeloa are developed.	1,899 <i>(+214 acres)</i>	8.16
Mid (2035)	Implementation of additional phases of the industrial parks developed under the low –growth scenario.	2,123 <i>(+437 acres)</i>	9.12
High (2035)	Implementation of additional phases of the industrial parks developed under the mid –growth scenario. Implementation of Ho‘opili’s plans for light industry.	2,370 <i>(+685 acres)</i>	10.18
Ultimate (~2080)	Complete implementation of all planned industrial parks, including Hoakalei Marina.	2,634 <i>(+949 acres)</i>	11.31

# Water Demand Projections: Golf Course Irrigation

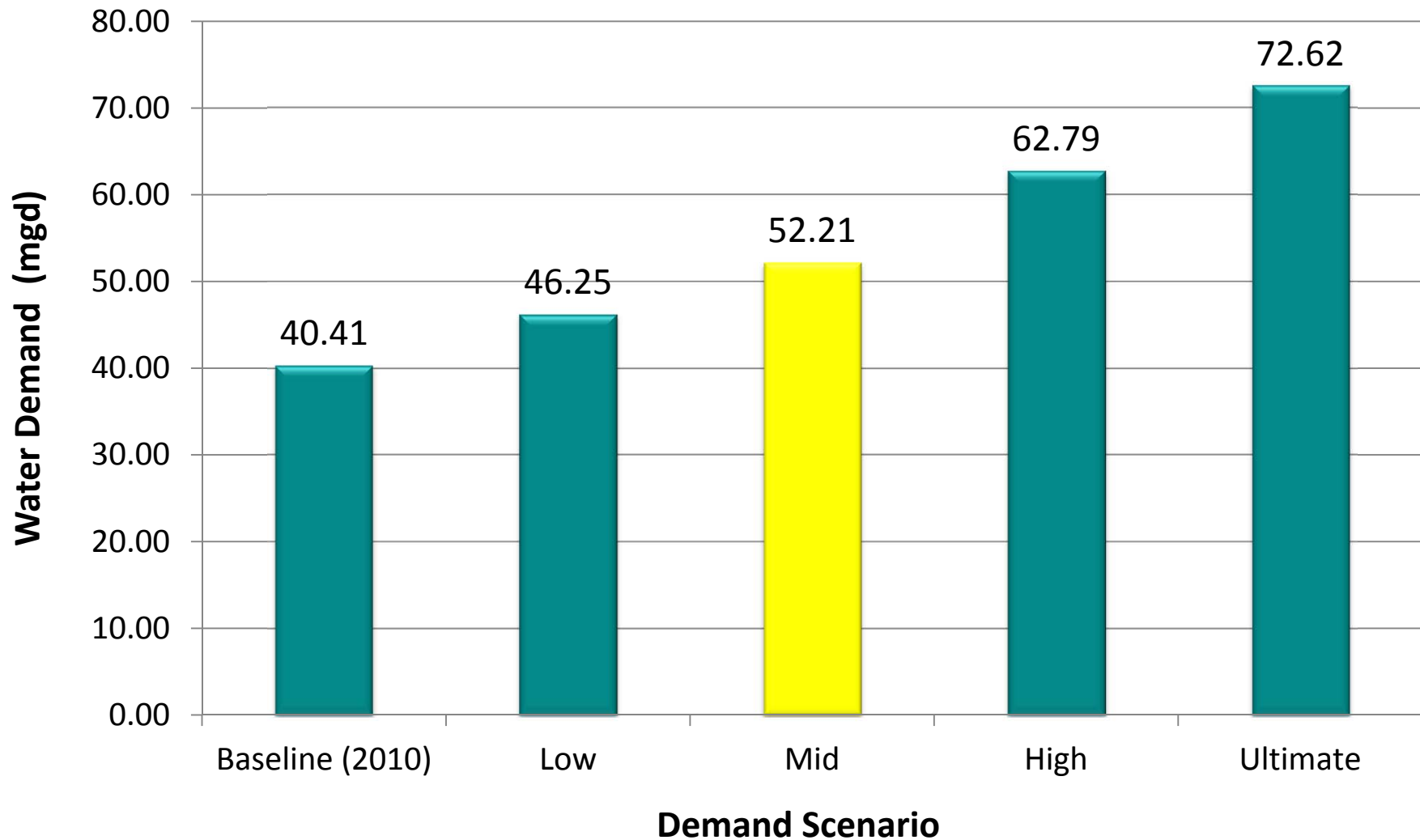
Scenario	Basis	Water Demand (mgd)
Existing (2010)	There are currently nine existing golf courses in the 'Ewa District.	7.45
Low (2035)	No change in the number of golf courses in the 'Ewa District.	7.45
Mid (2035)	No change in the number of golf courses in the 'Ewa District.	7.45
High (2035)	Kapolei West Golf Course has been built as the tenth golf course in the 'Ewa District.	8.35
Ultimate (~2080)	Global climate change assumes declining rainfall and increased evapo-transpiration rates due to higher temperatures, thus increasing irrigation rates by 15% for the 10 golf courses in 'Ewa.	9.60



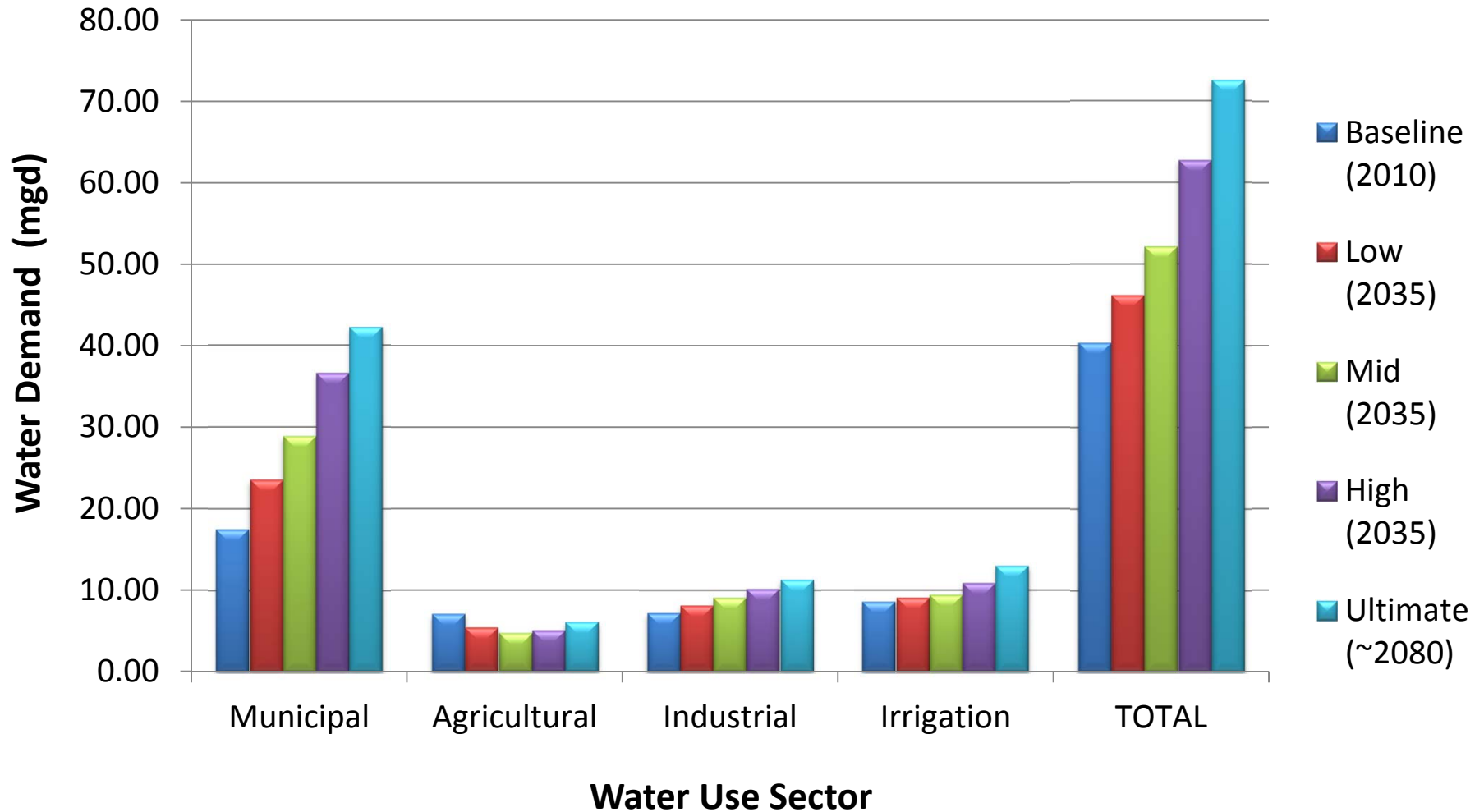
# Water Demand Projections: Landscape Irrigation

Scenario	% Increase in Population by 2035	Water Demand (mgd)
Existing 2010)	N/A	1.16
Low (2035)	+ 43%	1.66
Mid (2035)	+ 71%	1.99
High (2035)	+ 119%	2.55
Ultimate (~2080)	+ 153%	3.39

# 'Ewa Water Demand: Projections: Summary



# 'Ewa Water Demand Projections: Summary



# 'Ewa WMP Objectives and Sub-Objectives

---

- OBJECTIVE #1: Promote sustainable watersheds
  - a. Maintain and enhance the forests within the State Conservation District
  - b. Protect native plant and wildlife habitat
  - c. Mitigate the impact of planned development within the Community Growth Boundary
  - d. Provide for agricultural water needs
  - e. Retain drainageways as natural channels



# 'Ewa WMP Objectives and Sub-Objectives

---

- OBJECTIVE #2: Protect and enhance water quality and quantity
  - a. Maximize ground water infiltration
  - b. Conserve and reuse water to make the most efficient use of district water supplies and reduce the amount of effluent that is disposed of offshore
  - c. Implement regional drainage plans to mitigate flooding and reduce point and non-point source pollution of the ocean and Pearl Harbor
  - d. Protect the quality of the drinking water aquifer
  - e. Sustain the brackish caprock aquifer

# ‘Ewa WMP Objectives and Sub-Objectives

---

- OBJECTIVE #3: Protect Hawaiian rights and traditional and cultural practices
  - a. Preserve and provide access to sites and resources in ‘Ewa that are important to Hawaiian history and cultural practices
  - b. Protect the gathering of natural resources in the ‘Ewa coastal zone by understanding the role that fresh water and land use plays in the health of near shore waters

# 'Ewa WMP Objectives and Sub-Objectives

---

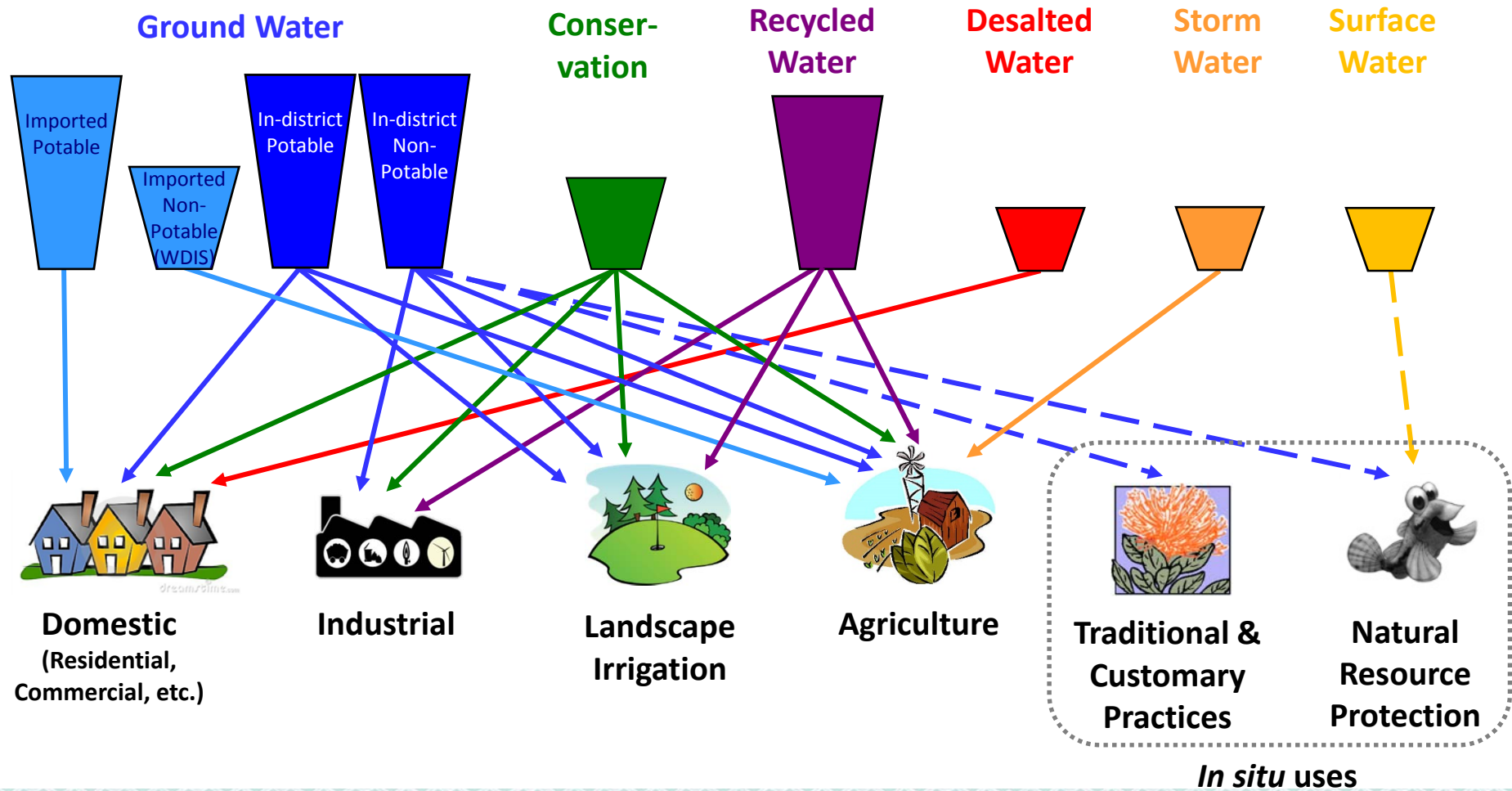
- OBJECTIVE #4: Facilitate public participation, education, and project implementation
  - a. Provide opportunities for the community to participate in the management of 'Ewa's cultural and natural resources
  - b. Provide opportunities for the community to learn about 'Ewa water resources and how to protect them
  - c. Collaborate amongst government agencies, non-profit entities, and community on issues related to 'Ewa's long-term land and water resources future

# 'Ewa WMP Objectives and Sub-Objectives

---

- OBJECTIVE #5: Meet future water demands at reasonable costs
  - a. Diversify Ewa's water supply to ensure that there will be enough potable water for potable needs and to allow for adequate water supply for all types of water demands
  - b. Improve the efficiency of water system delivery
  - c. Research climate change impacts and pursue adaptation and infrastructure resiliency strategies
  - d. Incorporate renewable energy and energy efficiency strategies into all water systems
  - e. Sustain the brackish caprock aquifer
  - f. Maintain reasonable costs to consumers

# Potential Water Supply Options: Framework



# 'Ewa WMP Next Steps: Projects and Strategies

---

## Projects with Champions

*Specific projects that are being planned and/or that are being implemented by a particular agency or agencies or by a particular group or non-profit entity.*

## Strategies

*Potential actions that would serve to implement the overall goal, objectives, and sub-objectives of the KPWMP, but that do not currently have a project champion.*

## 'Ewa WMP Next Steps: Nov 2014 through Sep 2015

---



# 'Ewa WMP Contact Information

---

Sherri Hiraoka  
Townscape, Inc.  
[sherri@townscapeinc.com](mailto:sherri@townscapeinc.com)  
(808) 536-6999, ext. 6

Barry Usagawa  
Honolulu Board of Water Supply  
[busagawa@hbws.org](mailto:busagawa@hbws.org)  
(808) 748-5900