

Safe, dependable, and affordable water now and into the future



Stakeholder Advisory Group

Board of Water Supply City & County of Honolulu

Thursday April 25, 2019

WATER FOR LIFE

Safe, dependable, and affordable water now and into the future



Barry Usagawa

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CLIMATE CHANGE PANEL DISCUSSION

BWS Strategic Plan





Delivering reliable, high-quality water requires a delicate balance between water supplies and customer demands.

While water managers continually strive to maintain this supply-and-demand balance through long-term water resource planning and demand management, new challenges exist due to the impacts of climate change, putting the world's water resources at risk.

The Water Utility Climate Alliance (WUCA) is dedicated to enhancing climate change research and improving water management decision-making to ensure that water utilities will be positioned to respond to climate change and protect our water supplies.





April 25, 2019

Impacts of Climate Change on Honolulu Water Supplies and Planning Strategies for Mitigation

Barry Usagawa, P.E., Water Resources, Board of Water Supply



Objectives

- Evaluate climate change impacts on Honolulu Board of Water Supply (BWS) infrastructure and water supply
- Develop a suite of strategies to address the anticipated changes

This project supports Water Research Foundation's (WRF) Climate Change Strategic Initiative objective to provide water utilities with a set of tools to assess their vulnerabilities and develop applicable adaptation strategies.

Jointly funded by Honolulu Board of Water Supply and Water Research Foundation through Water Research Foundation's Tailored Collaboration Program





Project Approach

- Adaptive management is an iterative process for flexible decision making in the face of uncertainties
- Utilized scenario planning to consider a range of potential changing conditions



Vulnerabilities & adaptive management strategies identified for 3 time frames:

- Short-term (2020–2030)
- Mid-term (2030–2050)
- Long-term (2050–2100)

Goal is to develop policies and actions that encourage "no regrets" strategies.

Vulnerability Assessment Approach



Downscaled Climate Models indicate a Range of Rainfall Futures



Climate Change - Rainfall Projections

Source: Figure developed by Abby Frazier April 2017

Current SY and Potential Range of SY from Climate Forecasts Current: 407 mgd, Low: 300 mgd, High: 443 mgd



Preliminary Supply Adaptation Strategies:

Recharge could decrease Oahu sustainable yields by ~27%. Statistical model From 407 mgd to 300 mgd a difference of 107 mgd, Turk, Report #9, B&C.

- Reduce per capita water demand from 155 gpcd to 100 gpcd through aggressive water conservation, like dual plumbing with recycled water
- Storm water capture in Nuuanu and on-site for new development
- Expanded Reuse at Honouliuli, Mililani, Wahiawa and Schofield WWTP's
- On-site reuse
- Increase transfers from Wahiawa and Waipahu Waiawa aquifers to Waianae and Honolulu. Drill more wells in Wahiawa and Waipahu-Waiawa
- Assertion of Public Trust Water Rights for Domestic Use to retain water use permits in a revocation process
- More desalination in Ewa and possibly for Honolulu
- Desalinated reuse in Honolulu, Waianae and Hawaii Kai where wastewater effluent is too salty for irrigation
- Indirect or Direct Potable Reuse with RO desalination and UV/Ozone disinfection



Infrastructure Impacts from Sea Level Rise



3.2 feet of SLR Exposure Areas on Oahu



24 Low Elevation/Coastal Water Pipeline Bridge Crossings may be subject to coastal erosion impacts.



Corrosion impacts to 21 miles of metallic pipelines with 3.2' of SLR by 2100

Pipe Lengths Impacted Island-wide by Hazard (feet)													
Time Period	Year	SLR (feet)	Pipe Length for Al inch to 42	l Diameters (1.25- -inch (feet)	Percent of Total BWS Infrastructure Impacted								
			МІ	GWI	МІ	GWI							
Mid-Century	2050	1	14,038	772	0.1%	0.01%							
End-of-Century	2100	3.2	60,409	52,026	0.6%	0.5%							





Nimitz & Alakawa, July 3, 2018, 8:00 am, Lowest high tide of the day. Highest tide 1' higher

2017 - King Tide - Waikiki



2017 - King Tide – Ala Wai Canal



2017 - King Tide - Mapunapuna



2017 - King Tide – Maunalua, Ala Moana



End-of-Century Sea Level Rise Could be Greater



Source: Habel et al. 2017

Flood Insurance Rate Map (FIRM)

Effective DFIRM

Zone XS (X shaded)
Zone A *
Zone AE *
Zone AEF *
Zone AH *
Zone AO *
Zone D
Zone VE *
Zone X
Zone X Protected by Levee

* Special Flood Hazard Area: 100-year flood plain 1968

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STORMWATER MANAGEMENT MASTER PLAN



Impacts of Sea Level Rise

- Higher groundwater
- Higher tides
- Increased flooding
- Decreased effectiveness of the existing stormwater system



INFRASTRUCTURE RESILENCY

- Elevating Public & Private Infrastructure
- Stormwater Retrofits
- Updating/Replacing Utilities
- Green Infrastructure







This rendering shows the elevated roadway at 20th Street and Purdy Avenue, in front of Pubbelly restaurant. To the right, the patio in front of Pubbelly is about two feet lower than the street. Floor drains down there feed into the same pipes that connect to the curb drains on the road, which routes water to the pump station.

Sunset Harbour 20 Street & Purdy Avenue



Draft Adaptation Framework/Action Plan

		Nuisance Flooding (24 x per year) at 0.52 m (Intermediate) 2044-2045												BY Muisance Flooding (24 x per year) at 0.5: n (Intermediate) 2004-2005 Mid-Century Benchmark of adapting flooding associated with 3.2 feet of content of century Benchmark of up to 6 feet of global sea level rise End of Century Benchmark of up to 6 feet of global sea level rise																
Research and Monitoring	Continue e Refinemen Continue u Expand an	2025	2030	2035	2036	2037	2038	2039		2040				2030	2035	2036	2038		2045	020	2055	206.0	2065	2070	2012	2080	2085	2090	2095	2100
//Regulation	City Climate Change Commission SLR Guidance and Recommendations Mayor's SLR Directive establishing SLR targets, City agency policies & responsibilities for implementation Governor's SLR Executive Order establishing SLR targets, State agency policies & responsibilities for implementation Amend land use plans to include SLR policies Establish SLRXA Resiliency Districts/Zoning Undate Fload Insurance Rate Mass (FIRM) for SLR								×	x	×		, ,	×																
ncing Policy	Add LUO SLR building codes and design criteria for new developments Add SLR requirements to long-range infrastructure facilities plans and CIP Adopt county framework for interagency coordination. Consolidate and streamline SLRXA environmental & permit review process. Authorize CIP appropriations for SLR adaptation measures. Develop alternative funding strategies to supplement CIP appropriations. Establish a SLRXA assessment/fee to implement SLR adaptation measures.										► X	Mi fle	Mid-Century Benchmark of adapting to high t flooding associated with 3.2 feet of SLR by e													tid end	e I			
St udies Fina	Authorization Develop tax i Establish SLR Initiate imple Utilize the SL Conduct vuln Develop crite	n and appropriation o incentive programs for i improvement district ementation of the lon RXA research to ident nerability and risk asse eria for selection of or						Ι	2055		2060			2065			2070			2075			2080							
Engine ering Feasibility	Develop ada Develop drai Create a GIS Install interin Conform/ele Conform/ele	daptive strategies for hardening/elevating or retreating/redevelopment. rainage master plans for 100-year storm with target SLR (elevating and stormwater pumping). IS elevation contour map for site-specific grading and drainage. rrim flood mitigation measures (one-way drainage valves, on-site stormwater pumps, berms). elevate new development consistent with the drainage master plans. elevate existing development consistent with the drainage master plans.													x															
h Planning and	Initiate P & E Mitigate coa: Initiate distri Revise and a Incorporate ! Continuous e	iate P & E to elevate roadways and utilities once nuisance flooding exceeds 24 times/year. igate coastal erosion impact areas; hardening coastal roadways, seawalls, and bridge improvements. iate district area EIS and long lead permitting/approvals. <i>iste</i> and adjust CIP sequencing for site-specific drainage, roadway elevation, pumping, bridge hardening, etc. orporate SLR CIP design and construction improvements in annual budgets.										×	x	×	x x x	x x	x)	X X X	x v v v v v v v v v v v v v v v v v v v	x x x	x	x x	x x	x x	X X	X X	x	X X	x x	1
Design Public Outread	Develop com Conduct proj Design of hig Phase 1 Phase 2 Phase 3	imunication materials ject-specific stakeholo thest priority adaptati	and outreach strateget er and community m on projects by district	gies for specific CIP p neetings. t such as Waikiki, Iwil	ojects. ei, Kakaako, Mapur	napuna, etc.																								3.2
Construction	Construct hig Phase 1 Phase 2 Phase 3	shest priority adaptat	ion projects by distric	ct such as Waikiki, Iwi	ei, Kakaako, Mapu	napuna, etc.											•	•		•		×								

WRF Study Identified Two Candidate Pilot Areas for Sea Level Rise Adaptation

West Waikiki



 Base

 Base
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Iwilei

Possible Selection & Prioritization Criteria:

- Potential severity of social, economic, or environmental impacts
 - Taxable real estate; flood impacts to pedestrians, commercial and recreation activities, tourism, transportation and infrastructure.
- Opportunity to add SLR adaptation measures with proposed improvements
 - Ala Wai Flood Mitigation Project
 - Iwilei Transit Oriented Development Plan

Iwilei Redevelopment Concept to Live with Water



The One Water Cycle



Acknowledgements

Research Team

Principal Investigators

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Project Team

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Technical Advisory Committee

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