



Climate Change Interactive Presentation





Climate Change Interactive Presentation Agenda

- Climate change forecasts for Los Angeles
- LASAN system-wide vulnerability by climate threat
- What are other cities doing?
- One Water L.A. approach to addressing climate change
- Q&A - Your input is important!



Clicker Question:

Have recent weather events (drought and wildfire) affected your thinking on climate change? (Yes or No)

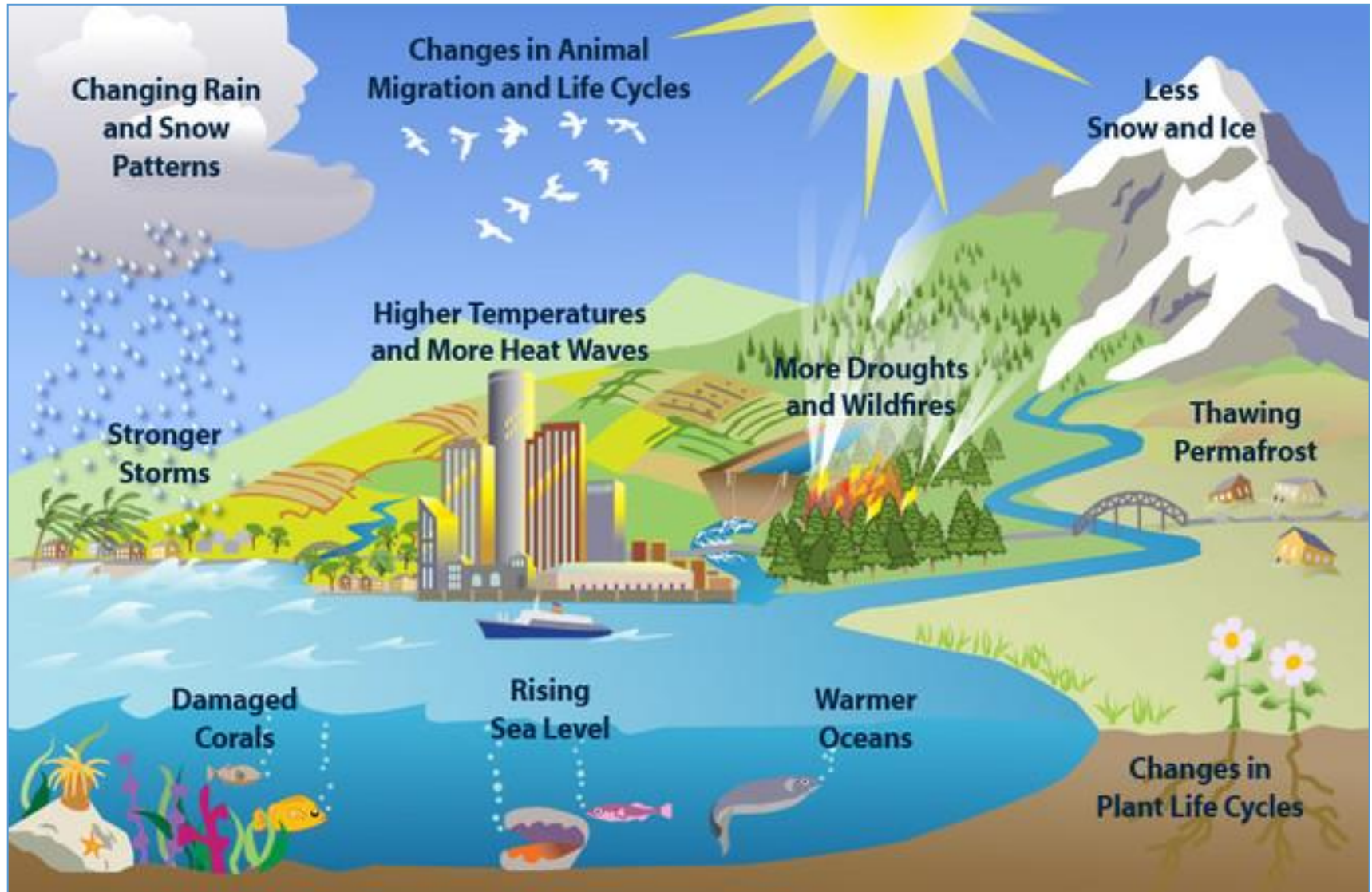


Clicker Question:

Do you know what our climate change threats are in Los Angeles? (Yes or No)



Climate Change impact forecasts vary greatly at the local level





Clicker Question:

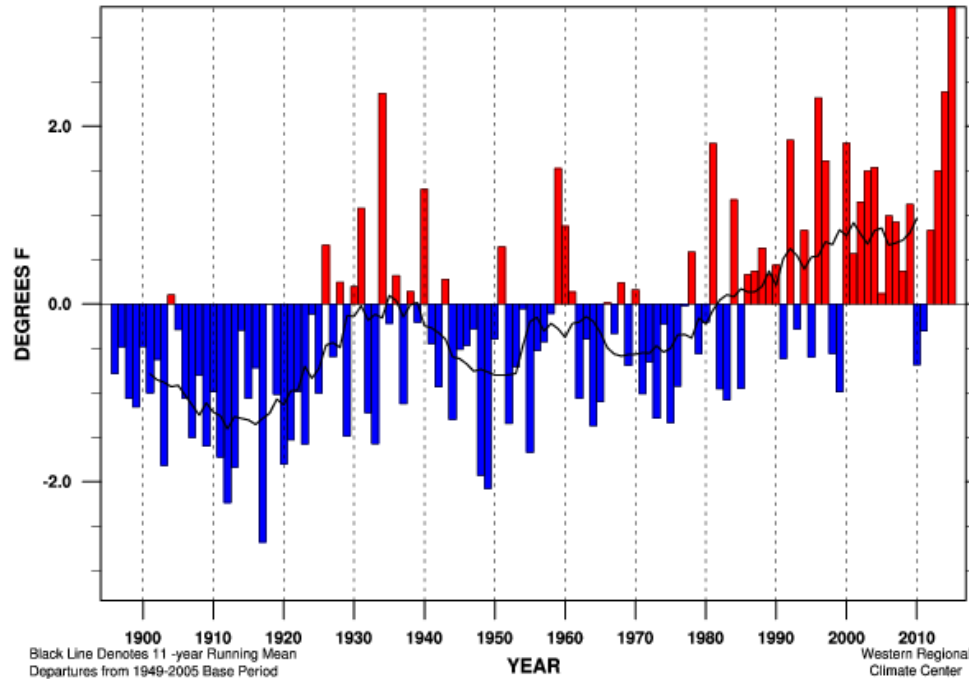
Which climate change condition have you thought about most?

- a) Rainfall (extreme rainfall and/or drought)
- b) Temperature
- c) Sea Level Rise



L.A. Sanitation Compilation of Temperature Variability and Trends

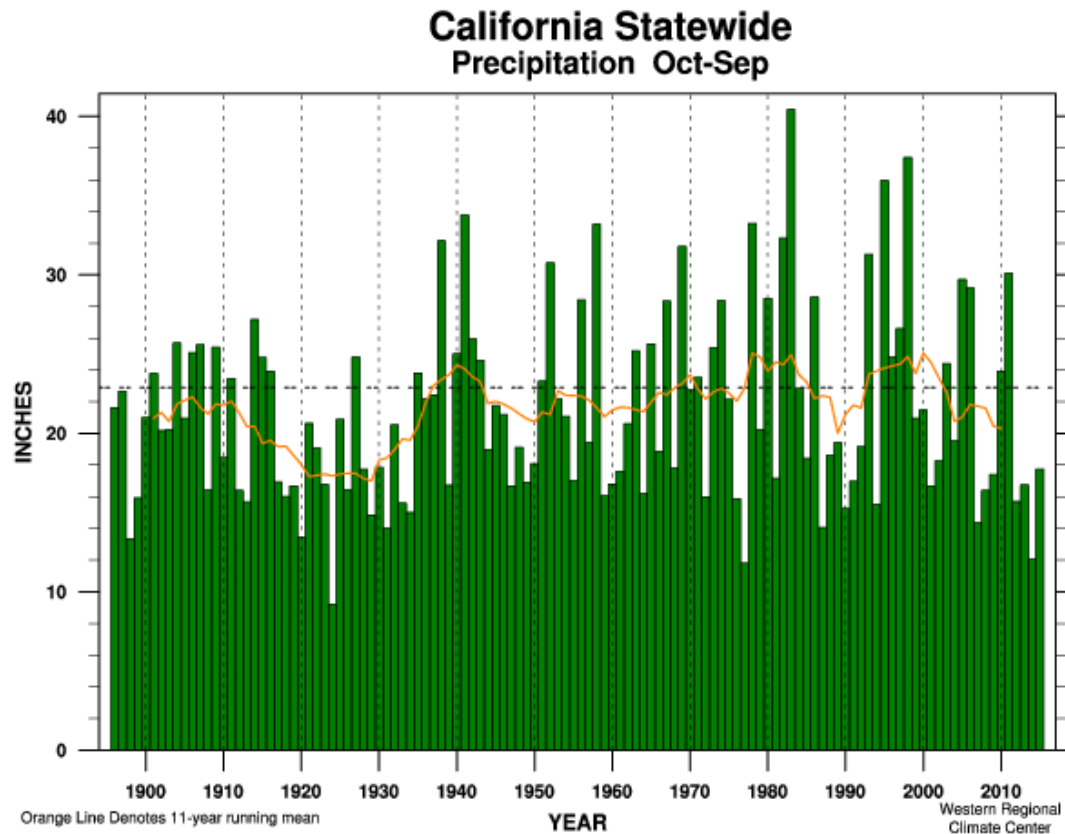
**California Statewide
Mean Temperature Departure Oct-Sep**



CLIMATE STATION	NUMBER OF DAYS OVER 95°F			
	2011	2012	2013	2014
Long Beach	1	5	0	12
Pierce College/ Woodland Hills	48	80	65	69
Santa Monica	0	2	4	2



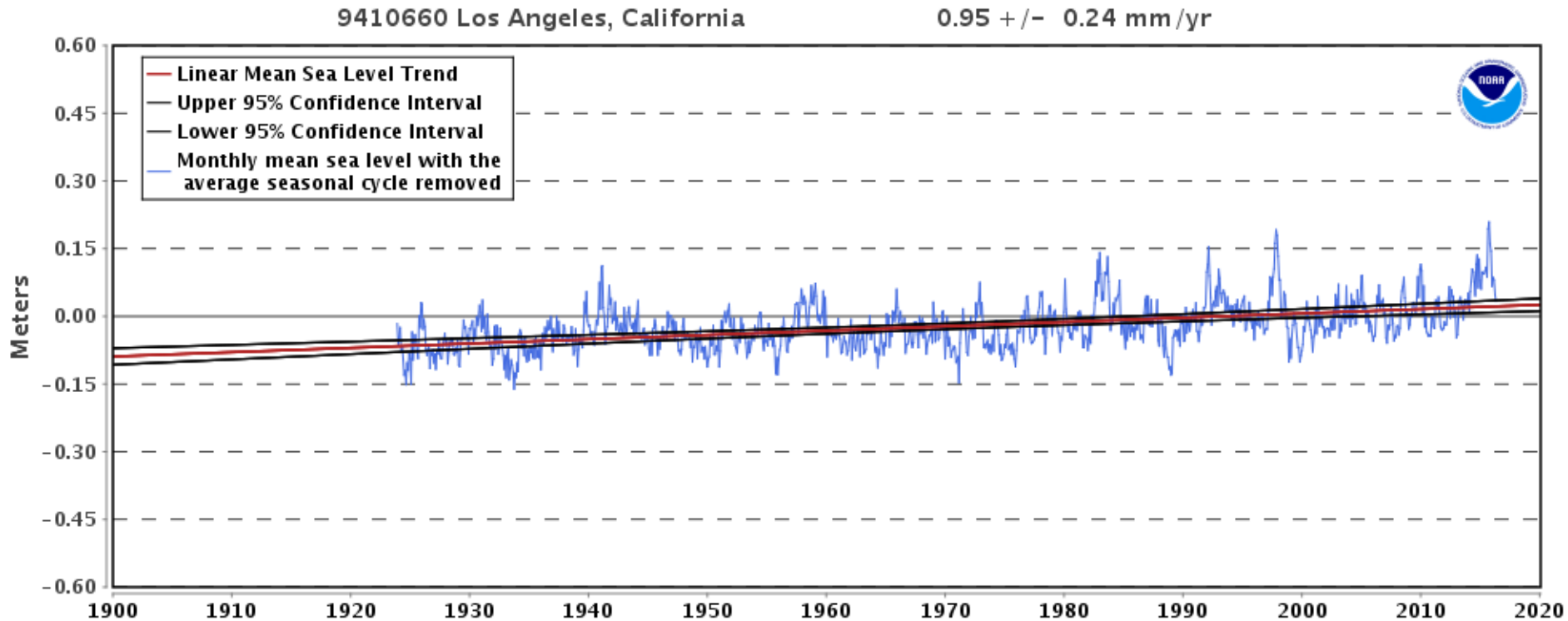
L.A. Sanitation Compilation of Temperature Variability and Trends



- Annual rainfall is historically 14 to 18 inches per year. In the past few years it has averaged about 6.8 inches/year due to the drought



Sea Level Rise Trend for Los Angeles





Clicker Question:

Which City's infrastructure are you more concerned about?

- a) Wastewater
- b) Stormwater Drainage
- c) Water Supply
- d) Transportation
- e) Power



Clicker Question:

Which climate change impact keeps you up at night?

- a) Not having enough water to drink
- b) Flooded roads and homes from rain
- c) Untreated wastewater in our waterways and on our beaches
- d) Mud slides
- e) Burned homes and infrastructure by wildfire
- f) Brownouts and Blackouts



System-Wide Vulnerability

Climate Threats



Temperature



Sea Level Rise



Precipitation



Drought



Wildfire



Extreme Winds

Asset Classes



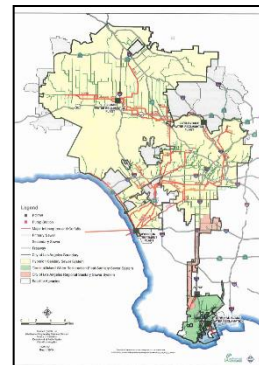
Wastewater
Treatment Plants



Watershed Protection



Solid Waste



Collection System

Pumping Plants



Clicker Question:

How often does climate change factor into your decision making?

- a) It's often a part of my decision making.
- b) Infrequently.
- c) I'll be gone before it matters.
- d) I let somebody else worry about it.



One Water L.A. Goals and Objectives

- Goal
 - Develop resilient water infrastructure in the face of a changing climate
- Objectives:
 - Apply climate change science to engineering
 - Integrate assessment of climate change impacts to the City's existing and planned Wastewater and Stormwater infrastructure
 - Develop adaptation strategies for consideration in OWLA Plan (using EPA's [Climate Resilience Evaluation & Awareness Tool](#))
 - Provide specific measures that could be incorporated into Wastewater and Stormwater Facility Plans



EPA's Climate Resilience Evaluation & Awareness Tool (CREAT)

The screenshot shows the homepage of the CREAT 3.0 tool. The header is blue with the CREAT 3.0 logo, navigation links (GET STARTED, RESOURCES, HELP), and the EPA logo. The main banner features a dramatic image of waves crashing against a rocky shore. Text on the banner includes 'Build Climate Resilience at Your Utility' and a description of CREAT as a climate change risk assessment and planning application. Below the banner, three key steps are listed: Discover, Assess, and Share. A 'Get Started' button is prominently displayed. On the right, there is a video player showing an aerial view of a water treatment facility with large circular tanks. The footer contains links to EPA Home, Disclaimer, and Contact Us, along with the 'CLIMATE READY WATER UTILITIES' logo.

CREAT 3.0 CLIMATE RESILIENCE EVALUATION & AWARENESS TOOL GET STARTED RESOURCES HELP mybcecr EPA

Build Climate Resilience at Your Utility

The Climate Resilience Evaluation and Awareness Tool (CREAT) is a climate change risk assessment and planning application for water, wastewater and stormwater utilities.

CREAT helps water sector utilities understand and adapt to climate change.

Discover: Find out which extreme weather events pose significant challenges to your utility and build scenarios to identify potential impacts.

Assess: Identify your critical assets and the actions you can take to protect them from the consequences of climate change on utility operations.

Share: Generate reports describing the costs and benefits of your risk reduction strategies for decision-makers and stakeholders.

[Get Started](#)

Climate Resilience Evaluation and Awareness Tool (CREAT) W...

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CLIMATE READY WATER UTILITIES EPA

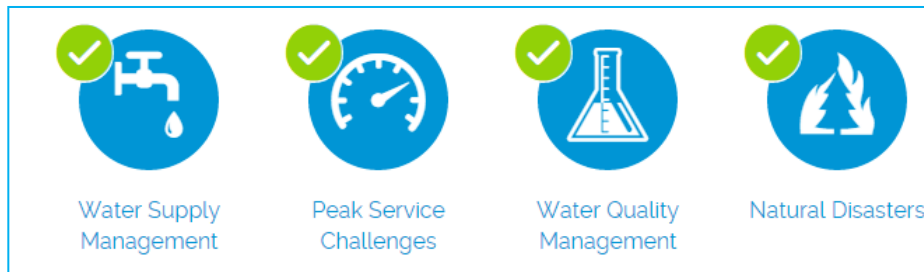
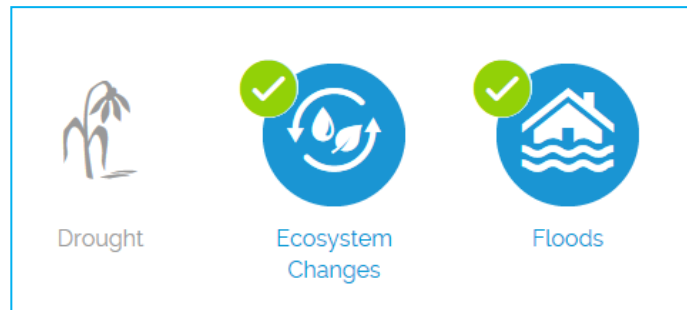
EPA Climate Ready Water Utilities: <https://www.epa.gov/crwu>



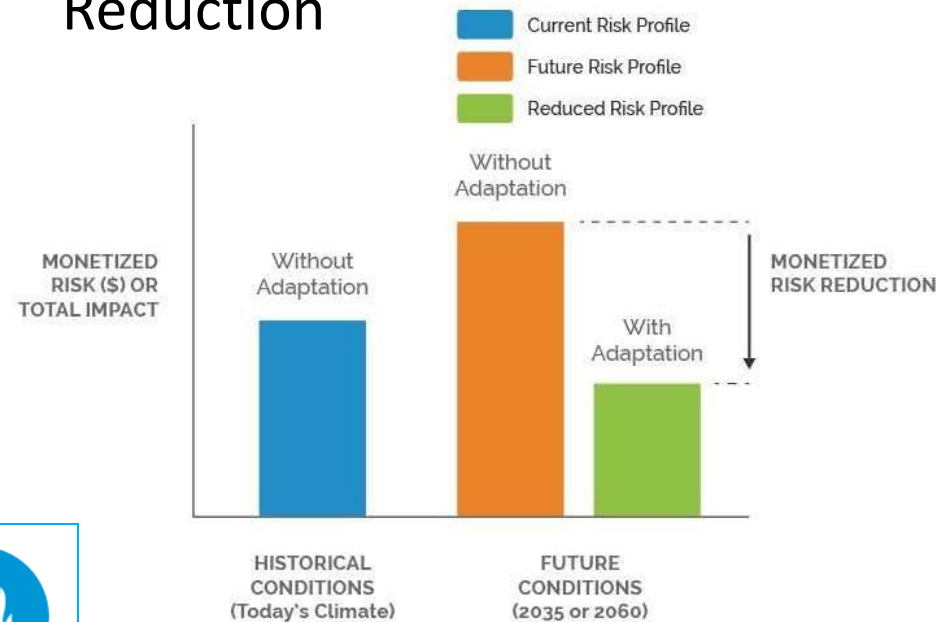


CREAT Risk Assessments

Evaluate Risk via Threat-Asset Pairing

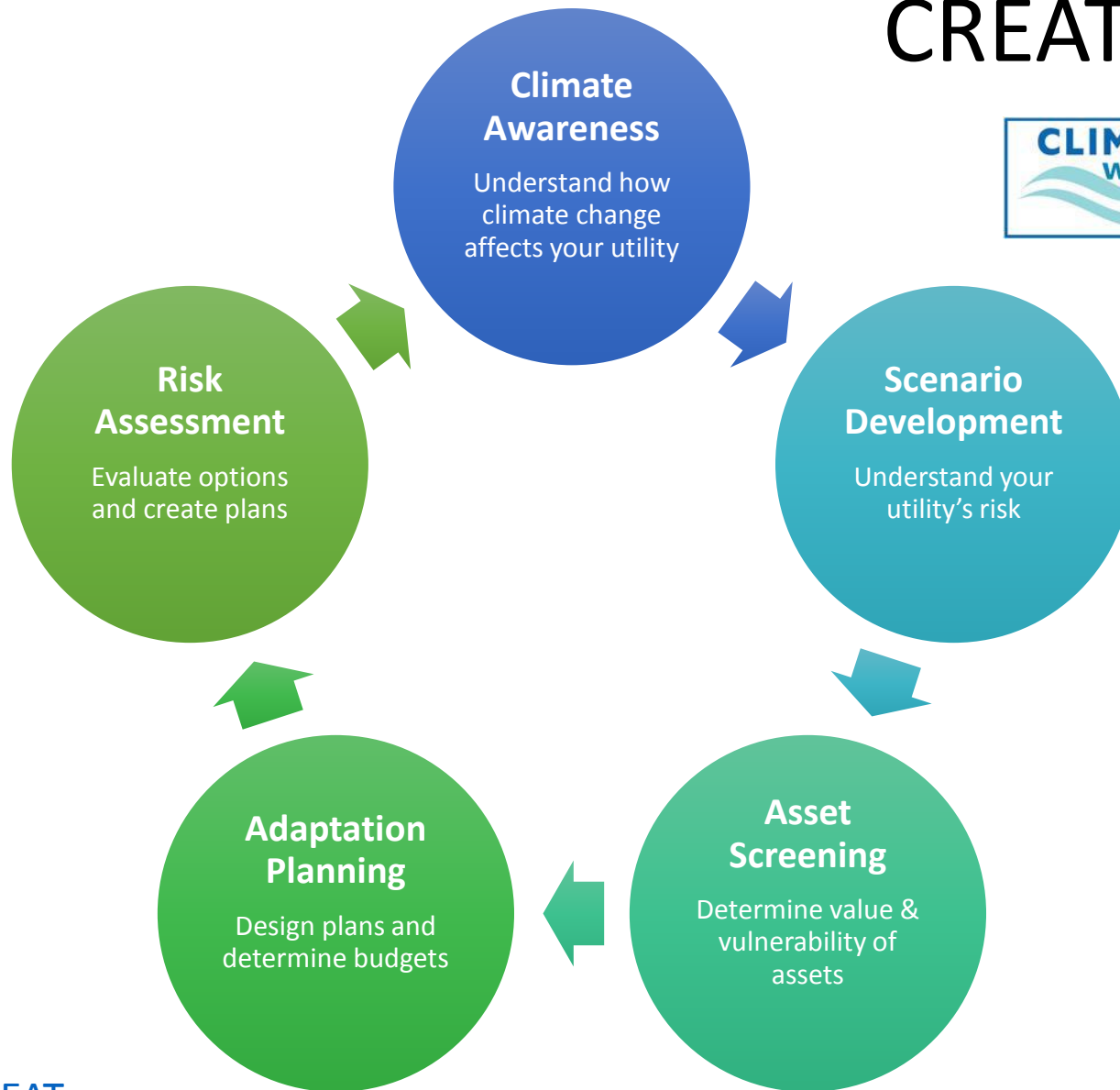


Quantity Benefits of Risk Reduction





EPA's Nationally Recognized CREAT Process





Climatic Threats for Los Angeles

Temperature

- Average maximum temperatures to increase 3-6°F by 2050 (Cal-Adapt, 2016; Hall, 2012)
- Increased frequency > 95°F temperature from 6 to 22 days/year by 2050 (EPA, 2016)

Sea Level Rise

- Sea level rise in Los Angeles of 0.1-0.6 m (0.3-2 ft.) by 2050 (EPA, 2016; NRC, 2012; Grifman et al., 2013)
- Storm surge may cause an additional 5ft. of sea level rise (EPA, 2016)

Precipitation

- Fewer, but heavier events (Hatfield et al., 2014)
- 100-year local storm intensity of 5-7.5 in. in 24 hrs increasing to projected 7-9.5 in. in 24 hrs (EPA, 2016)

Drought

- Increasing intensity of drought conditions
- Increasing frequency and duration of dry weather conditions (National Drought Mitigation Center, 2016)

Wildfire

- More frequent and intense wildfires due to persistent heat
- Increase of annual wildfires by 20% by 2085 (Cal-Adapt/UC Merced, 2016)



Climatic Threats for Los Angeles

Basic Climate Conditions

Increasing Average Annual Temperature
High Winds
Precipitation
Sea Level Rising
Earthquake
Tsunami

Threats To Assets

Power Outages During Peak Demand
Severe Drought/ Water Rationing
More Frequent & Intense Wild Fires
Mudslides / Landslides
Localized Flooding/ Erosion
Coastal Flooding/High Tides/ Storm Surges
Prolonged Power Outage/ Lack of Fuel

Risks to Assets

Property/Structural/ Equipment Damage
Loss of Power
Interrupted Service and Process Operations
Emergency Fuel Depletion
Inundation/Loss of Access
Regulatory Non-Compliance
Loss of Revenue



Rating Risks via Consequence Analysis

LEVELS	Utility Business Impacts	Utility Equipment Damage	Source/Receiving Water Impacts	Environmental Impacts
VERY HIGH	Long-term or significant loss of expected revenue or operating income	Complete loss of asset	Long-term compromise of source water quality or quantity	Significant environmental damage
	\$1,590,000+	\$513,000+	\$590,640+	\$86,940+
HIGH	Seasonal or episodic compromise of expected revenue or operating income	Significant damage to equipment	Seasonal or episodic compromise of source water quality or quantity	Persistent environmental damage
	\$1,062,000 - \$1,590,000	\$213,000 - \$513,000	\$246,100 - \$590,640	\$36,340 - \$86,940
MEDIUM	Minor and short-term reductions in expected revenue	Minor damage to equipment	Temporary impact on source water quality or quantity	Short-term damage, compliance can be quickly restored
	\$531,000 - \$1,062,000	\$84,000 - \$213,000	\$98,440 - \$246,100	\$14,490 - \$36,340
LOW	Minimal potential for loss of revenue or operating income	Minimal damage to equipment	No more than minimal changes to water quality	No impact or environmental damage
	\$0 - \$531,000	\$0 - \$84,000	\$0 - \$98,440	\$0 - \$14,490



Clicker Question:

What motivates you more to action? Are you a:

- a) Financial Success/Security
- b) Quality of Live
- c) Mix of Both



Other Cities

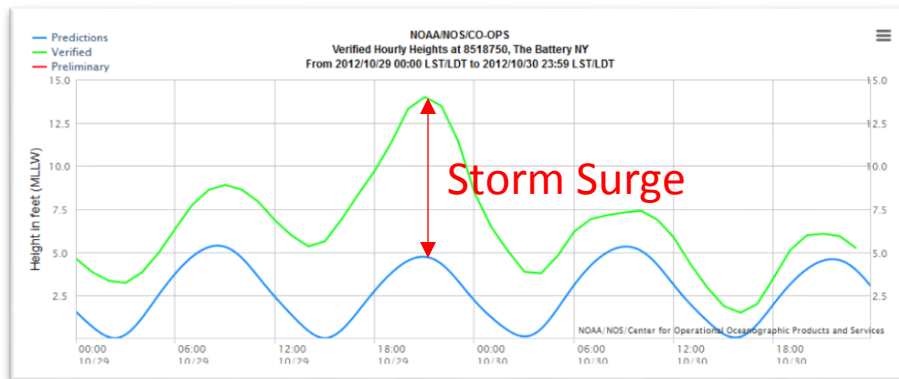
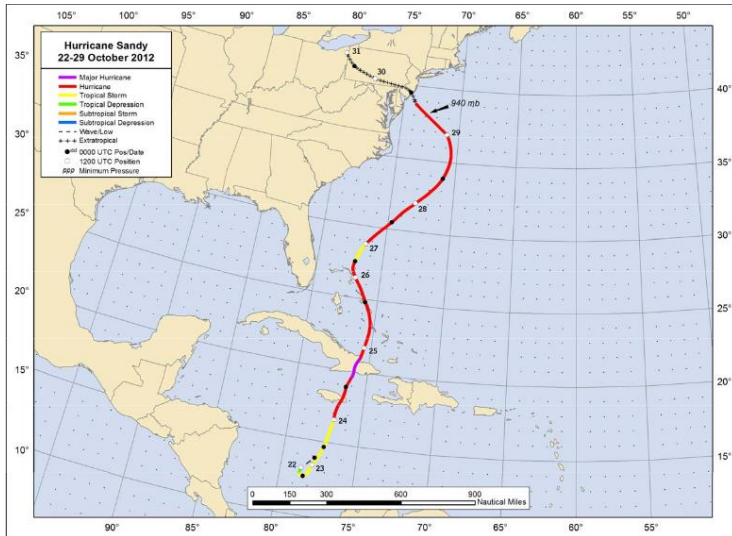


Clicker Question:

How Much Damage Do You Think NYC Wastewater Infrastructure Experienced during Hurricane Sandy?

- a) \$75M (LA Sanitation annual wastewater collections budget)
- b) \$500M (last El Nino damage in Los Angeles)
- c) \$248M (LA Sanitation annual capital improvement budget)

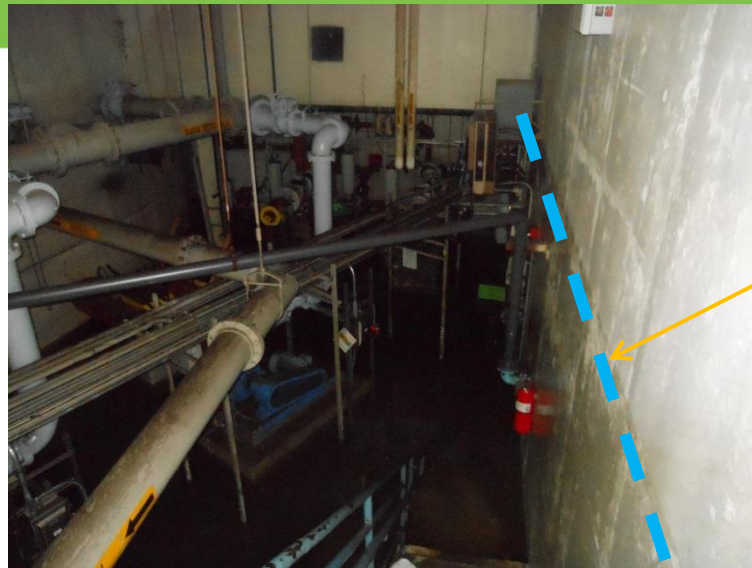
Hurricane Sandy in New York City Region



Water Elevation at Tip of Manhattan



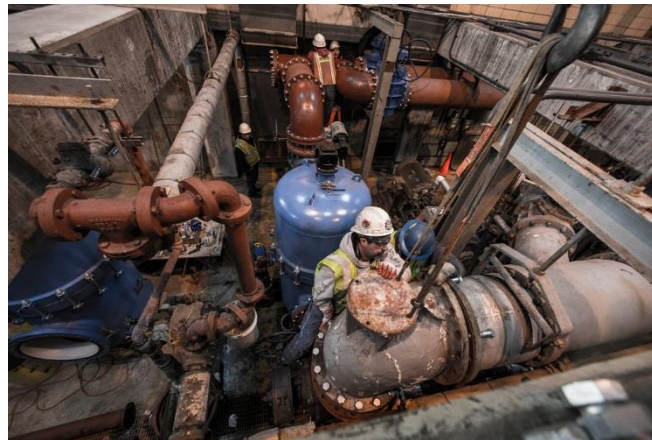
Hoboken, NJ outside NHSA Adams Street STP



NHSA Adams Street STP – Flooded Pump Basement



Replacing flooded pumps at Adams Street STP



Replacing flooded pumps at Nassau County's Bay Park WWTP



New York City Department of Environmental Protection

- NYCDEP Sustained > \$100,000,000 in Damage at Pump Stations and Wastewater Treatment Plants from Sandy
- Developed Adaptation and optimization strategy for minimizing risks related to climate change
- Scenario development: Temperature, sea level, rainfall and population
- Vulnerability appraisals and adaptation plans for pilot facilities and areas
- Climate adaptation plan for wastewater systems with cost estimates \$1-2 billion

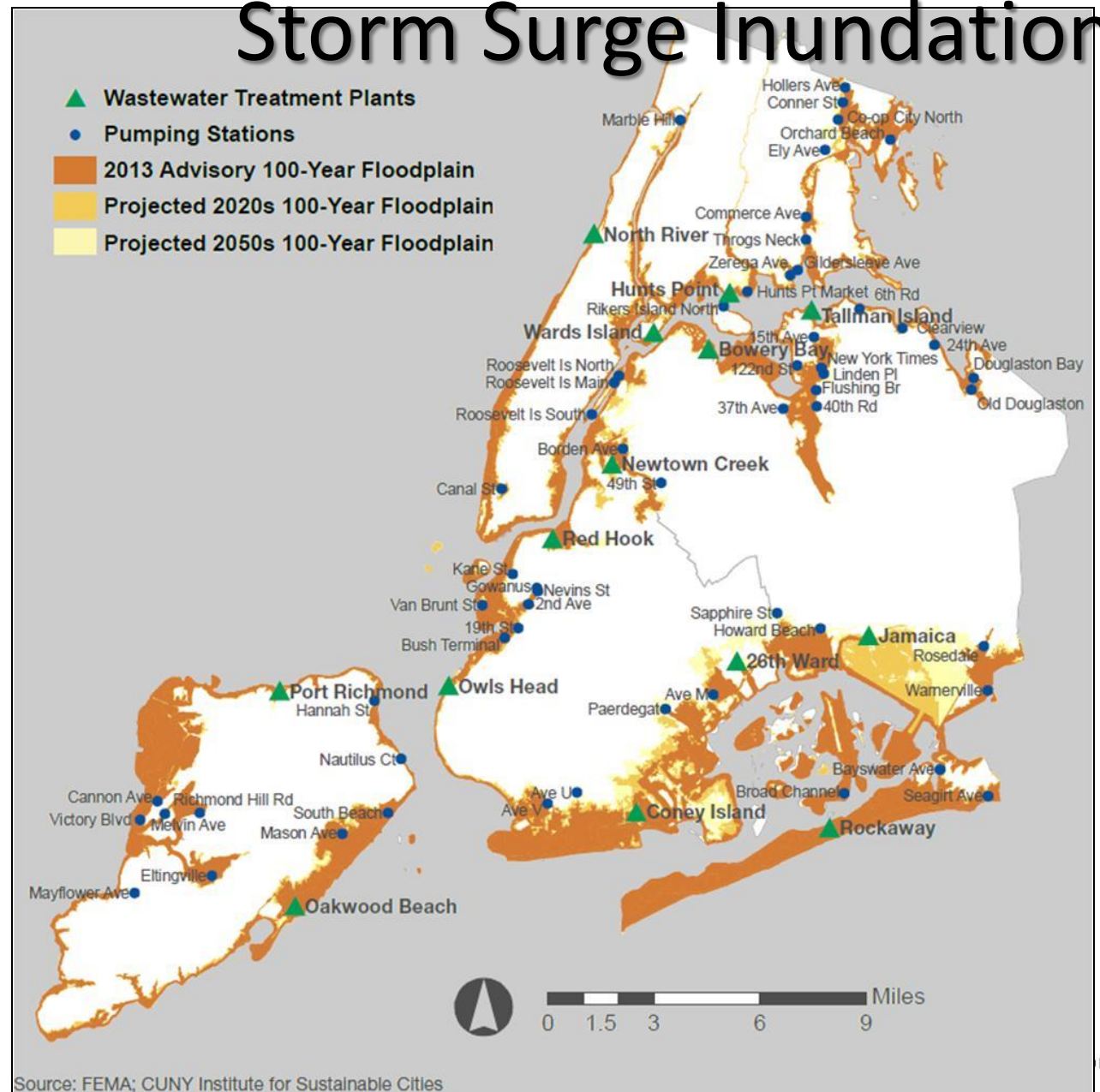




NYCDEP Facilities Risk of Storm Surge Inundation

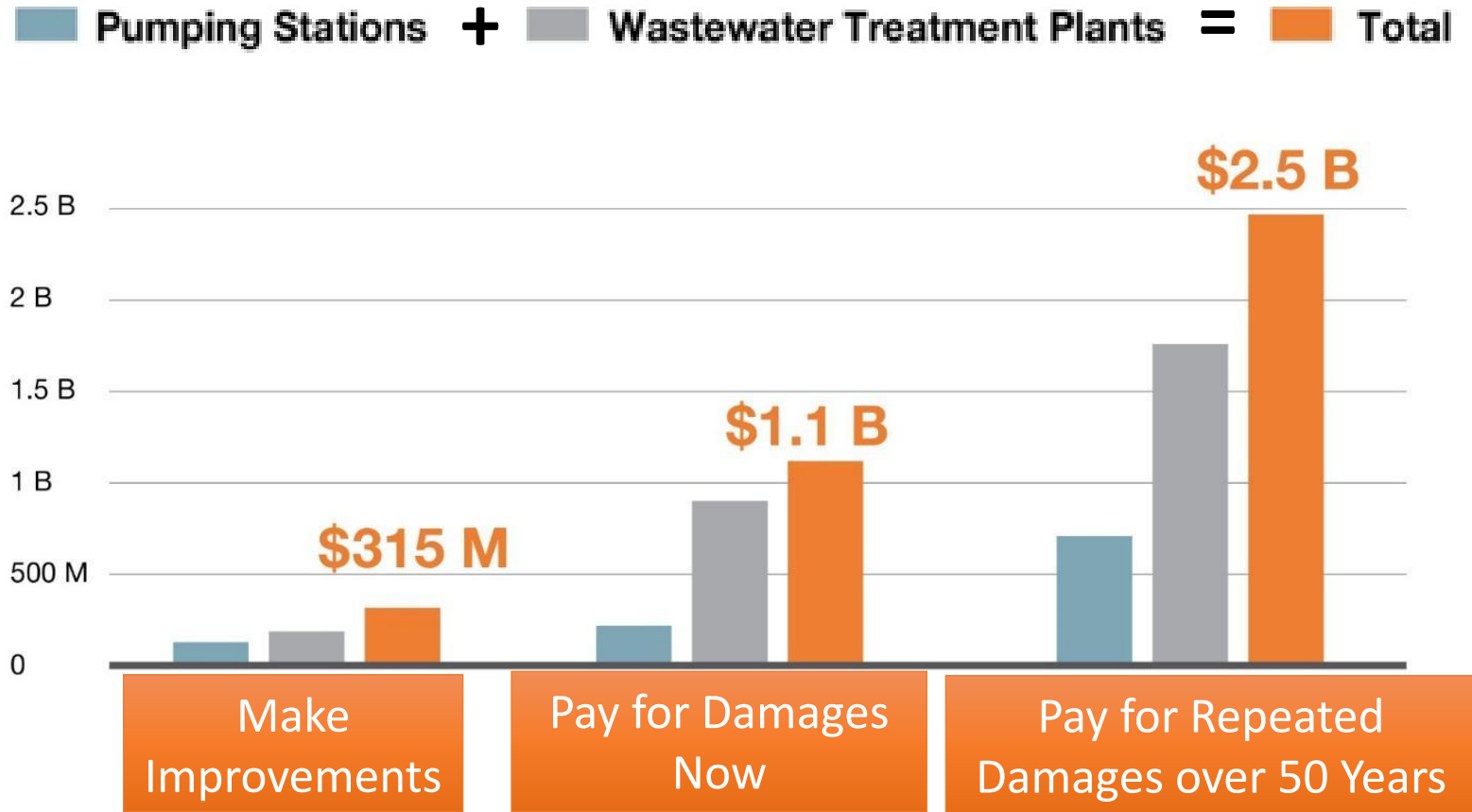
Based on 100-year floodplain plus 30 inches of SLR:

- All 14 treatment plants and 60% of pumping stations are at risk.
- Over \$1 billion of assets are at risk if no protective measures are implemented.
- Cumulative damages could exceed \$2 billion over 50 years





NYCDEP – pay now or pay A LOT MORE later!



All estimates are based on AACE Level 5 Cost Estimate guidelines as noted in the NYCDEP BEDC Cost Estimating Manual



NYCDEP – A No-brainer Decision

- Investing \$315 Million in strategic fortification can safeguard \$1.1 Billion of vital infrastructure.
- The investment now may save the City \$2.5 Billion in emergency response costs over the next 50 years.



Clicker Question:

Would you rather?

- a) Improve everything as soon as possible
- b) Make improvements gradually over time
- c) Fix it each time it gets damaged



**Boston Water and
Sewer Commission**

980 Harrison Ave. Boston, MA 02119

Martin J. Walsh, Mayor

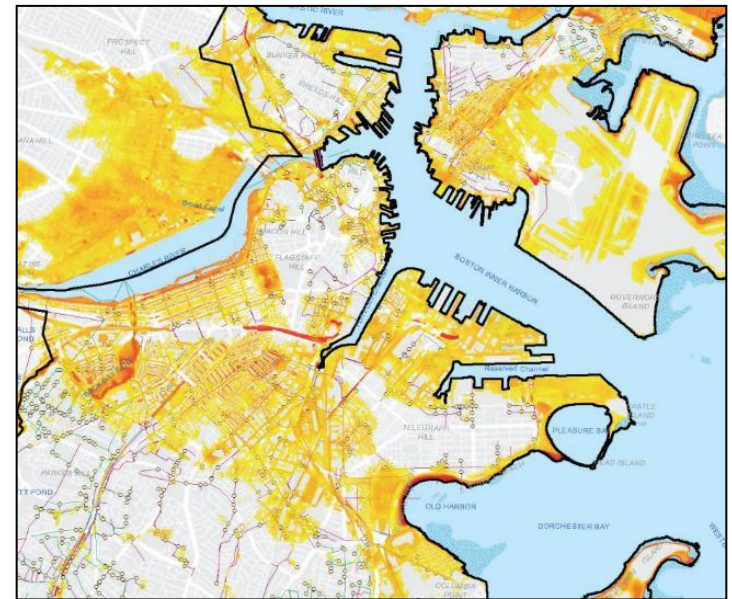
Henry F. Vitale, Executive Director



Climate Change Resilience Evaluations and Recommendations for Long-term Wastewater Planning

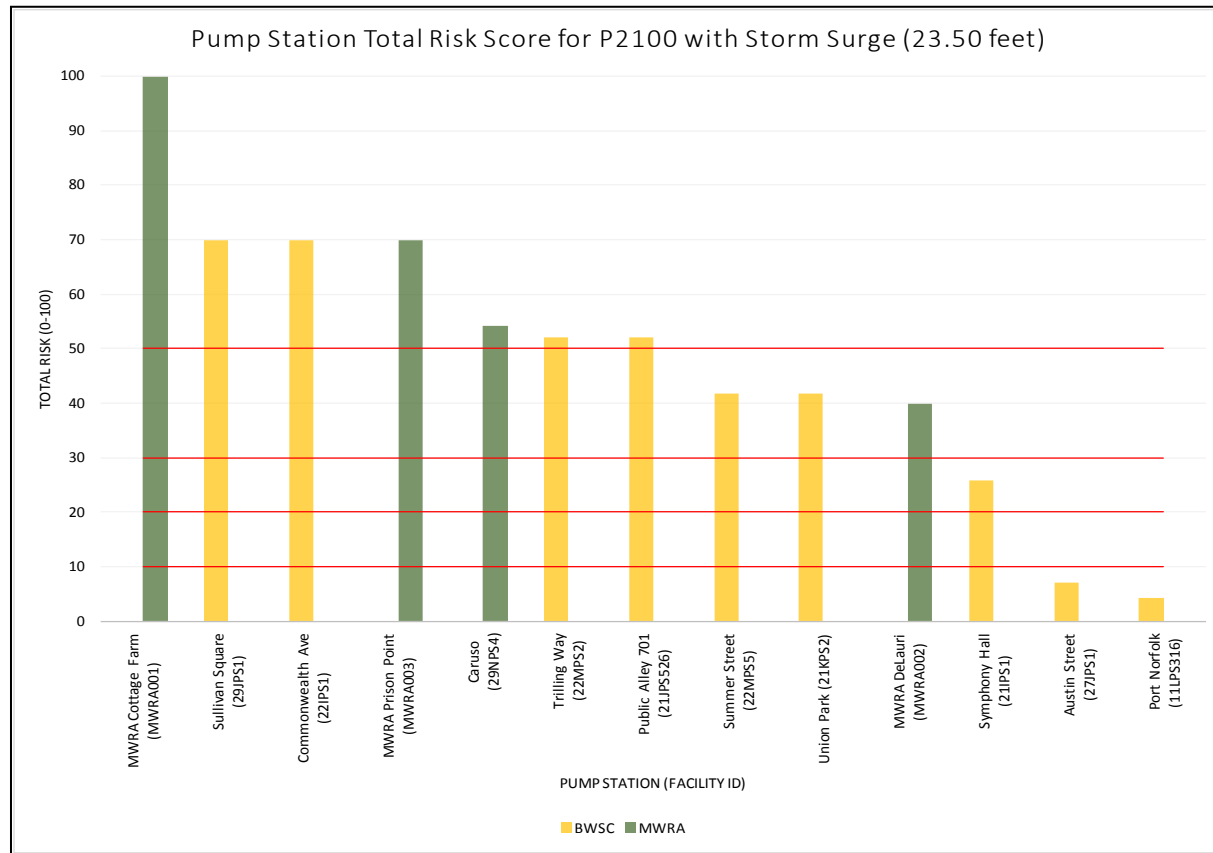
- Historical Data Analysis on Rainfall, River Flows and Sea Levels
- Climate Change Scenario Development for Facility Planning
- Vulnerability Assessment for River Stages, Sea Level Rise and Storm Surge
- Modeled Sewer and Storm Drain System Performance with Climate Change
- Recommended Adaptation Strategies and Design Standards

Year 2060 Rain and Storm Surge





Pump Station Risk Scoring for Worse-case Year 2100 Sea Level Scenario with Storm Surge



Pump Stations with the Highest Risk Scores are Being Prioritized and Scheduled for Improvements in the Future



BWSC Wastewater and Storm Drainage Facilities Plan

- Capital improvement planning and construction to:
 - Improve drainage and sewer services to protect public health and safety with climate change, and during and after storm events
 - Protect critical BWSC infrastructure vulnerable to flooding now and in the future
- Update planning and design guidelines for climate change:
 - Drainage design
 - Sewer design
 - Pump stations and other facilities





One Water LA Approach



Clicker Question:

Do you know how to assess your climate threats in your neighborhood? (Yes or No)



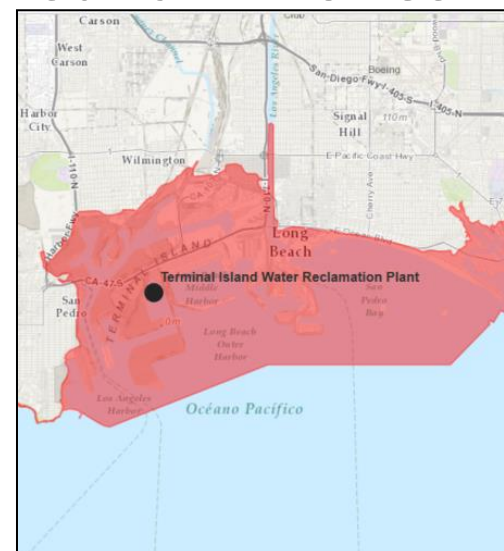
Threat Analysis

Terminal Island Water Reclamation Plant

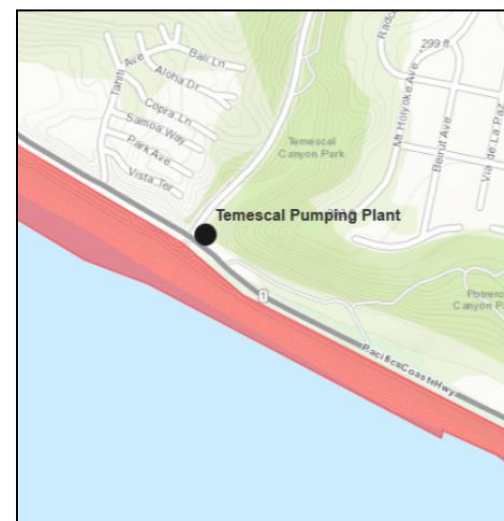
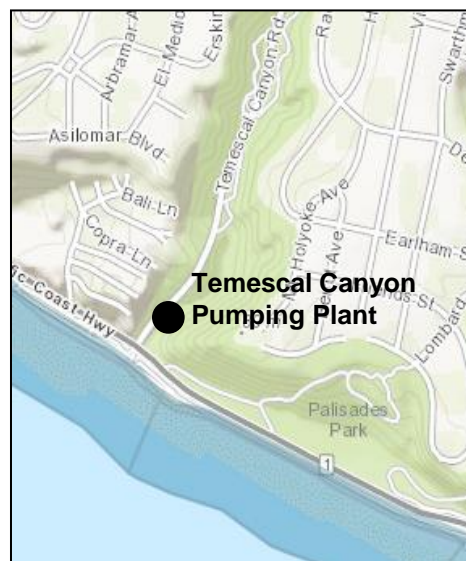
Flood Zones



Tsunami Zones



Temescal Canyon Pumping Plant No. 634





Climate Conditions and Threats Used For EPA Pilot

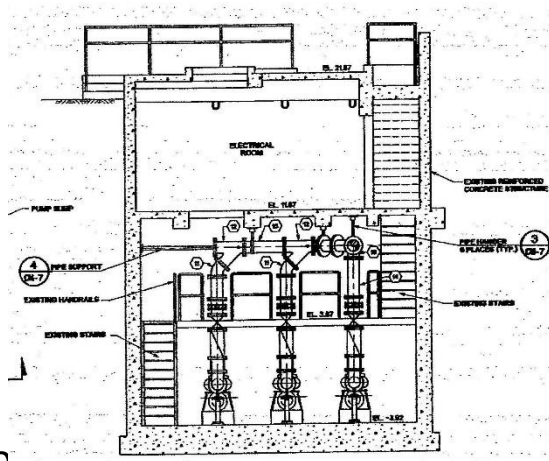
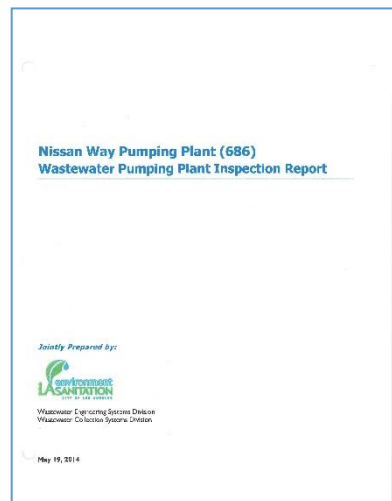
EXAMPLE LOCATIONS	CLIMATE VARIABLE	HISTORICAL VALUE (OBSERVED)	PROJECTED VALUE FOR MID-CENTURY (OBSERVED + CHANGES)
Coastal	Average Annual Temperature	62.9°F	66.0°F
	Total Annual Precipitation	18.5 inches	22.4 inches
	100-Year Storm Event	5.4 inches in 24 hours	7.0 inches in 24 hours
	Hot days (over 95°F)	6 days (1981-2000)	22 days
	Sea-Level Rise	2 mm/year	0.5 meters (1.64 feet)
Port of Los Angeles	Average Annual Temperature	63.2°F	66.1°F
	Total Annual Precipitation	13.7 inches	15.2 inches
	100-Year Storm Event	7.3 inches in 24 hours	9.5 inches in 24 hours
	Hot days (over 95°F)	6 days (1981-2000)	22 day
	Sea-Level Rise	2 mm/year	0.5 meters (1.64 feet)



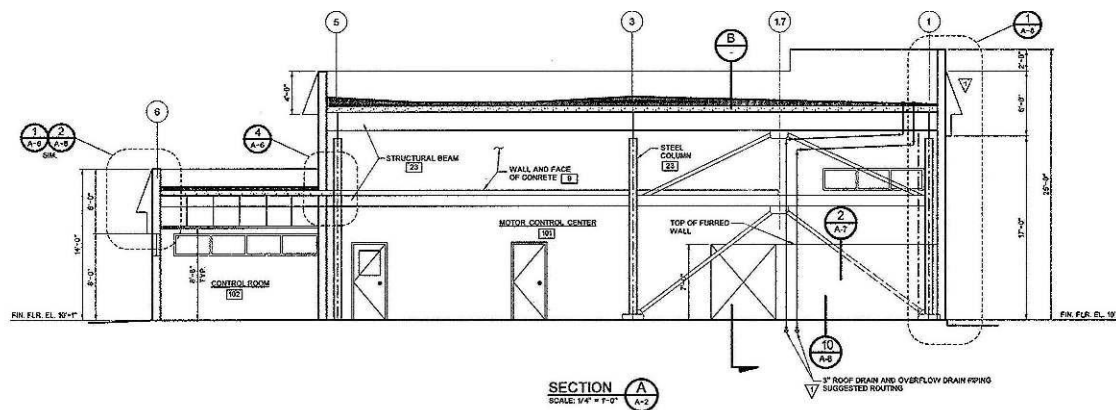
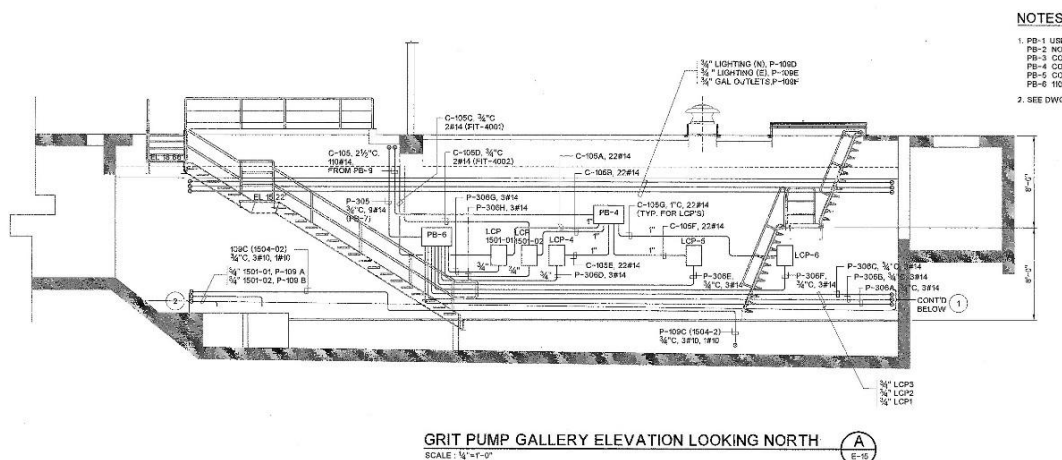
One Water LA - Facility Walkthroughs



Pumping Plants



Terminal Island WRP





Example Adaptation Measures for Water Reclamation Plants

Threats	Adaptations
Flooding by storm surge and tsunami with sea level rise	Waterproof individual structures
	or
	Build perimeter wall around facility



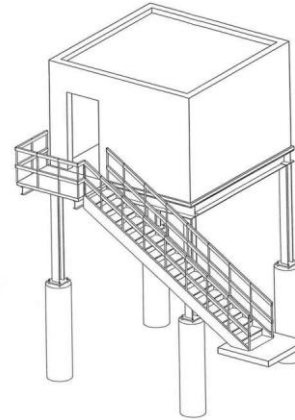
Climate change impacts require modifications to planning, design, and construction approaches





Example Adaptation Measures for Pumping Plants

Threats	Adaptations
Flooding by storm surge and tsunami with sea level rise	Waterproof and protect from debris
Power loss	Permanent or temporary backup generators
Landslides with heavier rainfall	Slope stabilization
Street flooding worse with heavier rainfall/higher tides	More BMPs for stormwater management w/ capture/reuse



gardenscouts.com





Example From EPA Pilot- Vulnerability and Recommended Adaptation Costs

WASTEWATER FACILITIES	MAKE IMPROVEMENTS	PAY FOR DAMAGES NOW
PUMPING PLANTS		
Pumping Plant No. 632 Sunset Boulevard	\$1,240,000	\$3,500,000
Pumping Plant No. 634 Temescal Canyon	\$1,220,000	\$2,700,000
Pumping Plant No. 639 North Pulga Canyon	\$860,000	\$2,200,000
Pumping Plant No. 647 Venice Beach (Stormwater & Low-Flow Diversion)	\$510,000	\$1,400,000
Pumping Plant No. 680 22 nd and Signal	\$150,000	\$500,000
Pumping Plant No. 686 Nissan Way	\$640,000	\$1,700,000
TOTAL	\$4,620,000	\$12,000,000
TERMINAL ISLAND WATER RECLAMATION PLANT		
Headworks and Lift Station	\$390,000	\$8,500,000
Motor control centers (MCC)	\$11,000,000	\$15,000,000
Advanced Water Purification Facility (AWPF)	\$1,800,000	\$15,000,000
Effluent pumping plant, including standby generators	\$310,000	\$10,800,000
TOTAL	\$13,500,000	\$49,300,000
or Perimeter Wall Alternative To Above Options	\$6,340,000	Entire Facility



Next Steps

- Verify CREAT (EPA model) database input
- Risks analysis to be evaluated from CREAT
- Adaptation strategy for pump stations and treatment plants, low flow diversions, drainage areas (vulnerable to flood & sea level rise)
- Costs estimated
- Recommended projects
- Implementation plan developed



Clicker Question:

What services do you think are at risk when pumping plants and water reclamation plants go out of service?

- a) Having to use less water
- b) Not being able to flush toilets
- c) Not being able to swim and surf
- d) All of the above



Clicker Question:

In your opinion how long is an acceptable time for service disruptions?

- a) Hours
- b) Days
- c) Weeks
- d) Months



Clicker Question:

Given what you've heard today, what water utility assets are you most concerned about functioning in L.A. in the future?

- a) Drinking Water Distribution System
- b) Sewer Collection System and Pumping Plants
- c) Water Reclamation Plants
- d) Stormwater Collection System
- e) Not Sure



Clicker Question:

Is spending on preparedness worth the expense despite the uncertainty in likelihood? (Yes or No)



Clicker Question:

How much more would you be willing to pay for preparedness?

- a) None
- b) 5% more
- c) 10% more
- d) Whatever it takes



Clicker Question:

Do you think that One Water L.A. is addressing climate change appropriately? (Yes or No)



Thank you!
Questions?



INNOVATION + INTEGRATION + INCLUSION = A SUSTAINABLE & RESILIENT CITY

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