



One Water and Stewardship Committee

# Delta Islands Strategic, Fiscal, & Risk Analysis

Item 6a

February 13, 2024

## Item #6a

# Delta Islands Strategic, Fiscal, & Risk Analysis

## Subject

Delta Islands Strategic, Fiscal and Risk Analysis

## Purpose

Conduct a strategic, fiscal, and risk analysis of the Delta islands to assess the financial resources, identify potential threats to the Delta islands, and evaluate the value of these islands to Metropolitan.

## Next Steps

Board discussion and direction

# Today's Discussion

- Overview
- Challenges and opportunities
- Fiscal and risk analysis
- Strategic considerations for Board discussion

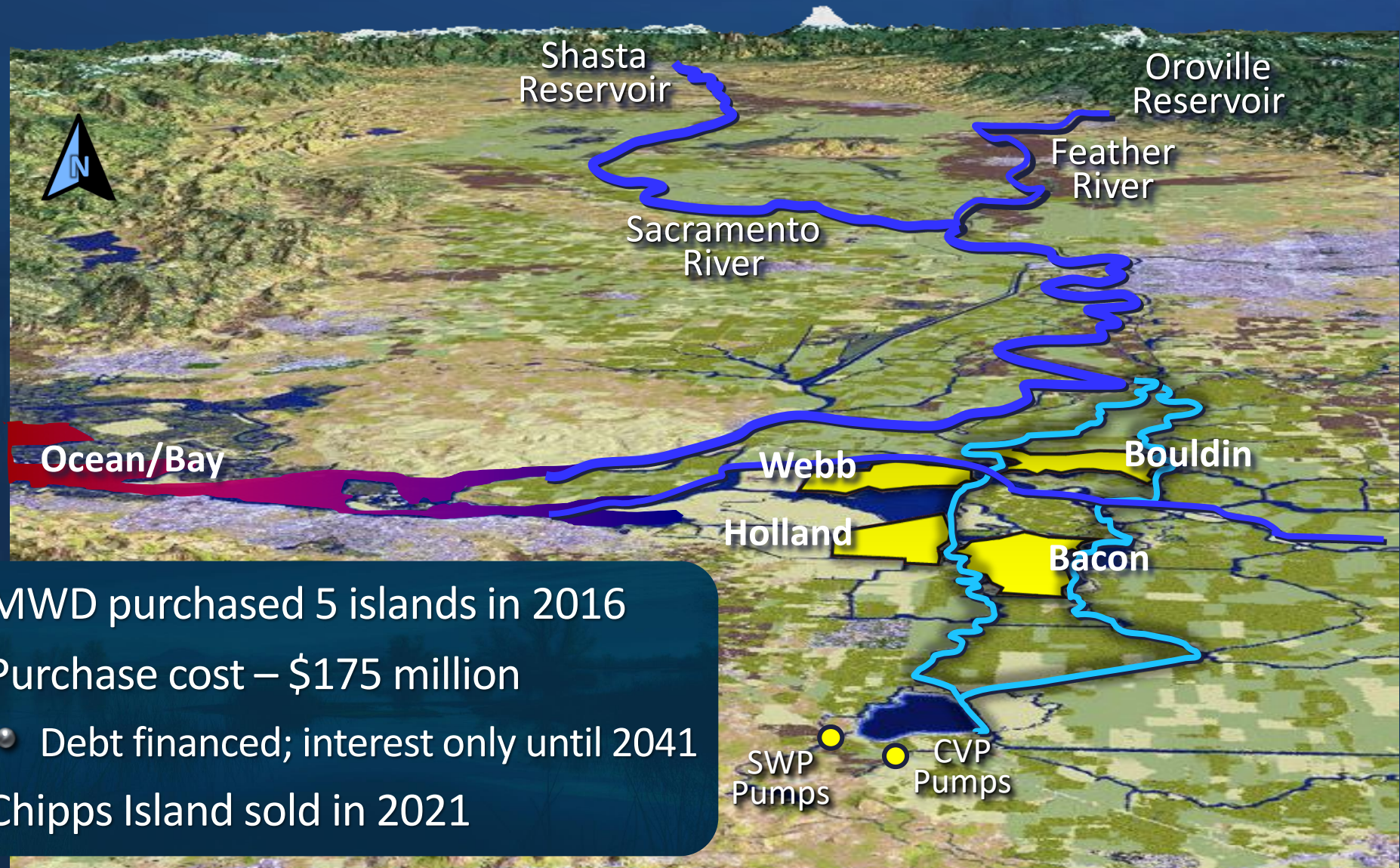
An aerial photograph of a delta island, showing a winding road that follows the curve of the land. The island is surrounded by water, and there are some trees and vegetation on the land. The title "DELTA ISLANDS" is written in large, white, serif capital letters, and "Overview" is written in a smaller, white, serif font below it. A horizontal white line separates the two lines of text.

# DELTA ISLANDS

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## Overview

# Delta Islands



- MWD purchased 5 islands in 2016
- Purchase cost – \$175 million
  - Debt financed; interest only until 2041
- Chipps Island sold in 2021

# Initial Board Focus at Time of Island Purchase & Key Changes

- Improved thru-Delta reliability & levee improvements
- Delta conveyance mitigation & ~~tunnel portals~~
- Preventing land subsidence
- Enhancing carbon sequestration
- Advancing ecosystem restoration, regenerative agriculture, & climate resiliency
- Conducting applied science
- *New opportunities that add value*

An aerial photograph of a delta island, showing a winding waterway that splits into two channels. A dirt road follows the outer curve of the island. The island is covered in green vegetation, and the surrounding water is a deep blue. The title text is overlaid on a dark blue horizontal band across the middle of the image.

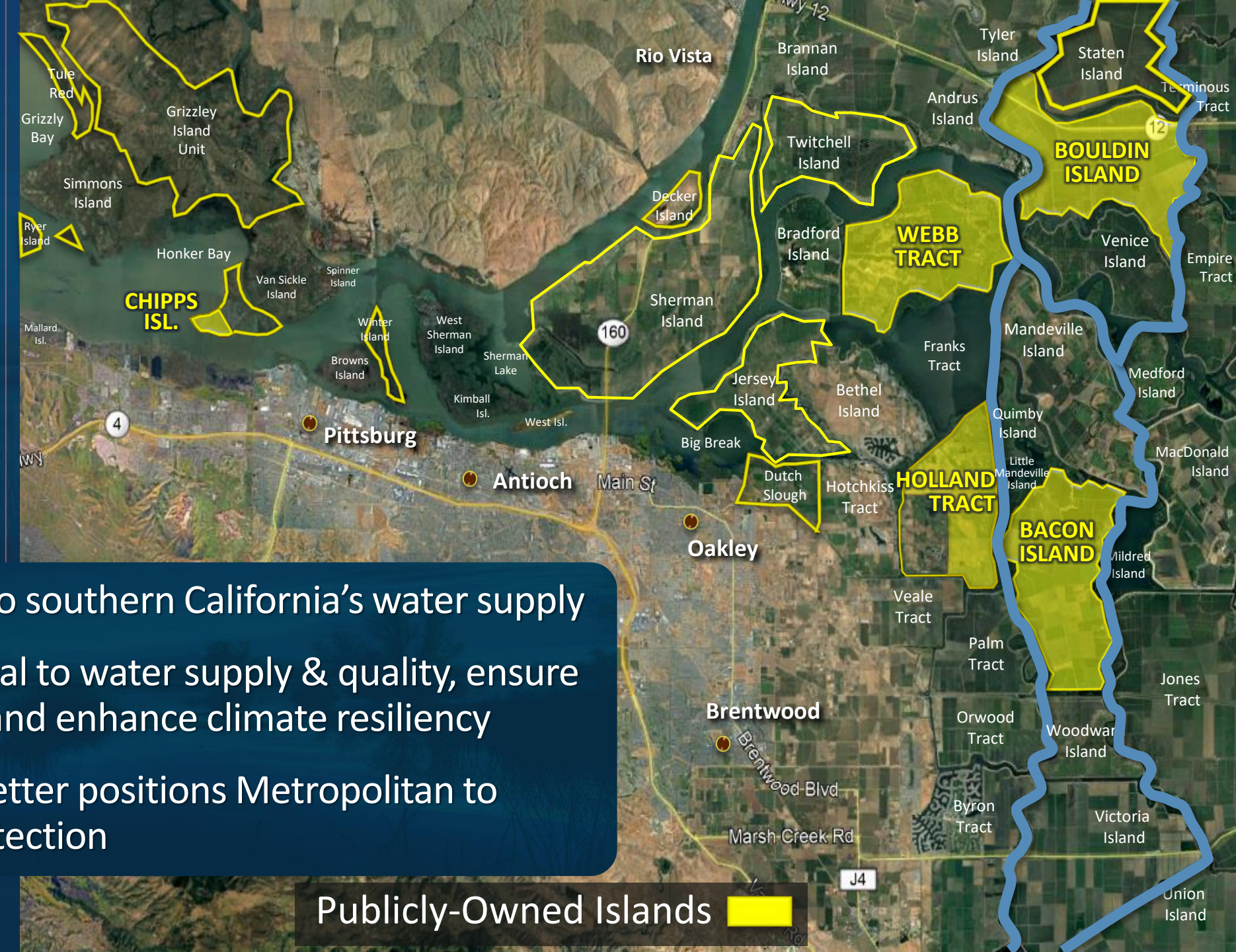
# DELTA ISLANDS

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## Challenges and Opportunities

# Delta Challenges Place at Risk the Freshwater Pathway

- Delta is important to southern California's water supply
- Island levees are vital to water supply & quality, ensure ecosystem health, and enhance climate resiliency
- Island ownership better positions Metropolitan to influence Delta protection



# Critical Challenges in the Delta



**Flood & Seismic Risk**



**Sea-Level Rise**



**Fishery Declines**



**Subsidence Control**

# Leadership Opportunities

## Advancing Solutions to Critical Challenges



### WATER SUPPLY

- ☐ Levee modernization
- ☐ Water diversion meters & alternative technologies like OpenET
- ☐ Delta Conveyance Project mitigation (\$)



### ECOSYSTEM

- ☐ Habitat restoration (\$)
- ☐ Floating wetlands
- ☐ Native fish conservation & culture facility
- ☐ Eco-mitigation bank (\$)
- ☐ Fish food production (\$)
- ☐ Voluntary Agreement Water Conservation (\$)



### CLIMATE

- ☐ Carbon sequestration & subsidence control (\$)
- ☐ Multi-benefit farming (\$)
- ☐ Clean energy production
- ☐ Carbon capture & underground storage (\$)



### SCIENCE

- ☐ Aquatic research
- ☐ Innovation & resiliency center
- ☐ Paludiculture farming (\$)

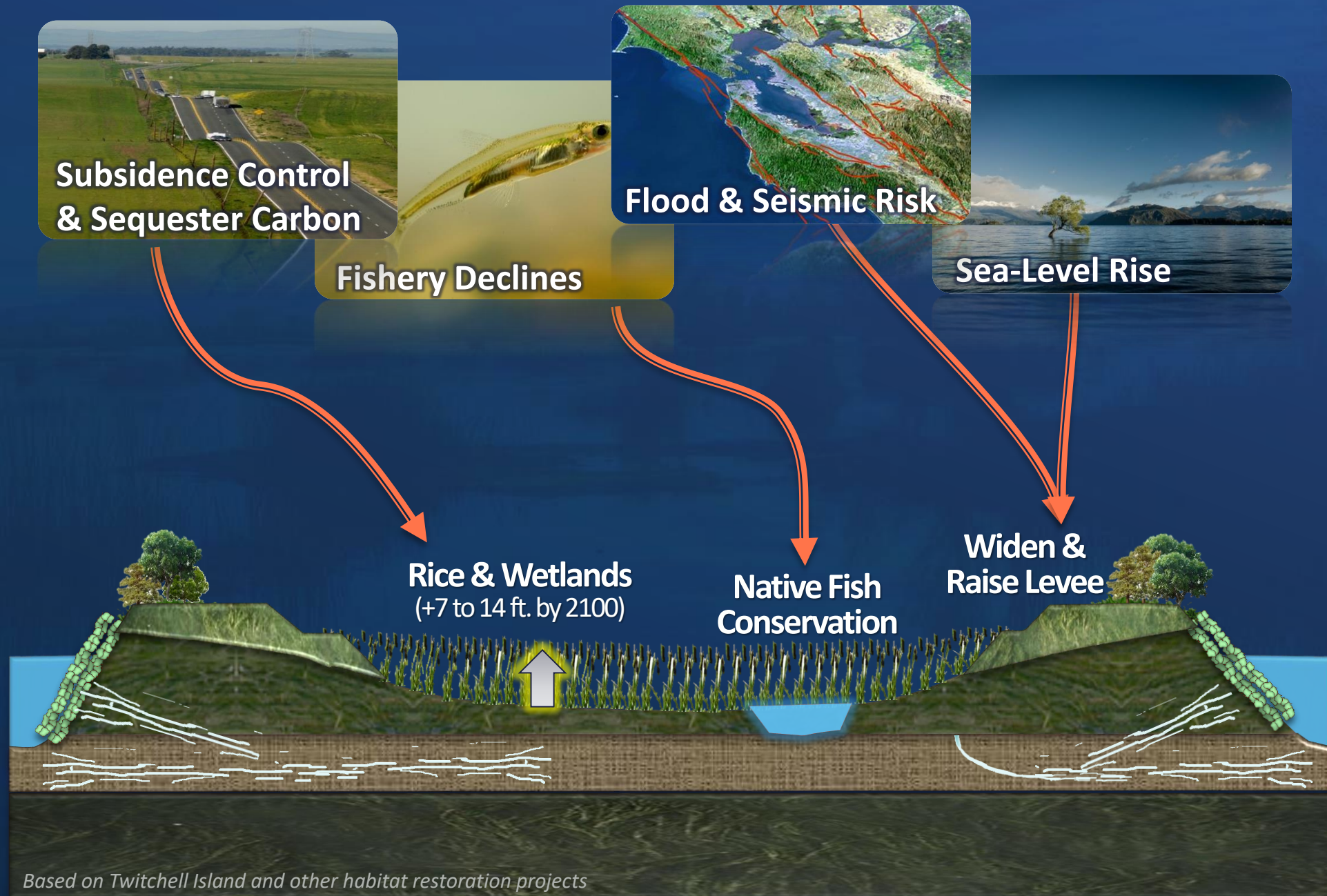


### COMMUNITY

- ☐ Waterfowl recreation (\$)
- ☐ Small family farms
- ☐ Tribal activities
- ☐ Bird watching & nature trails

*\$ = Revenue sources*

# Islands Provide Opportunity to Advance Solutions to Critical Challenges



Increasing wetland & rice  
supports additional habitat for  
36,000 sandhill cranes &  
114,000 waterfowl

# Leading Efforts to Develop New Value for Lands within the Delta

## Fish Conservation and Culture Laboratory

- Use lands to assist in spawning and rearing of aquatic species (e.g., Delta and Longfin smelt)

## Carbon Sequestration

- Support opportunities to sequester CO<sub>2</sub>

## Eco-Mitigation Banking

- Targeted landscape restoration to enhance habitat, reduce subsidence, and support funding of management and maintenance activities

## Waterfowl Recreation & Preservation

- Utilize lands to increase waterfowl habitat and populations while still realizing revenue generating recreational activities

## Renewable Energy Production

- Utilize renewable energy to support water management on Delta islands

An aerial photograph of a delta island, showing a winding waterway that splits into two channels. A dirt road follows the outer curve of the island. The island is covered in green vegetation, and the surrounding water is a deep blue. The title text is overlaid on a dark blue horizontal band across the middle of the image.

# DELTA ISLANDS

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## Fiscal & Risk Analysis of Island Ownership

# Fiscal Analysis

Current property value lower than purchase

PROPERTY VALUE					
Island	Gross Acres	Per Acre		Total	
		Purchase <sup>1</sup>	Current <sup>2</sup>	Purchase <sup>1</sup>	Current <sup>2</sup>
<b>Bouldin</b>	6,053	\$8,650/ ac.	\$8,000/ ac.	\$52.4 million	\$48.4 million
<b>Webb</b>	5,498	\$8,650/ ac.	\$5,000/ ac.	\$47.6 million	\$27.5 million
<b>Bacon</b>	5,603	\$8,650/ ac.	\$8,000/ ac.	\$48.5 million	\$44.8 million
<b>Holland</b>	3,007	\$8,650/ ac.	\$5,500/ ac.	\$26.0 million	\$16.5 million
<b>Chipps<sup>3</sup></b>	243	\$2,469/ ac.	\$4,000/ ac.	\$0.6 million	\$0.97 million
<b>TOTAL</b>	<b>20,404</b>	<b>---</b>	<b>---</b>	<b>\$175 million</b>	<b>\$138 million</b>

1) Purchase price does not include legal & other associated costs

2) Bouldin & Bacon appraisals completed November 2023; Webb & Holland appraisals completed December 2023

3) Chipps was sold to DWR in 2021 for \$972,000

4) Debt service – Interest only on through FY 2039-40; Principal payment starts FY 2040-41 thru FY 2044-45 averaging \$34.8 million/yr.

# Fiscal Analysis

## Current Expenses Exceed Revenues

CURRENT EXPENSES		
Expense Centers	Average Year 2021-23	
Debt Service	\$2,459,000	32%
Property Taxes	\$2,074,000	27%
Reclamation District	\$2,283,000	29%
Vector Control & State Lands	\$102,000	0.8%
Repairs & Maintenance	\$167,000	2%
Labor & Professional Service	\$744,000	9%
Travel & Incidentals	\$29,000	0.4%
TOTAL ESTIMATE	\$7.8 million	100%

CURRENT REVENUE		
Revenue Centers	Average Year 2021-23	
Agriculture	\$850,000	94%
Cell Tower	\$40,000	6%
TOTAL	\$0.9 million	100%

# Fiscal Analysis

## Forecasted Revenues Exceed Expenses

### FORECASTED EXPENSES

Expense Centers	Year 2030 (Low – High Range)	
Debt Service <sup>1</sup>	\$542,000	\$6,063,000
Property Taxes	\$2,296,000	\$2,806,000
Reclamation District	\$2,527,000	\$3,089,000
Vector Control & State Lands	\$75,000	\$91,000
Repairs & Maintenance	\$184,000	\$225,000
Labor & Professional Service	\$824,000	\$1,006,000
Travel & Incidentals	\$32,000	\$40,000
<b>TOTAL ESTIMATE</b>	<b>\$6.5 million</b>	<b>\$13.3 million</b>

### FORECASTED REVENUES

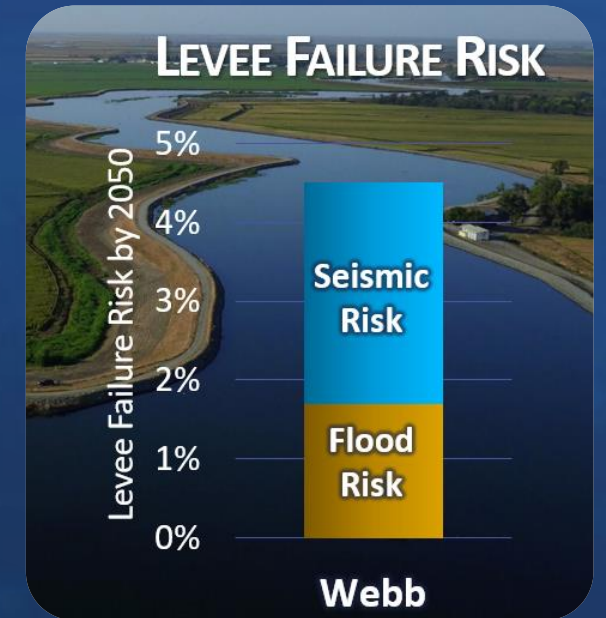
Revenue Centers	Year 2030 (Low – High Range)	
Agriculture	\$4,500,000	\$7,800,000
Cell Tower	\$49,000	\$49,000
Waterfowl Preservation	\$81,000	\$343,000
Renewable Energy Prod	\$720,000	\$720,000
Carbon Sequestration	\$1,500,000	\$1,700,000
Eco-Mitigation Banking	\$7,400,000	\$11,500,000
<b>Sub Total</b>	<b>\$14 million</b>	<b>\$22 million</b>
Carbon Capture & Storage	\$112 million	\$270 million
<b>TOTAL</b>	<b>\$126 million</b>	<b>\$292 million</b>

1. Debt service range based on variable interest rates

# Risk Analysis

## Key Risks

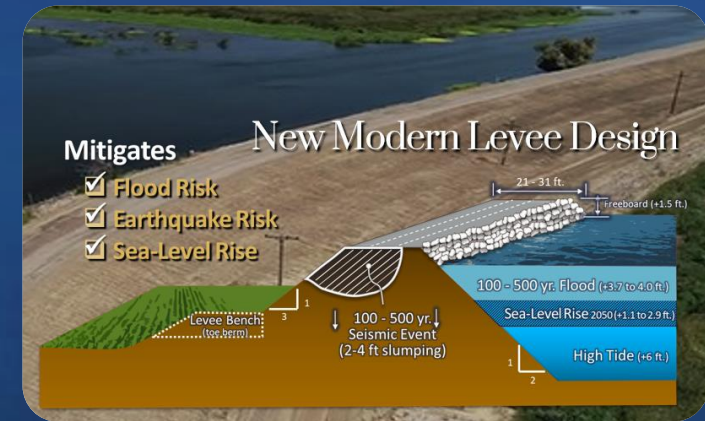
- Key Risks
  - Agricultural operations
  - Environmental regulations
  - Levee failure (flooding, seismic)
  - Subsidence and sea-level rise
- Assessment
  - Analyzed response time, infrastructure, equipment, life, crop damage, levee repair, recovery period
  - Levee breaks occur over hours allowing ample time to evacuate
  - Preliminary estimate \$40 - 70 million to reclaim if full breach
  - Levees meet FEMA standard to qualify for disaster funding
  - No complete Delta levee failures since 2005



# Risk Analysis

## Risk Mitigation

- Mitigation Actions
  - Agricultural operations safety BMPs
  - Emergency response and recovery plans
  - Targeted levee structural improvements – over \$51 million in grants (\$87 million for all island activities)
  - Regional and on-island rock stockpiles and warehouses
  - Invasive species control and monitoring (nutria, etc.)
  - Seismic vulnerability research
  - Real-time, early-warning levee monitoring system
  - Modern levee design to mitigate flood, earthquake, sea-level rise



An aerial photograph of a delta island, showing a winding road that follows the curve of the land. The island is surrounded by water, and there are some trees and vegetation on the land. The background is a dark blue gradient.

# DELTA ISLANDS

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## Strategic Considerations for Board Discussion

# Strategic Considerations

- Fiscal & Risk Analysis
  - Land appraisal is below the 2016 purchase price
  - Debt service is interest only until 2041
  - Current revenues do not cover expenses; however, forecasted revenues exceed annual expenses by 2030
  - Real-time levee monitoring allows for early warning from weeks to months in advance
- Mitigation actions will continue to reduce risks with island ownership & compliment efforts to address Delta challenges
- Based on current appraisal, selling the islands now would require a significant use of existing reserves to pay off the loan

# Strategic Considerations

- Strategic Analysis
  - Conditions have evolved since the purchase, but still consistent with Board policies
  - Delta is important to southern California's water supply
  - Island levees are vital to water supply and quality, to protect Delta communities, and to ensure ecosystem stability and climate resiliency

Island ownership provides enhanced opportunities to advance Delta solutions

# Recommendations

- Original areas of Board focus (slide 5) still apply
  - Continue to pursue these opportunities
- Pursue additional funding and partnerships
  - Goal to operate islands with revenues covering costs
- Continue regular Board check-ins
  - Do not sell island now, but consider options before principal payments





# BACKUP SLIDES FOR REFERENCE PURPOSES



# FISCAL ANALYSIS Summary

# Fiscal Analysis Overview

- Ongoing
- In Development
- Initial Analysis

- Revenue Centers
  - Property value
  - Agricultural leases
  - Cell tower leases
  - DWR subventions levee maintenance funds
  - DWR special project improvement grants
  - County emergency response materials grants
  - Waterfowl recreation and preservation
  - Carbon sequestration
  - Eco-mitigation banking
  - Renewable energy production
  - Carbon capture and underground storage

# Fiscal Analysis

## Annual Expenses Total

ANNUAL EXPENSES			
Expense Centers	Current Year 2021-23 (Average)	Forecast Year 2030 (Low-High Range)	
Debt Service	\$2,459,000	\$542,000	\$6,063,000
Property Taxes	\$2,074,000	\$2,296,000	\$2,806,000
Reclamation District Assessment	\$2,283,000	\$2,527,000	\$3,089,000
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Labor & Professional Service	\$744,000	\$824,000	\$1,006,000
Travel & Incidentals	\$29,000	\$32,000	\$40,000
<b>TOTAL ESTIMATE</b>	<b>\$7.8 million</b>	<b>\$6.5 million</b>	<b>\$13.3 million</b>

- Current expenses based on three-year average years 2021-2023
- Future expenses based on year 2030
- Debt service – Interest only on through FY 2039-40; Principal payment starts FY 2040-41 thru FY 2044-45 averaging \$34.8 million/year

# Fiscal Analysis

## Annual Revenue Opportunities

ANNUAL NET REVENUE			
Revenue Centers	Current Year 2021-23 (Average)	Forecast Year 2030 (Low-High Range)	
Agriculture	\$850,000	\$4,500,000	\$7,800,000
Cell Tower	\$40,000	\$49,000	\$49,000
Waterfowl Recreation/Preservation	\$0	\$81,000	\$343,000
Clean Energy Production	\$0	\$720,000	\$720,000
Carbon Sequestration	\$0	\$1,500,000	\$1,700,000
Eco-Mitigation Banks	\$0	\$7,400,000	\$11,500,000
<b>Sub Total</b>	<b>\$0.9 million</b>	<b>\$14 million</b>	<b>\$22 million</b>
Carbon Capture & Underground Storage	\$0	\$112 million	\$270 million
<b>TOTAL</b>	<b>\$0.9 million</b>	<b>\$126 million</b>	<b>\$292 million</b>



# FISCAL ANALYSIS

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## Property Value

# Fiscal Analysis

## Property Value

- Overview
  - MWD purchased 5 Delta islands in 2016
  - Purchase cost – \$175 million (20,404 acres)
  - Chipps Island sold to DWR in 2021 for \$972,000
- Investment Analysis
  - Land valuation was conducted by independent appraiser
  - Appraisals completed in November/December 2023
  - Land valuation range was dependent on factors such as market conditions, location, physical characteristics, permanent crop suitability, farmable land, etc.

# Fiscal Analysis

Current property value lower than purchase

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# FISCAL ANALYSIS

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## Agricultural Leases

# Fiscal Analysis

## Agricultural Leases

### Overview

- Focus of land use was to avoid long-term encumbrances
- Move to short-term leasing, provided below-market revenues

### Investment Opportunities

- Uniquely positioned to maximize revenues
- Loss of Northern Cal rice acreage, more demand for Delta rice
- Multi-benefit vs. single-benefit agricultural land use model
- Revenue sources will significantly increase

# Fiscal Analysis

## Agricultural Leases

Delta Islands	Annual Revenue Estimate	
	Business as Usual 2030 Forecast	Proposed Approach 2030 Forecast
Bouldin Island	\$511,000 – 624,000	\$1.7 – 3.0 million
Webb Tract	\$125,000 – 153,000	\$0.5 – 1.0 million
Holland Tract	\$ 73,000 – 90,000	\$0.5 – 1.0 million
Bacon Island	\$260,000 – 318,000	\$1.8 – 2.8 million
<b>TOTAL</b>	<b>\$1.0 – 1.1 million</b>	<b>\$4.5 – 7.8 million</b>



# FISCAL ANALYSIS Waterfowl Recreation & Preservation

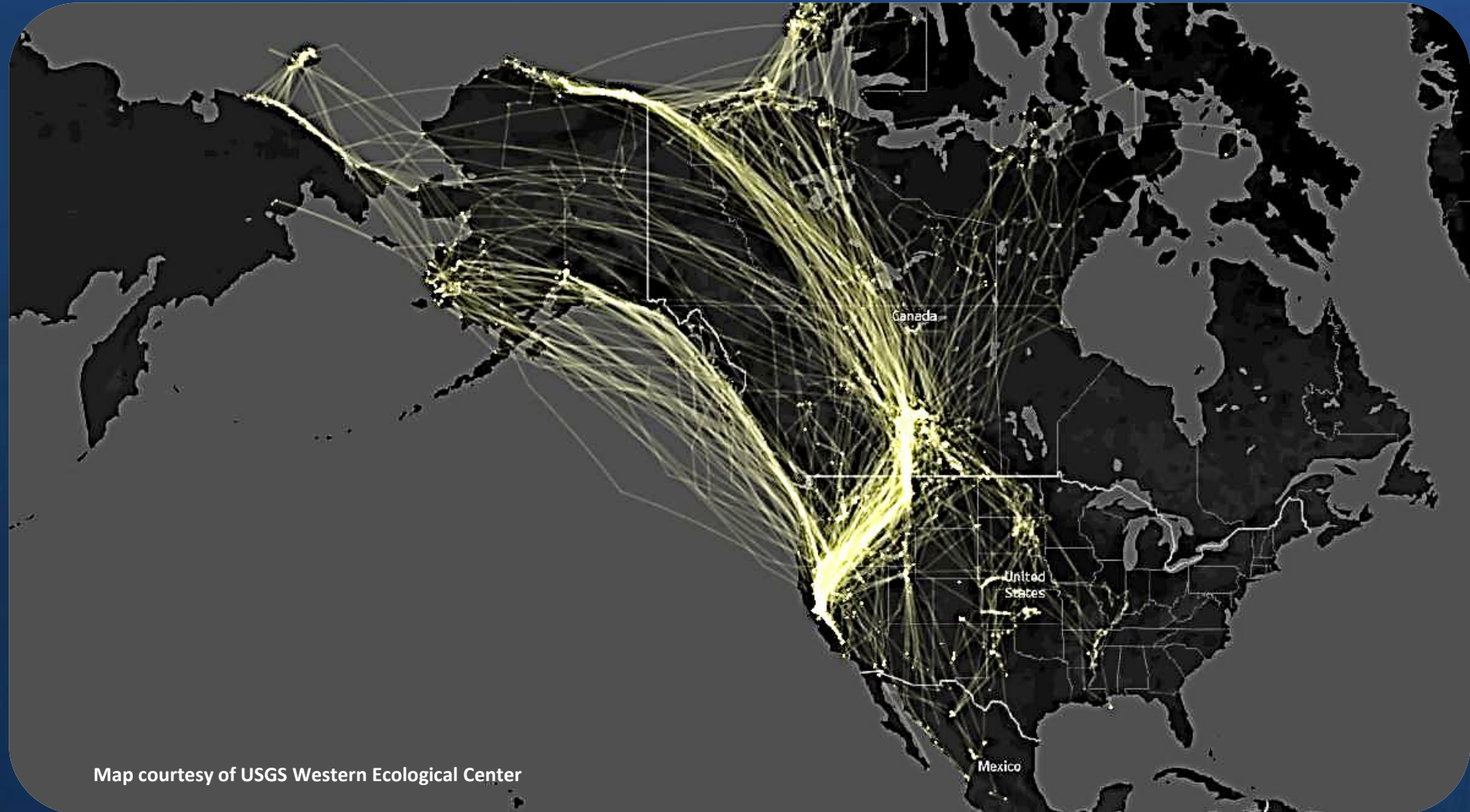
# Fiscal Analysis

## Waterfowl Recreation & Preservation

- Overview
  - No current Metropolitan program to enhance waterfowl habitat and populations
  - Waterfowl recreation is mainly conducted by farmer tenant
  - Audubon's annual bird survey shows Metropolitan's islands are critical habitat for Pacific Flyway bird migration
- Investment Opportunities
  - Utilize lands to increase waterfowl habitat and populations while still realizing revenue generating recreational activities
  - Partner with resource design experts Point Blue Conservation Science, Audubon, California Waterfowl, Ducks Unlimited
  - Work with Restore the Delta and tribal representatives to conduct wildlife and educational tours

# Fiscal Analysis

## Waterfowl Recreation & Preservation



# Fiscal Analysis

## Waterfowl Recreation & Preservation

Delta Islands	Annual Revenue Estimate	
	Business as Usual 2030 Forecast	Proposed Approach 2030 Forecast
Bouldin Island	\$0	\$23,000 – 119,000
Webb Tract	\$0	\$58,000 – 234,000
Holland Tract	\$0	\$ TBD
Bacon Island	\$0	\$ TBD
<b>TOTAL</b>	<b>\$0</b>	<b>\$81,000 – 343,000</b>



# FISCAL ANALYSIS Renewable Energy Opportunities

# Fiscal Analysis

## Renewable Energy Opportunities



- Overview
  - MWD's pump discharge stations control groundwater levels and prevent flooding
  - Pumps only connected to PG&E power lines
  - Off-grid power important in case of outage
  - Solar microgrids strategy aligns with MWD's Climate Action Plan – carbon neutrality by 2045
- Investment Opportunities
  - Clean Coalition preliminary economic analysis
    - Energy cost-savings
    - Energy resilience
    - Reduction in greenhouse gas emissions

# Fiscal Analysis

## Renewable Energy Opportunities

Costs and Savings Estimate			
	Without Solar	With Solar + Battery	Total Cost Savings
PG&E Electric	\$45 million	\$19 million	\$26 million
Capital + O&M	\$0 million	\$8 million	<\$8 million>
<b>TOTAL</b>	<b>\$45 million</b>	<b>\$27 million</b>	<b>\$18 million (\$720,000/yr.)</b>

*Assumptions of the nine pumps on four islands:*

- *Battery Energy Storage Systems (BESS) at least two hours of resilience*
- *Utility Cost Escalation Rate 10%*
- *Federal incentives: Investment Tax Credit (ITC) 40% (Direct Pay)*
- *Average Payback is 16 years*

A close-up photograph of a person's hands, wearing a dark jacket, cupping a large amount of dark, moist, and crumbly soil. The soil is piled high in the palms. The background is a soft, out-of-focus green, suggesting foliage or a garden. The lighting is bright and natural, highlighting the texture of the soil and the skin of the hands.

# FISCAL ANALYSIS Carbon Sequestration

# Fiscal Analysis

## Carbon Sequestration

- Overview
  - MWD's islands can be used to sequester CO<sub>2</sub> emissions
  - Sequestration projects in the planning phase
  - Developing carbon emission baselines with the Nature Conservancy, Environmental Defense Fund, Delta Conservancy
- Investment Opportunities
  - Implement multi-benefit farming (i.e., convert corn to rice)
  - Apply for carbon sequestration crediting to increase revenue
  - Aligns with Metropolitan's Climate Action Plan
  - Reduces land subsidence and levee stability risks

# Fiscal Analysis

## Carbon Sequestration

Delta Islands	Annual Revenue Estimate	
	Business as Usual 2030 Forecast	Proposed Approach 2030 Forecast
Bouldin Island	\$0	\$579,000 – 661,000
Webb Tract	\$0	\$677,000 – 773,000
Holland Tract	\$0	\$123,000 – 141,000
Bacon Island	\$0	\$130,000 – 148,000
<b>TOTAL</b>	<b>\$0</b>	<b>\$1.5 – 1.7 million</b>



# FISCAL ANALYSIS

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## Eco-Mitigation Banking

# Fiscal Analysis

## Eco-Mitigation Banking

### Overview

- Mitigation banking is a tool used to offset the environmental impact of development projects
- These banks generate credits that can be used to support funding of management & maintenance activities

### Investment Opportunities

- MWD's Delta islands can generate revenue in non-farmable areas by implementing eco-mitigation banks
- Eco-mitigation is in-demand in the Delta region
- Staff is collaborating with environmental groups and indigenous communities to leverage resources, expertise, and support

# Fiscal Analysis

## Eco-Mitigation Banking

Delta Islands	Annual Revenue Estimate	
	Business as Usual 2030 Forecast	Proposed Approach 2030 Forecast <sup>1</sup>
Bouldin Island	\$0	\$900,000 – 1,500,000
Webb Tract	\$0	\$6,000,000 – 9,200,000
Holland Tract	\$0	\$500,000 – 800,000
Bacon Island	\$0	\$ TBD
<b>TOTAL</b>	<b>\$0</b>	<b>\$7.4 – 11.5 million</b>

*1. Assumes only 1/3 of proposed eco-mitigation has been implemented by 2030. Additional acreage is available to be phased in over 30 years.*

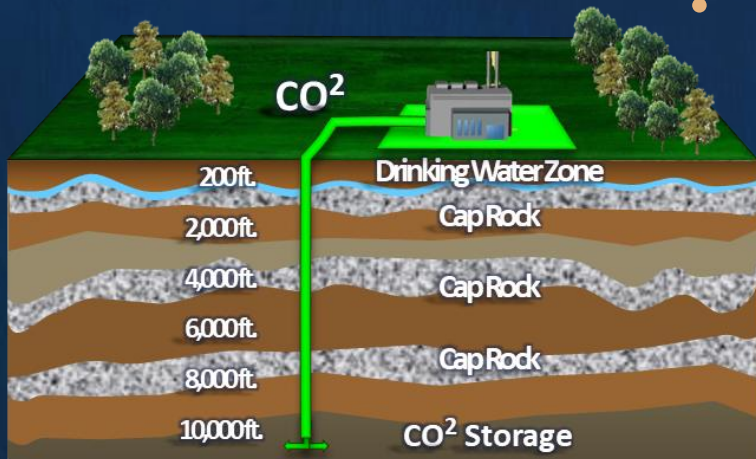


# FISCAL ANALYSIS

## Carbon Capture & Geologic Storage

# Fiscal Analysis

## Carbon Capture & Underground Storage



- Overview

- Gov. Newsom – “CCS is essential to meet State’s 2045 carbon neutrality goals”
- 5 projects in development in California
- Delta geology well suited for safe CO<sub>2</sub> storage
- Test wells in Delta (King Island, Montezuma Hills)
- CO<sub>2</sub> from Bay Area industries injected 2-miles underground
- 2021 & 2023 study by Lawrence Livermore National Lab
- Delta Conservancy & Resources Agency holding local stakeholder coordination meetings

## Investment Opportunities

- Potential MWD revenue – hundreds of millions/year

# Fiscal Analysis

## Carbon Capture & Underground Storage

Delta Islands	Annual Revenue Estimate	
	Business as Usual 2030 Forecast	Proposed Approach 2030 Forecast <sup>1</sup>
Bouldin Island	\$0	\$47 – 114 million
Webb Tract	\$0	\$47 – 114 million
Holland Tract	\$0	\$12 – 29 million
Bacon Island	\$0	\$ 6 – 14 million
<b>TOTAL</b>	<b>\$0</b>	<b>\$112 – 271 million</b>

*1. Assumes MWD share of 50% after all implementation expenses have been deducted.*



# RISK ANALYSIS

## Overview

# Risk Analysis Overview

- Overview
  - Analyzed key agricultural operations, environmental regulations, flood/seismic, sea-level rise, subsidence
- Investment Opportunities
  - Support proposed modern levee design standard
  - Promote Delta smelt propagation & associated reduction in regulatory restrictions
  - Create a unified approach for efficient levee management with other island owners & stakeholders

# Risk Analysis Key Risks



**Flood/Seismic**



**Sea-Level Rise**

**Delta Islands  
Manage Key Risks**



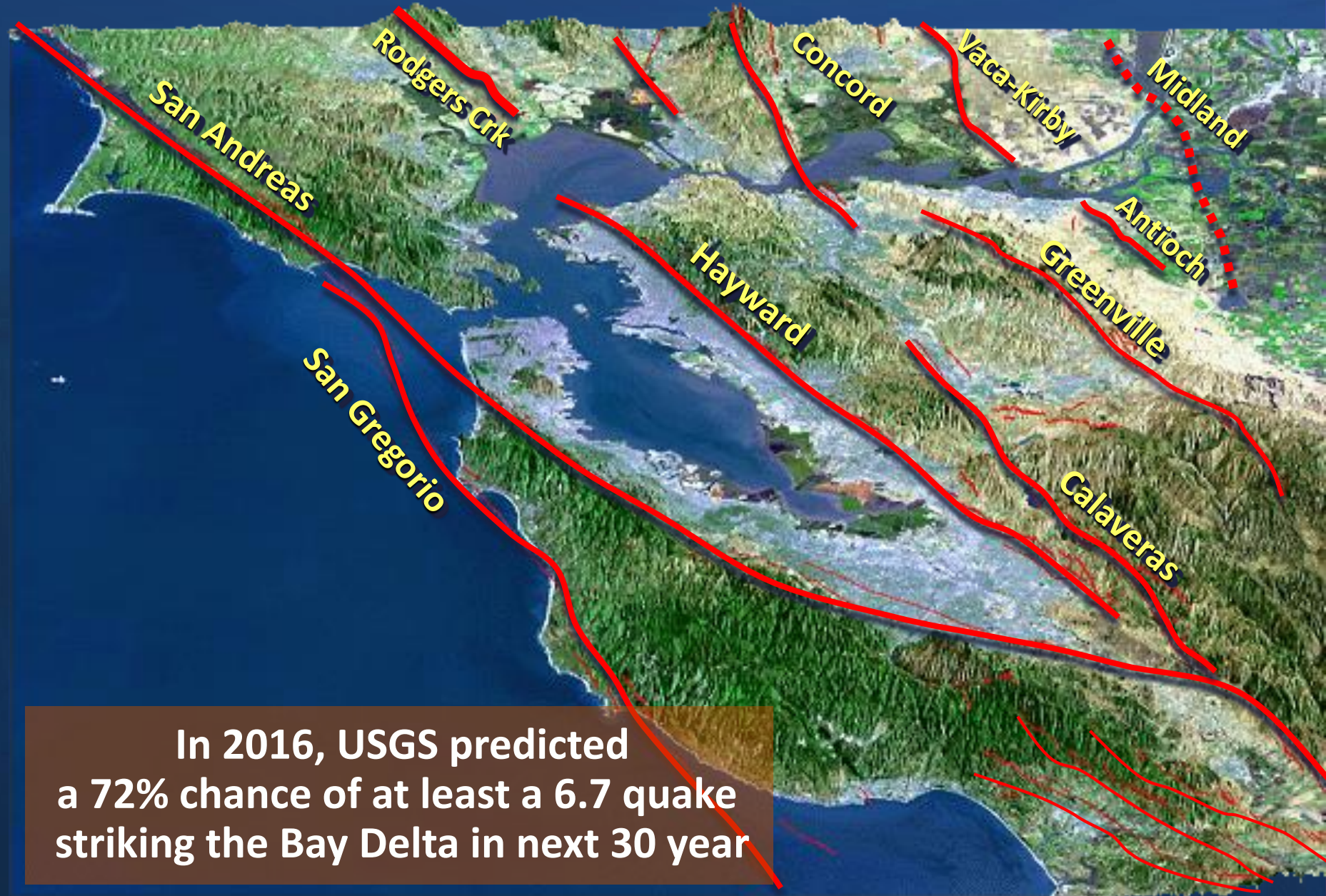
**Fishery Declines**



**Subsidence Control**

# Risk Analysis

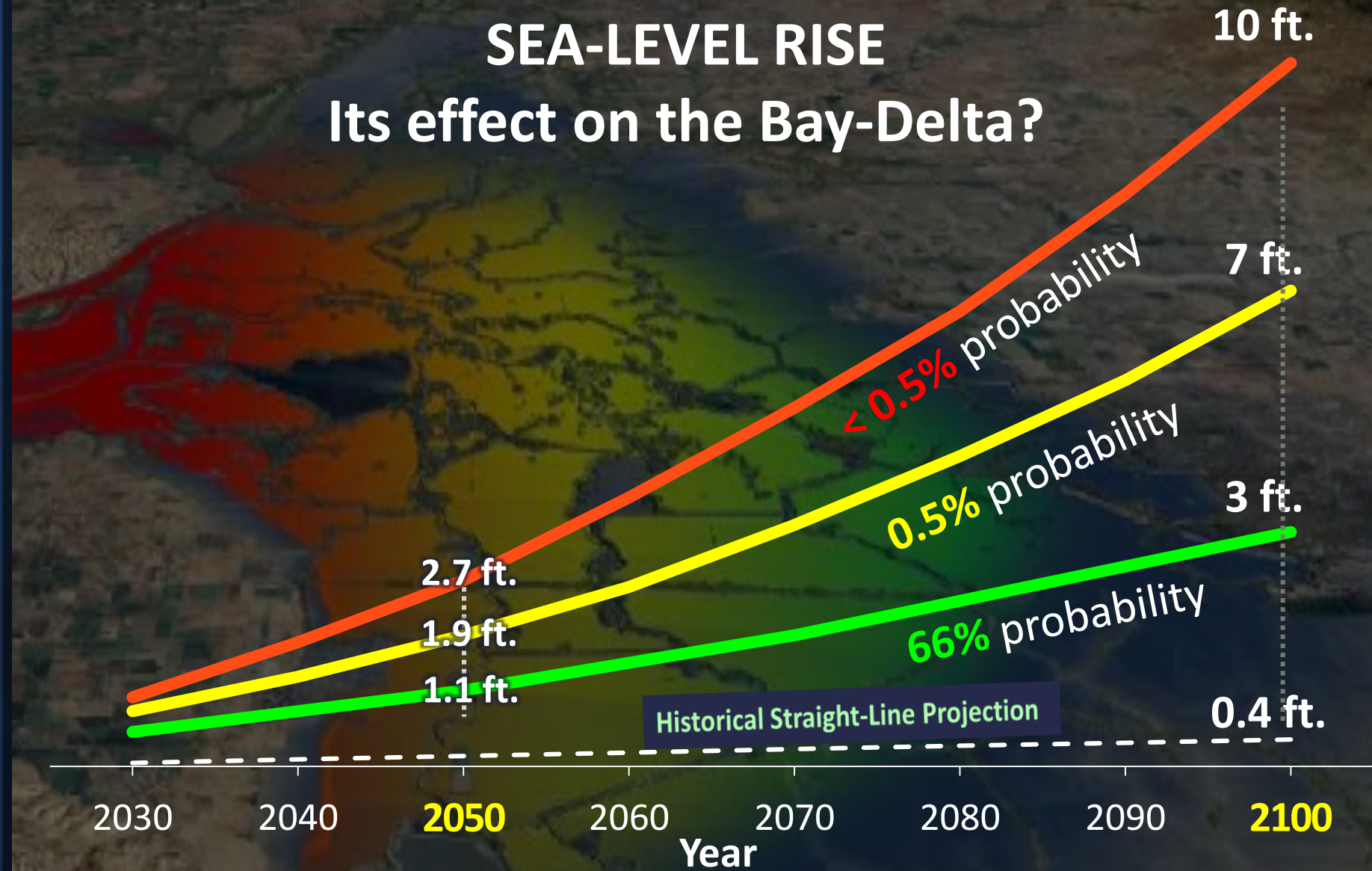
## Seismic Vulnerability



# Risk Analysis

## Sea-Level Rise

### SEA-LEVEL RISE Its effect on the Bay-Delta?

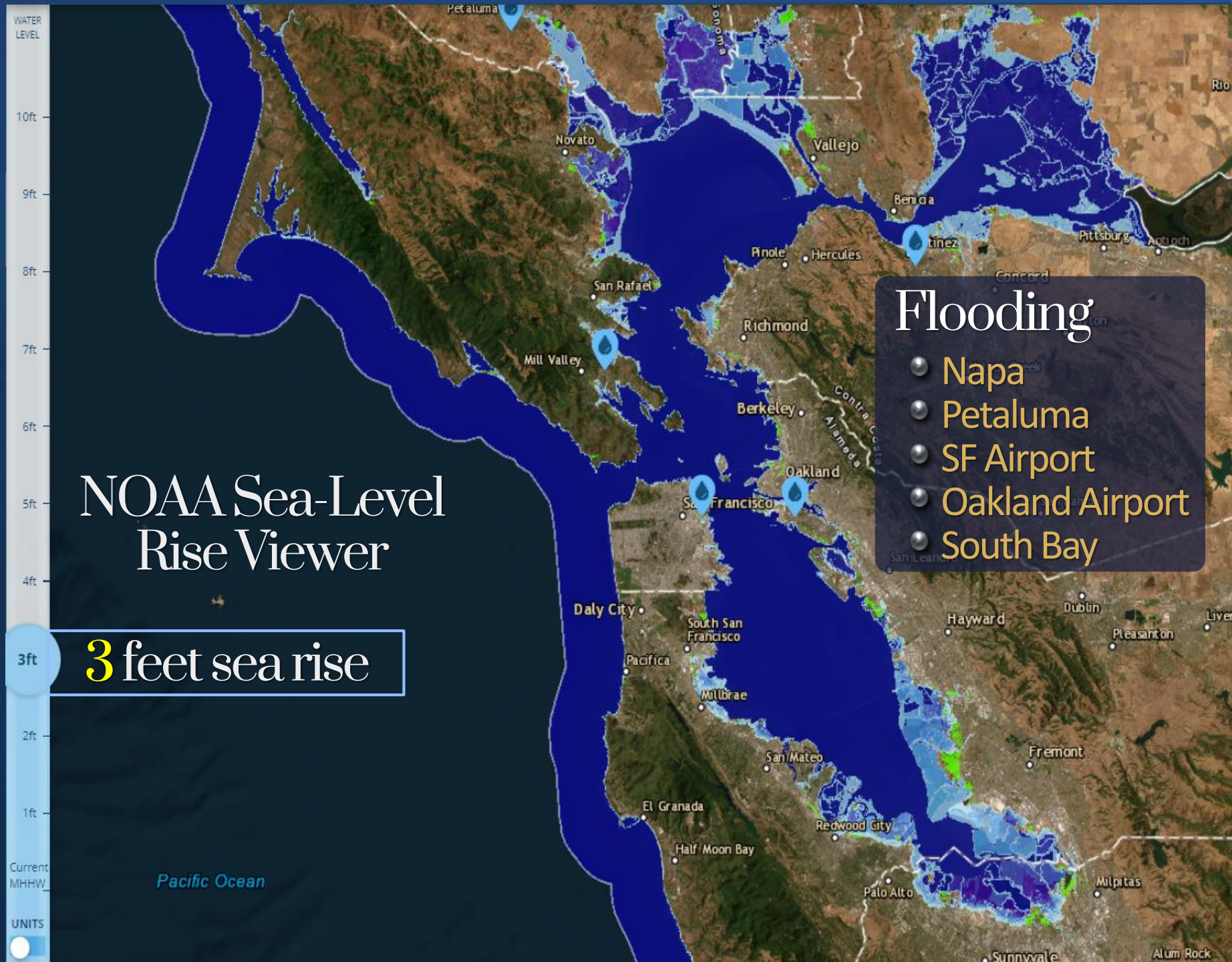


2018 projection by Cal Resources Agency & Ocean Protection Council

- Historical – 0.64 feet in last 130 years
- Low Risk Aversion – 66% probability of sea-level rise (Kopp et al. 2014)
- Med-High Risk Aversion – 0.5% probability of sea-level rise (Kopp et al. 2014)
- Extreme Risk Aversion – Single scenario of sea-level rise (Sweet et al. 2017)

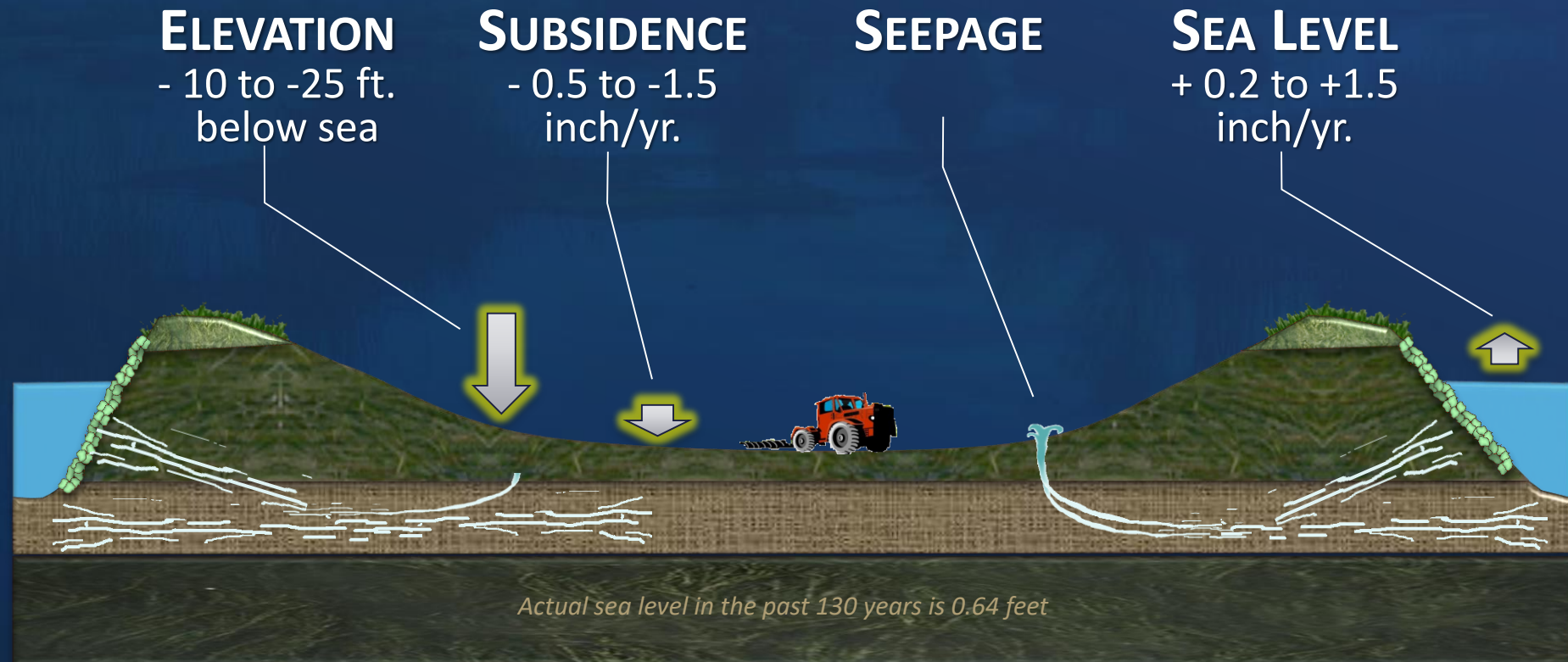
# Risk Analysis

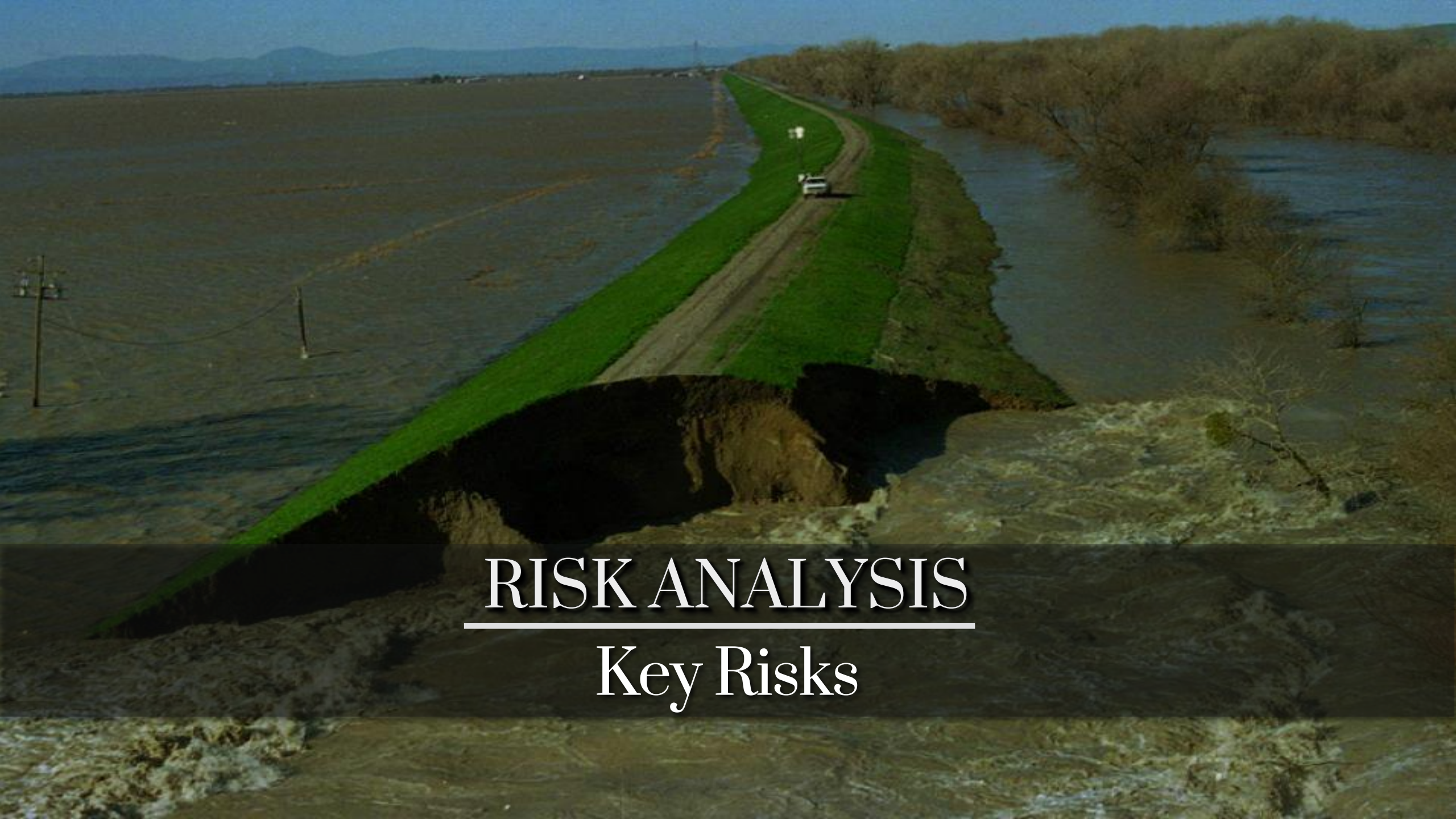
## Sea-Level Rise



# Risk Analysis Subsidence

## CURRENT LANDSCAPE





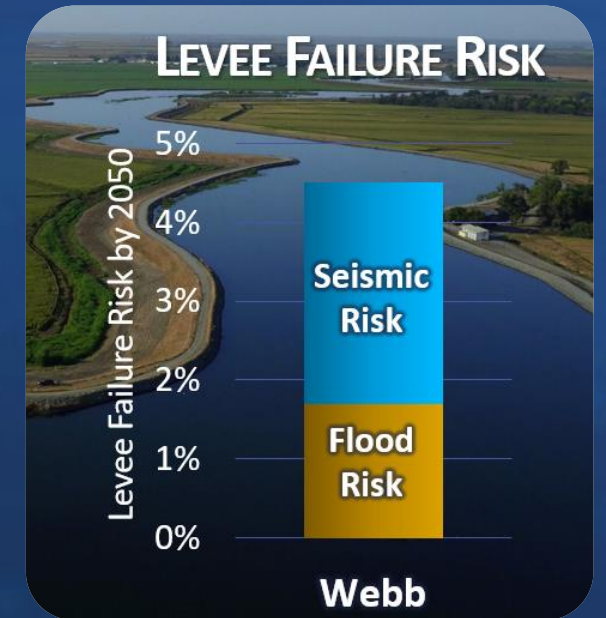
# RISK ANALYSIS

## Key Risks

# Risk Analysis

## Key Risks

- Key Risks
  - Agricultural operations
  - Environmental regulations
  - Levee failure (flooding, seismic)
  - Subsidence and sea-level rise
- Assessment
  - Analyzed response time, infrastructure, equipment, life, crop damage, levee repair, recovery period
  - Levee breaks occur over hours allowing ample time to evacuate
  - Preliminary estimate \$40 - 70 million to reclaim if full breach
  - Levees meet FEMA standard to qualify for disaster funding
  - No complete Delta levee failures since 2005



# Risk Analysis

## Delta Levee Failures



# Risk Analysis

## Seismic & Flood Analyses



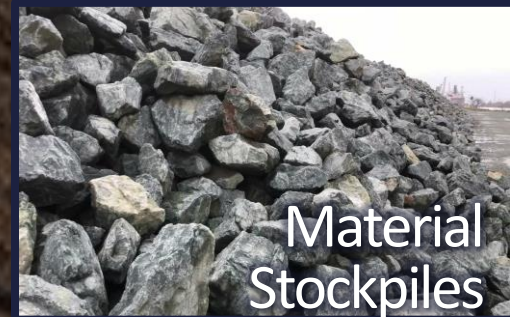
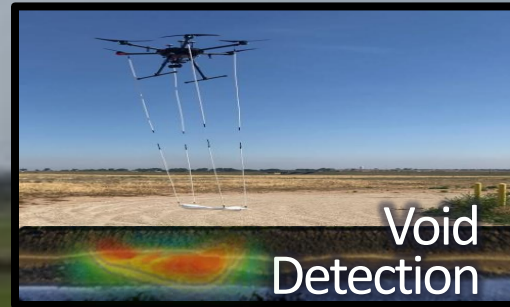
- Multiple Seismic/Flood Risks Analyses
  - 2008 - Delta Risk Management Study (DWR/URS/JBA)
  - 2011 - Levee Stability Analyses of Freshwater Pathway (URS)
  - 2012 - Emergency Response Tool (DWR/RMA)
  - 2012 - Peat Deformation/Consolidation Mechanisms (UCLA)
  - 2013 - Seismic Hazard Analyses of Freshwater Pathway (URS)
  - 2018 - Seismic Hazard Analysis of Freshwater Pathway (Lettis)
  - 2018 - Emergency Operations Integration Plan (DWR/USACE)
  - 2018 - Nor Cal Catastrophic Flood Management Plan (Cal OES)
  - 2018 - Emergency Response Tool Model (DWR/RMA)
  - 2019 - Updated Levee Stability Pathway Analysis (AECOM/Lettis)

A large drone is shown in flight against a clear blue sky, with four white smoke trails trailing behind it. Below the drone, a desert landscape with dry grass and a dirt path is visible. In the foreground, a body of water is partially visible. At the bottom of the image, there is a rectangular thermal image overlay showing a bright orange and yellow area, likely representing a heat source or a specific target. The text "RISK ANALYSIS" is written in a large, white, serif font, underlined, and "Management Actions" is written in a smaller, white, serif font below it.

# RISK ANALYSIS

## Management Actions

# Risk Analysis Management Actions

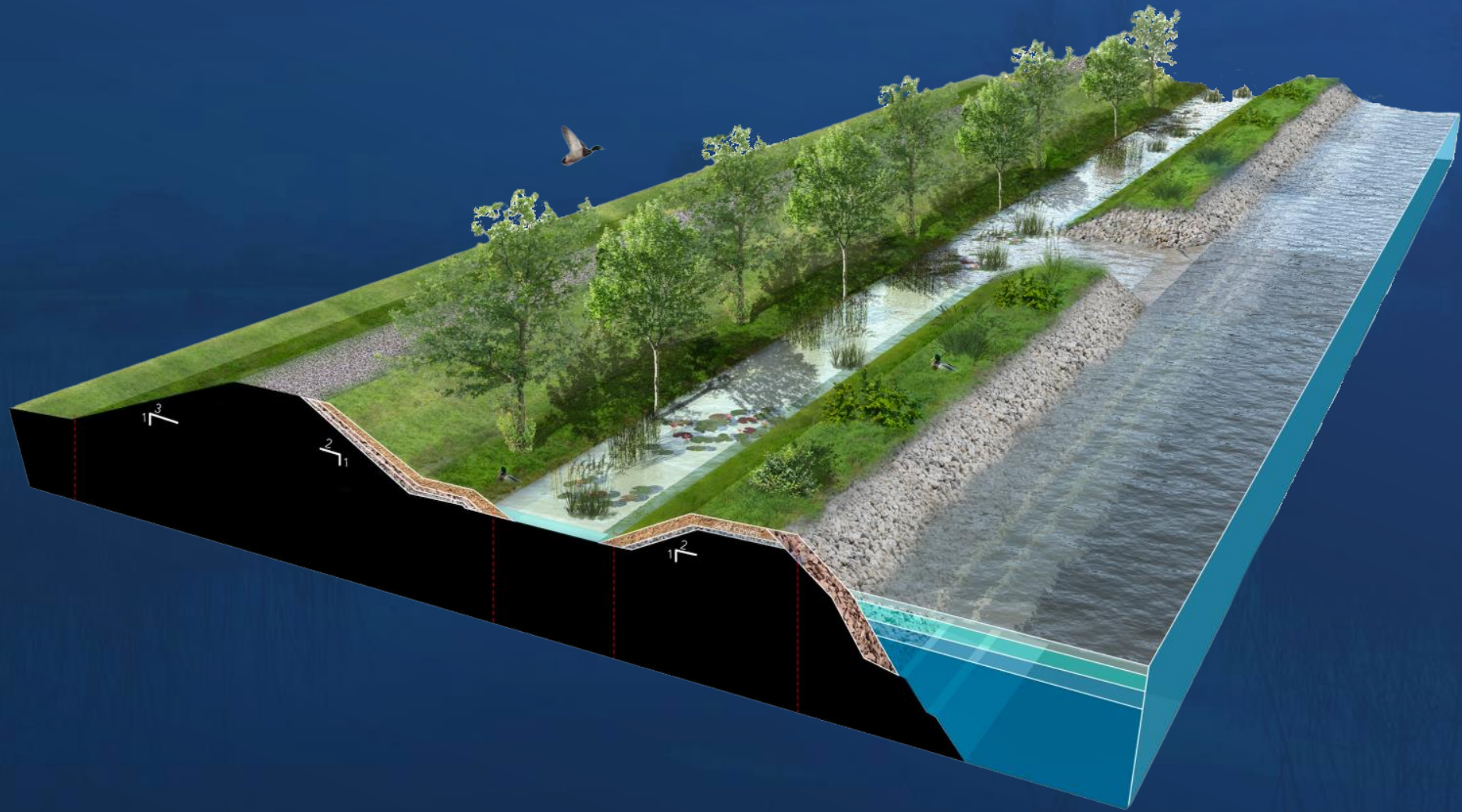


# Risk Analysis Management Actions



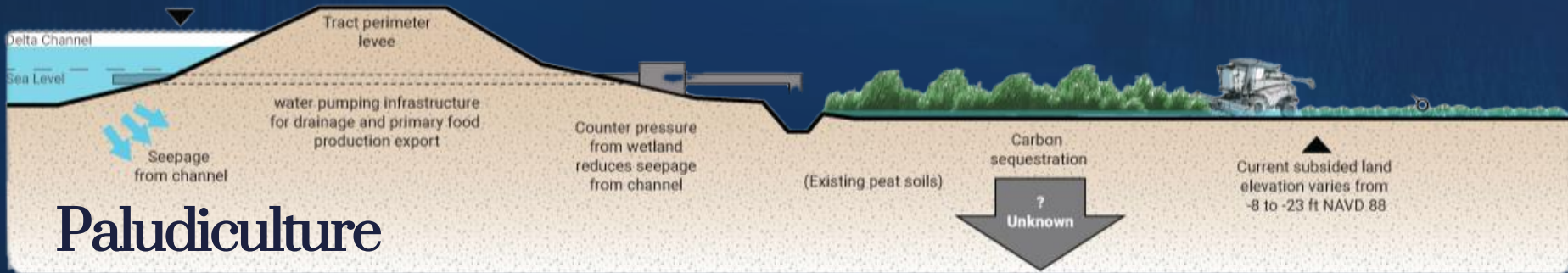
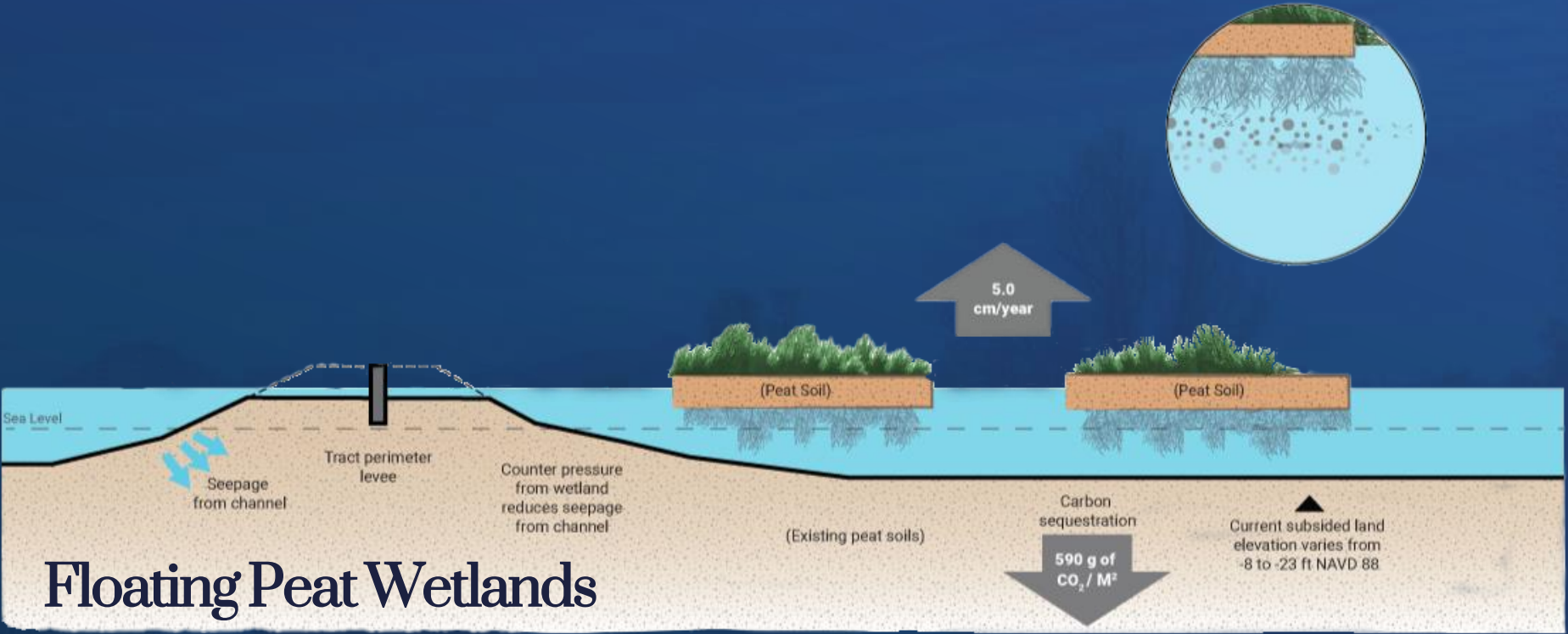
# Risk Analysis Management Actions

## Multi-Benefit Setback Levee



# Risk Analysis Management Actions

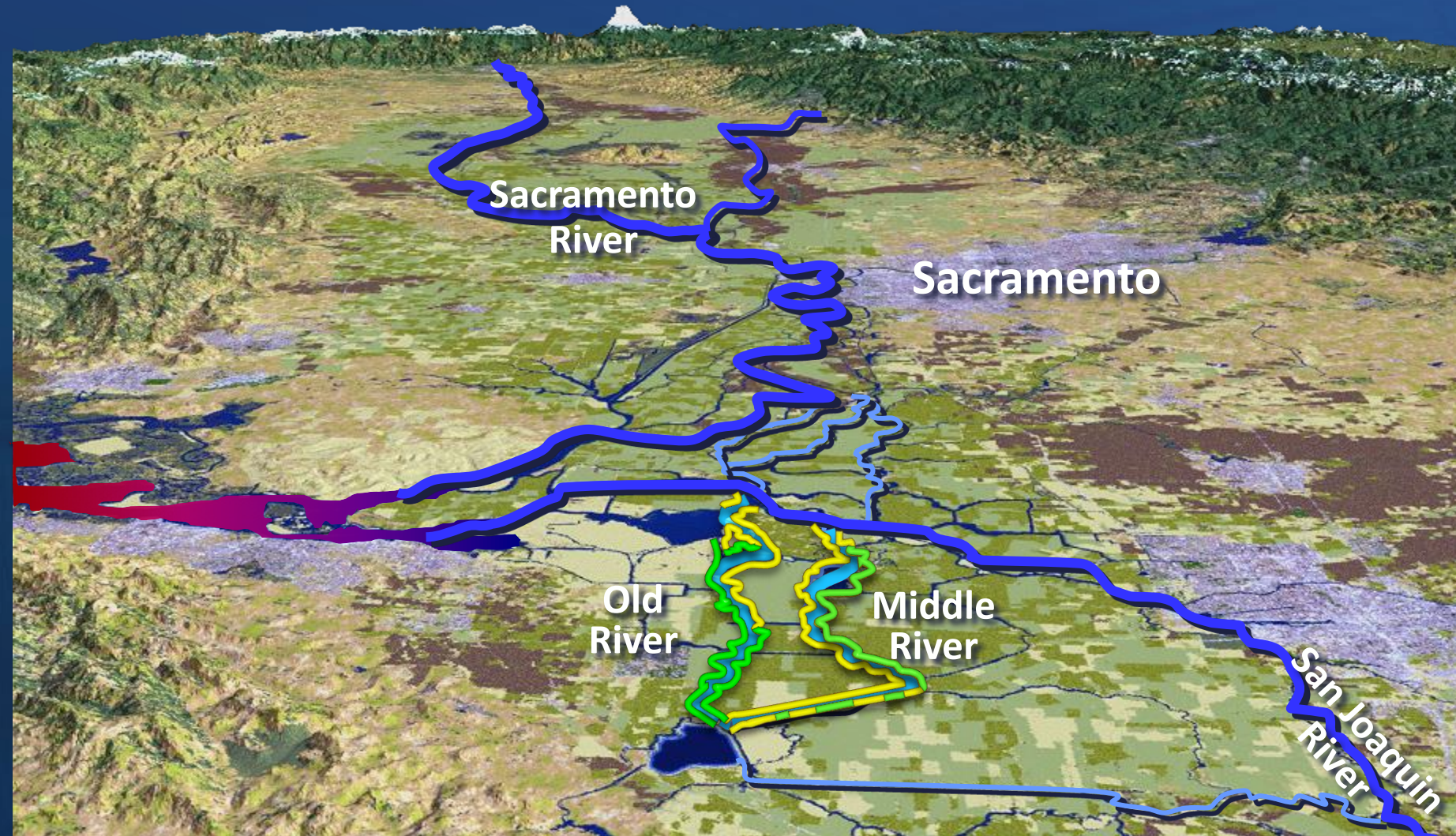
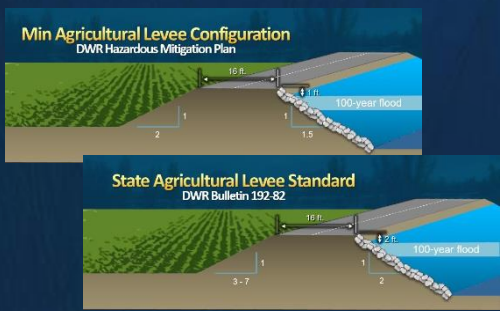
## Subsidence Control & Eco-Agriculture



# Risk Analysis

## Management Actions

### Thru-Delta Freshwater Pathway



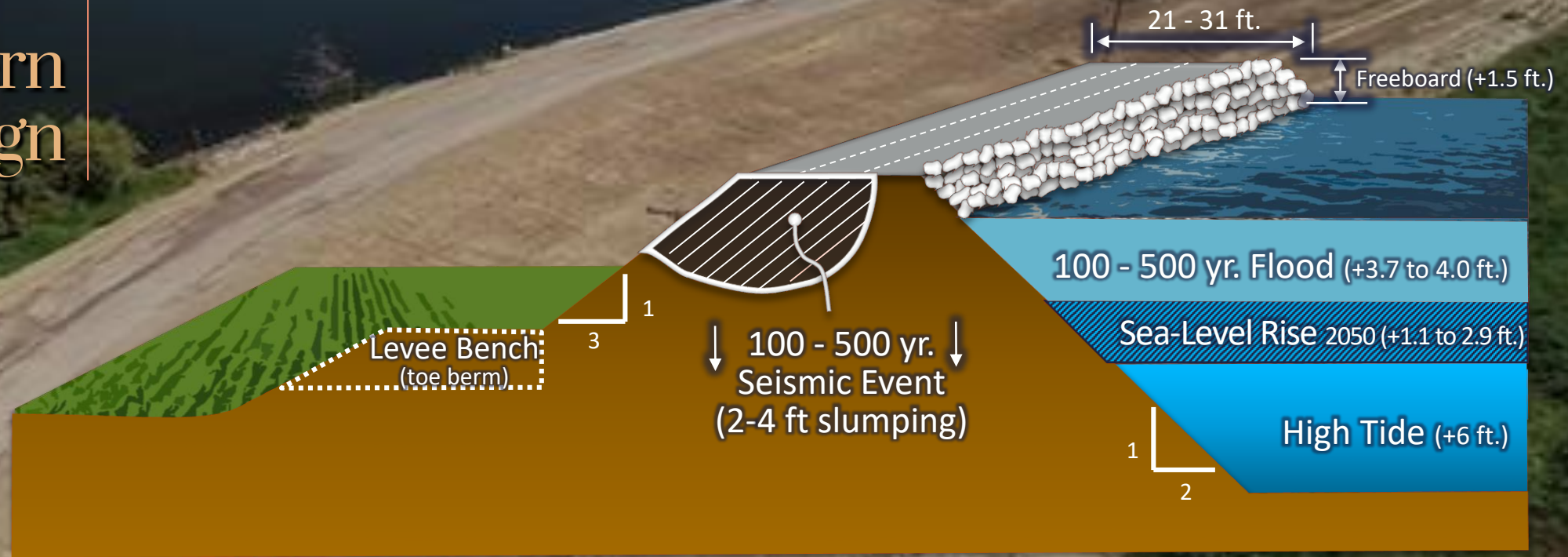
	LEVEE STANDARD	STATUS	UPGRADE
<div style="writing-mode: vertical-rl; transform: rotate(180deg);">BETTER</div>	<input checked="" type="checkbox"/> 100-Year Criteria (FEMA-HMP)	100% compliant	\$ 0 million
	<input type="checkbox"/> 300-Year Criteria (DWR Bul. 192-82)	53% compliant	\$ 131 million
	<input type="checkbox"/> Earthquake/Sea-Level Rise (Proposed)	0% compliant	\$ 400-700 mill

# Risk Analysis

## New Modern Levee Design

### Mitigates

- ✓ Flood Risk
- ✓ Earthquake Risk
- ✓ Sea-Level Rise



1. Assumes continued State/Federal investment in levee improvements, stockpiles, etc.

2. Flood & seismic risks occurring separately is a 1 in 500-year event; Both events occurring simultaneously is 1 in 50,000-year event)

3. COLLABORATORS – UC Davis, UC Los Angeles, UC Berkeley, MBK Engineers, KSN Engineers, AECOM, Hultgren-Tillis, Lettis, Schnabel, Moffatt & Nichol, Central Delta Water Agency, DWR, MWD, etc.

# Risk Analysis

## Management Actions



Real-time, early warning levee monitoring system

- Assesses small movements inside a levee structure
- Allows corrective actions weeks to months in advance
- Previously in a reactive mode; now in a proactive mode

# Risk Analysis

## New Modern Levee Design Cost Estimate

Thru-Delta Freshwater Pathway \$400 – 700 million

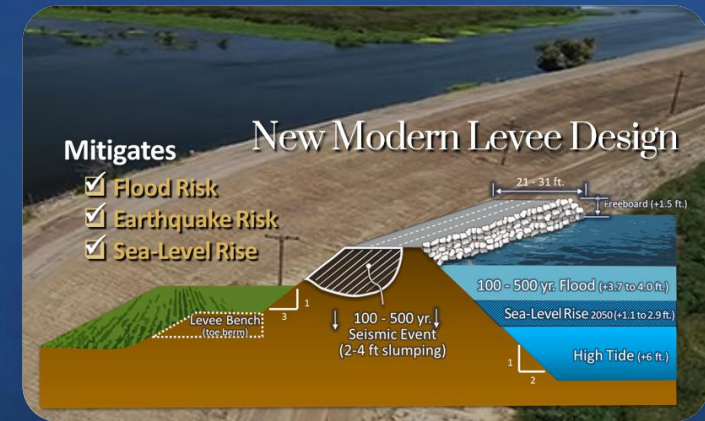
Primary Delta \$3 – 5 billion



# Risk Analysis

## Risk Mitigation

- Mitigation Actions
  - Agricultural operations safety BMPs
  - Emergency response and recovery plans
  - Targeted levee structural improvements – over \$51 million in grants (\$87 million for all island activities)
  - Regional and on-island rock stockpiles and warehouses
  - Invasive species control and monitoring (nutria, etc.)
  - Seismic vulnerability research
  - Real-time, early-warning levee monitoring system
  - Modern levee design to mitigate flood, earthquake, sea-level rise



# Risk Analysis

## Summary

- No major levee failures over last two decades
- All MWD's islands meet minimum FEMA standard, allowing for state/federal emergency disaster funding
- Proposed modern levee standard is designed to meet future sea-level & seismic risks
- Real-time levee monitoring allows for early warning from weeks to months in advance
- Need to continue coordinated Delta levee management approach