Introduction to Appendix K:
Multi-Benefit Project Opportunities Identified to Reduce Flood Risks and Improve SWP Water Conveyance Through the Delta by the Sacramento County Delta Legacy Communities, November 2020 – April 2021

The following PowerPoint Presentation(s) were largely developed November 2020 - April 2021 by the Sacramento County Delta Legacy Communities participating in the DWR SCFRRP grant program focused on reducing flood risks along the Sacramento River Corridor. The Sacramento County Delta Legacy Communities and the Sacramento River Corridor collectively coincide with the freshwater conveyance corridor of SWP and CVP deliveries through the North Delta.

A common theme shared amongst all the Sacramento County Legacy Communities includes improving the entirety of the State Plan of Flood Control (SPFC) levee system to current FEMA engineering accreditation standards along both banks of the Sacramento River also provides the multi-benefit of improving the Delta water conveyance corridor between Freeport and the USBR Delta Cross Channel in Walnut Grove.

PPT slides 2 through 12: Provide a brief explanation of the SCFRRP program and identification of flood risks and vulnerabilities to the Sacramento County Delta Legacy Communities.

Slides 13 – 38: Provide a summary of key structural-based flood risk reduction Management Actions (MAs). Cost summaries are also included for levee improvements that would result in: (1) FEMA accreditation for the communities located within the larger RDs: (2) improving the entirety of the RD perimeter levee systems to current FEMA engineering accreditation standards; or (3) just improving the SPFC levee system(s) along the Sacramento River Corridor to current engineering standards.

Slides 39 – 49: Present the Delta Legacy Communities' proposal of improving the levees along Sacramento River conveyance corridor to current FEMA engineering standards that includes the multi-benefit of improving reliability and resiliency of conveying water through the North Delta. The Communities' proposal can possibly serve as a more cost-effective alternative to the DCA's current single-purpose proposal with intakes and tunnels in the North Delta.

Slides 50 – 52: Present the need to collaborate and include multi-beneficiaries in developing and financing levee improvements in the Delta, including identification of funding mechanisms to implement levee improvements that are also beneficial for greater reliability and resiliency of through-Delta water conveyance. (Per California's Flood Futures Recommendations of Nov. 2013, and the DPC's Levee Financing Options Feasibility Study of May 2018.)

Slides 53 - 71: Present the latest cost comparisons, and science behind improving said levee system(s) in the North Delta also has the multi-benefit of improving the reliability and resiliency of conveying SWP and CVP water through the Delta w/ or w/o a modified DCA proposal. The latter slides also suggest improving the levees in the conveyance corridor of the North Delta Region will not result in a stranded investment.

2018-2021 Flood Studies for Sacramento County Delta Legacy Communities Identifying Opportunities to Improve SWP Water Conveyance Through the Delta

http://sacdelta.stormready.org

Help Us Reduce YOUR Flood Risk

Sacramento County is hosting online community meetings via ZOOM so you can help choose and prioritize flood risk reduction measures for your communities.

West Walnut Grove & Ryde
Thursday, November 5
6:00 p.m.-7:30 p.m.
https://tinyurl.com/WWG1105

Courtland
Tuesday, November 10
6:00 p.m.-7:30 p.m.
https://tinyurl.com/Courtland1110

Hood
Thursday, November 12
6:00 p.m.-7:30 p.m.
https://tinyurl.com/Hood1112

East Walnut Grove
Tuesday, December 1
6:00 p.m.-7:30 p.m.
https://tinyurl.com/EWG1201

Locke
Thursday, December 3
6:00 p.m.-7:30 p.m.
https://tinyurl.com/Locke1203

Walnut Grove Rotary Club Meeting
Monday, 12-14-2020

Delta Legacy Communities Meeting
Wednesday, 2-3-2021

Sacramento-San Joaquin Delta County Coalition Meeting
Friday, 2-19-21

Walnut Grove Rotary Club Meeting
Monday, 3-8-2021

Sacramento-San Joaquin Delta County Coalition Meeting
Thursday, 4-1-21

2018-2021 Flood Studies for Sacramento River Delta Legacy Communities

(Funded by DWR per Central Valley Flood Protection Plan - CVFPP)

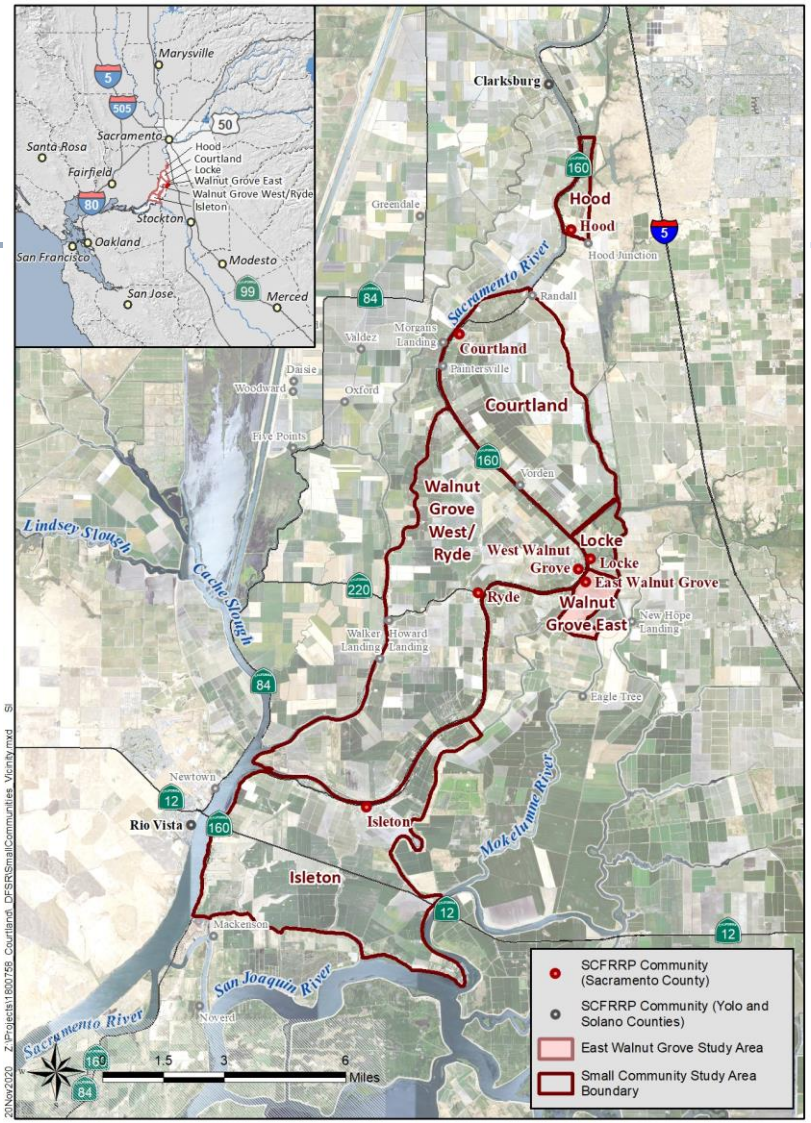
- Central Valley Flood Protection Board (CVFPB) and DWR's goal is to reduce flood risks to 35+ Central Valley Small Communities, inclusive of Delta Legacy Communities (8 Communities in North Delta)
  - Small Community Populations of less than 10,000 residents
  - Protected by Federal/State Authorized Levee Systems
- Large Focus on Communities with less than 100-Yr. Level of Flood protection
  - not currently accredited by FEMA
- Also Focusing on Multi-Benefit Opportunities within Delta

Flood Studies for Delta Legacy Communities in Sacramento River Corridor

- Eight Legacy Communities in North Delta received DWR grant funds in the Sacramento River corridor:
- **Sacramento County**
  - **Hood** – State DWR Maintenance Area 9
  - **Courtland** – RDs 551 & 755
  - **Locke** – RD 369
  - **East Walnut Grove** - RDs 554 & 563
  - **West Walnut Grove/Ryde** – RD 3

- Clarksburg, Yolo County
- City of Isleton, Sacramento Co.
- City Rio Vista, Solano County

- *Freeport addressed by Sacramento Area Flood Control Agency (SAFCA) Improvements*



Flood Risk Management Challenges of Sacramento County Delta Legacy Communities

- Delta Legacy Communities subject to Deep Flooding

- Most all Delta Legacy Communities have not flooded in last 100 years; *but the NFIP administered by FEMA doesn't recognize presence of the current Fed/State authorized levee system when assessing flood risk and flood insurance premiums due to their current (2016) status of not providing a 100-year level of flood protection*

- Levees fall well short (millions of $$'s) of meeting current through-seepage and under-seepage FEMA engineering accreditation standards (44 CFR §65.10); *High NFIP flood insurance rates required for federally-backed home mortgage loans*

- RDs/LMAs are largely limited to acreage-based assessments, not structure improvement-based values (CA Water Code 12981); *(RD 563-Tyler Island is an exception, via passage of a Proposition 218 ballot measure, includes assessments for residential and farming structures)*

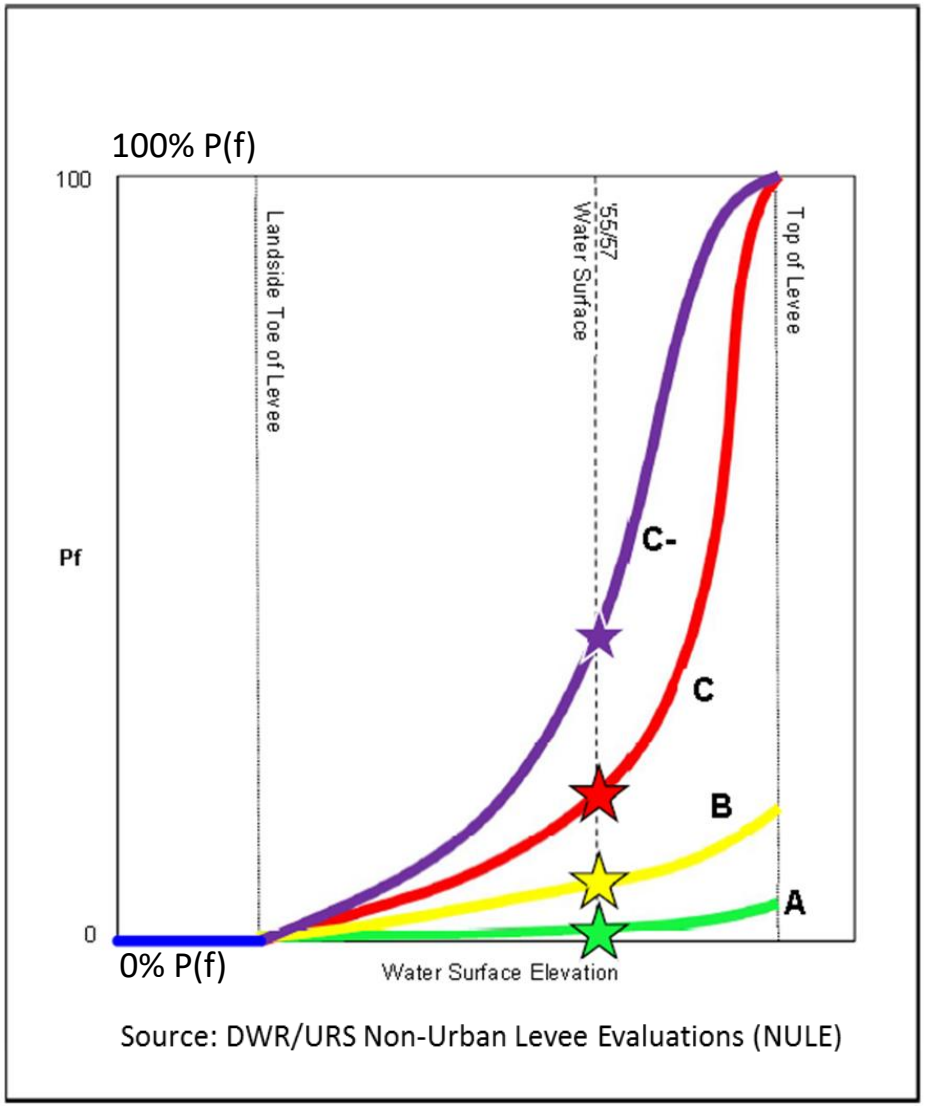
California DWR Levee Hazard Ratings Report Card for Levees Protecting Locke & East Portions of Walnut Grove

(Values Presently used by DWR for 2017 - 2022 CVFPP Updates)

LFPZ Region & Communities	DWR Basin ID	Levee Reach Description/RDs NULE Segment #	Former Base Categorizations				Updated Categorizations				Current Estimated Level of Flood Protection	
			US	ST	TS	E	US	ST	TS	E	Year	Annual Chance; Chance %/yr.
Locke RDs 369/551/554	SAC51	Sac River @ RD 369 - 121	A	A	A	A	C	A	B	A	6.25	16%
		Sac River @ RD 554 north of DCC - 127	A	A	A	A	C	A	B	A	6.25	16%
		Delta Cross Channel (DCC) North Bank @ RD 554 - 1053	B	A	A	A	B	A	A	A	50	2.0%
		Snodgrass Slough NE of Locke - 1054-1	B	B	B	A	C	A	C	A	6.25	16%
		Snodgrass Slough East of Locke - 1054-2	B	B	B	A	C	B	B	A	6.25	16%
		Former RR embankment SE of Locke - 1054-3	B	B	B	A	B	B	B	A	50	2.0%
East Walnut Grove RDs 554 and 563	SAC52/53	Sac River & Georgiana Slough @ RD 554 - 128	A	A	A	A	B	A	C	C-	3.1	32%
		Georgiana Slough @ RD 563 - 130	C-	B	B	C-	C-	B	B	C-	3.1	32%
		N F Mokelumne River @ RD 563 - 1043	C	B	C	B	C	B	C	A	6.25	16%
		RD 554 Dry Cross Levee adjoining RD 563 - N/A	n/a	n/a	n/a	n/a	A	A	A	A	100	1.0%
		Snodgrass Slough @ RDs 554 & 563 - 1051	B	B	B	A	B	B	B	A	50	2.0%
		Delta Cross Channel (DCC) South Bank RD 554 - 1052	A	B	A	B	B	A	A	A	50	2.0%

US = Under-Seepage
ST = Stability
TS = Through-Seepage
E = Erosion

Typical Levee Performance Curve for Different Levee Segments Protecting Delta Legacy Communities per DWR Hazard Ratings

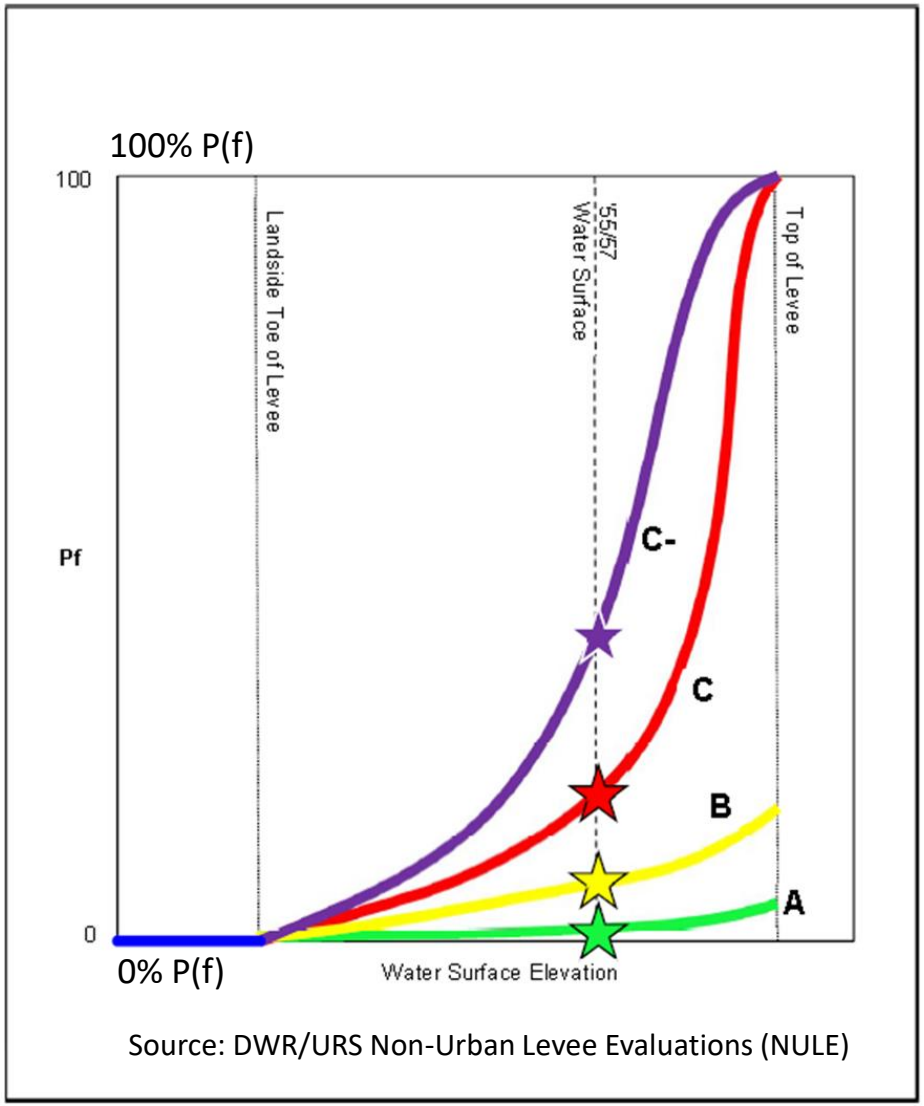


Source: DWR/URS Non-Urban Levee Evaluations (NULE)

Typical Levee Performance Curve for Different Levee Segments Protecting Delta Legacy Communities per DWR Hazard Ratings

FEMA Gives the North Delta Levees an "F" Grade;
FEMA Assumes the Levees are Non-Existent

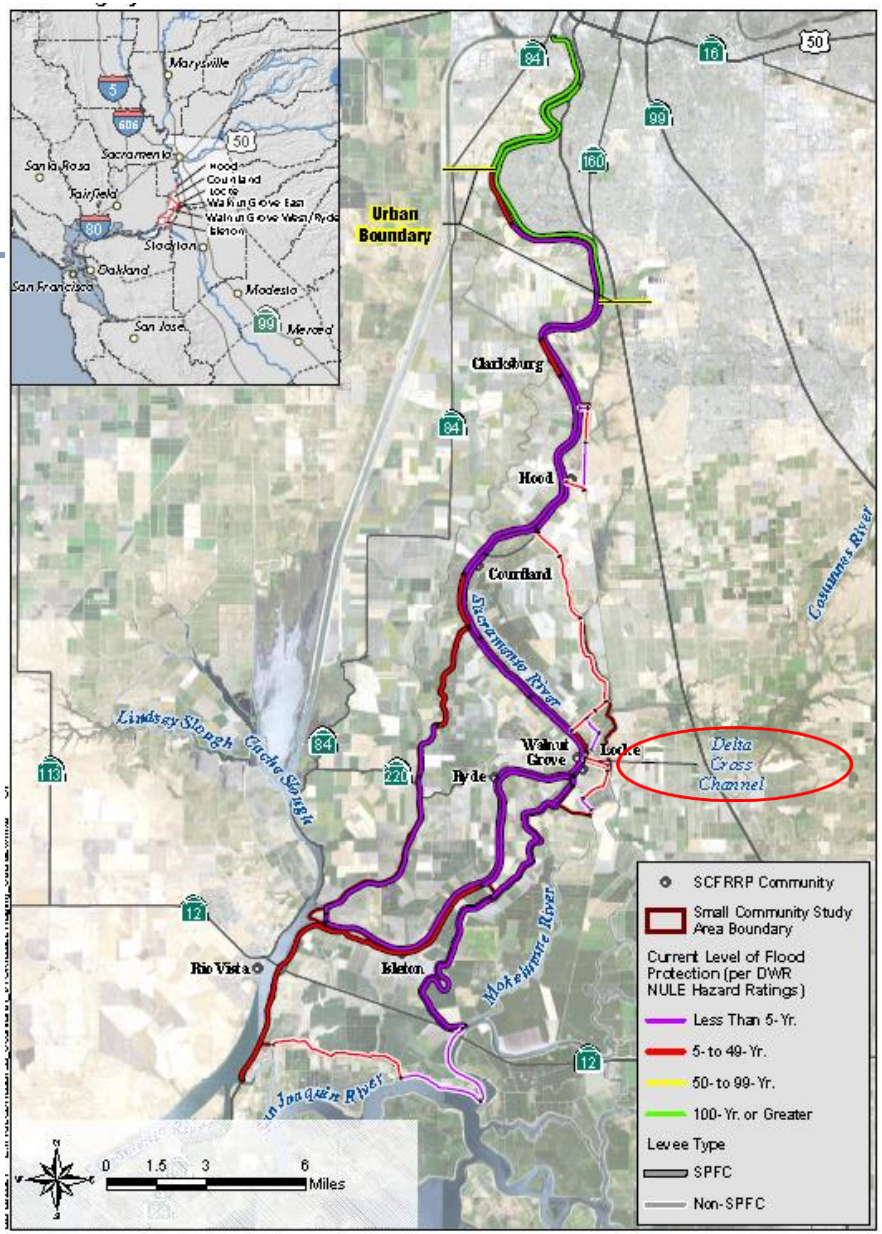
URS



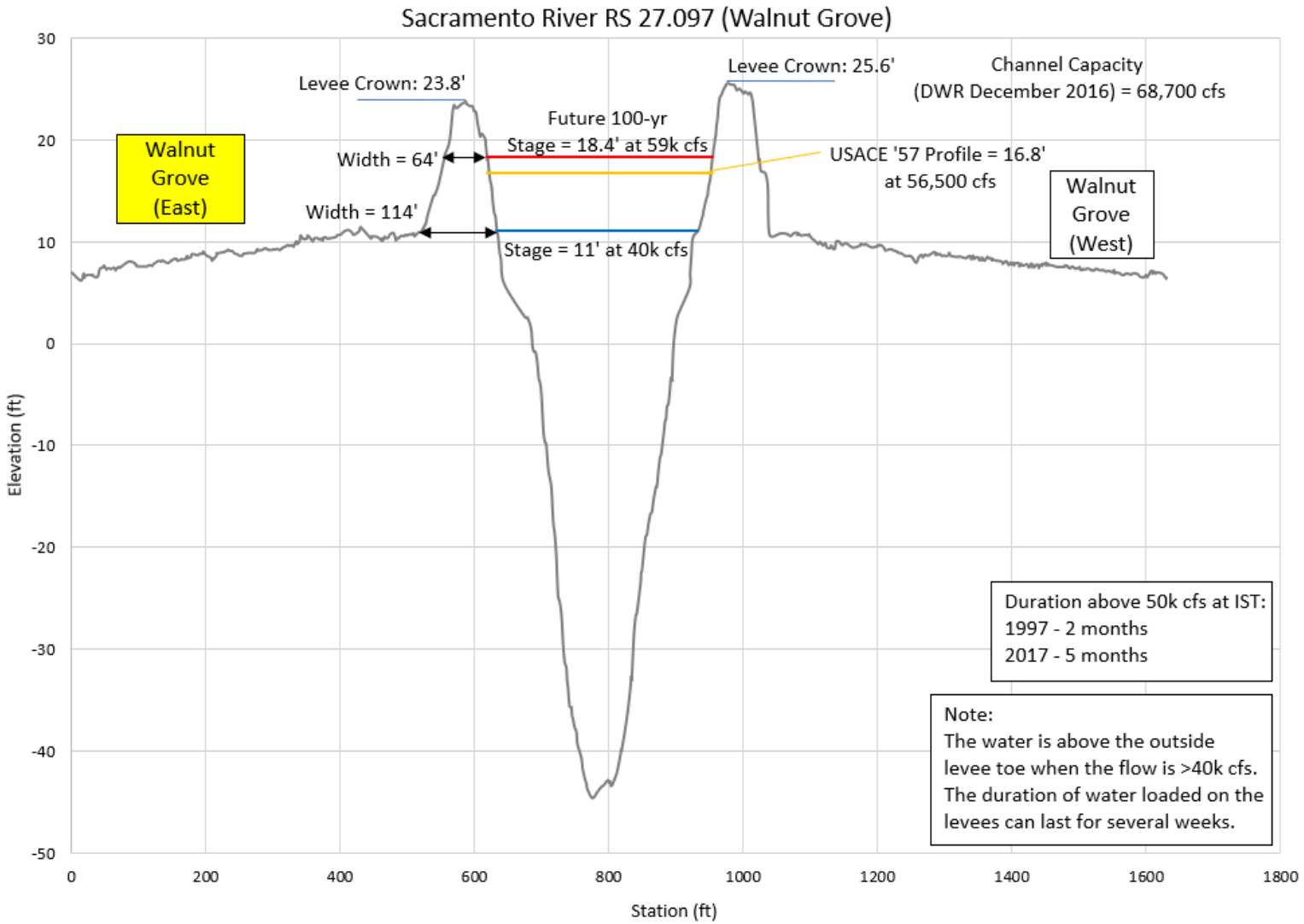
Source: DWR/URS Non-Urban Levee Evaluations (NULE)

Current Low Levels of Flood Protection for North Delta Legacy Communities

per DWR Non-Urban Levee (NULE) Hazard Rating Report Card



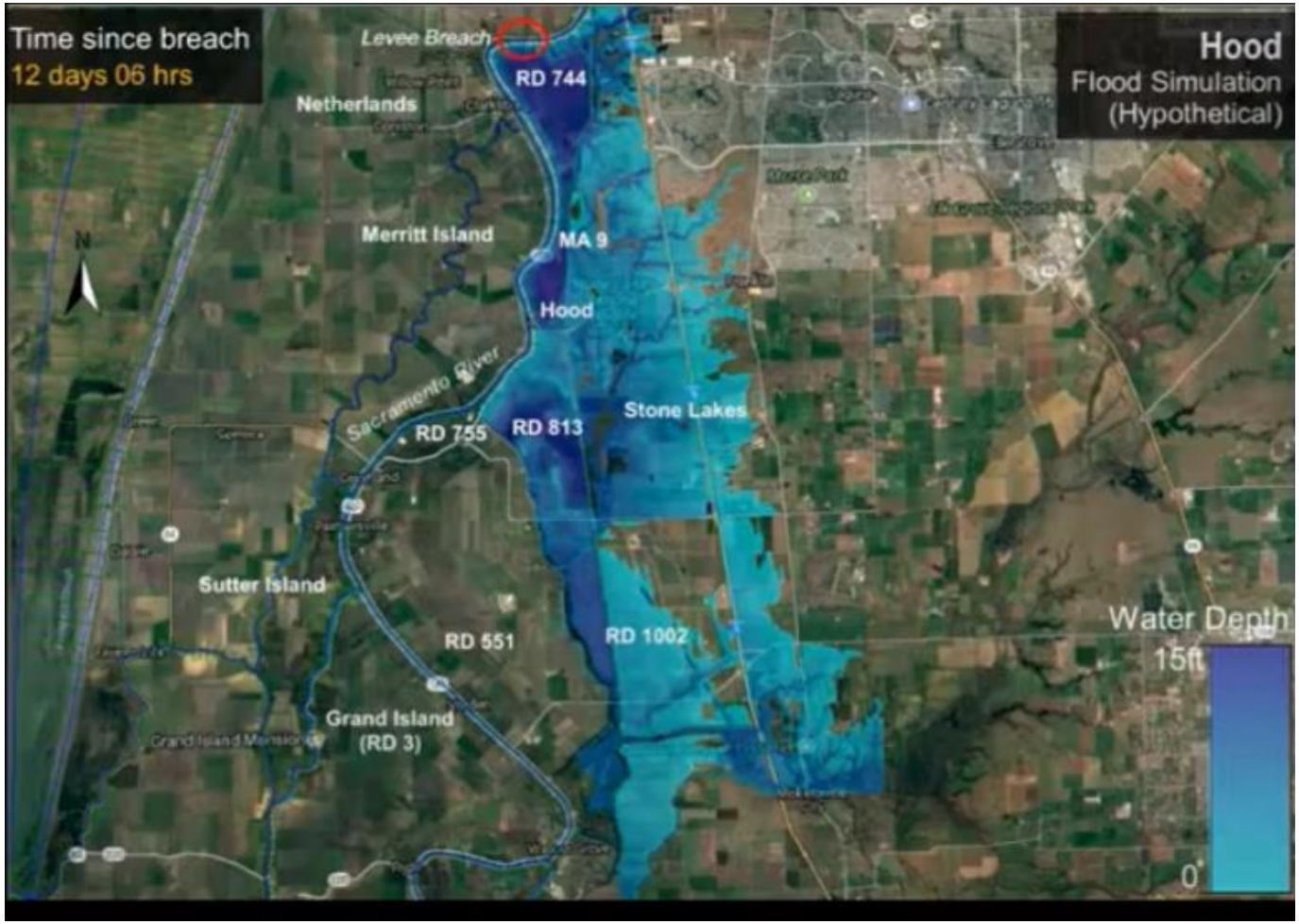
Future 100-Yr. WSEL > USACE 1957 Profile
(Typical for Most Subject Legacy Communities in North Delta)



Key Structural-Based Management Actions (MA's) for Community of Hood

MA 1&3	Repair DWR Flood System Repair Project (FSRP) Critical and Serious Sites: 9 total between Freeport and Hood: MA 1 includes 4 Sites in Hood Study Area; MA 3 includes 5 Sites in RD 744 South of Freeport *Hood Community Council letter of April 2021 to DWR (similar to RD 551/755 letter of February 2021 for Courtland)*
MA 2	Raise and strengthen RD 744 south cross levee 2.2 miles north of Hood
MA 5	New cross levee system north of Hood utilizing community-preferred alignment to secure FEMA accreditation for immediate community of Hood
MA 6	Repair and strengthen-in-place 2.48 miles of SPFC levee system along Sacramento River in Hood Project Study Area
MA 8	Repair and strengthen-in-place 5.83 miles of SPFC levees & former railroad embankments to secure FEMA accreditation for entire perimeter of Hood Study Area
MA 9	Repair and Strengthen-in-place entire 9.0-mile DWR Maintenance Area 9 levee system between Freeport and lands south/downstream of Hood: Multi-objective element to improve SWP/CVP conveyance through Delta

Potential Limits and Depths of Flooding from a Levee Breach on Sacramento River at Scribner Bend near Delta Legacy Community of Hood

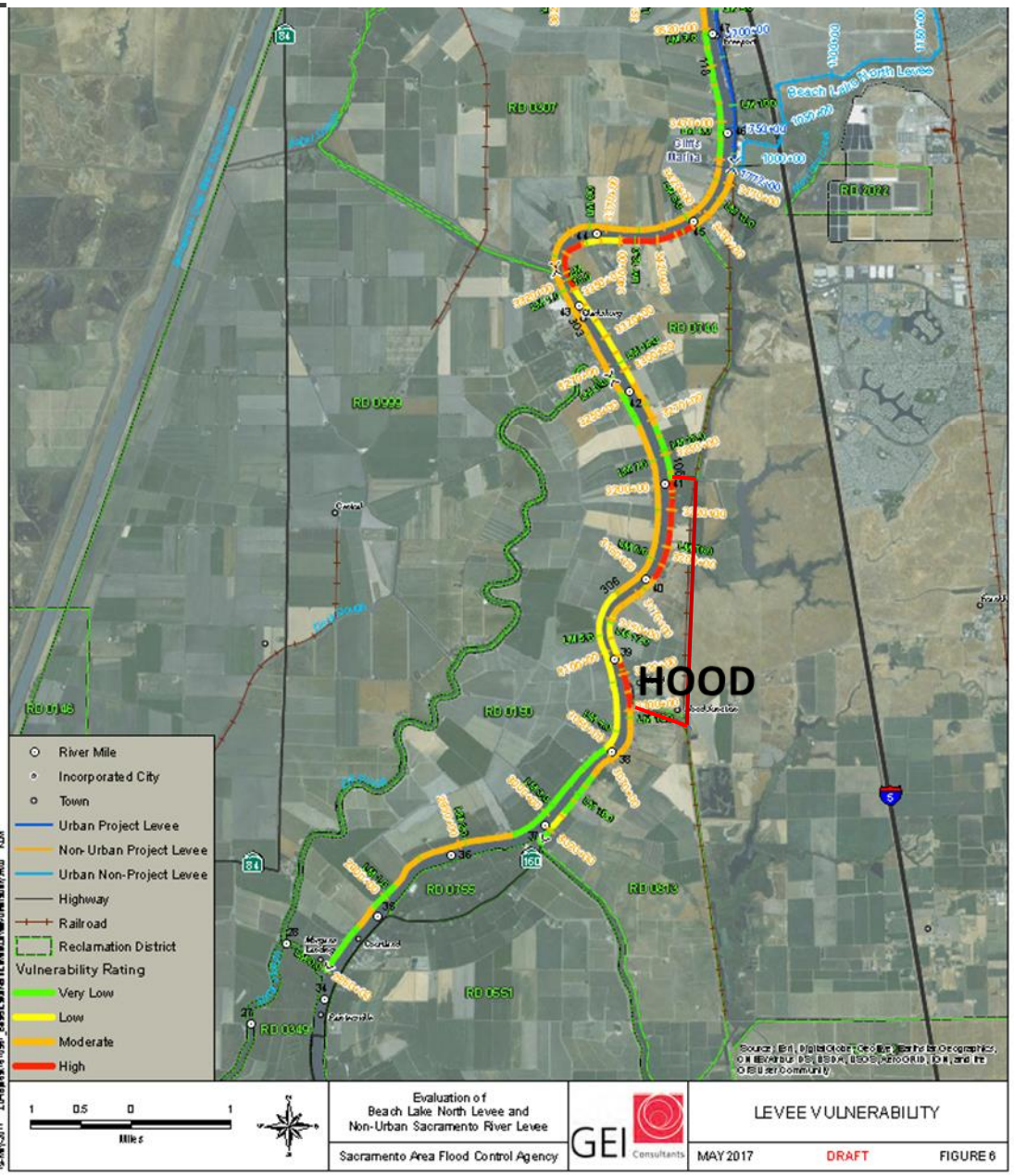


Hood Study Area within State DWR Maintenance Area No. 9:

9.0 miles of High Levee Vulnerability, &

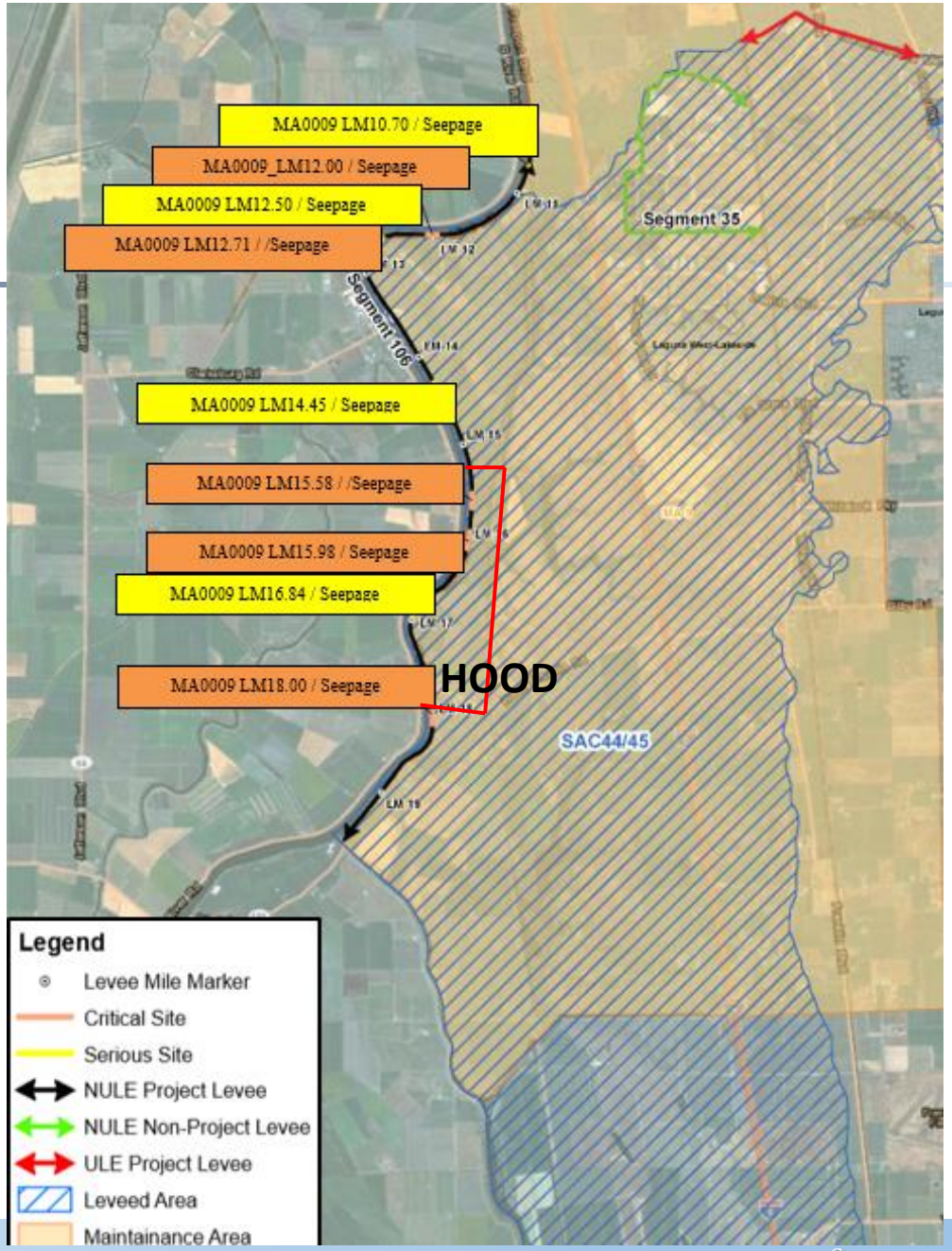
9 DWR Flood System Repair Project (FSRP) Sites:

(4 within Hood Study Area – MA 1; & 5 north of Hood Study Area – MA 3)



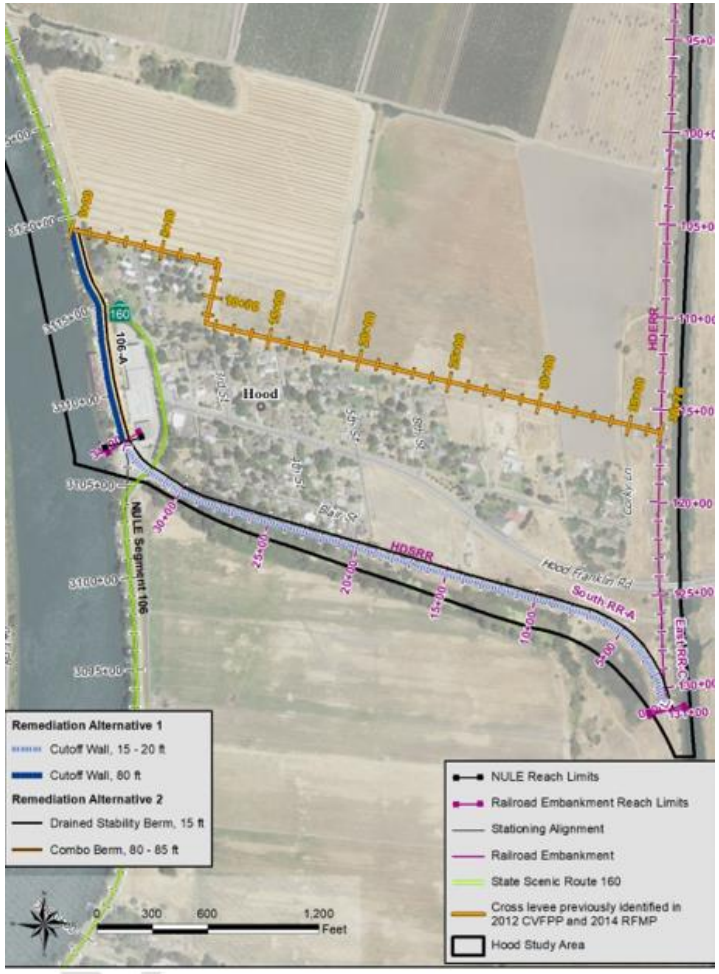
9 DWR Flood System Repair Project (FSRP) Sites in DWR Maintenance Area 9

(4 within Hood Study Area – MA 1;
& 5 north of Hood Study Area in RD 744 – MA 3)

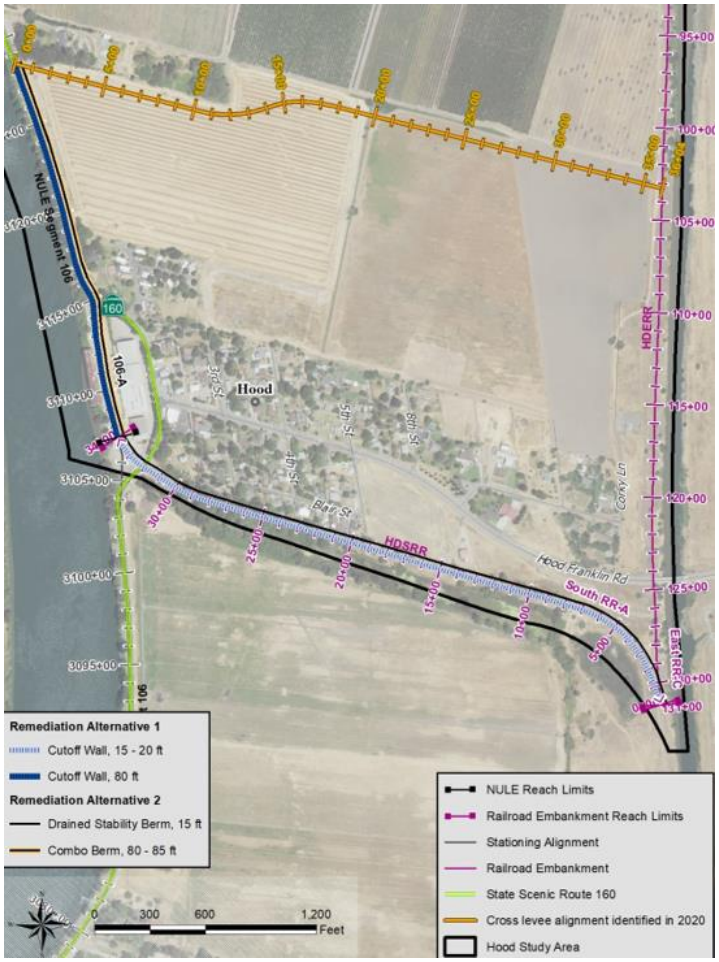


Cross Levees Evaluated for Community of Hood

2012 CVFPP - 2014 RFMP Alignments

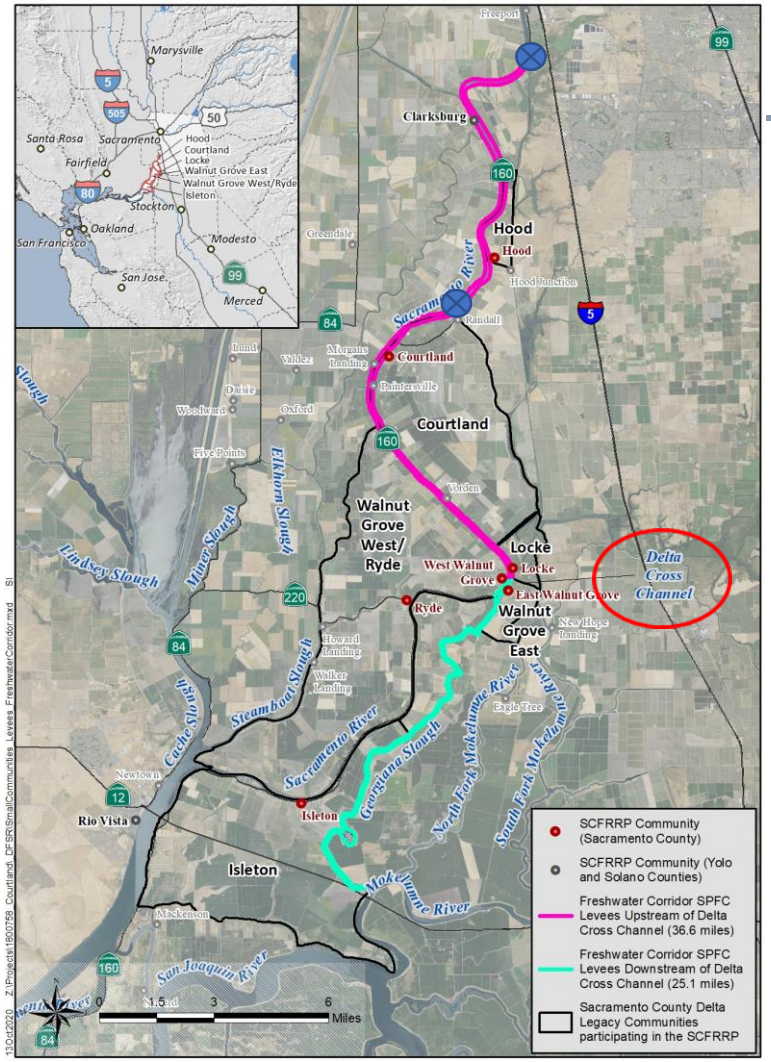


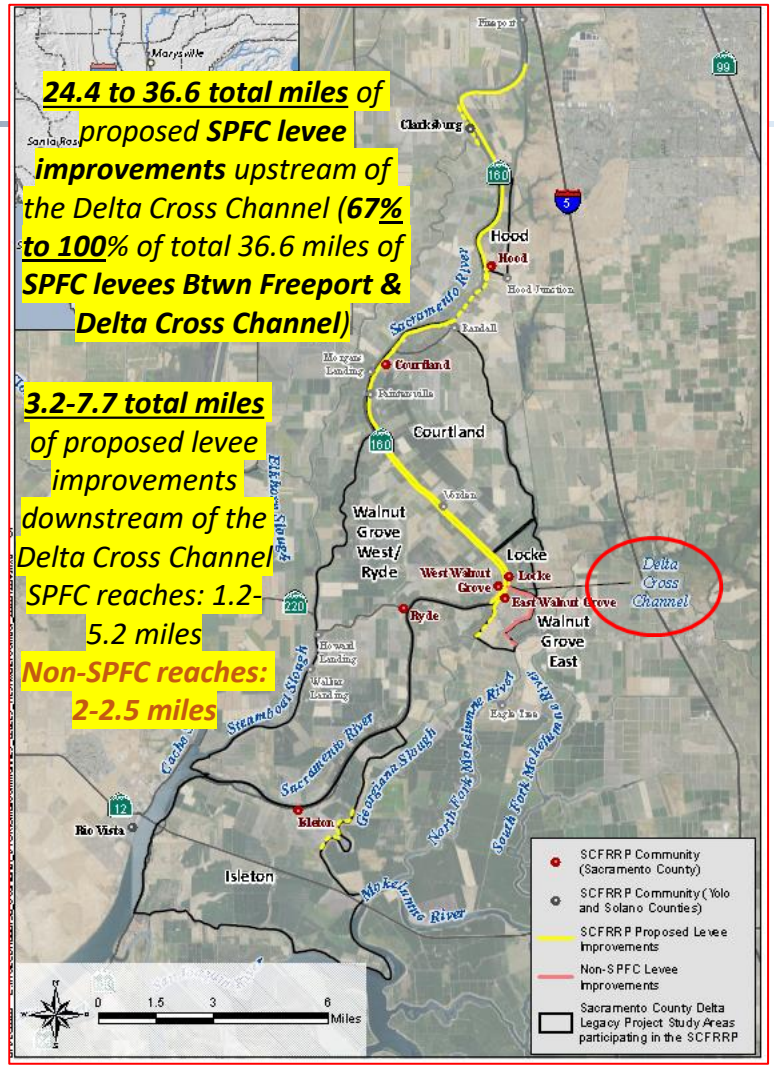
2020 Preferred Alignment by Community of Hood



Hood MA 9: Multi-Benefits Include Improving Levees and Existing Fresh Water Conveyance Corridor: More Cost-Effective Alternative to DCA Intakes and Tunnel Elements North of Delta Cross Channel

Reduces Flood Damages in Expected Annual Damages & Improves Resiliency, Reliability of SWP Conveyance





Key Structural-Based Management Actions (MA's) for Community of Courtland – RDs 551 & 755

MA 1	1A: Repair DWR Flood System Repair Project (FSRP) Critical Site in RD 755 – (Per Letter Request of February 2021 to DWR by RDs 551 & 755) 1B: Repair DWR Flood System Repair Project (FSRP) Serious Site in RD 755; 1C: Repair and strengthen-in-place 0.73-mile segment of SPFC levee @ Courtland
MA 2 & 3	Address known erosion deficiencies/concerns on SPFC levees and non-SPFC levees
MA 4	New All-Weather Flood Fight Road around community of Courtland
MA 5	New Ring Levee System to secure FEMA accreditation for immediate community of Courtland (not preferred by Community and RD 551)
MA 6	Repair and Strengthen-in-place entire 8.52-mile SPFC levee system in study area of RDs 551 and 755: Multi-objective element to improve SWP/CVP conveyance through Delta
MA 8	Repair and strengthen-in-place 15.9 miles to Secure FEMA accreditation for entire Courtland Study Area (RDs 551 & 755)

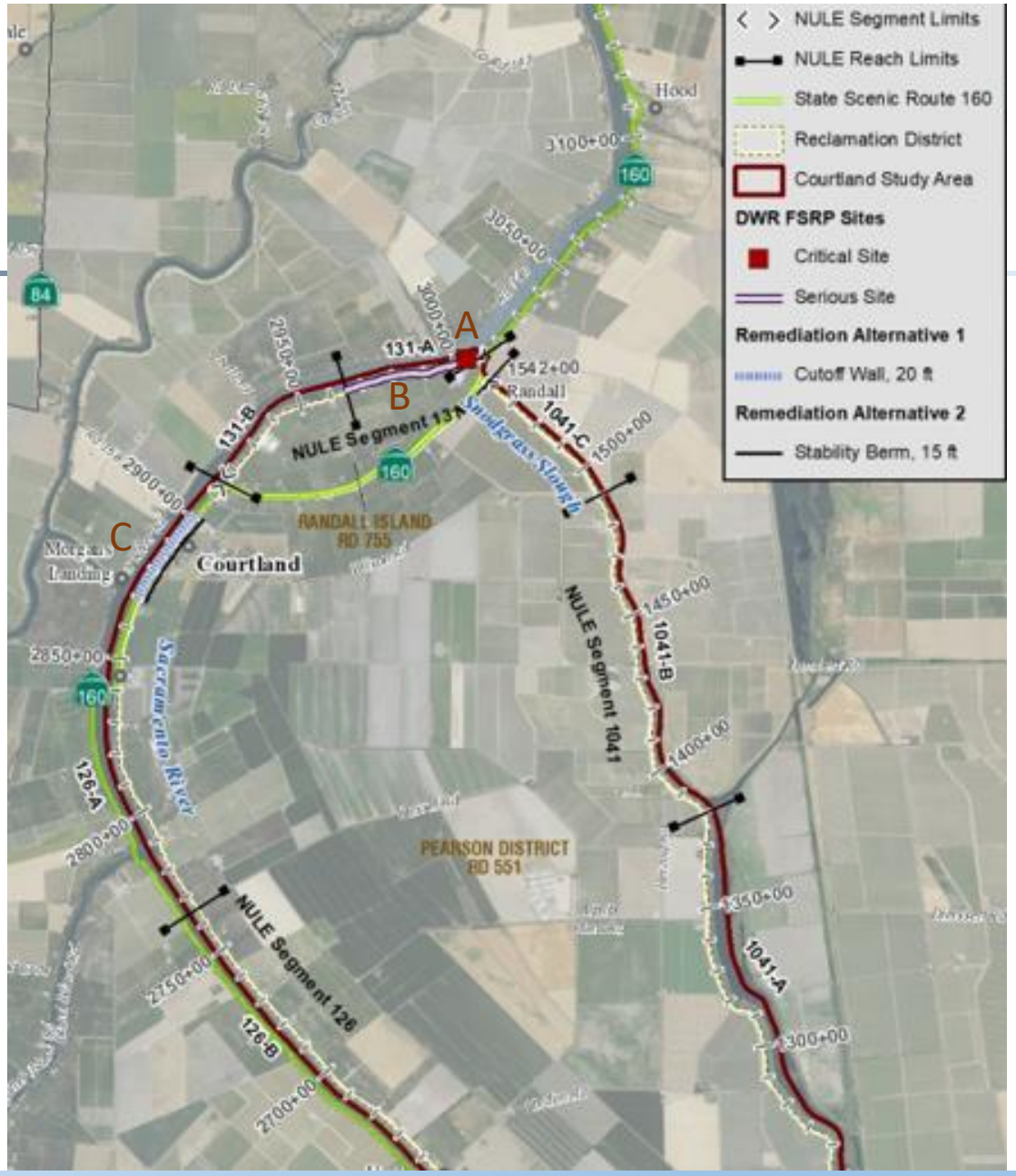
Community of Courtland

Primary Management Action 1:

A: DWR FSRP Critical Site

B: DWR FSRP Serious Site

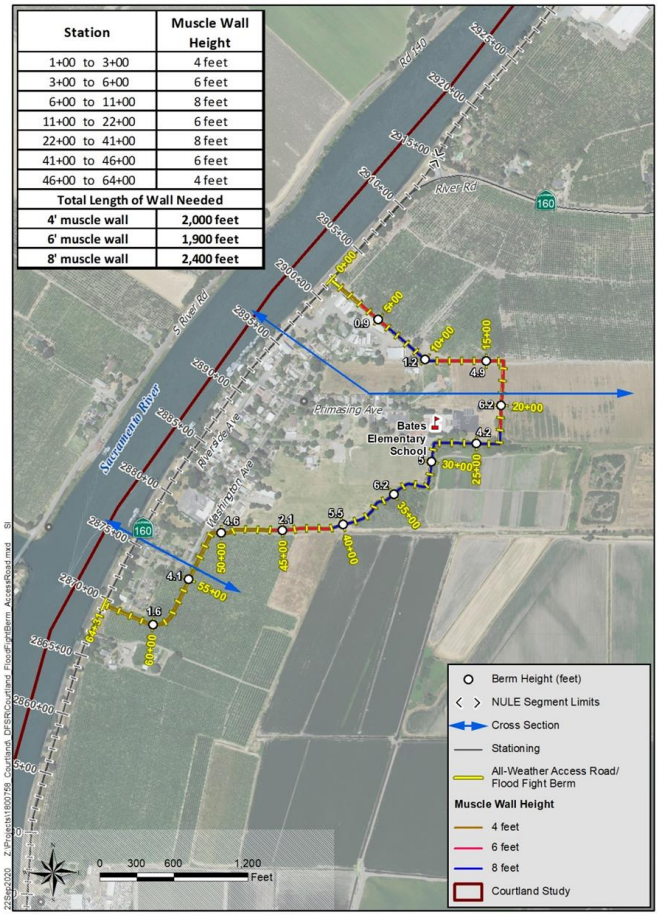
C: Levee @ Courtland



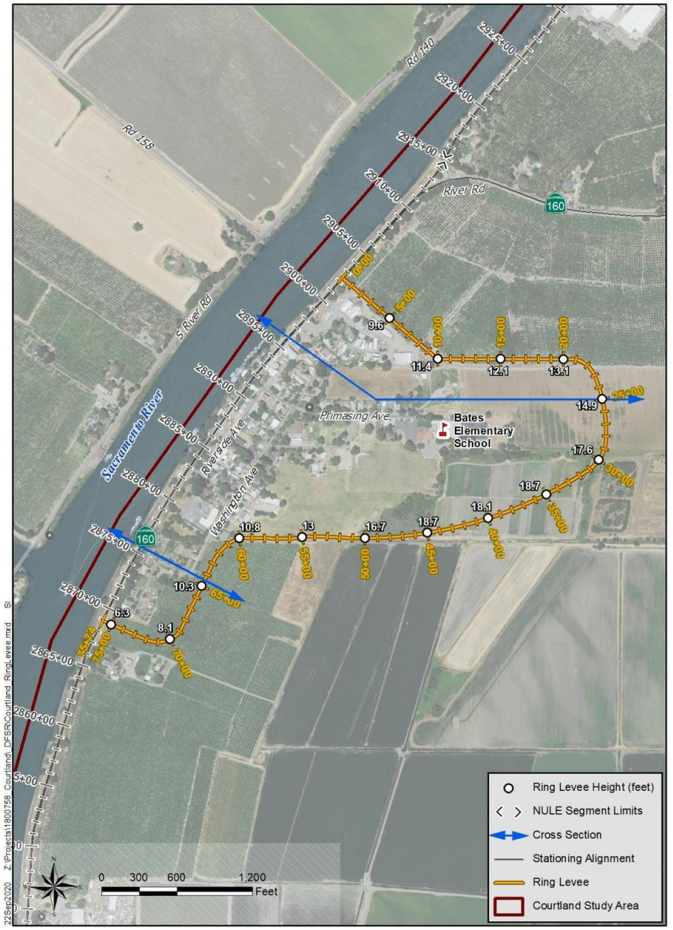
Flood Fight Berm & Ring Levee Evaluations for Community of Courtland

All-Weather Flood Fight Berm/Road
Community Support Required beyond RD 551

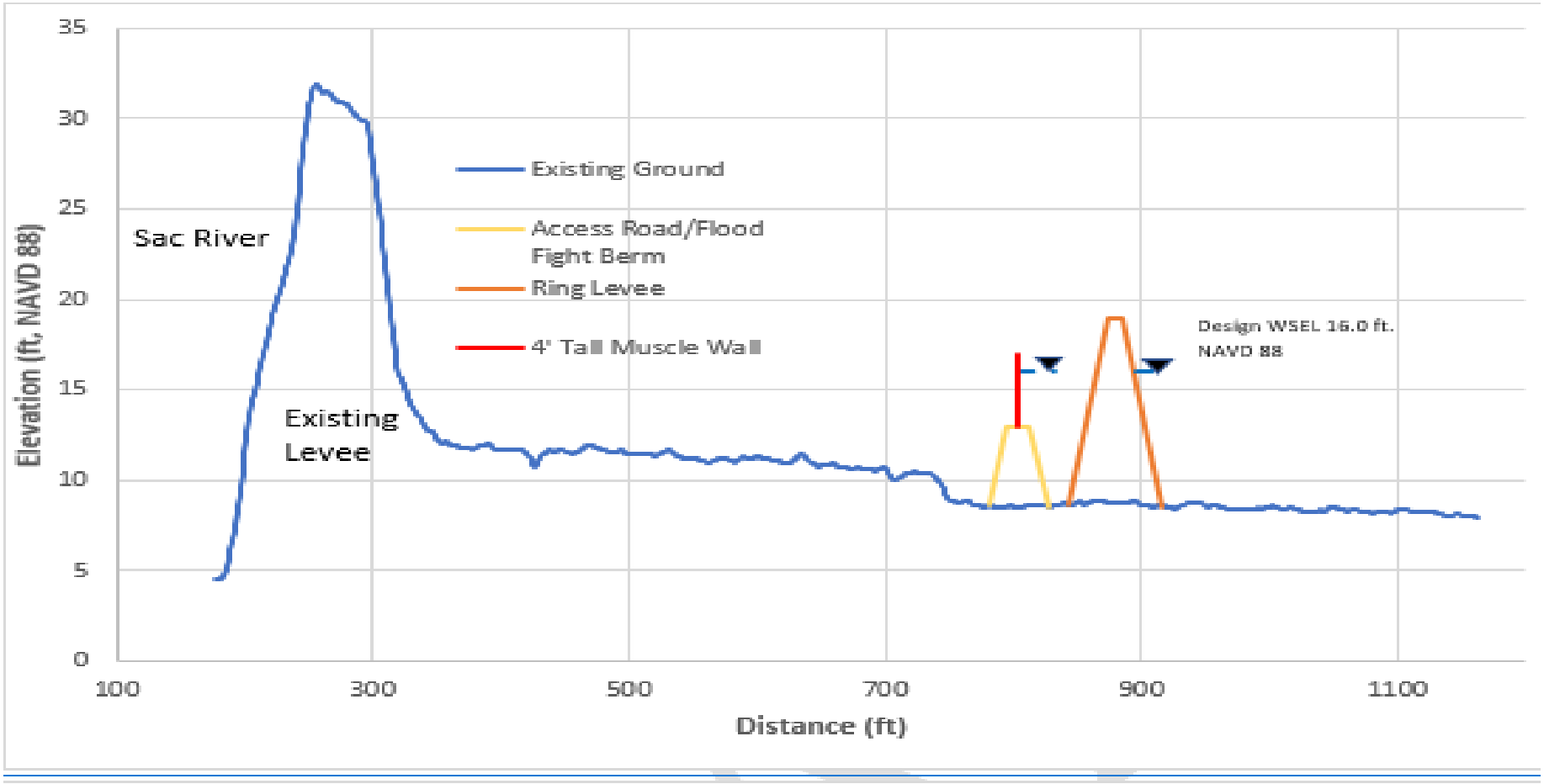
Station	Muscle Wall Height
1+00 to 3+00	4 feet
3+00 to 6+00	6 feet
6+00 to 11+00	8 feet
11+00 to 22+00	6 feet
22+00 to 41+00	8 feet
41+00 to 46+00	6 feet
46+00 to 64+00	4 feet
Total Length of Wall Needed	
4' muscle wall	2,000 feet
6' muscle wall	1,900 feet
8' muscle wall	2,400 feet



Ring Levee
(Not preferred by Community)



Cross Sections of Flood Fight Berm or Ring Levee for Community of Courtland

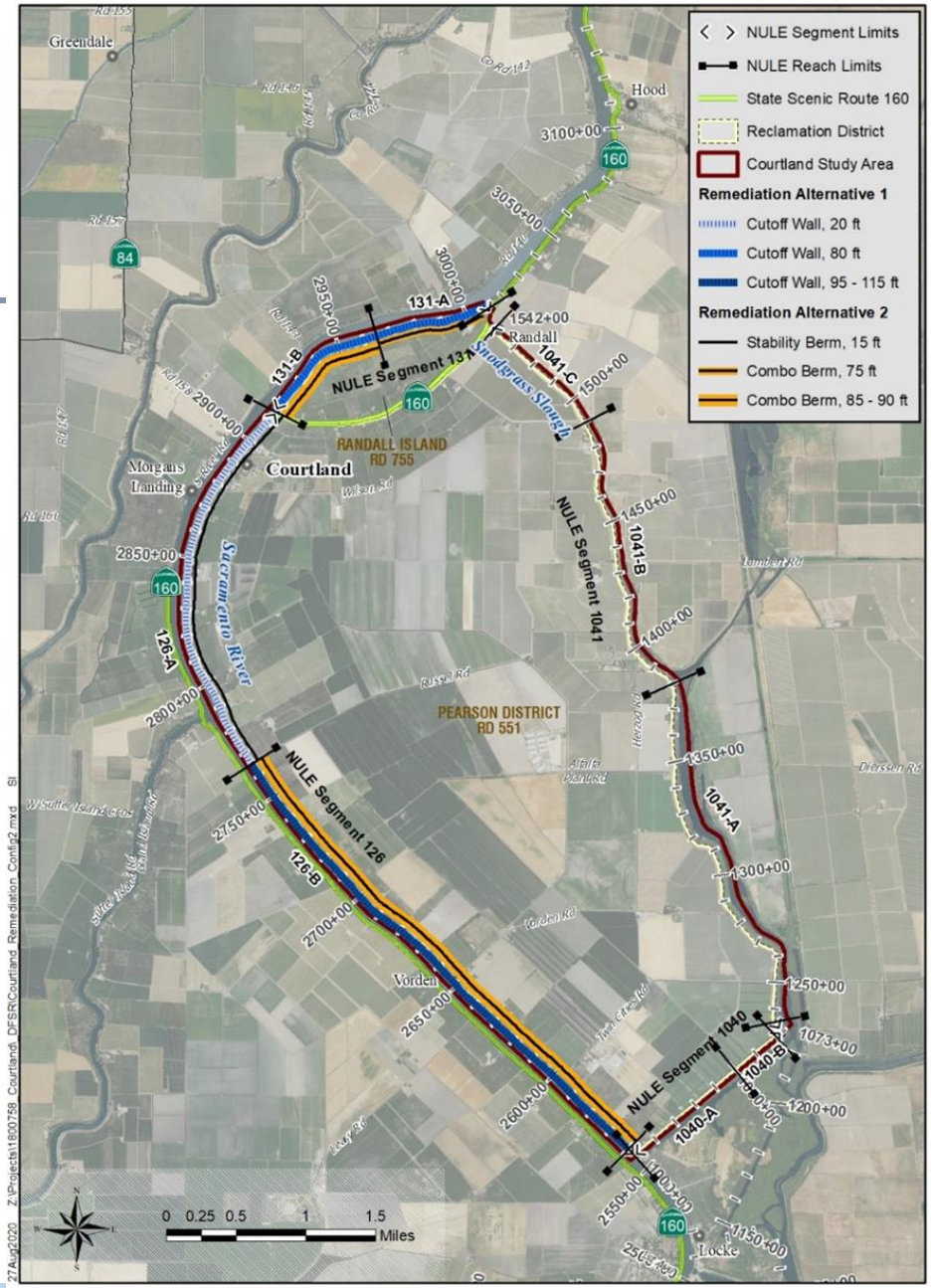


Community of Courtland

Management Action 6:

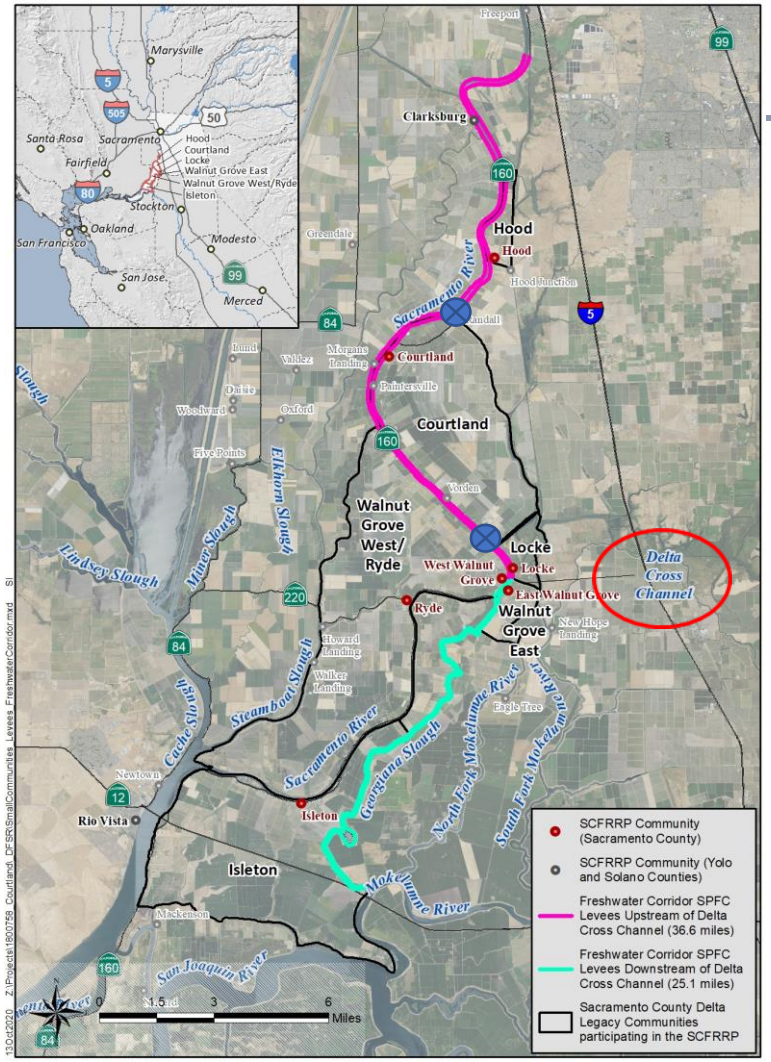
Repair and Strengthen-in-Place entire 8.52-mile SPFC levee system in Courtland Study Area:

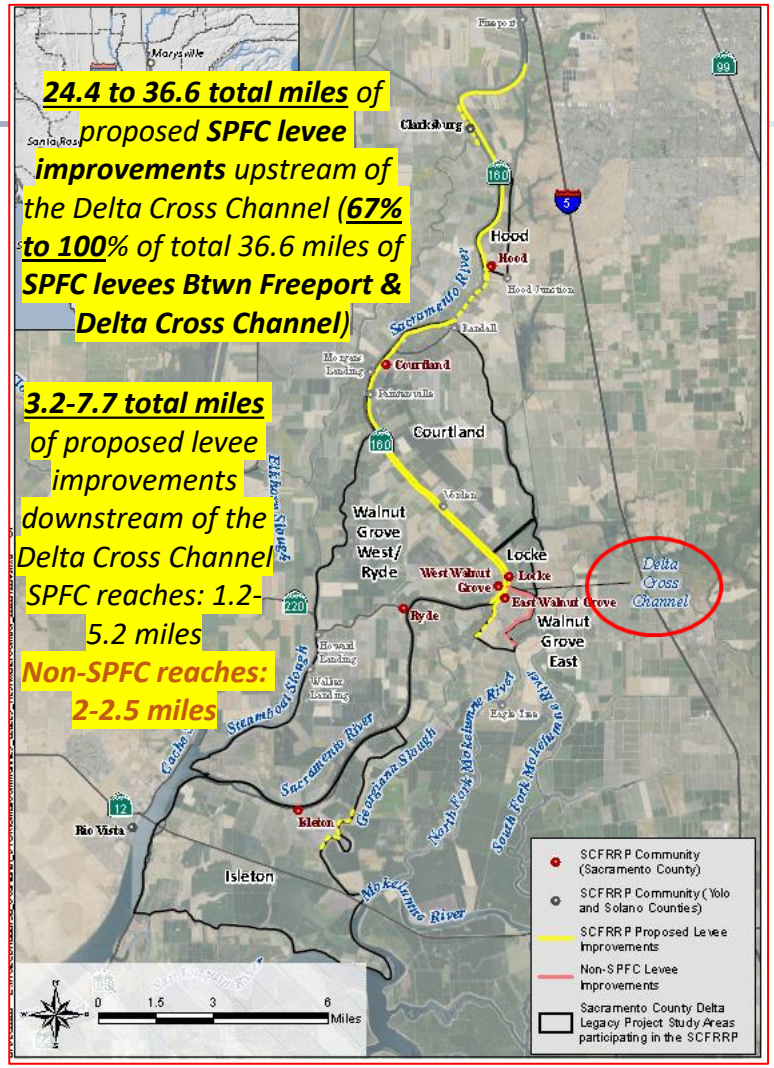
Multi-objective element to improve reliability and resiliency of SWP/CVP conveyance through Delta



Courtland MA 6: Multi-Benefits Include Improving Levees and Existing Fresh Water Conveyance Corridor: More Cost-Effective Alternative to DCA Intakes and Tunnel Elements North of Delta Cross Channel

Reduces Flood Damages in Expected Annual Damages & Improves Resiliency, Reliability of SWP Conveyance





Key Structural-Based Management Actions (MA's) for Communities of West Walnut Grove & Ryde – Grand Island - RD 3

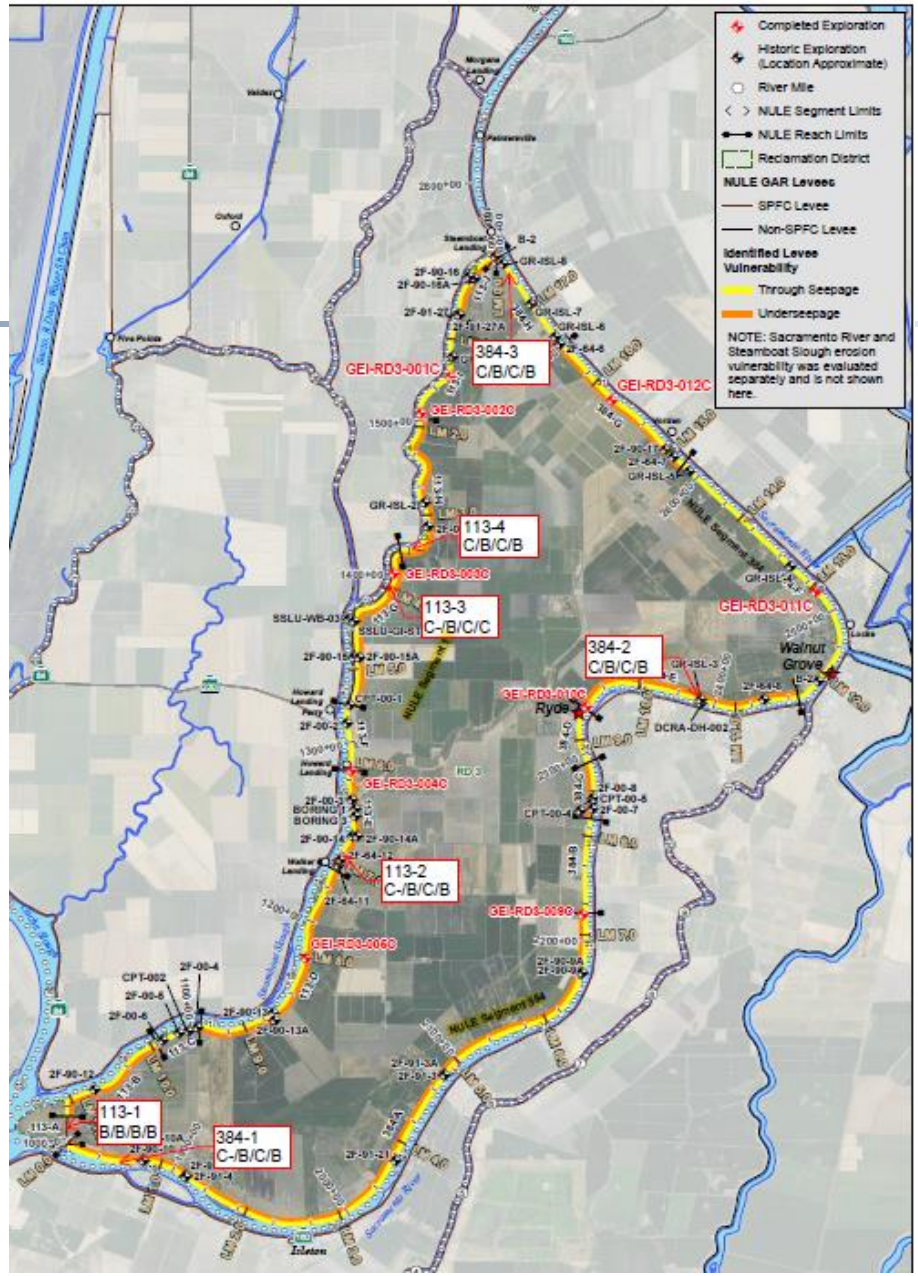
MA 1	1A: Repair DWR Flood System Repair Project (FSRP) Critical Site in RD 3; 1B: Address known erosion deficiencies/concerns on SPFC levees
MA 2	Repair and Strengthen: (a) 1.38-miles of SPFC levee fronting the community of West Walnut Grove/Clampett Tract; and (b) 0.47-miles of SPFC levee fronting the community of Ryde
MA 3	New Flood Fight Road around community of West Walnut Grove/Clampett Tract
MA 5	New Ring Levee System to secure FEMA accreditation for immediate community of West Walnut Grove/Clampett Tract (not preferred by RD 3 and community)
MA 6	Repair and Strengthen-in-Place 5.93-mile SPFC levee system on Grand Island - RD 3 between Snodgrass and Georgiana Sloughs: Multi-objective project to improve reliability and resiliency of SWP/CVP conveyance through Delta
MA 8	Repair and strengthen-in-place 14.15 miles of SPFC levees on north half of Grand Island and improve State Hwy 220 as new cross levee to secure FEMA accreditation for north half of Grand Island - West Walnut Grove/Clampett Tract

DWR's Geotechnical Hazard Ratings for Grand Island Levees, Updated 2020

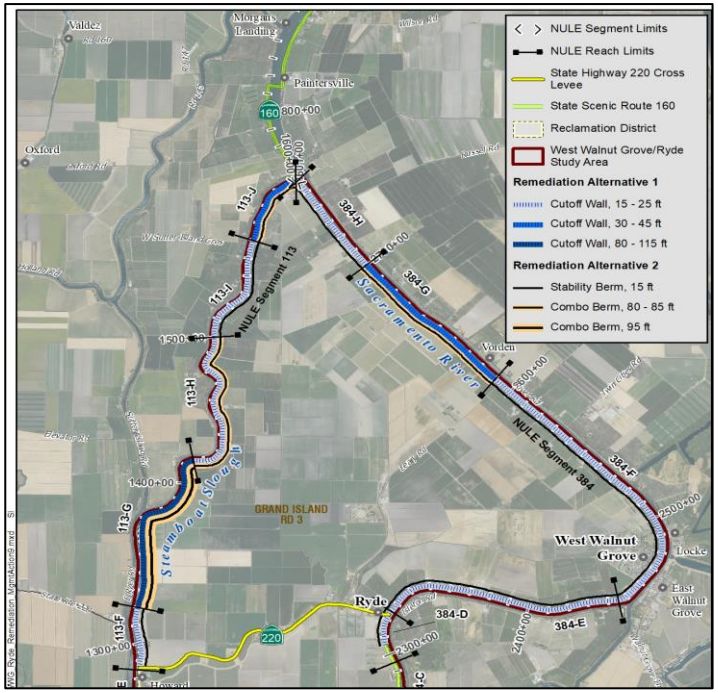
Segments 113-1 thru 113-4
Steamboat Slough D/S to U/S
113-3 most critical @ C-/B/C/C

Segments 384-1 thru 384-3
Sacramento River D/S to U/S
384-1 most critical @ C-/B/C/B

US/ST/TS/E
US = Under Seepage
ST = Stability
TS = Through Seepage
E = Erosion

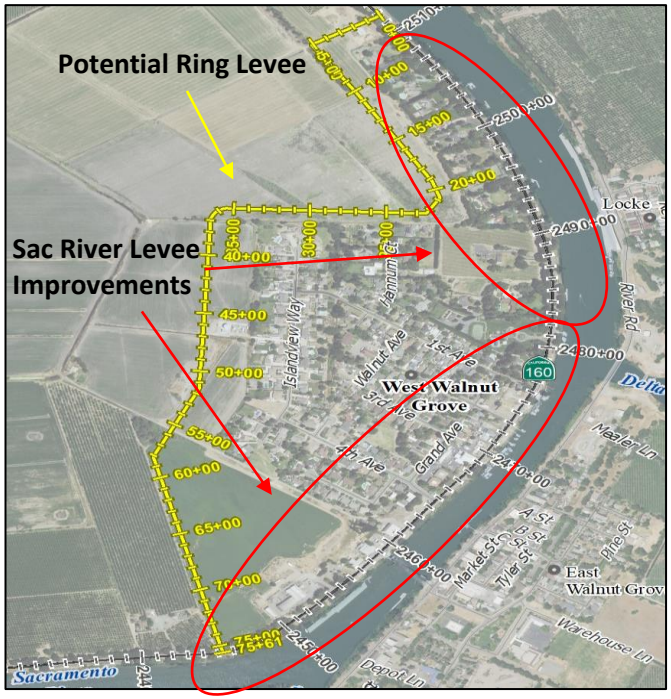


West Walnut Grove: Perimeter Levee System North of Highway 220 and Clampett Tract Ring Levee



MA 9: FEMA Certification of Levees North of Highway 220 Paired with a Highway 220 Cross Levee

Estimated Cost for FEMA Certification of Perimeter Levee System North of Highway 220:
$200M - $387M ($11.8 - $22.9M/mile)

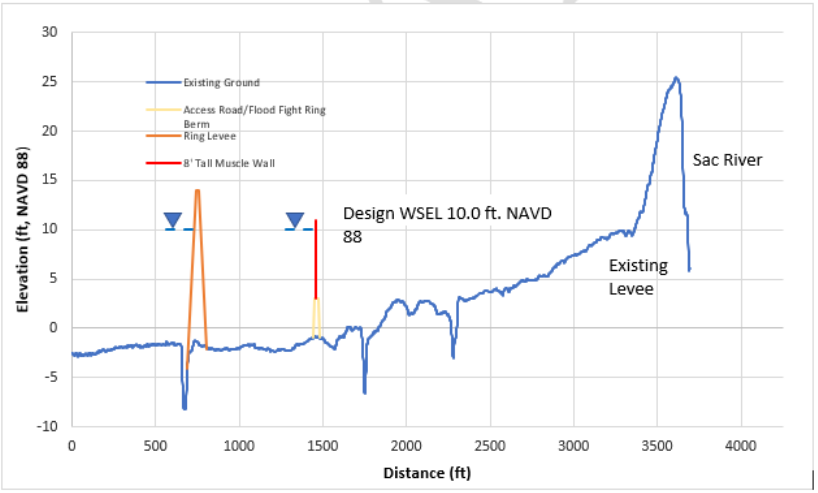


MA 4: FEMA Certification of West Walnut Grove Ring Levee and Sacramento River Levee Improvements

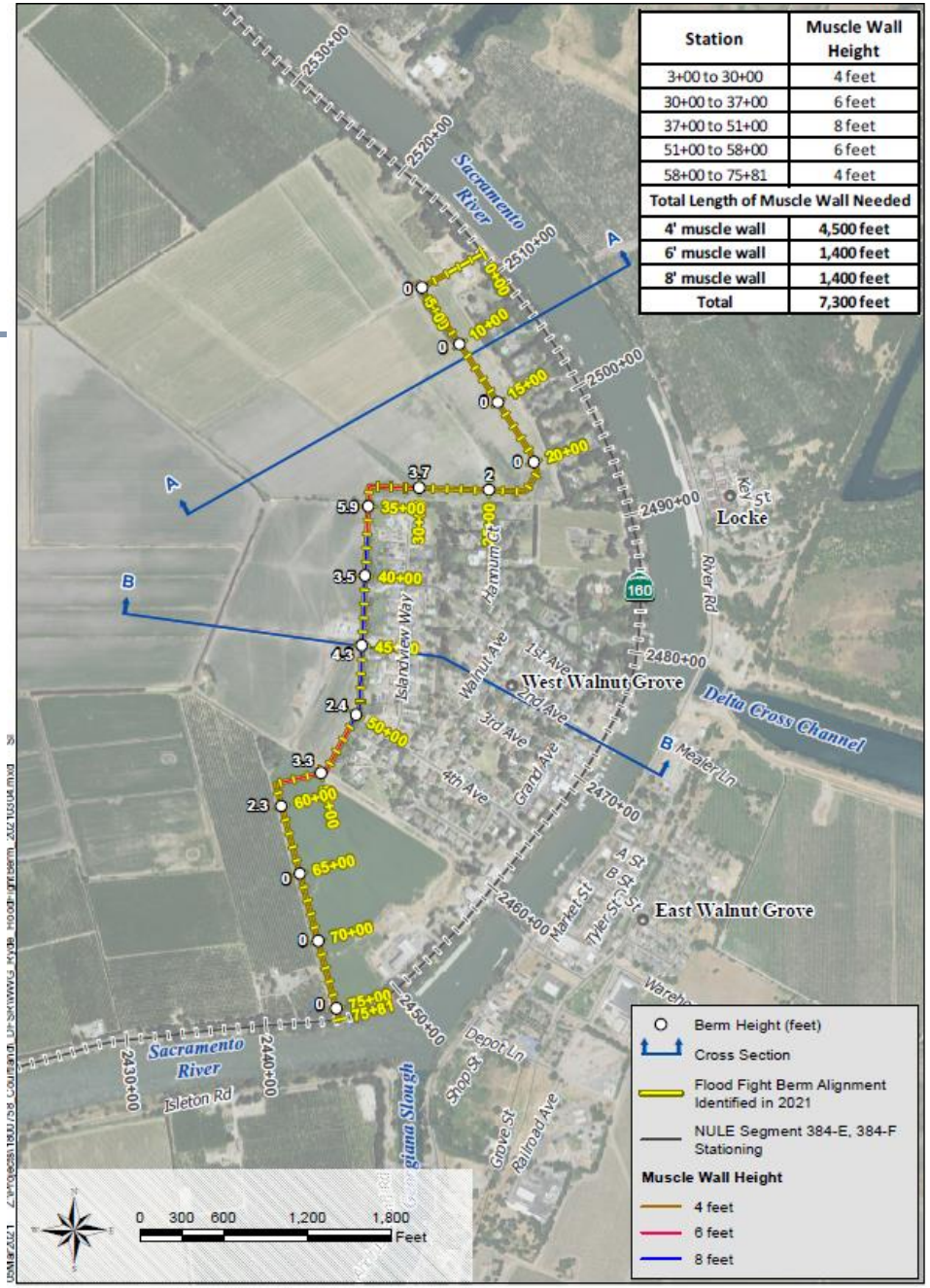
Estimated Cost for FEMA Certification of Ring Levee System: **$23M - $38M ($8.2M -$13.5M/mile)**

West Walnut Grove - Clampett Tract Flood Fight Berm

Modified Alignment 2021 (MA 3)



Station	Muscle Wall Height
3+00 to 30+00	4 feet
30+00 to 37+00	6 feet
37+00 to 51+00	8 feet
51+00 to 58+00	6 feet
58+00 to 75+81	4 feet
Total Length of Muscle Wall Needed	
4' muscle wall	4,500 feet
6' muscle wall	1,400 feet
8' muscle wall	1,400 feet
Total	7,300 feet



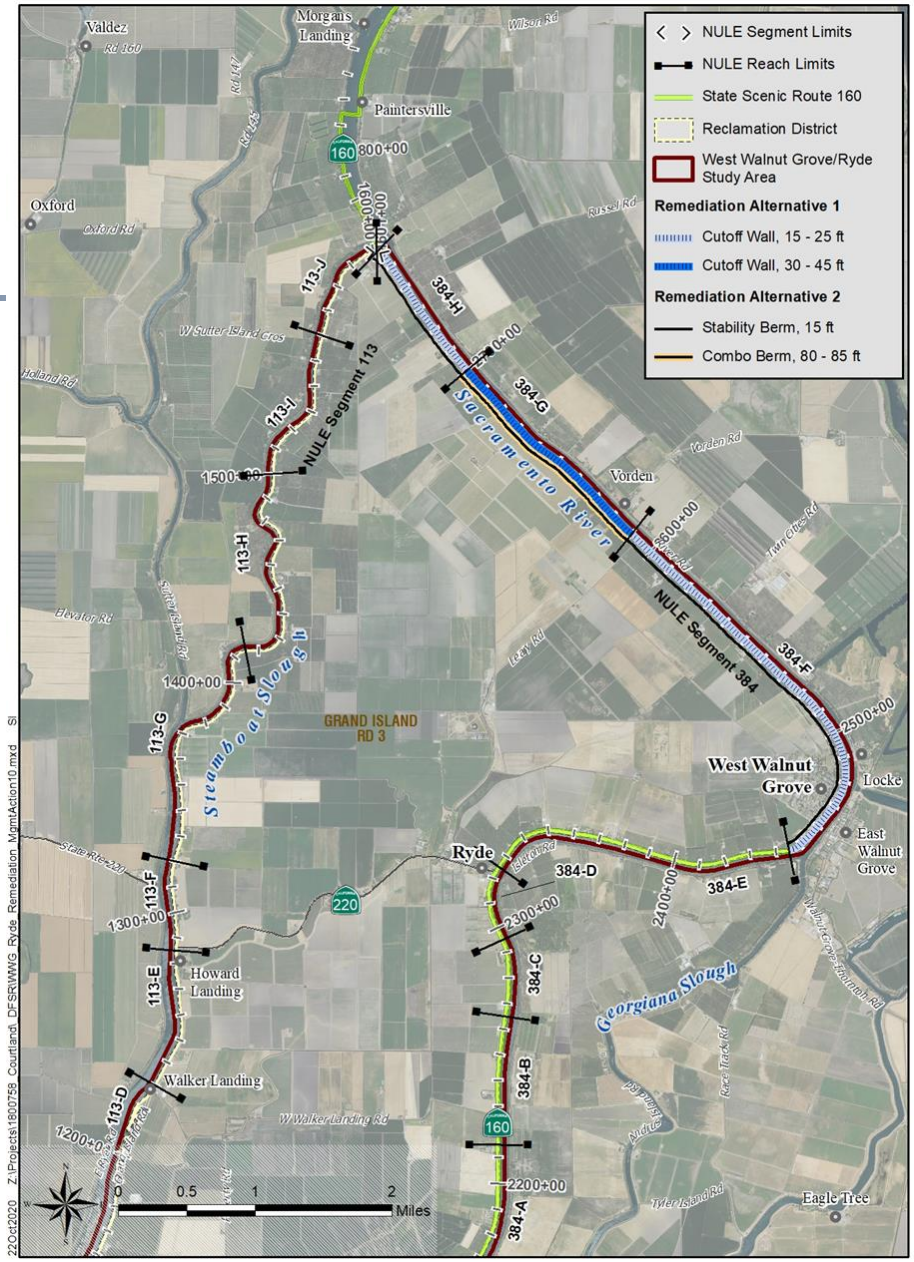
Estimated Cost for Flood Fight Berm for West Walnut Grove/Clampett Tract ($5.38M)

Communities of West Walnut Grove and Ryde

Management Action 6:

Repair and Strengthen-in-place 5.93-mile SPFC levee system on Grand Island between Snodgrass and Georgiana Sloughs:

Multi-objective element to improve reliability and resiliency of SWP/CVP conveyance through Delta



MA 6: Multi-Benefits Include Improving Levees and Existing Fresh Water Conveyance Corridor: More Cost-effective Alternative to DCA Intakes and Tunnel Elements North of Delta Cross Channel

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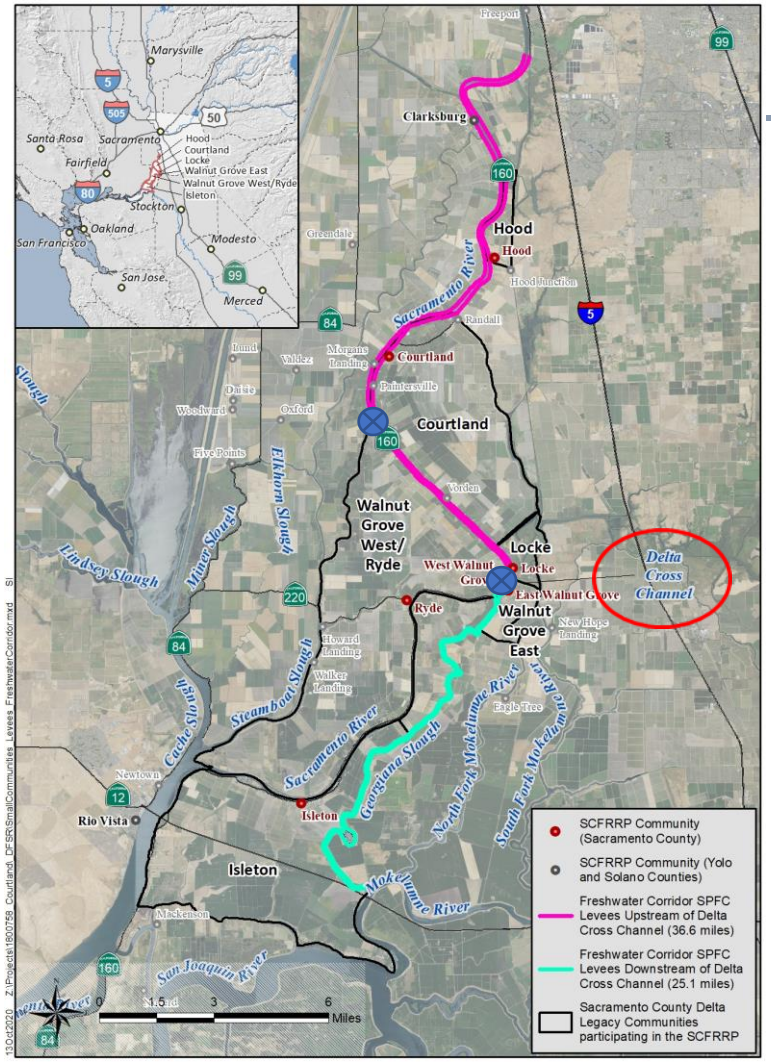
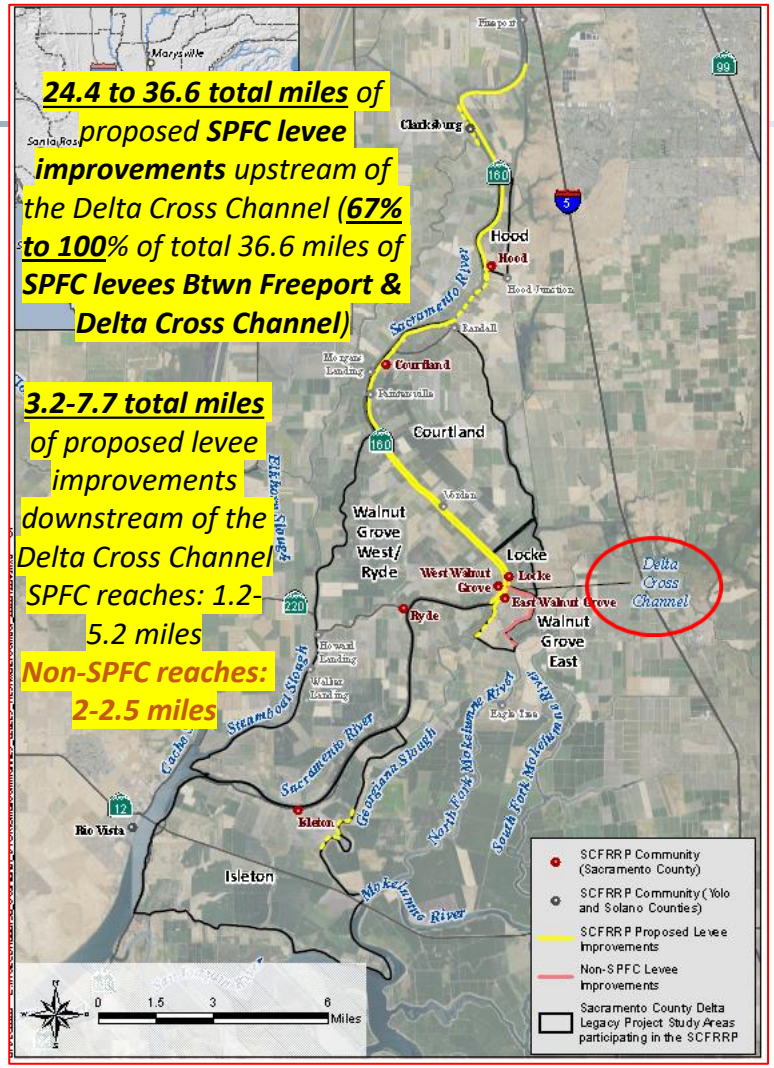




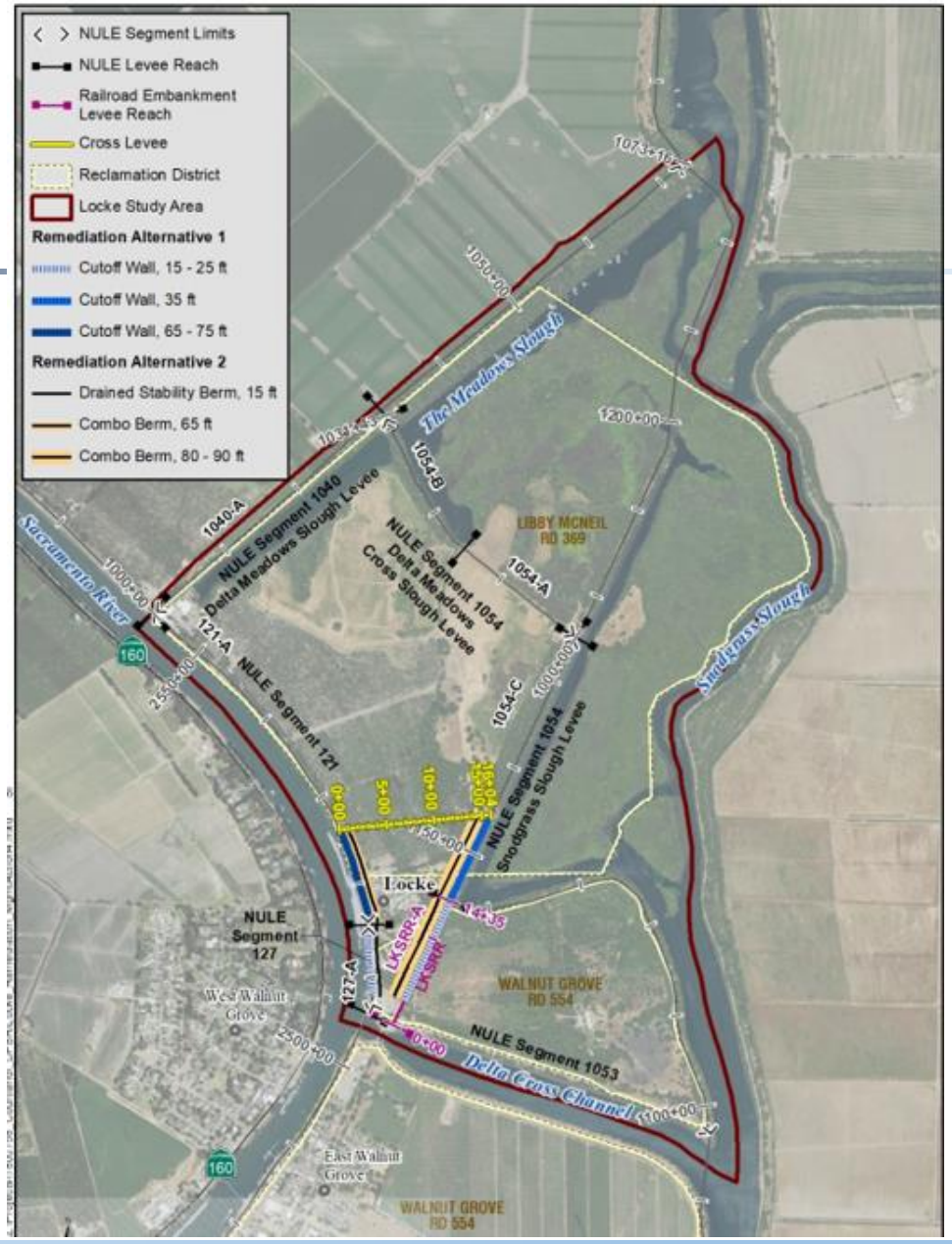
Key Structural-Based Management Actions (MA's) for Community of Locke – RD 369

MA 1,2,4	Repair and strengthen-in-place 2.07 miles of non-SPFC levee segments north, east, and south of Locke within RD 369, and short segments within RDs 551 & 554
MA 3	Repair and strengthen-in-place 0.95-mile-long segment of SPFC levee along Sacramento River west of Locke: Multi-objective element to improve reliability and resiliency of SWP/CVP conveyance through Delta
MA 5	Potential new cross levee system just north of Locke to secure FEMA accreditation for community of Locke; 0.30-mile-long cross levee with 0.65-mile portions of levee improvements south of Locke cross levee
MA 6	Repair and strengthen-in-place 3.02 miles of perimeter levees of Locke (MAs 1-4) to secure FEMA accreditation for entire Locke Study Area
MA 8	MA 3 and MA 5 Combined: Secure FEMA accreditation for community of Locke with a potential 0.30-mile cross levee and levee improvements south of the cross levee; and repair/strengthen-in-place 0.95-mile-long segment of levee along Sacramento River west of Locke - Multi-objective element to improve reliability and resiliency of SWP/CVP conveyance through Delta

Community of Locke Management Action 5 (least preferred by community):

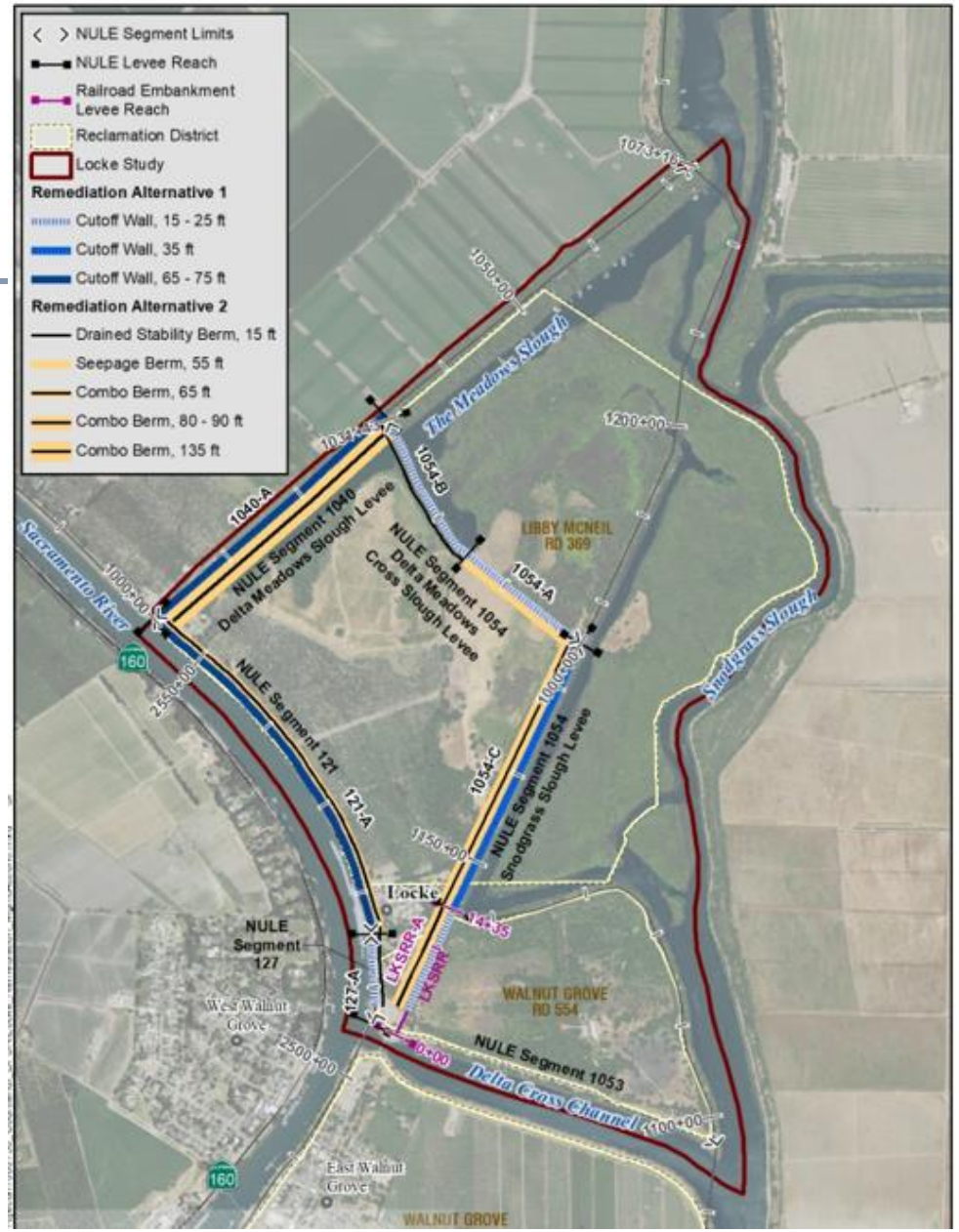
New 0.30-mile cross levee system just north of Locke to secure FEMA Accreditation for Locke

(including 0.65-miles of levee improvements south of Locke)



Community of Locke Primary Preferred Management Action 6:

Repair and strengthen-in-place 3.02 miles of perimeter levees of Locke (MAs 1-4) to Secure FEMA accreditation for entire levee system(s) protecting community of Locke



Key Structural-Based Management Actions (MA's) for Community of East Walnut Grove (portions of RDs 554 and 563)

RD 554 - East Walnut Grove

MA 1 Repair and Strengthen-in-place entire 0.88-mile reach of SPFC levee in RD 554 south of the Delta Cross Channel (DCC) along Sacramento River and Georgiana Slough to current FEMA standards

MA 2-4 Repair and Strengthen-in-place entire 2.66-mile non SPFC levee system in RD 554 south of the DCC to current FEMA standards, including dry-cross levee adjoining RD 563; These MAs also serve as multi-objective component to improve reliability and resiliency of SWP/CVP conveyance through the Delta

MA 5 Secure FEMA accreditation for RD 554 south of Delta Cross Channel

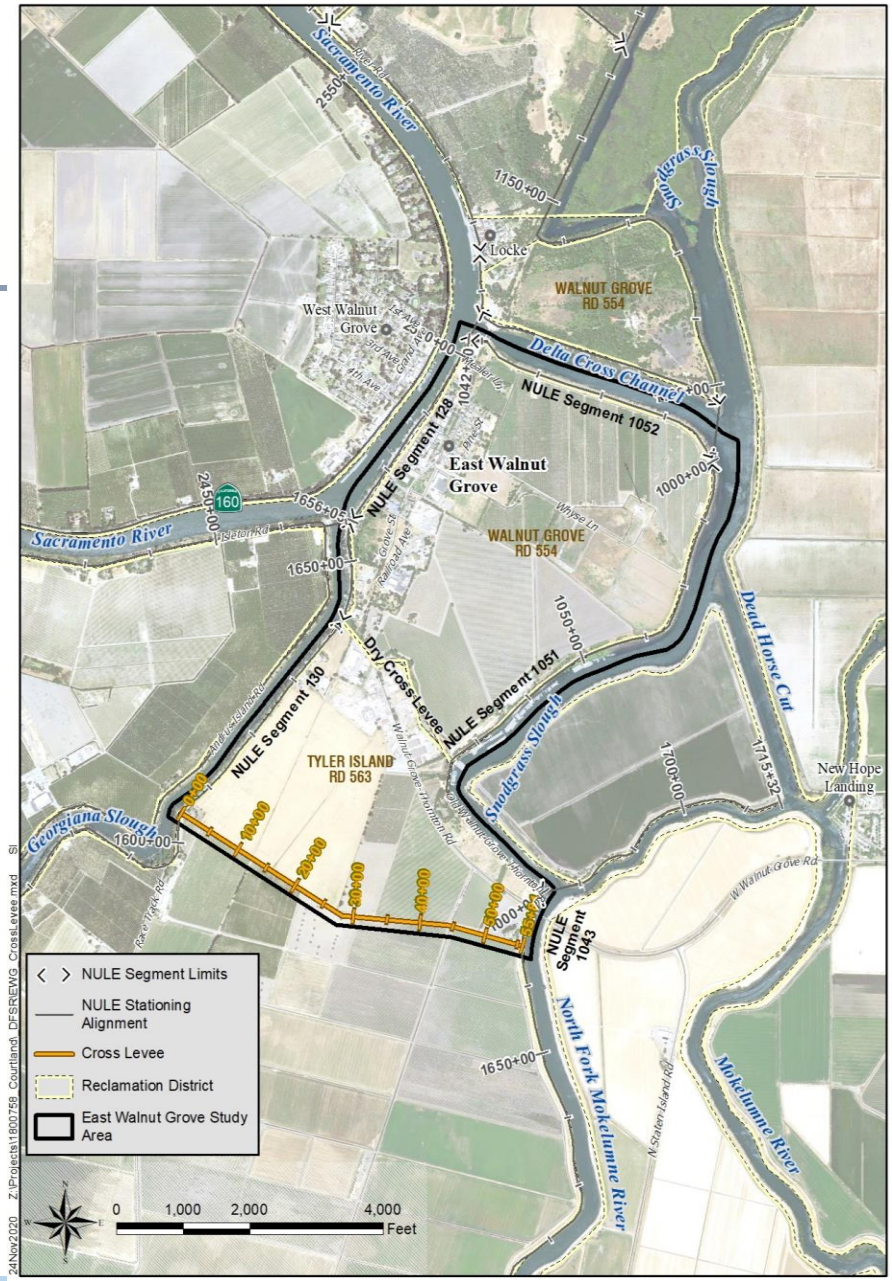
RD 563 - Tyler Island

MA 6 5A: New all-weather flood fight berm and widened shoulder of Walnut Grove-Thornton Rd. in RD 563 to protect industrial park area of Walnut Grove within RD 563; 5B: New all-weather flood fight berm and raising/widening of Walnut Grove Thornton Rd. in RD 563 to protect industrial park and ensure flood evacuation route to I-5

Community of East Walnut Grove Study Area:

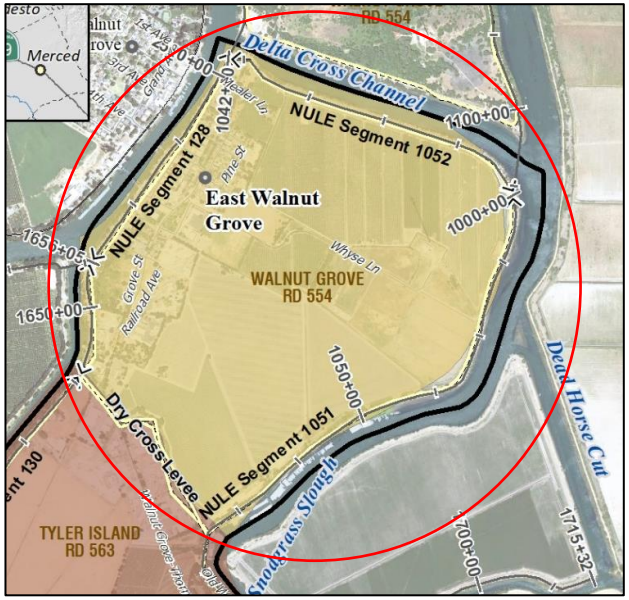
Portions of RDs 554 & 563

RD 554 South of Delta Cross Channel
&
Northern Tip of RD 563
Tyler Island
(Industrial Area Flooded in 1986)



East Walnut Grove

RD 554 Perimeter Levee System (MAs 1-5); and
RD 563 Flood Fight Berm along Walnut Grove-Thornton Road (MA 6)



FEMA Certification of RD 554 Perimeter Levee System South of Delta Cross Channel - (MAs 1-5)

Estimated Cost for FEMA Certification of RD 554 Perimeter Levee System South of Delta Cross Channel:

Up to $29.1M ($8.5M/mile)

RD 563 Flood Fight Berm and Elevation Raise/Widening of Flood Evacuation Route (J11) Walnut Grove - Thornton Road (MA 6)

Estimated Cost for Flood Fight Berm and Road Widening:
$3.0M - $5.3M ($3.8M - $6.0M/mile)

Smaller Community-Specific Ring Levees and Cross Levee Systems Evaluated for Each Delta Legacy Community to Obtain FEMA Accreditation

Community / Study Area	Estimated Cost for FEMA Certification of Smaller Levee Systems (Ring/Cross Levees & Shorter Perimeter Levee Segments Improvements)	Levee Improvements/ Strengthening-in-Place Costs per Mile for Smaller Ring/Cross Levee Systems
Hood / MA 9	$38.4M - $56.9M (cross levee system)	2.27 mi. $16.9M - $25.1M/mile
Courtland / RDs 551 & 755	$25.2 - $35.1M (ring levee system)	2.15 mi. $11.7M – $16.3M/mile
Locke / RD 369	$15.7M - $22.5M (cross levee system)	1.05 mi. $15.0M - $21.4M/mile
East Walnut Grove / RD 554 Portion Rd 563 Portion	RD 554 Certification $29.1M RD 563 Cross Levee Certification: $40.0M	3.44 mi. RD 554: $8.5M/mile; 2.50 mi. RD 563: $16.0M/mile
West Walnut Grove & Ryde/ Grand Island – RD 3	$22.6M - $37.3M (ring levee system for Clampett Tract only)	$8.0M – 13.3.M/mile
Sacramento County Delta Legacy Communities Ring/Cross Levee Totals	**$171M - $220M** **Small Community Rings/FEMA Certified**	**Lowest: $8.5M/mile - RD 554 (EWG)** **Highest: $25.1M/mile – State MA 9, Hood**

Entire RD Perimeter Levee Systems Evaluated for each Delta Legacy Community while Estimating Costs for full FEMA Accreditation

Community / Study Area	Estimated Costs for FEMA Certification of Full Perimeter Levee Systems of Delta Legacy Community Study Areas	Levee Repair/ Strengthen-in-Place Costs per Mile of Full Perimeter Levee Systems
Hood / State MA 9	$95.8M - $229.1M	5.83 mi: $16.4M - $39.3M/mile
Courtland / RDs 551 & 755	$195.6M - $656.1M	15.9 mi: $12.3M - $41.3M/mile
Locke / RD 369	$50.3M - $76.2M	2.95 mi: $17.2M - $26.0M/mile
East Walnut Grove (EWG)/ portions of RDs 554 & 563	$29.1M RD 554 portion $39.0M RD 563 portion	RD 554 - 3.43 mi: - $8.5M/mile RD 563 - 2.50 mi: - $15.6M/mile
West Walnut Grove & Ryde/ Grand Island – RD 3	$200.2M - $387.3M (north of Hwy 220 only with Hwy 220 cross levee)	16.90 mi: $11.8M - $22.9M/mile
Sacramento County Delta Legacy Communities Perimeter Levee Totals	**$610M – $1,417M Perimeter Levees Certified**	**Lowest: $8.5M/mile - RD 554 (East WG) Highest: $41.3M/mile - RD 551 - Courtland**

Non-Structural Measures for Flood Risk Reduction of Delta Legacy Communities

(Previously Identified by DWR & Local Agencies)

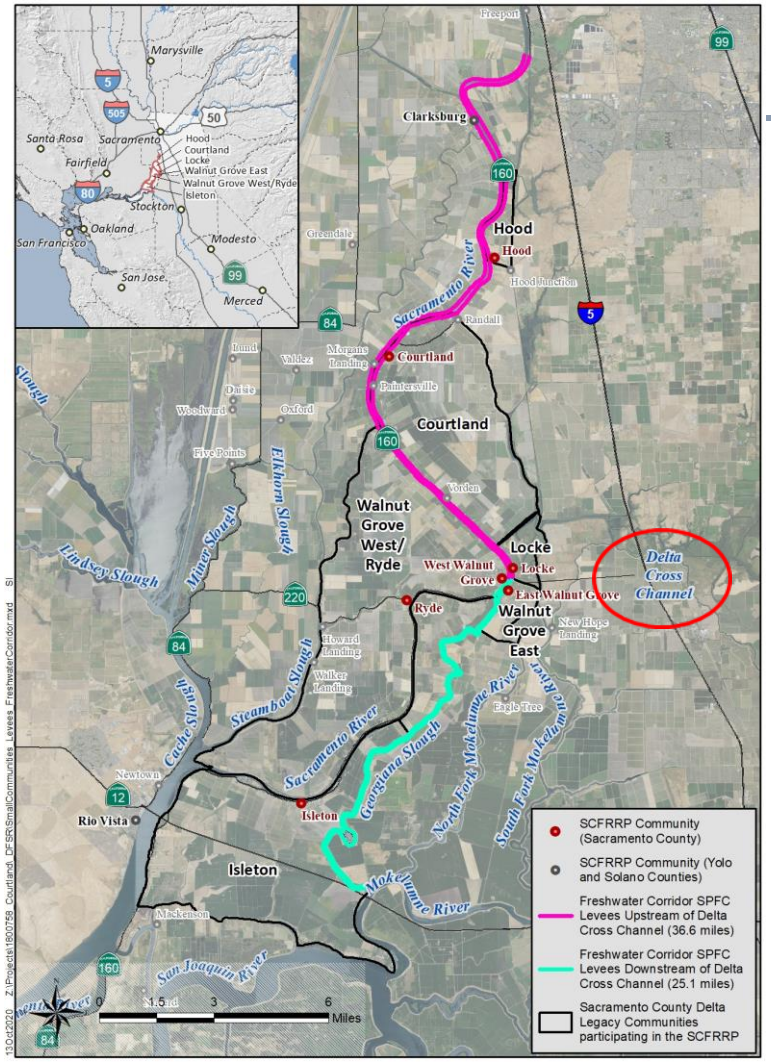
- Non-Structural Measures
  - Voluntary Elevation of Existing Homes/Structures
  - Floodproofing Dry/Wet
  - Acquisition/Relocation (not preferred in Delta)
  - Floodplain Management – Local Hazard Mitigation Plans, Including Formalized Relief Cuts
  - NFIP Reform to recognize protection provided by existing levees to reduce insurance rates
  - Public Education/Awareness (annual flood risk notifications by DWR & DPC)
  - Private/Community-Based Flood Insurance (alternatives to NFIP)
  - Potential Flood Easements on Staten Island with TNC/DWR, and channel improvements on North/South Forks of Mokelumne River

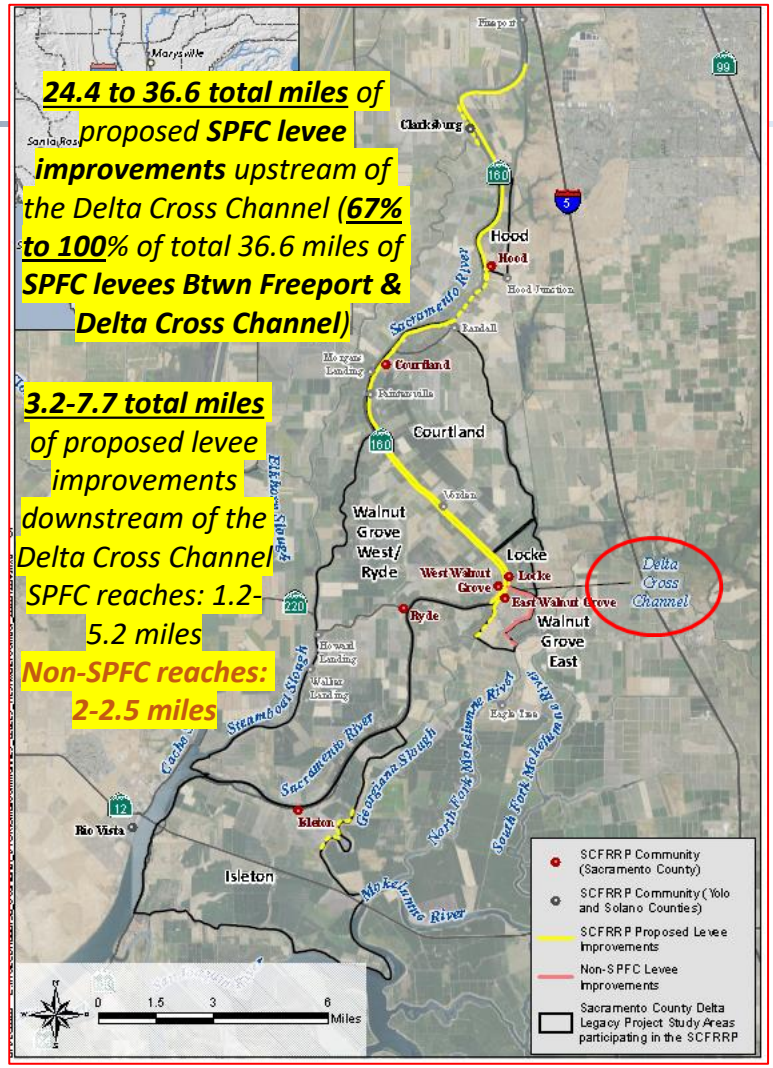
Additional Non-Structural Measures to Reduce Flood Risks to Delta Legacy Communities

- System Wide Improvement Frameworks (USACE SWIFs) within each, adjoining Reclamation District.
- Improved Governance between Local Maintaining Agencies (RDs) and Delta Legacy Communities (LMA Workgroup & Legacy Communities)
- Improved Emergency Response - Flood Safety Plans for each Reclamation District.
- Sacramento County Decision Support Tool
- Updates to NFIP via Agricultural Floodplain Ordinance Task Force (AFOTF)
- Sacramento County NFIP Community Rating System (Sac County currently rated in top 3 Nationwide, little room for improvement)
- Land Use Regulations – Delta Primary Zone Limitations

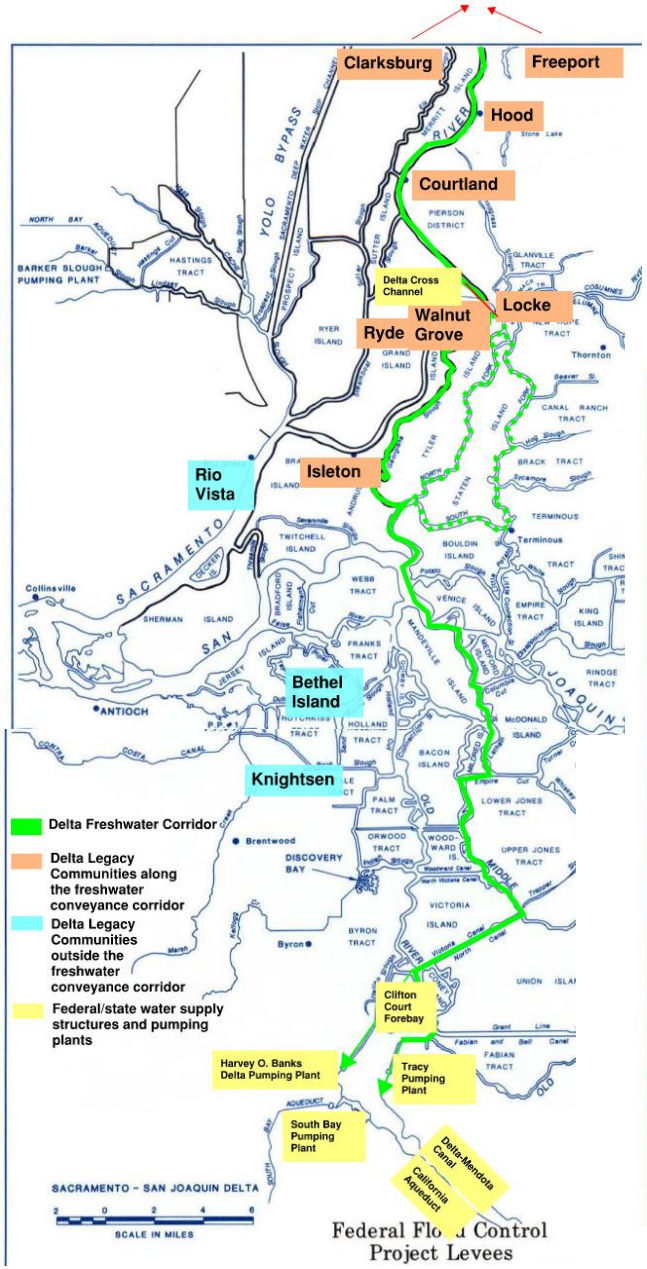
Multi-Benefits Include Improving Levees and Existing Fresh Water Conveyance Corridor: Better and Cheaper Alternative to DCA Intakes and Tunnel Elements North of Delta Cross Channel

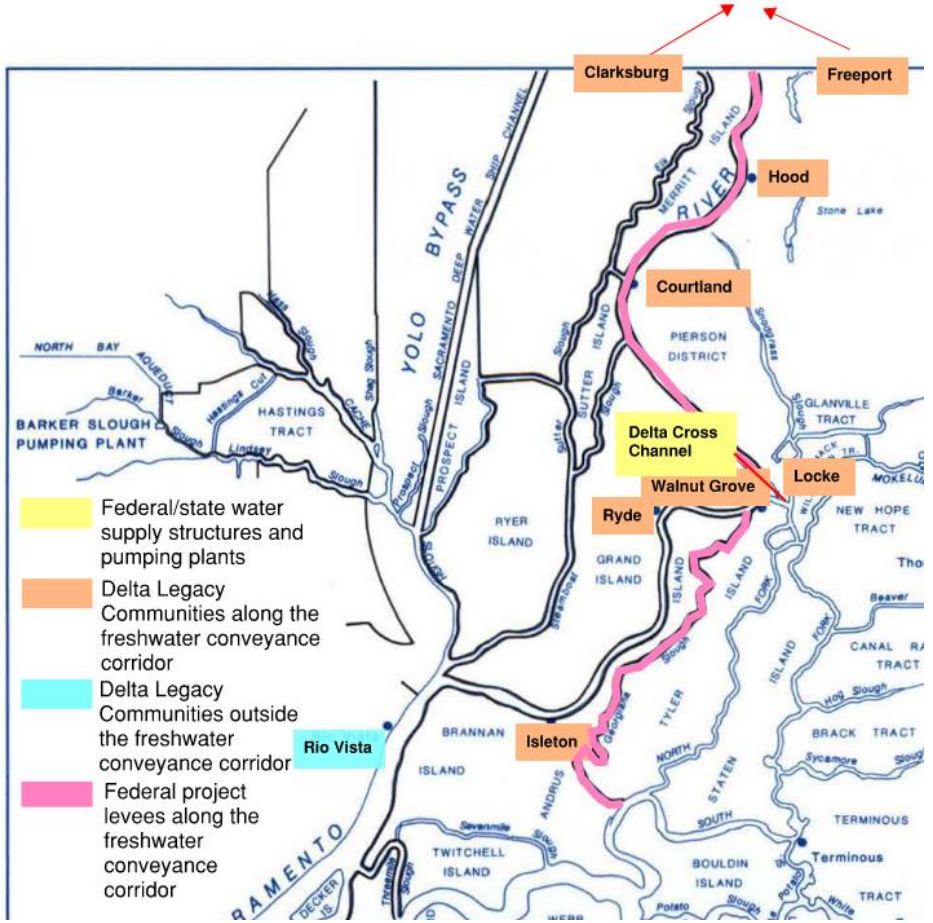
Reduces Flood Damages in Expected Annual Damages & Improves Resiliency, Reliability of SWP Conveyance





Improve Delta Freshwater Conveyance Corridor along Existing State/Federal Authorized *(SPFC)* Levee System





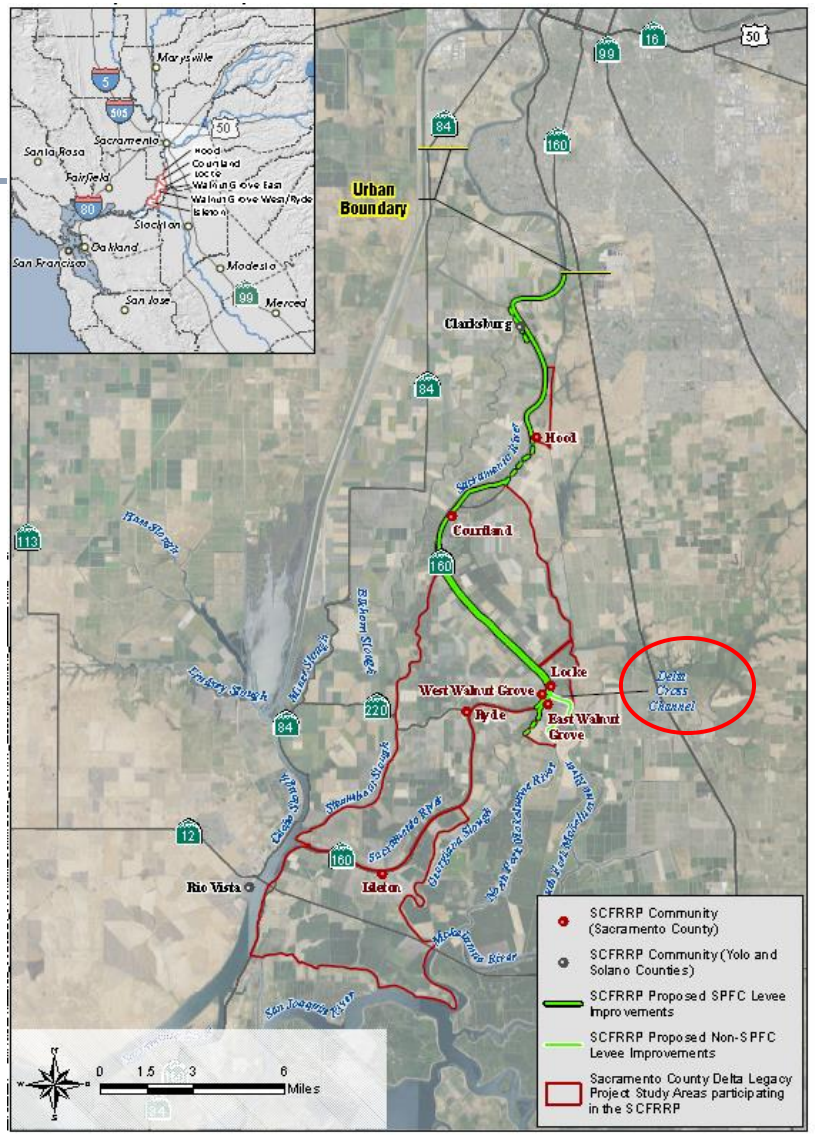
Base Map Source: DWR Delta Atlas July 1995;
SPFC Levees Shown in Black and along Pink Corridor

Combined Levee Improvement & Delta Flow Conveyance Strategy for North Delta

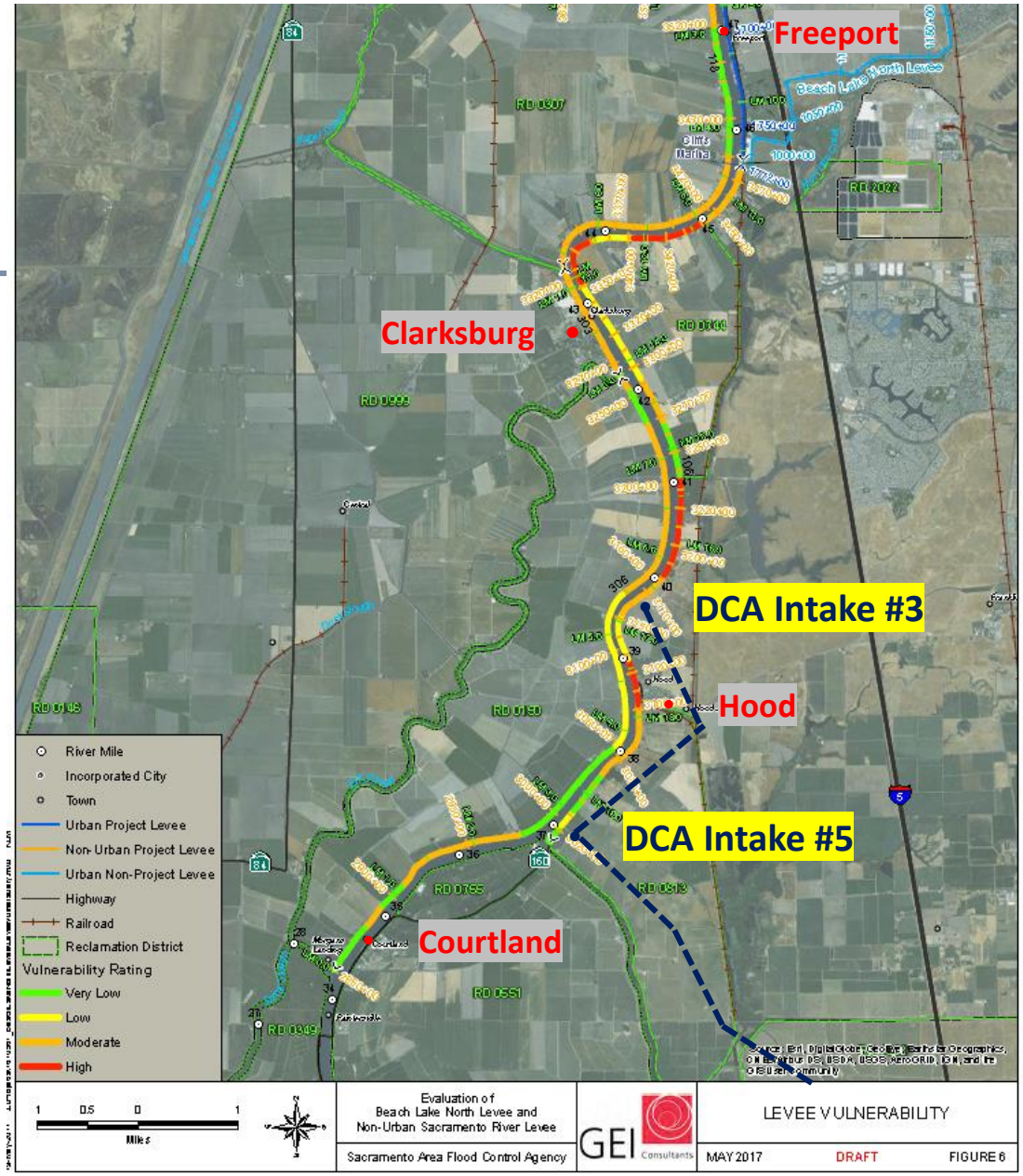
- **Repair and Improve Fed/State Levees Now, Prior to New/Additional Delta Water Conveyance**

- **Multi-Benefits Gained by Improving Levees and Existing Fresh Water Conveyance Corridor**
  - Reduce Flood Damages
  - Improve Reliability and Resiliency of Delta Conveyance

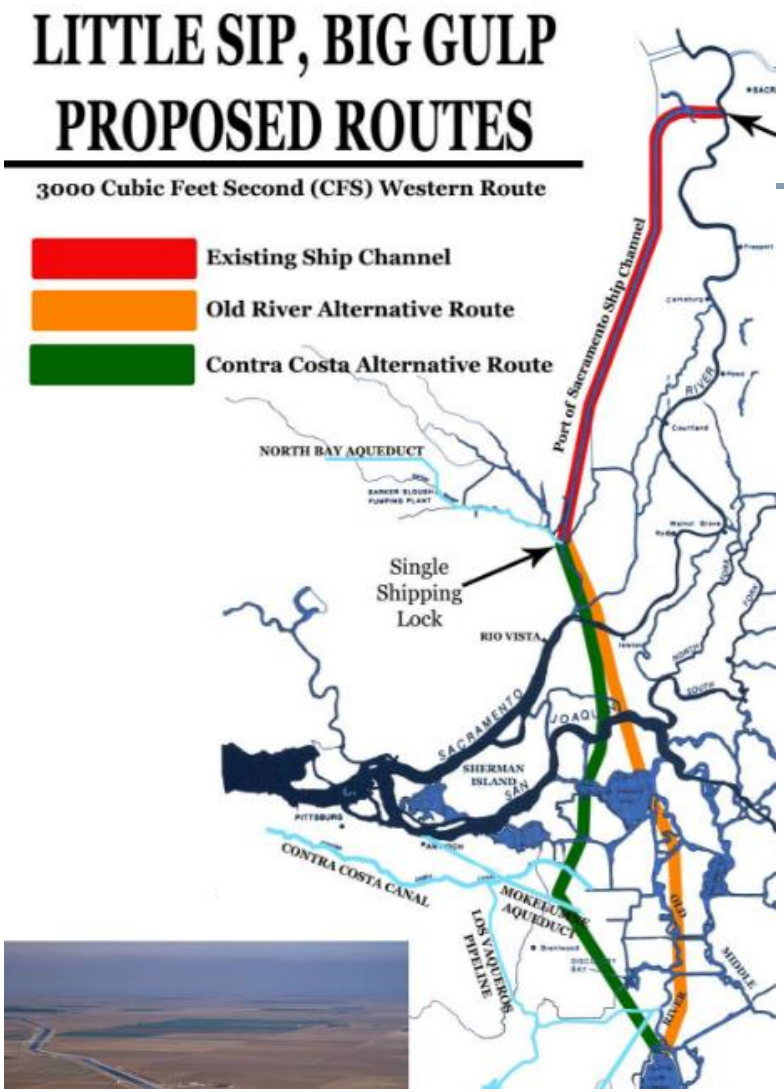
- **More Cost-Effective Alternative to North Delta DCA Intakes and Tunnel North/Upstream of Delta Cross Channel**



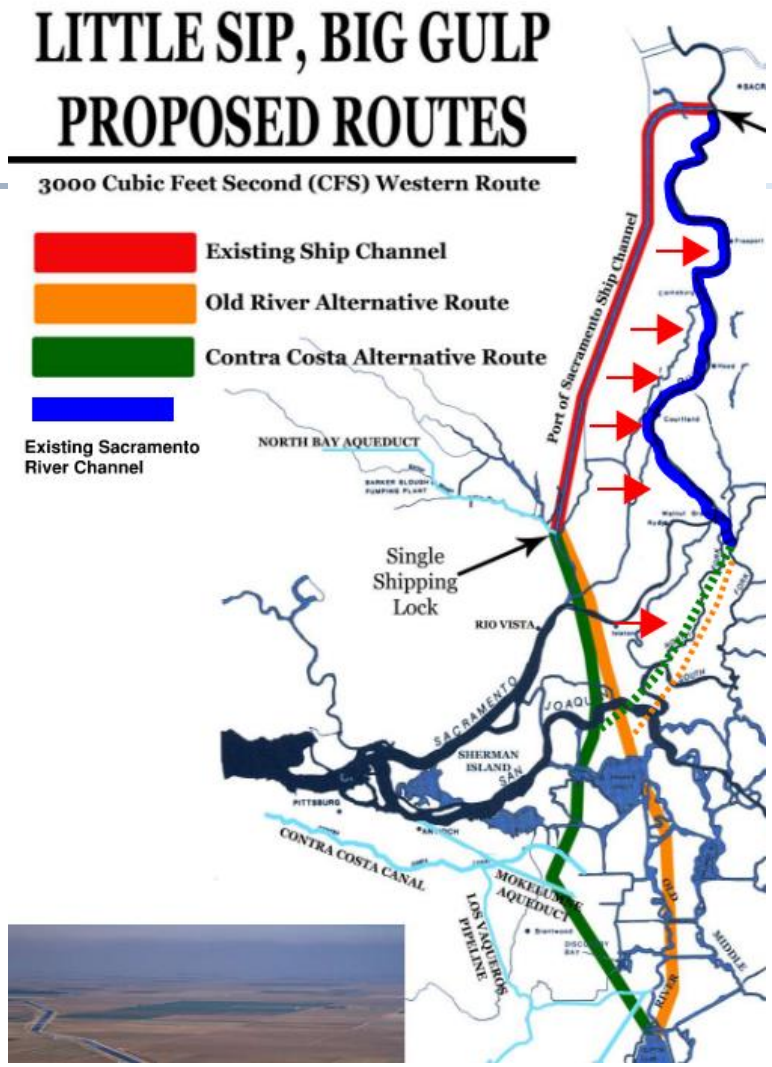
Vulnerability Assessment of Sacramento River Levee System Btwn. Freeport and Courtland Indicating Greatest Vulnerability along Left Bank @ DCA Intake Sites Near Hood



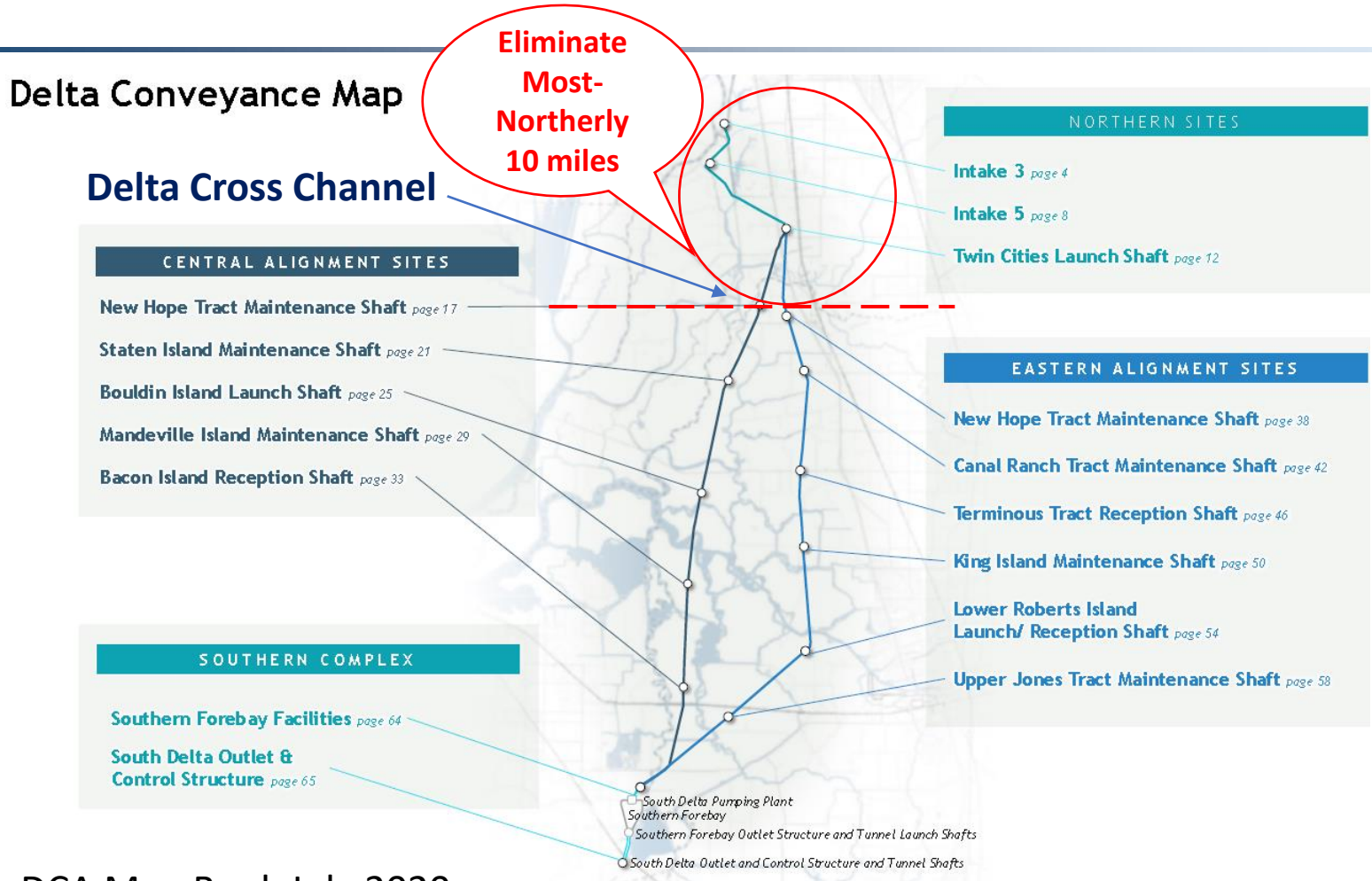
Garamendi's West Side Corridor



Sacramento River Delta Legacy Community Corridor



Current DCA Single Purpose Conveyance Project Components with Either Central or Eastern Tunnel Routes



Source: DCA Map Book July 2020

Proposed Sacramento County Delta Legacy Communities Multi-Objective Project: Sacramento River Levee Improvements in North Delta Upstream of Delta Cross Channel will Improve Sustainability, Reliability & Resiliency of Through-Delta Water Conveyance for SWP & CVP

Community - Study Area Reclamation District / Levee Miles	Estimated Costs per mile for Repairing and Strengthening-in-Place Sacramento River Corridor Levees in North Delta - Legacy Community Study Areas	Sacramento River Corridor SPFC Levee Repair/ Strengthen-in-Place Costs
Hood - DWR State MA 9 (incl. Stone Lakes, Elk Grove, & I-5) / 9.00 miles	$14.0M/mile - $68.0M/mile	$125.7M - $612.2.1M
Courtland - RDs 551 & 755 –Pearson Dist.- Randall Is./ 8.52 miles	$12.6M/mile - $53.9M/mile	$107.3M - $459.3M
Locke - RD 369 Libby McNeil / 0.95 miles	$15.2M/mile - $33.3M/mile	$14.4M - $31.6M
West Walnut Grove- Grand Island – RD 3 - 5.93 miles (Btwn Steamboat & Georgiana Sloughs)	$7.9M/mile - $17.6M/mile	$47.0M - $104.2M
Left Bank Sac River Levee Btwn Freeport and Steamboat Sl., Incl. **Clarksburg** / @12.2 miles	$12.1M/mile - $49.5M/mile	$147.6M - $603.9M
Sacramento & Yolo County Sac River – Levee Corridor Totals: 36.6 miles	**$12.1M/mile - $49.5M/mile**	**$442 M - $1,811 M** **vs. DCA Tunnel of $1,400 M - $1,840 M ($140 M – $184 M/Mile)**

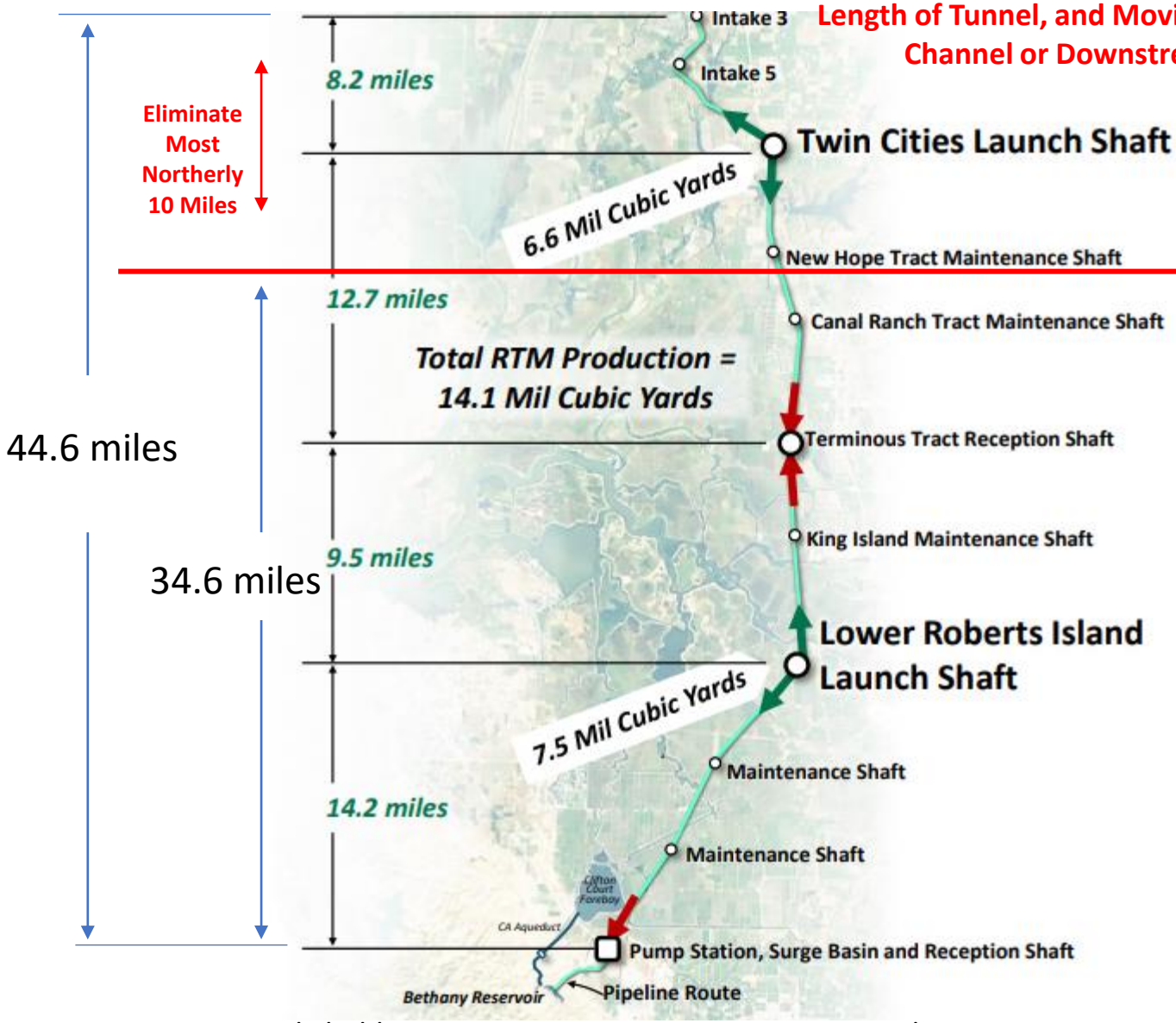
Sacramento River Corridor Levee Improvement Costs vs. Single-Purpose DCA Tunnel/Intakes in Delta North of Delta Cross Channel

FEMA Certification of Shorter Perimeter Levee Systems (Ring/Cross Levees & Shorter Perimeter Levee Segments Improvements)	FEMA Certification of Full, Larger Perimeter Levee Systems, including Non-SPFC Levee within RDs/Study Areas	Multi-Benefit Sacramento River Corridor SPFC Levee/Conveyance Improvements
$171M - $220M	$610M – $1,417M	$442M - $1,811M

Why spend over $1.40 Billion to 1.84 Billion on a single purpose DCA conveyance element when a Multi-Benefit alternative can reduce flood risks to North Delta Legacy Communities and improve reliability and resiliency of North Delta conveyance for less than $1.82 Billion utilizing existing/natural infrastructure??

DCA/DWR should consider the dual-purpose project of improving the Sacramento River corridor infrastructure and locate any tunnel elements/intakes downstream of Delta Cross Channel/Walnut Grove

Cost Reduction of $1.40B - $1.84B to DCA by Reducing Length of Tunnel, and Moving Intakes near Delta Cross Channel or Downstream of Walnut Grove



10.0mi/44.6 mi = 22.4% of Total Tunnel Length :

22.4% x $6.262B/Tunnel = **$1.40 Billion** for 10 Miles of Tunnel/Shaft Construction

With DCA Soft Costs and Mitigation Estimated at 31.4% of Construction; Total Project Costs for 10.0 mi. of Tunnel = **$1.84 Billion**

Map Source: DCA Stakeholder Engagement Committee Mtg. September 23, 2020

Key "Take Away Messages" of Multi-Benefit Opportunity for North Delta Levee Improvements/Delta Flow Conveyance Strategy

1. Multi-Objectives to improve water conveyance and reduce flood risks in Delta are consistent with the Governor Newsom's Water Resiliency Portfolio (and an improved version of Congressman Garamendi's Little Sip - Big Gulp proposal)
2. Proposed flood risk reduction measures are consistent with the goals and objectives of the 2017 Central Valley Flood Protection Plan (CVFPP) adopted by the CVFPB, and in-line with Delta Stewardship Council "Consistency Determination" to protect Delta Legacy Communities
3. Delta Legacy Communities proposal strategy more cost-effective, and more versatile than current, single-purpose DCA tunnel proposal
4. The Delta Stewardship Council "Delta Adapts" Creating a Climate Resilient Future" Study of January 2021 further confirms the North Delta is well suited to convey water in the river corridor vs. in a closed, single-purpose tunnel. The North Delta, compared to the Central/South Delta is less susceptible to Sea Level Rise (SLR), ground subsidence, and levee failures due to earthquake-induced events.

Key "Take Away Messages" for Multi-Benefit Opportunity for Levee Improvements/Delta Flow Conveyance Strategy for North Delta (cont'd.)

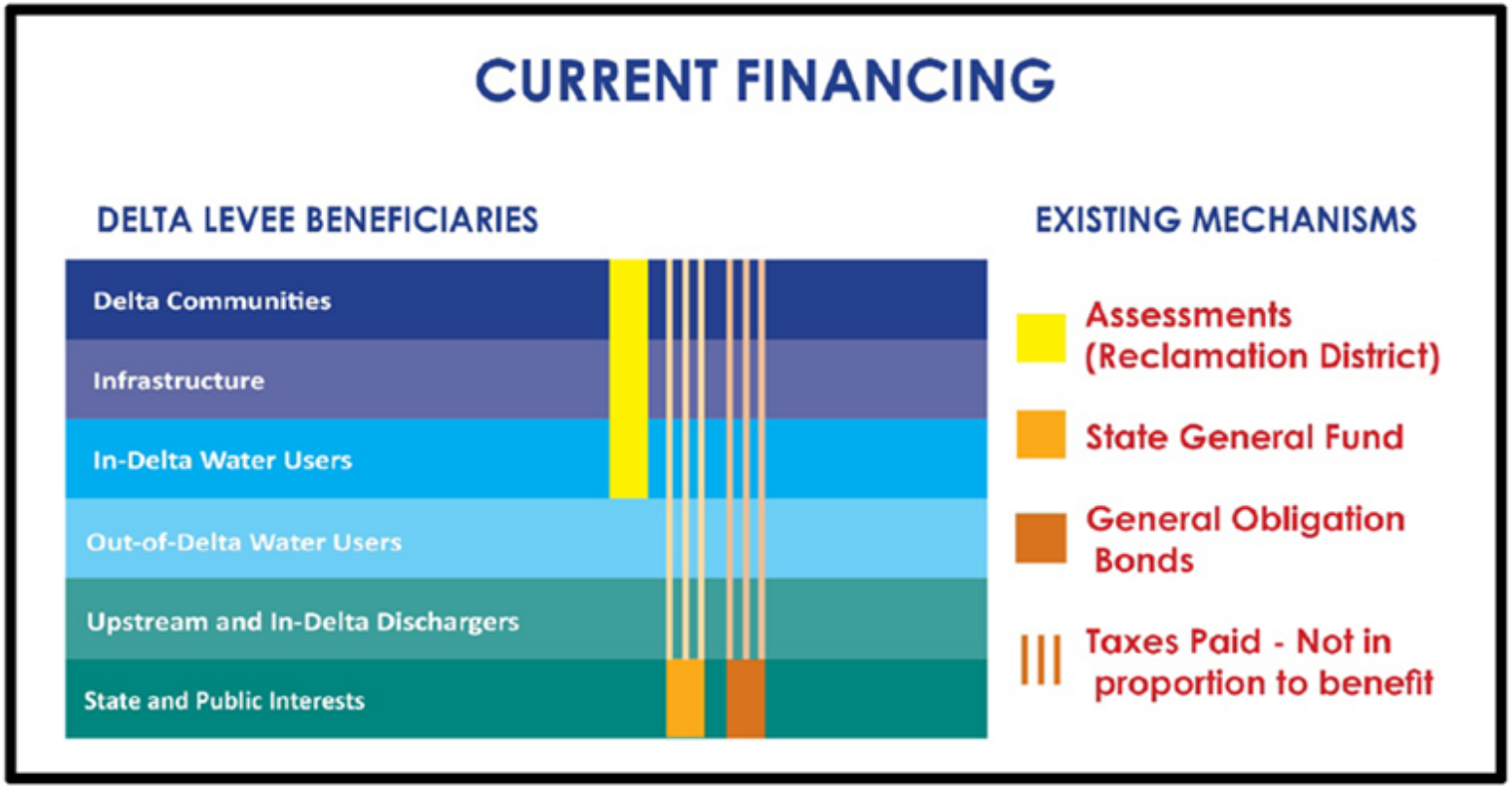
5. Sacramento River levees in North Delta are of sufficient height, they are situated on non-organic peat soil foundations, and are not highly susceptible to ground subsidence. They need to be repaired and improved-in-place to meet current Federal/State engineering standards to largely address seepage concerns
6. Proposed levee improvements in North Delta are not stranded investments due to the flood risk reduction values alone. Levee modernization efforts will provide greater reliability and resiliency to convey SWP and Federal CVP water through the North Delta to either dual or isolated conveyance facilities that may ultimately be needed through the Central/South Delta
7. The Delta Legacy Communities (several of which are considered Disadvantaged Communities – DACs) in the Sacramento River Corridor are looking for financial assistance from DWR, the US Corps of Engineers, and South of Delta Water User Interests (including SWP Contractors and DCA) to help offset costs that will also improve reliability and resiliency in conveying water through the Delta.

Levee Improvements in the Delta Should be Orchestrated with Improving the Conveyance of SWP/CVP Water Through the Delta

- The Sacramento-San Joaquin Delta provides a major source of water supply to more than 60 percent of California Residents and is a vital source of water supply for Agriculture. The Delta levees also provide a network of channels that direct movement of SWP and CVP water across the Delta.
- The Delta is also a unique place defined by its ecological value as the transitional ecosystem from fresh to salt water and by its extensive levee system. Virtually all assets and attributes of the Delta, including its present ecosystem are highly dependent upon this large levee system.
- Questions about Delta flood management and Delta levee integrity cannot be considered in isolation of other resource needs, nor can financing of Delta flood risk reduction measures be fully burdened by the small communities within the Delta, particularly when there are statewide interests and beneficiaries of Delta levees outside of the Delta.

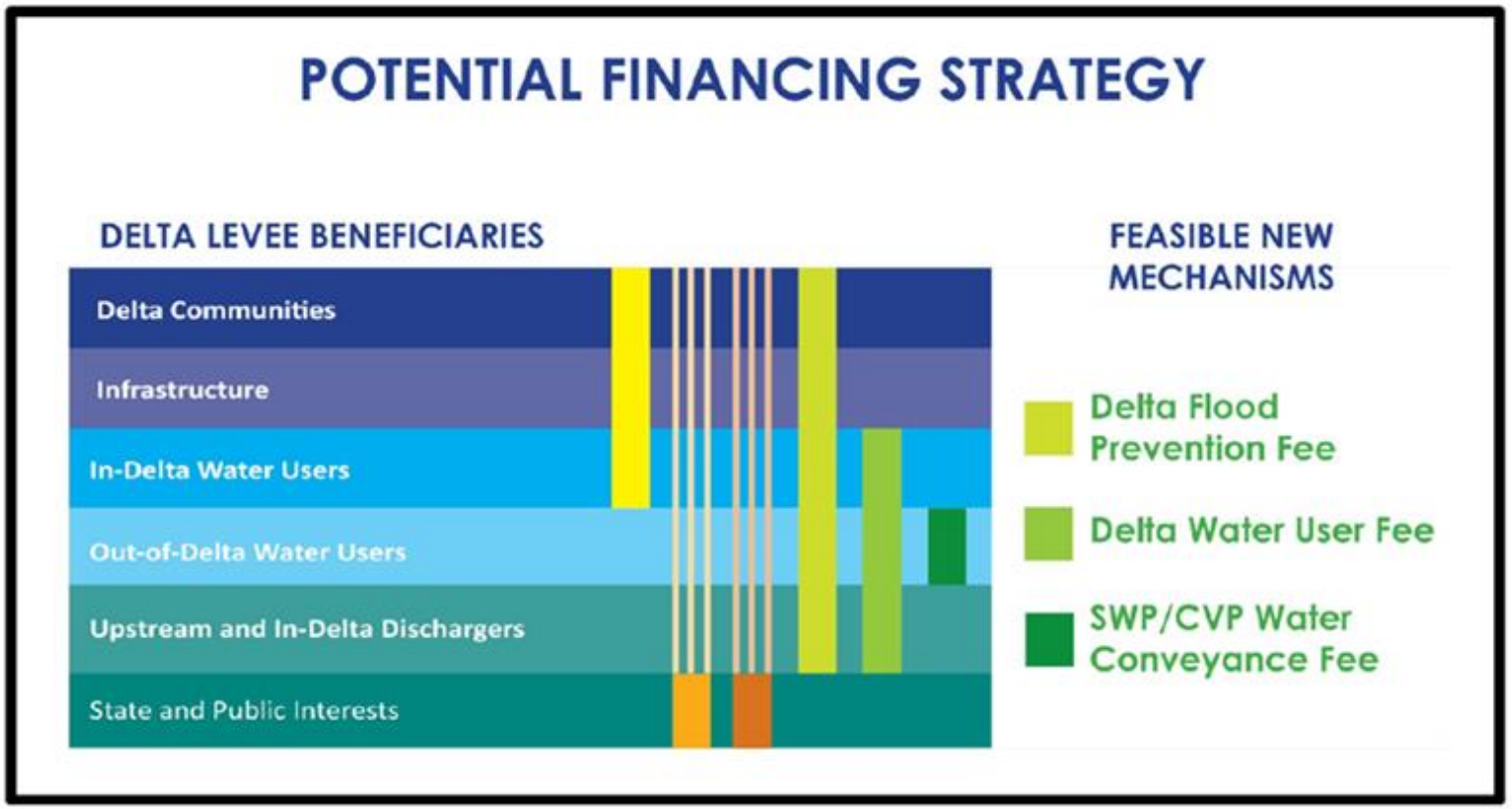
Source: DWR California's Flood Future Recommendations for Managing the State's Flood Risk - Statewide Flood Management Planning Program - Flood Safe California - Nov. 2013

Current Levee Improvement Financing Mechanisms in the Delta are Largely Limited to In-Delta Beneficiaries, Namely Delta Communities, Utilities and In-Delta Water Users



Source: Delta Protection Commission (DPC). May 17, 2018. Delta Flood Risk Management Assessment District Feasibility Study and Delta Levee Financing Options. Available at: https://delta.ca.gov/levees

Levee Improvement Financing Strategies in the Delta Could also Include Out-of-Delta Water Users, Upstream and In-Delta Dischargers, and Statewide Interests by Establishing Delta Flood Prevention Fees & Water Use/Conveyance Fees



Source: Delta Protection Commission (DPC). May 17, 2018. Delta Flood Risk Management Assessment District Feasibility Study and Delta Levee Financing Options. Available at: https://delta.ca.gov/levees

Flood Studies for Sacramento County Delta Legacy Communities Identifying Opportunities to Improve SWP Water Conveyance Through the Delta

See following PPT slides for additional findings, studies, and references in support of proposed levee improvements in North Delta Legacy Communities.

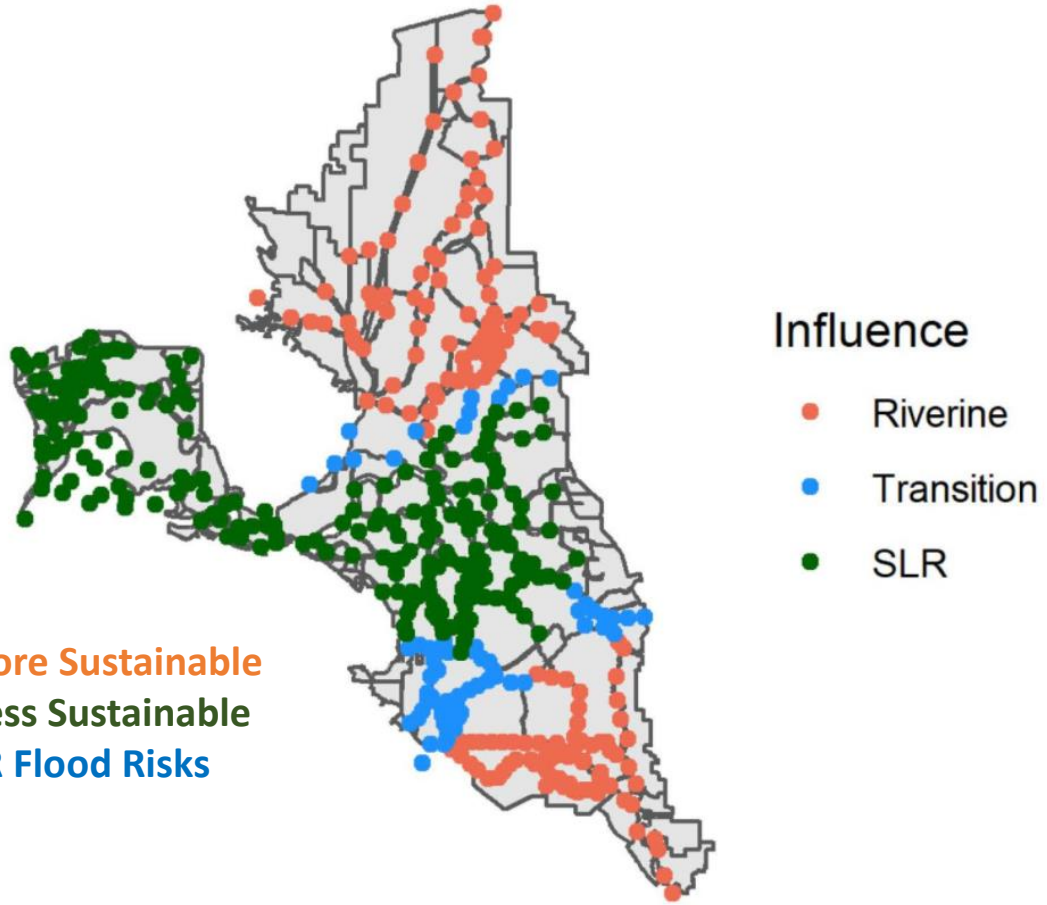
Excerpts from DSC's "Delta Adapts: Creating a Climate Change Resilient Future"; the Governor's Water Resilience Portfolio; & North Delta Water Agency's Water Contract with DWR

http://sacdelta.stormready.org

Sacramento-San Joaquin Delta County Coalition Meeting
Friday, 2-19-21

Where is the Greatest Source of Potential Flooding Within the Delta Riverine or Sea Level Rise (SLR)? Where are the Greatest Challenges of Sustaining the Fresh Water Corridor Through Delta?

Adaptation to climate change should focus on the source of vulnerability



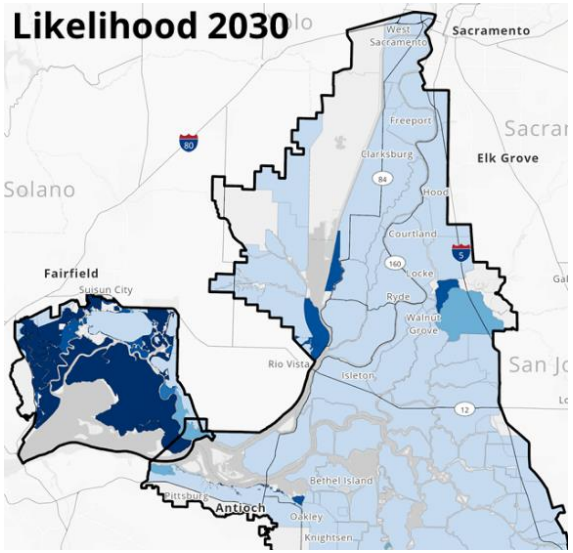
Orange Subject to Riverine Flooding – More Sustainable
Green Subject to SLR and Subsidence - Less Sustainable
Blue Transition Area Btwn Riverine & SLR Flood Risks

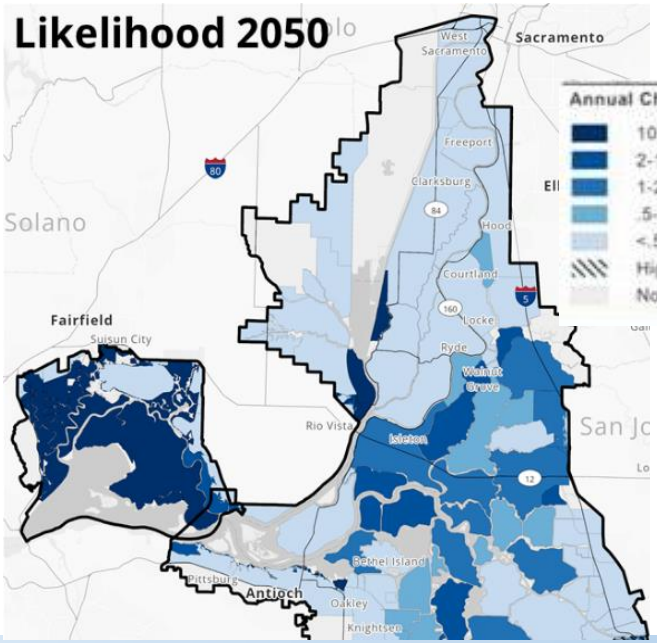
Source: Delta Stewardship Council Jan 21, 2021 Presentation to Delta Protection Commission

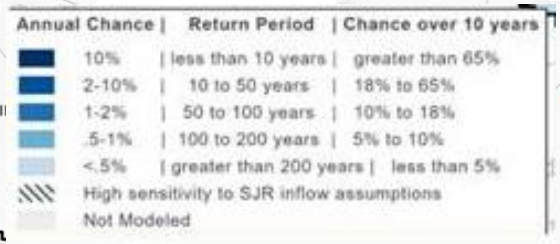
Delta Populations Exposed to Flood Risks During a 100-Yr Flood

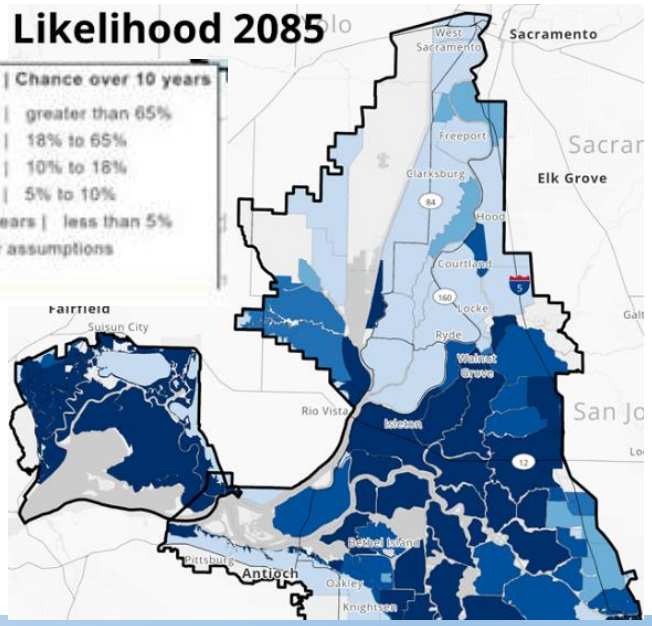
Source: Delta Adapts Study – Delta Stewardship Council Jan 2021

Note: Under the Delta Stewardship Council's adopted Land Use Plan very limited population growth is allowed in the Delta Primary Zone, including within the Delta Legacy Communities of Sacramento County. The figures included herein, correctly indicate very minimal increases in risks to populations in the North Delta relative to other locations within the Delta



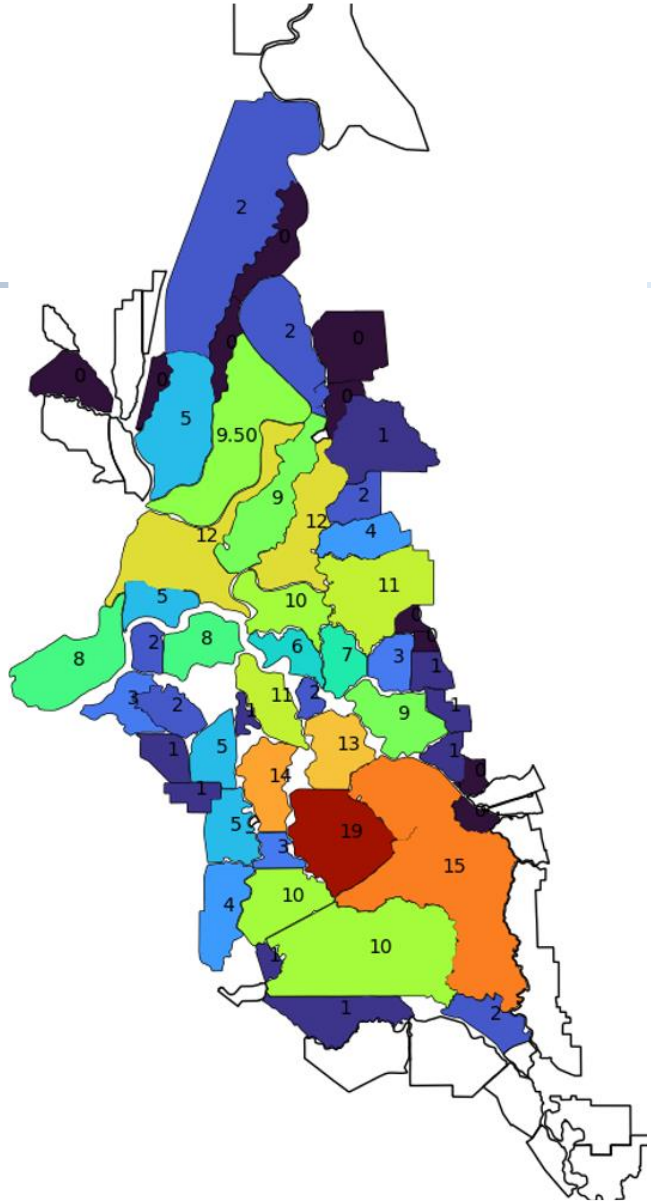






Median Days of Delta Export Disruption for Each Delta Island

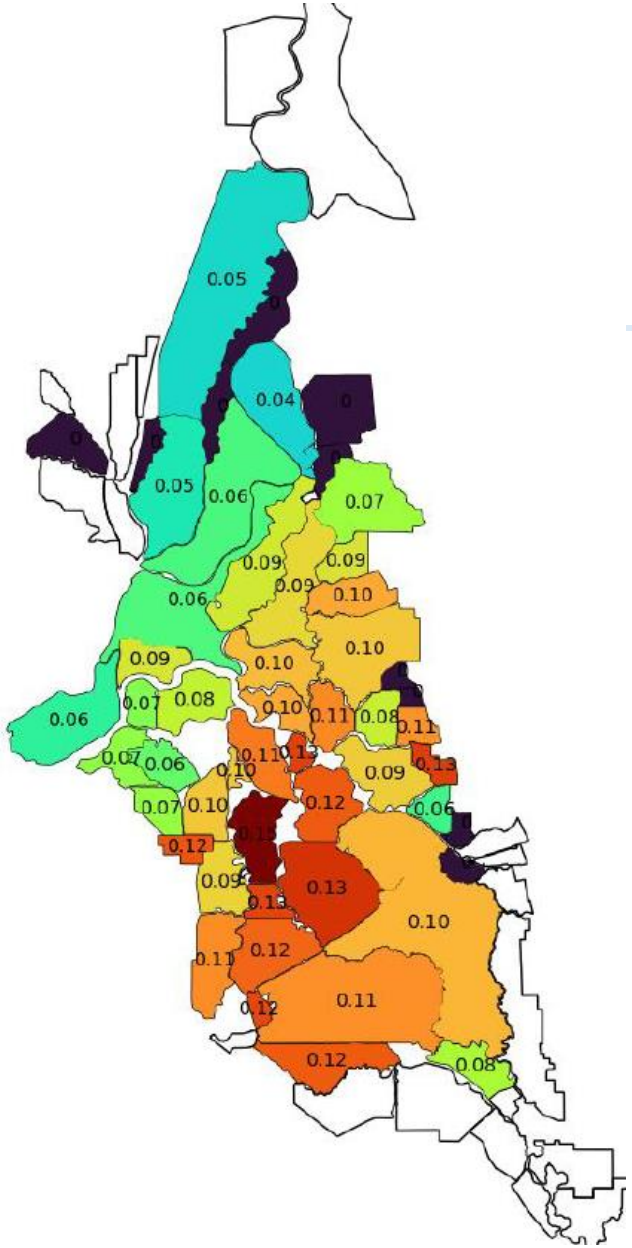
- *Levee Breaches in North Delta can Result in Disruptions to Delta Exports, but Present Smaller Risks to Delta Exports Compared to Central /South Delta Levee Breaches*
- *DCA Intakes/Tunnel(s) Don't need to Extend to Extreme North Delta as Currently Proposed; and Upstream Reservoir Releases through the North Delta help Maintain Water Quality Standards in the Central/South Portions of the Delta*
- *Greatest Risks to Disruption of Delta Exports are in Central/South Delta Where Selenium Levels are Higher, and Island Interiors have Subsided to Lower Elevations*
- *Tunnel is of Greatest Value in Central/South Delta Where Islands are More Susceptible to Subsidence and Sea Level Rise (SLR)*



Source: Delta Science Program for Delta Stewardship Prepared by Resource Management Associates, Inc., July 2020

Median Days of Delta Export Disruption per 1,000 Acre-Ft of Island Volume

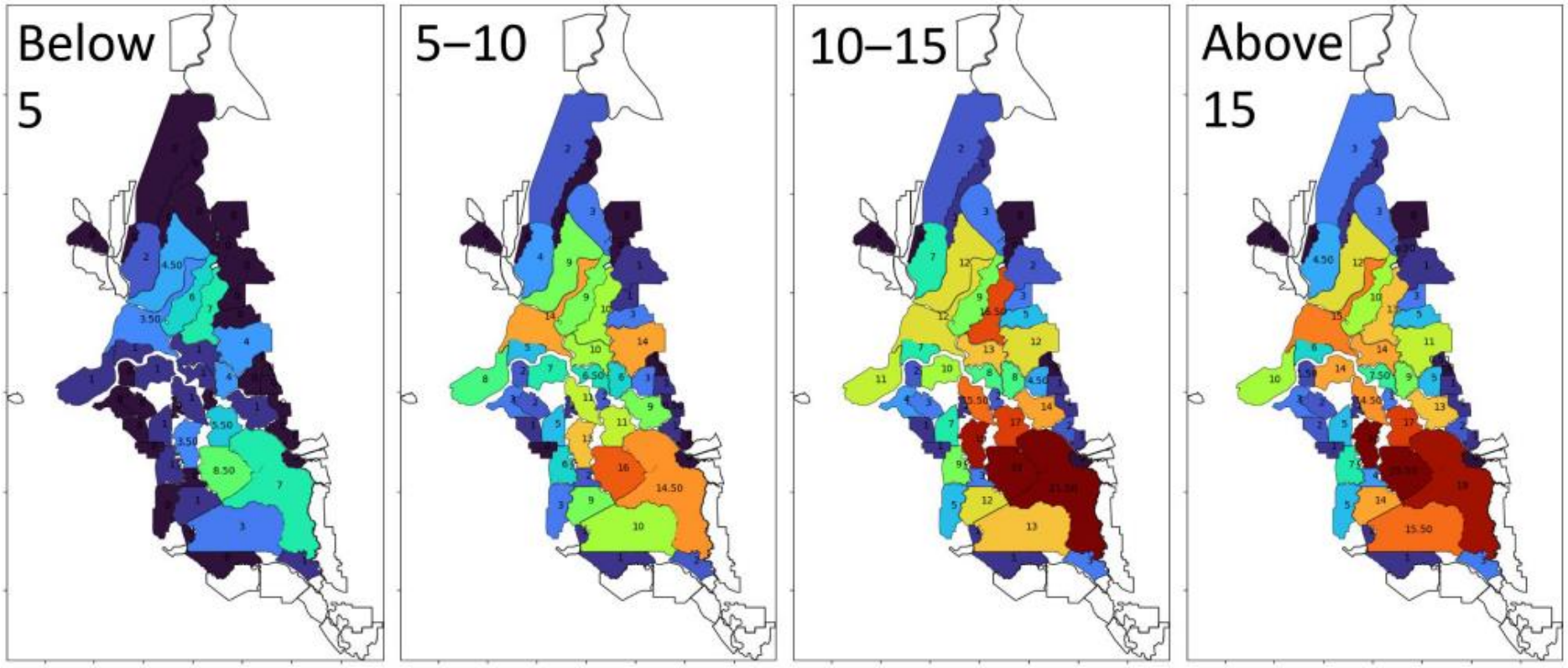
- *Levee Breaches in North Delta can Result in Disruptions to Delta Exports, but Present Smaller Risks to Delta Exports Compared to Central /South Delta Levee Breaches*
- *DCA Intakes/Tunnel(s) Don't need to Extend to Extreme North Delta as Currently Proposed; and Upstream Reservoir Releases through the North Delta help Maintain Water Quality Standards in the Central/South Portions of the Delta*
- *Greatest Risks to Disruption of Delta Exports are in Central/South Delta Where Selenium Levels are Higher, and Island Interiors have Subsided to Lower Elevations*
- *Tunnel is of Greatest Value in Central/South Delta Where Islands are More Susceptible to Subsidence and Sea Level Rise (SLR)*



Source: Delta Science Program for Delta Stewardship Prepared by Resource Management Associates, Inc., July 2020

Median Days of Delta Export Disruption, Binned by Number of Islands Breached

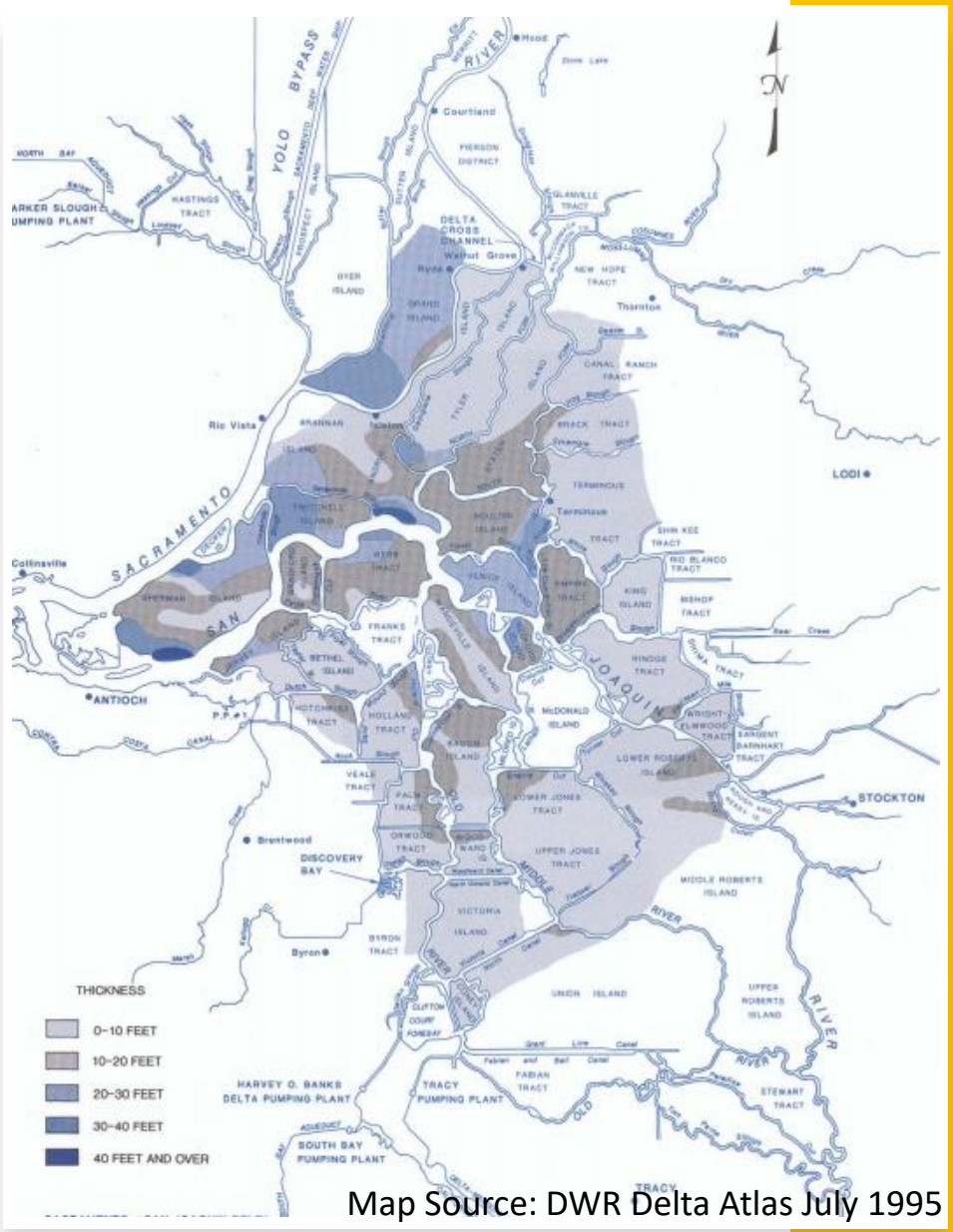
(Dark Blue Islands Have Zero Median Disruption Days)



Source: Delta Science Program for Delta Stewardship Prepared by Resource Management Associates, Inc., July 2020

Thickness of Organic Materials, Peat Soils Subject to Subsidence

- Subsidence and Levee Instability Not Prevalent in North Delta.
- Repair/Strengthening-in-Place Federal State Levees Along Sacramento River Corridor as far South as Walnut Grove/Delta Cross Channel are Sustainable and not Stranded, Long-Term Investments
- Sacramento River Corridor Levee Investments in North Delta Could Negate Need for 10 Miles of DCA Tunnel(s)



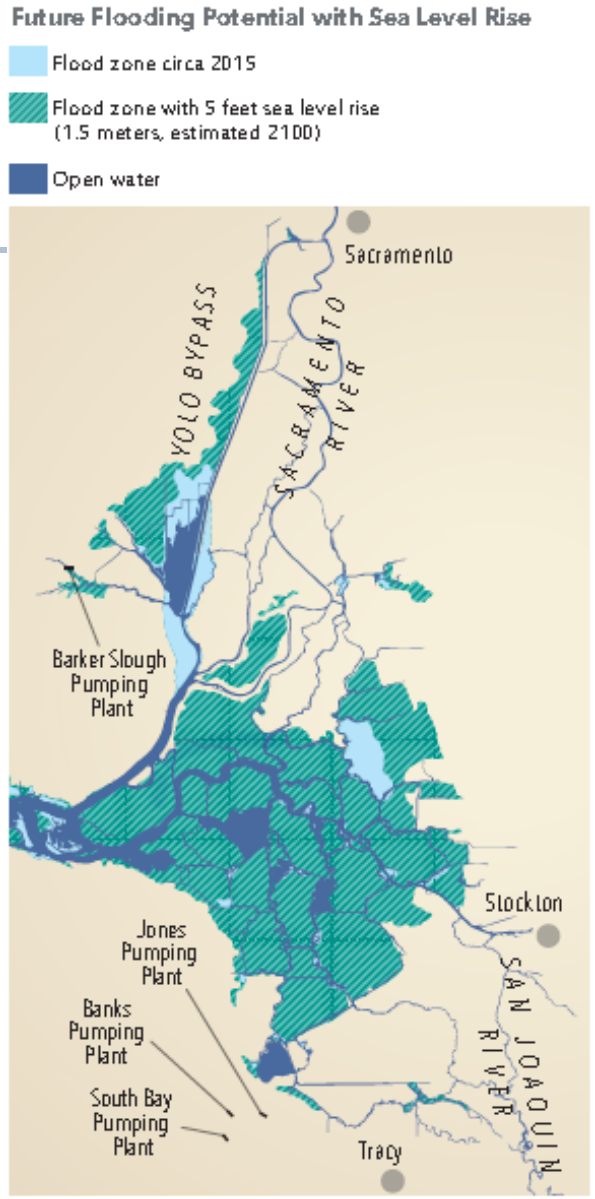
Map Source: DWR Delta Atlas July 1995

Multi-Benefit Attributes of Improved Sacramento River Conveyance Corridor in North Delta with Legacy Community Levee Repairs and Improvements

- Improved State/Federal Levees along the Sacramento River Corridor in the North Delta will Substantially Reduce Flood Risks to the Delta Legacy Communities of Clarksburg, Hood, Courtland, Locke, Walnut Grove, Ryde, and Isleton. These flood risk reduction measures also reduce the potential liability of the State and DWR MA 9 who are largely responsible for the operation and maintenance of significant portions of said levee system adjoining the noted Legacy Communities in the North Delta
- Shifting DCA intakes further downstream, closer to the Delta Cross Channel or downstream/east of Walnut Grove will: (1) preserve more natural stream flows in river channels vs. a longer tunnel; and (2) naturally help reduce EC values in North/Central/South Delta waterways.
- Levee Improvements on the Federal/State SPFC levees will not be stranded investments in the North Delta due to favorable, non-peat foundation materials (compared to Central Delta levee systems founded on organic peat soils that are likely more susceptible to Seismic failures). Planned CVFPP improvements to Yolo/Sacramento Weirs and Bypasses upstream on the Sacramento River system also offer added protection against Climate Change in the North Delta.
- Investments in the North Delta Levees could substantially reduce the length and cost of the DCA's tunnel facility presently proposed upstream of the Delta Cross Channel. Repairing and strengthening-in-place the levees upstream of the Delta Cross Channel is estimated between $0.45B and $1.81B, which is less than $1.40B to $1.84B estimated for the same, parallel reach of the single-purpose proposed DCA tunnel.
- Levee repairs and strengthening-in-place should and could take place now in advance of any formal authorization of the DCA's proposals being considered. They would not be stranded investments.
- Investing in the State/Federal levees now and potentially reducing DCA capital costs in the future could potentially leave more DCA Community Benefit Funds available for infrastructure and community improvements in other portions of the Delta.

Sea Level Rise (SLR) in North Delta not a Concern Relative to Central/South Delta

Source: California Water Resilience Portfolio – July 2020



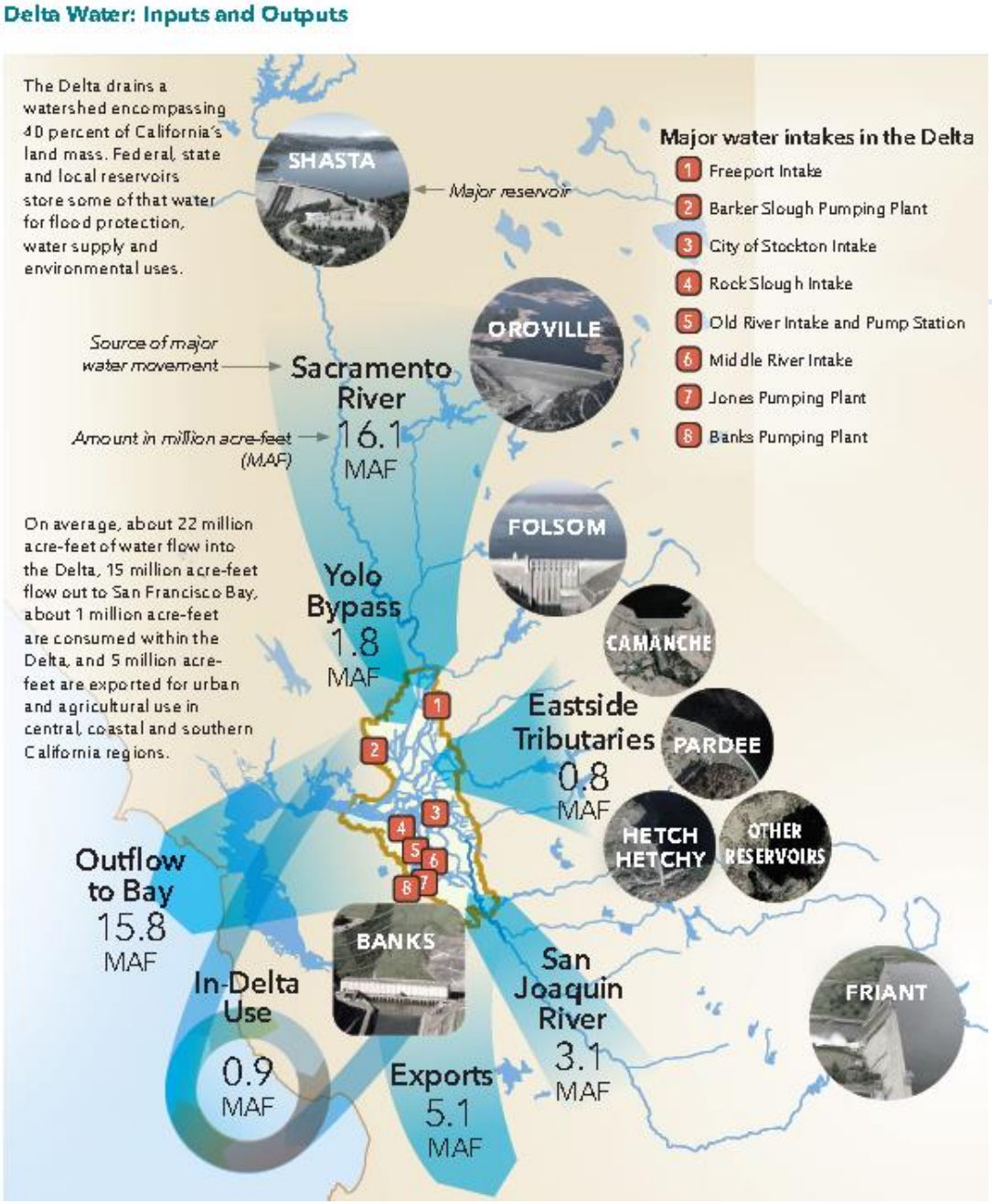
Average Annual Flows Utilized and Routed Through Delta

21.8 MAF Inflow
- 15.8 MAF Outflow to Bay
- 0.9 MAF In-Delta Use

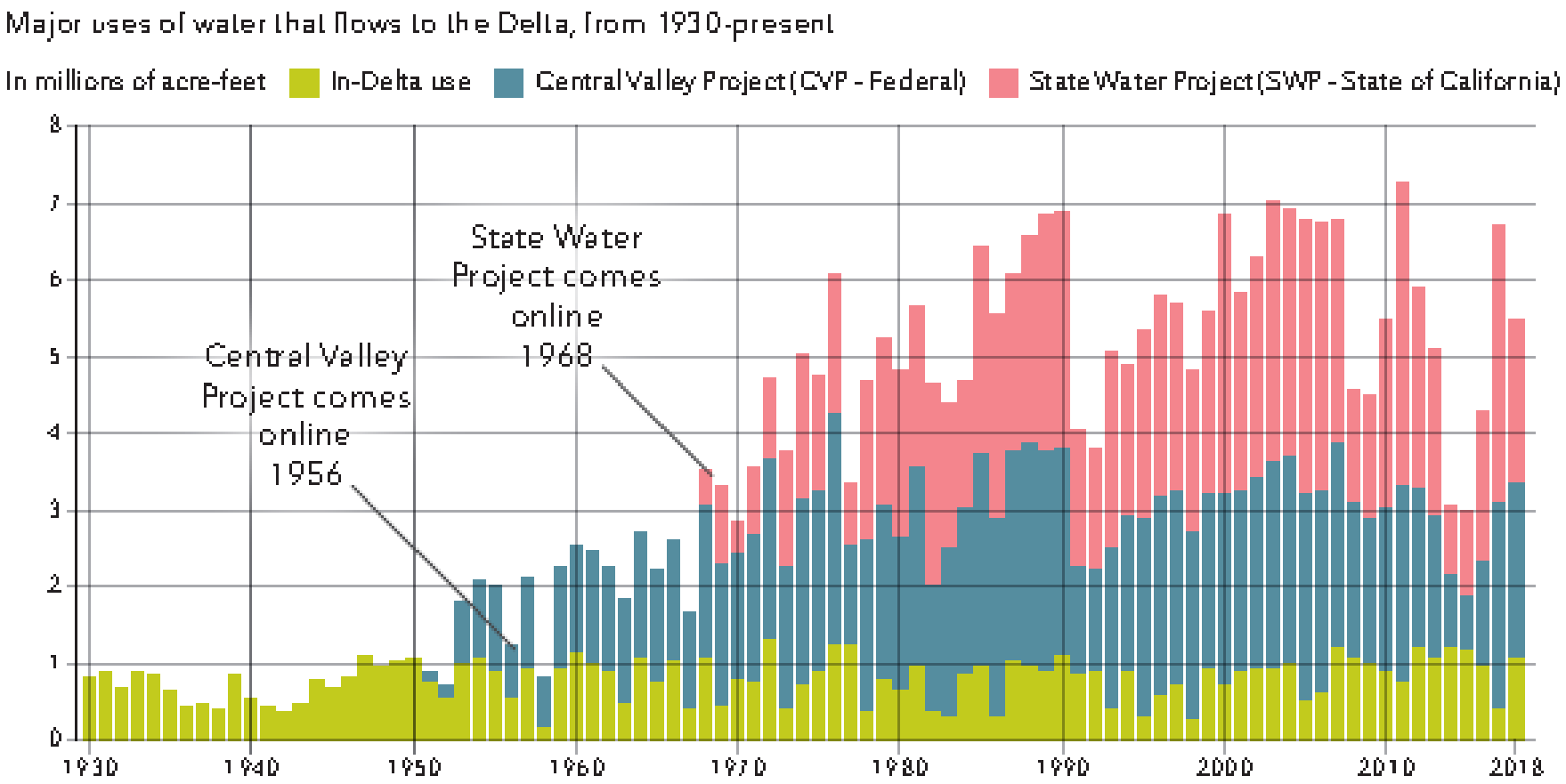
5.1 MAF Avail. for Exports

Source: California Water Resilience Portfolio – July 2020

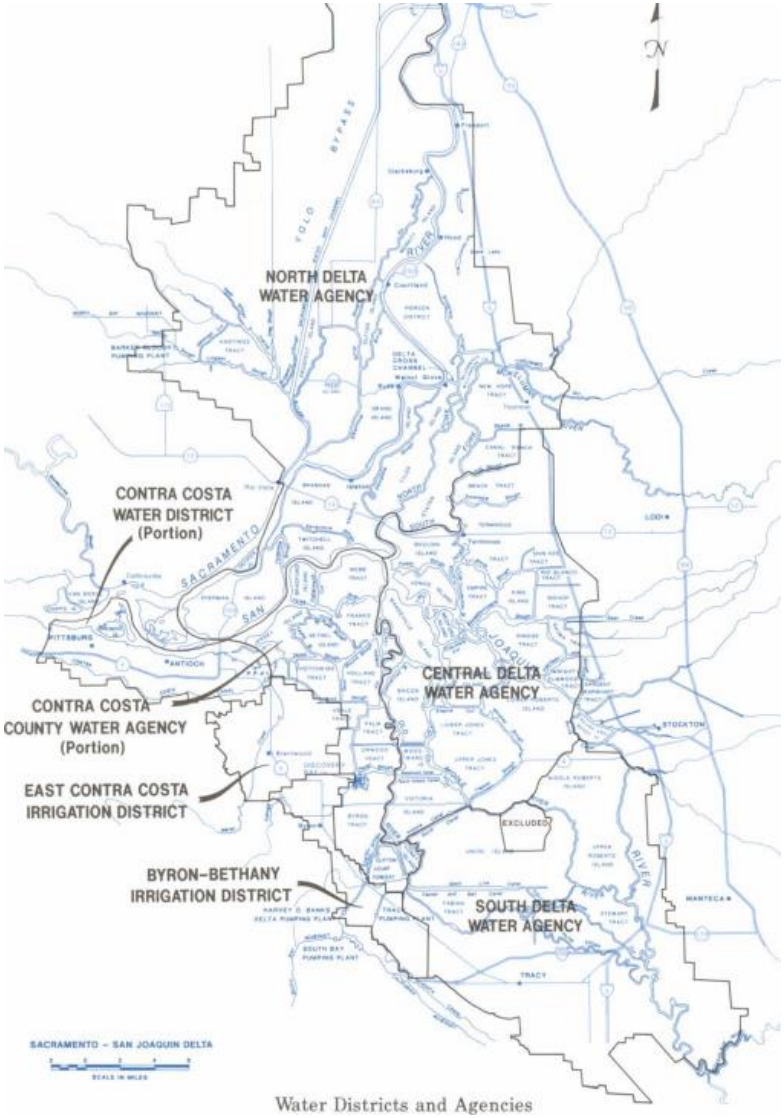
Note: During Drought Conditions Delta Inflow Values are Substantially Reduced in Comparison to Reductions of Delta Exports



Historic Water Consumption Demands of Water Flowing Within and Through the Delta



Source: California Water Resilience Portfolio – July 2020



Map Source: DWR Delta Atlas July 1995

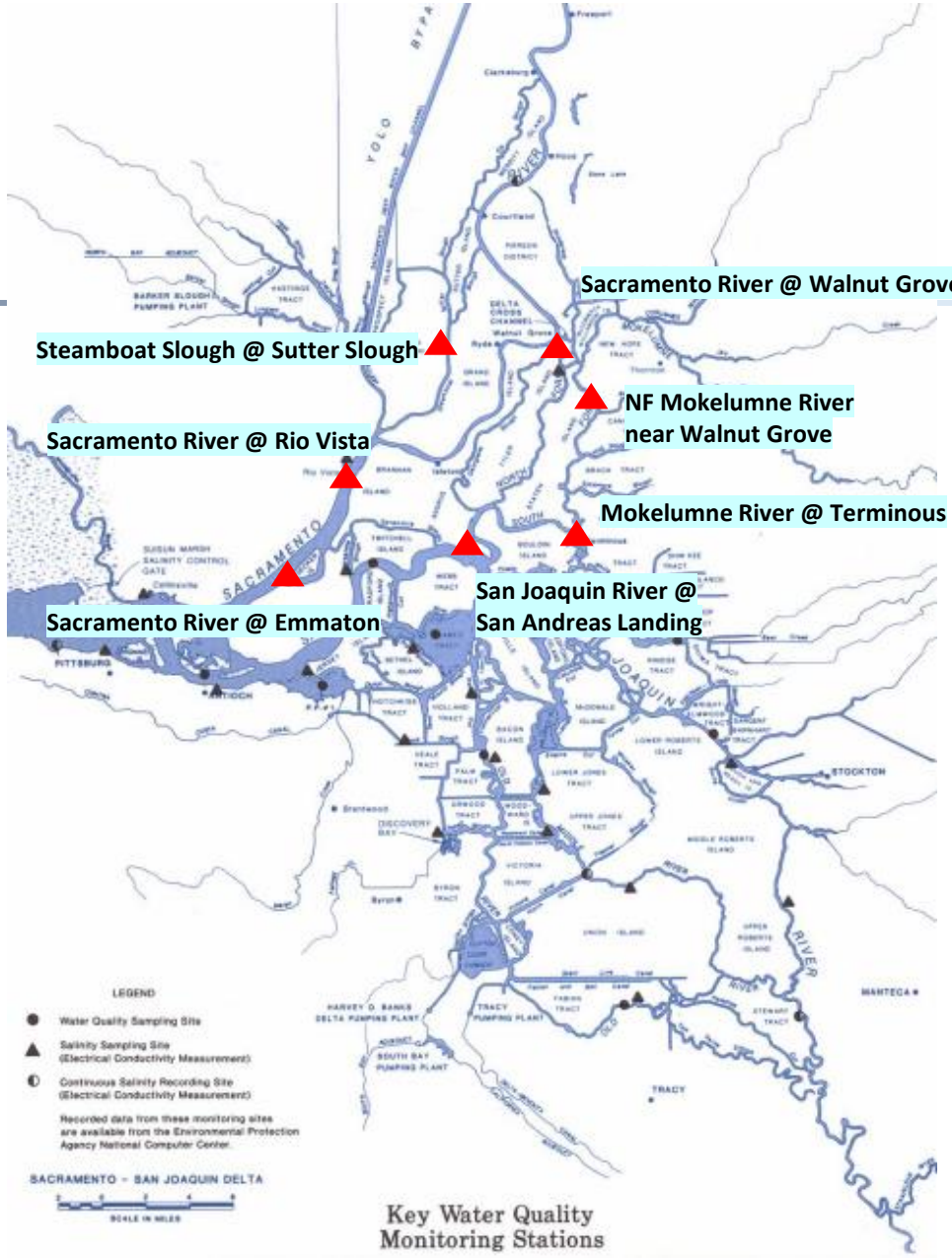
Water Agencies/Districts in Delta

- North Delta Water Agency has a Water Quality Contract with DWR State Water Project – Dated January 28, 1981
- Water Quality (EC) Requirements must be met at Multiple WQ/EC monitoring Stations within the Greater Delta for Various Times of Years w/ or w/o Isolated Tunnel
- Different EC Requirements Must be met for: Drought Years; and non-Drought Conditions with or without an Improved DCA Conveyance System

Delta Water Quality Monitoring Stations

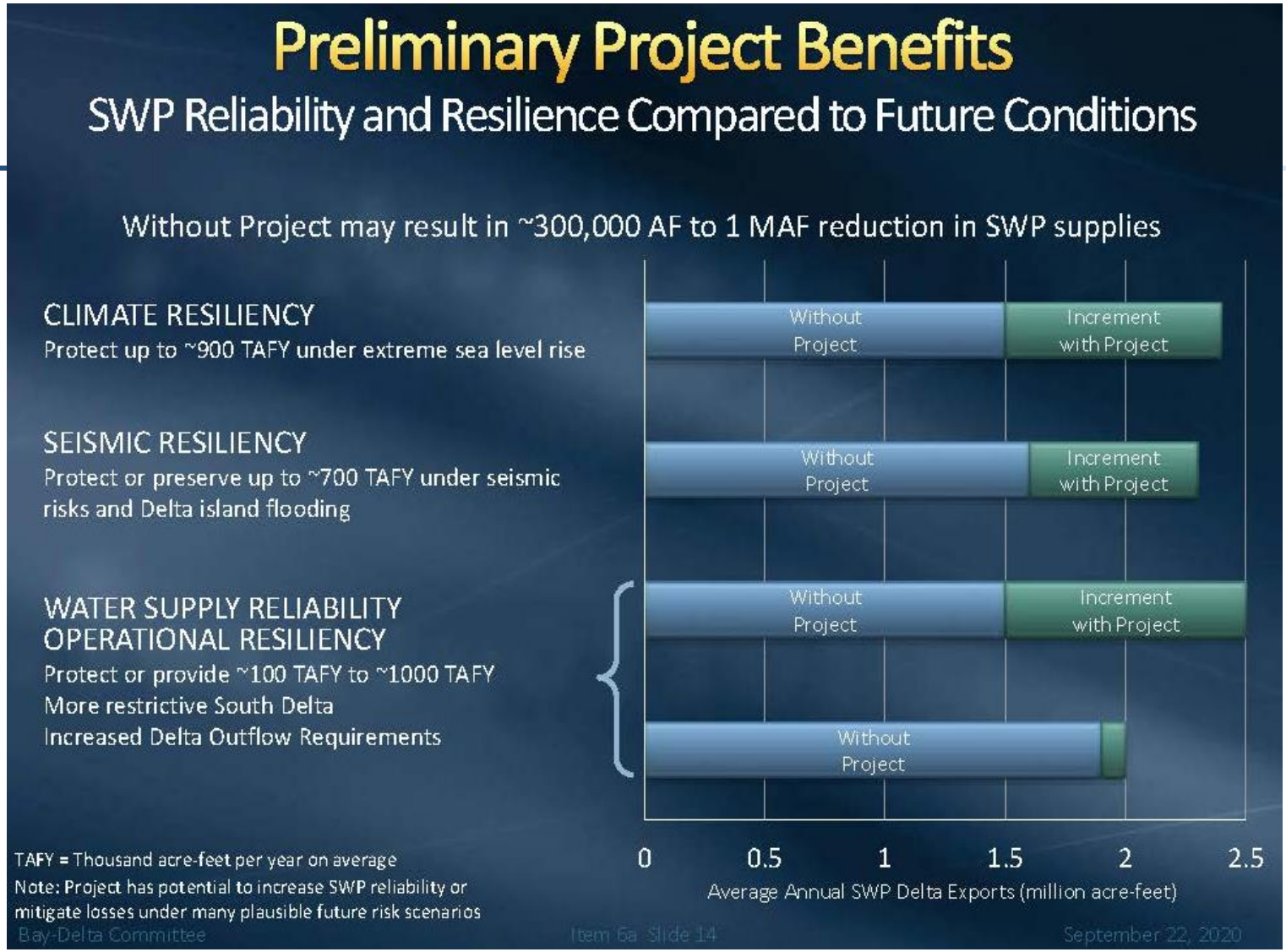
DWR - State Water Project (SWP) and DCA must Adhere to North Delta Water Agency WQ Requirements

WQ Stations Referenced in North Delta Water Agency – DWR Agreement of 1/28/1981



Map Source: DWR Delta Atlas July 1995

DCA Isolated/Dual Facility – September 2020



Source: DCA SEC Mtg Sept 22, 2020

DCA Construction Cost Estimates for Tunnel Segments and Contingencies

ITEM	VALUE
CONSTRUCTION[1]	**$ 12,100,000,000**
Two Intakes	$ 1,448,000,000
Southern Complex Facilities (Forebay, Hydraulic Structures)	$ 1,521,000,000
Pumping Plant	$ 805,000,000
Tunnel and Shafts	$ 4,473,000,000
Utilities, Power and Logistics	$ 522,000,000
Construction Sub-Total	**$ 8,769,000,000**
Contingency (38%)	**$ 3,331,000,000**
SOFT COSTS	**$ 3,400,000,000**
DWR Oversite	$ 180,000,000
DCA Program Management Office	$ 420,000,000
DCA Engineering (Design and CM Services)	$ 2,420,000,000
DCA Permits and Agency Coordination	$ 60,000,000
Land Acquisition	$ 320,000,000
ENVIRONMENTAL MITIGATION	**$ 400,000,000**
Mitigation Program	$ 400,000,000
TOTAL	**$15,900,000,000**

[1] All material, labor and equipment rates used to develop the construction costs were based on Year 2020 values.

8/20/2020

DCA Construction Cost Estimates for Tunnel Segments and Contingencies

Construction Cost Summary

ELEMENT	BASE COST[1]	CONTINGENCY	TOTAL
Intakes	$ 1,448,000,000	$ 507,000,000	$ 1,955,000,000
Tunnels and Shafts	$ 4,473,000,000	$ 1,789,000,000	$ 6,262,000,000
Pumping Plant	$ 805,000,000	$ 242,000,000	$ 1,047,000,000
Southern Facilities Complex (Forebay, Hydraulic Structures)	$ 1,521,000,000	$ 532,000,000	$ 2,053,000,000
Early Works, Utilities, Logistics	$ 522,000,000	$ 261,000,000	$ 783,000,000
Total	**$ 8,769,000,000**	**$ 3,331,000,000**	**$ 12,100,000,000**

1. Base cost includes all defined items derived from the available engineering information including materials, labor, equipment, allowances, risk mitigations, construction field management and contactor overhead and profit. The unit costs and rates used to develop the estimate are based on **Year 2020 values**.

Source: DCA Mtg August 20, 2020

DCA Construction Cost Estimates for Tunnel Segments and Contingencies

COST ASSESSMENT UPDATE

Soft costs added to reflect DCA delivery and DWR oversite costs

Categories of Soft Costs

DCO OVERSIGHT	**1.5% OF CONSTRUCTION**
• Engineering Standards Compliance • Program Controls Monitoring (Schedule and Budget)	• Invoice Processing and Payment • Start-up and Commissioning Support • Environmental Monitoring
PROGRAM MANAGEMENT OFFICE	**3.5% OF CONSTRUCTION**
• Executive Office • Executive Support (HR, Legal, Audits, Treasury)	• Program Controls (Inc. Procurement) • Shared Professional Services (Safety, Permitting, Real Estate, Quality, Sustainability, Outreach)
ENGINEERING MGT, DESIGN, AND CONSTRUCTION MGT	**20% OF CONSTRUCTION**
• Project Management • Design Services thru Construction Closeout • Field Investigations and Temporary Easements • Independent Technical Reviews	• Construction Project Management • Construction Oversite Services • Off-site/ Factory Inspections and Validations • Commissioning and Start-up
PERMITTING AND AGENCY COORDINATION	**0.5% OF CONSTRUCTION**
• Permit fees	• Agency fees
LAND ACQUISITION:	**2.5% OF CONSTRUCTION**
• Easements	• Land purchase

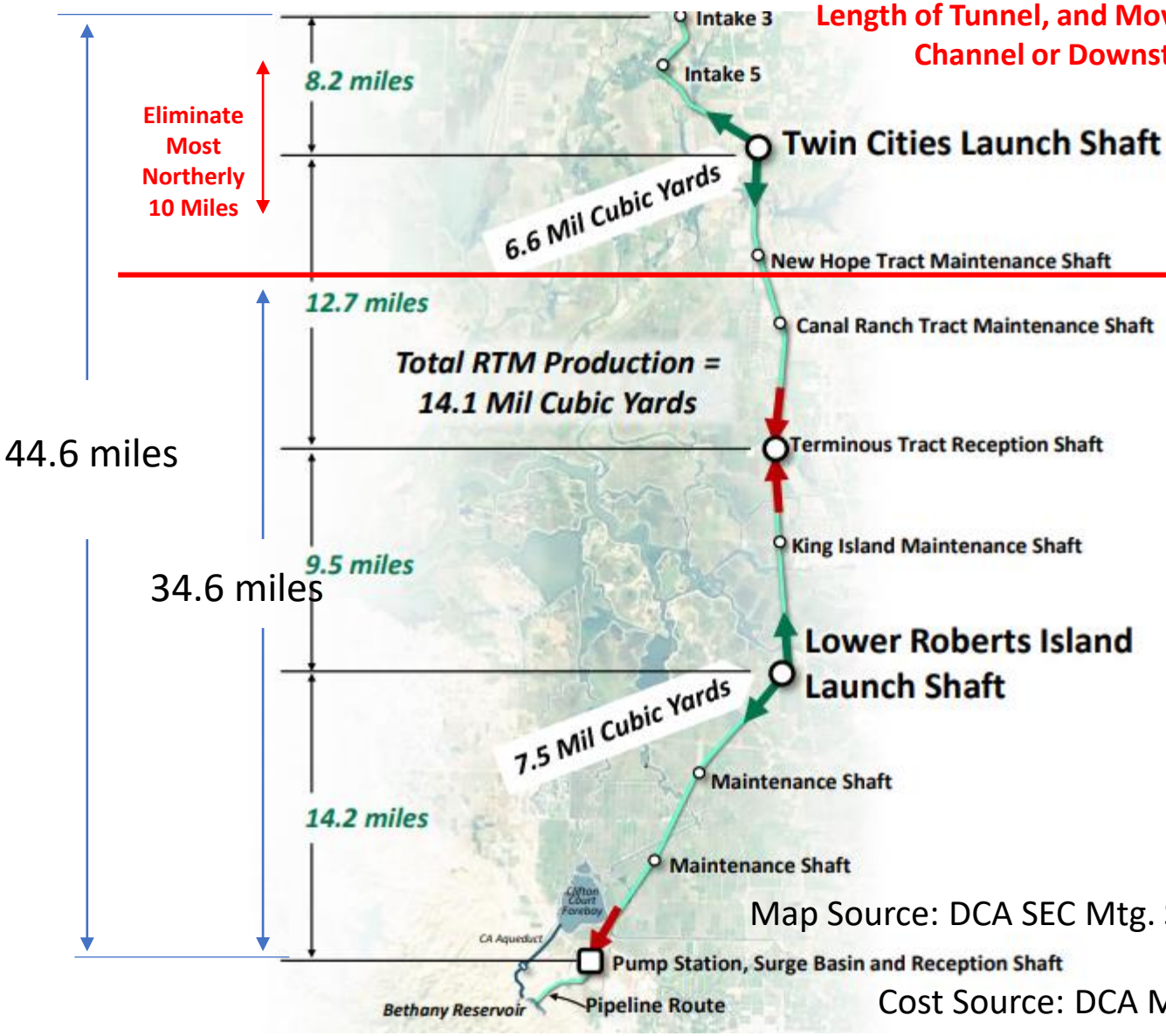
DCA

8/20/2020 10

Total Soft Cost is 28% of Construction Costs Excluding $0.4B for Mitigation; (31.4% w/Mitigation)

Source: DCA Mtg August 20, 2020

Cost Reduction of $1.40B - $1.84B to DCA by Reducing Length of Tunnel, and Moving Intake(s) near Delta Cross Channel or Downstream of Walnut Grove



10.0mi/44.6 mi = 22.4% of Total Tunnel Length :

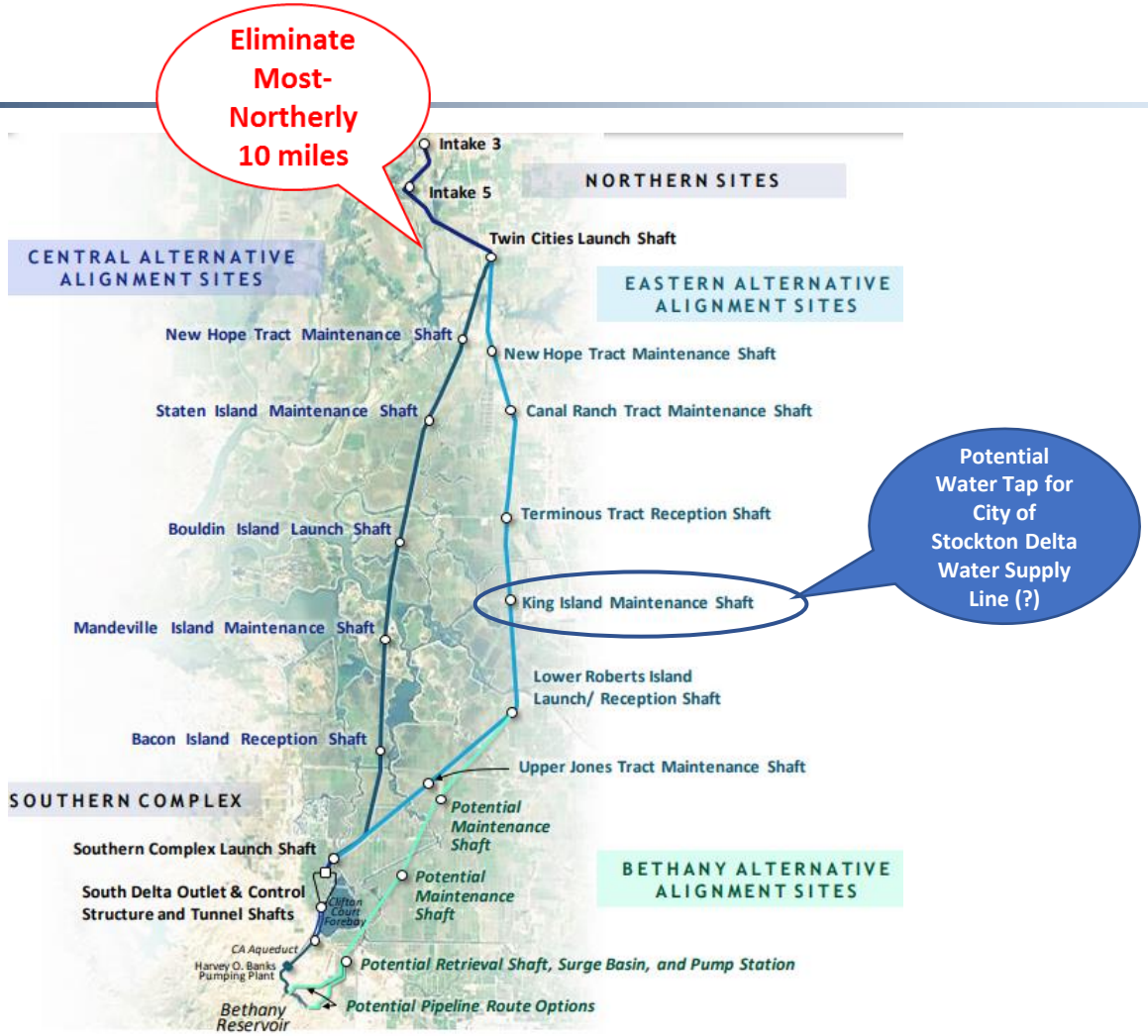
22.4% x $6.262B/Tunnel = **$1.40 Billion** for 10 Miles of Tunnel/Shaft Construction

With DCA Soft Costs and Mitigation Estimated at 31.4% of Construction; Total Project Costs for 10.0 mi. of Tunnel = **$1.84 Billion**

Map Source: DCA SEC Mtg. September 23, 2020

Cost Source: DCA Mtg. August 20, 2020

Potential Betterments of Current DCA Conveyance Components with Either Central or Eastern Tunnel Routes



Source: DCA SEC Mtg. August 26, 2020