

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



West Walnut Grove
& Ryde

Courtland

Hood

East Walnut Grove

Locke

<http://sacdelta.stormready.org>

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

Delta Legacy Communities
Meeting
Wednesday, 2-3-2021

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>

**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**

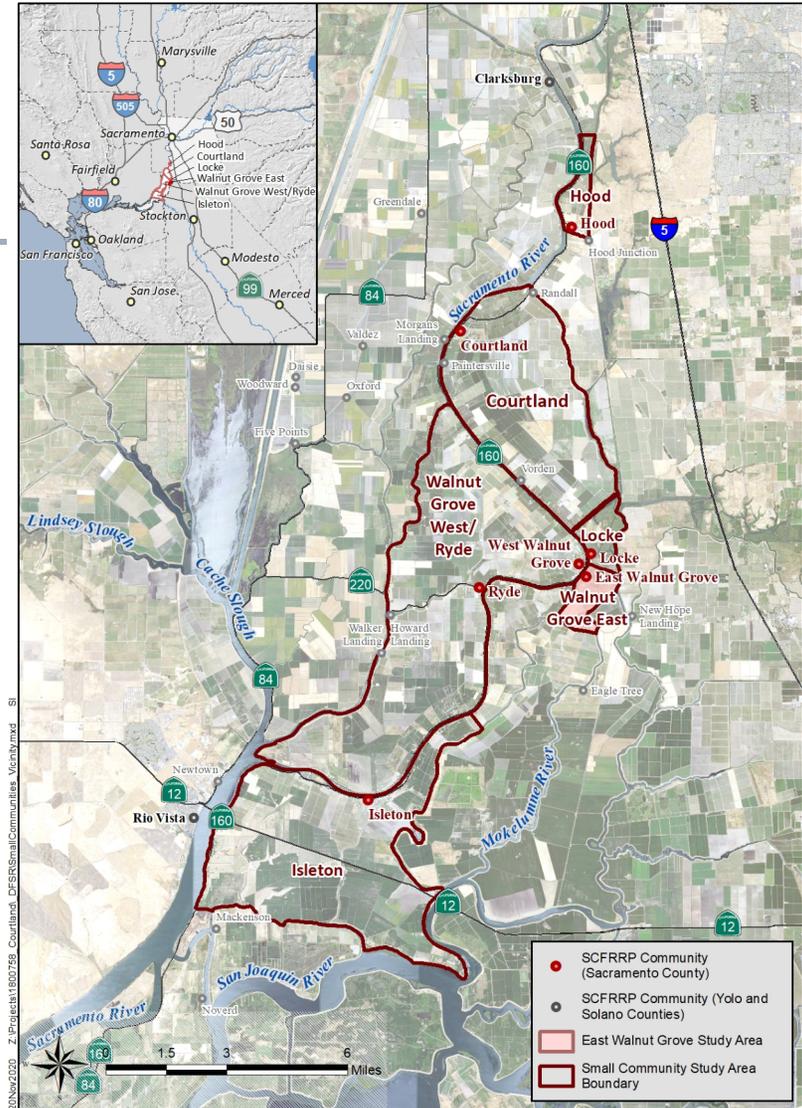
2018-2021 Flood Studies for Sacramento River Delta Legacy Communities

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

- California State Flood 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 grant funds in the Sacramento River corridor:
- **Sacramento County**
 - **Hood** – State MA 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

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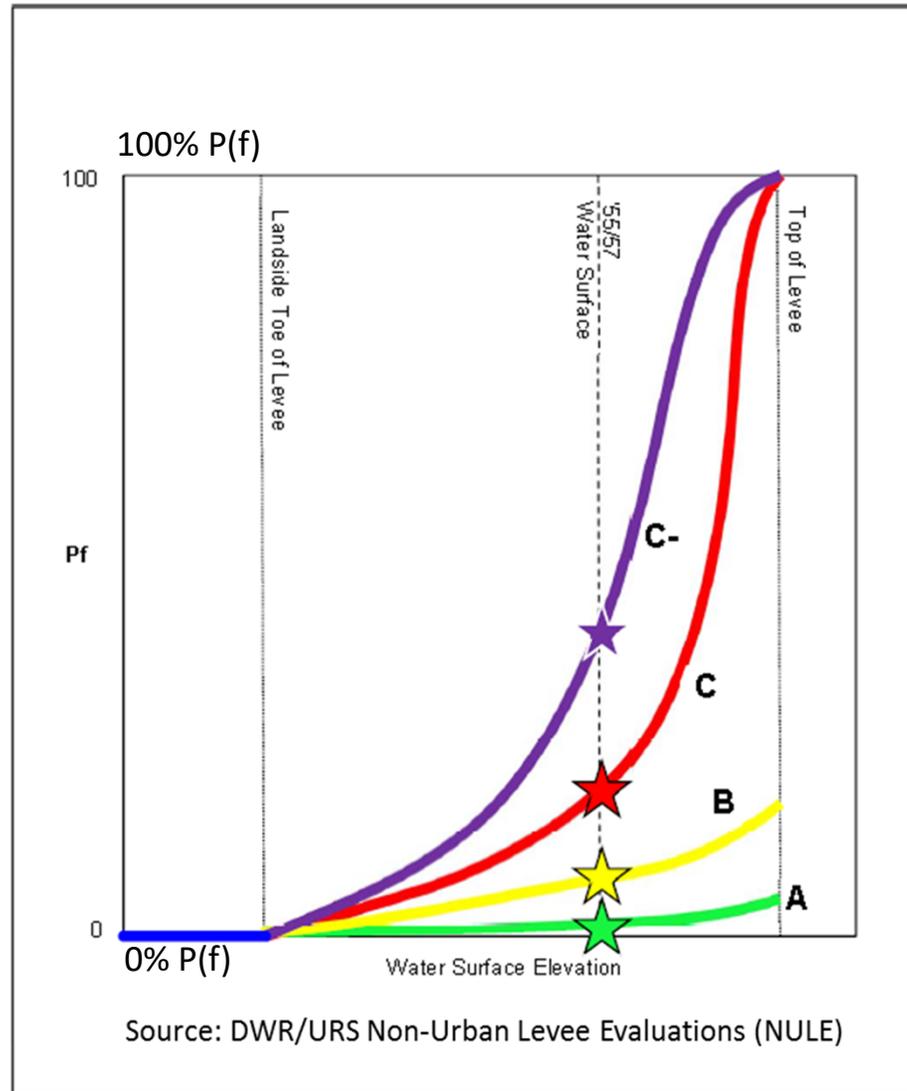
- Delta Legacy Communities subject to **Deep Flooding**
- Most all Delta Legacy **Communities have not flooded in last 100 years;**
but FEMA doesn't recognize presence of Fed/State authorized levee system
- **Levees fall well short (millions of \$\$'s) of meeting current through-seepage and under-seepage FEMA accreditation standards (44 CFR §65.10);**
High FEMA flood insurance rates required for federally-backed home mortgage loans
- **RDs/LMAs largely limited to acreage-based assessments,** not structure improvement-based values (CA Water Code 12981); *(RD 563 Tyler Island is an exception, where RD 563 assessments also include residential/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%		

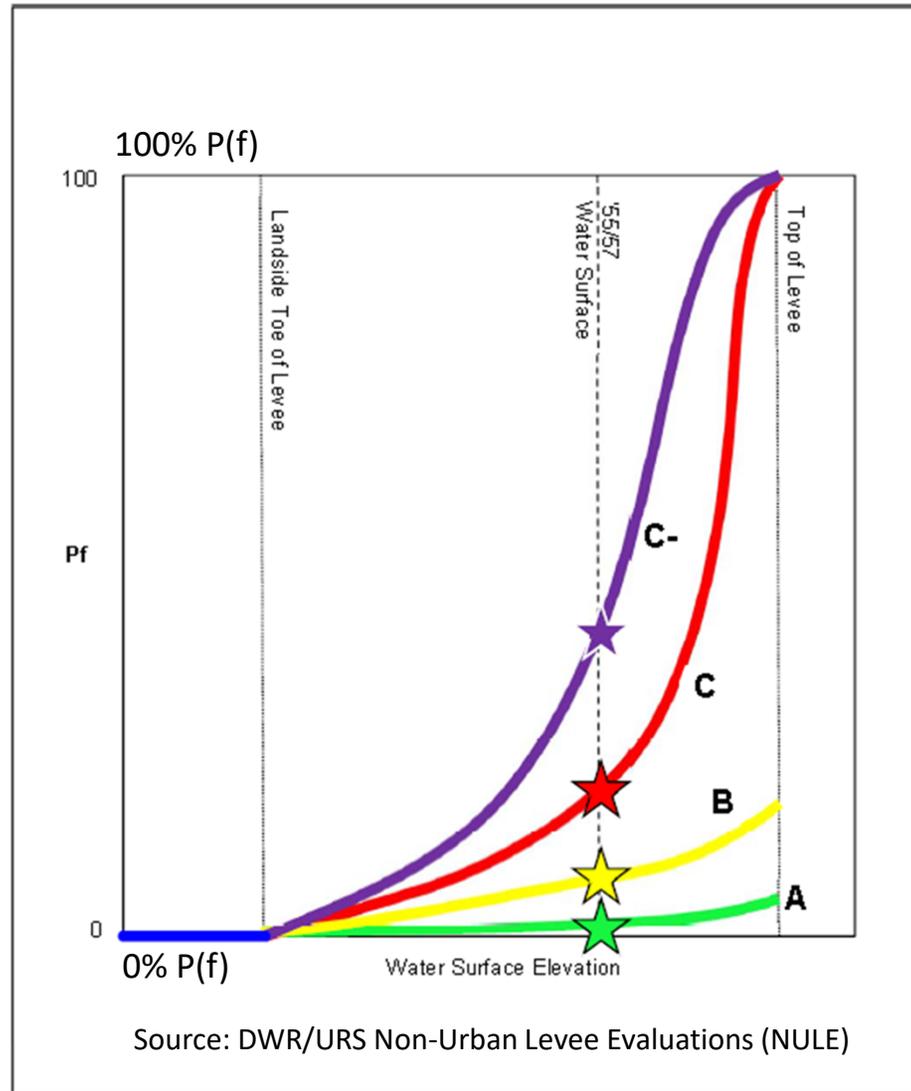
US = Under-Seepage
ST = Stability
TS = Through-Seepage
E = Erosion

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

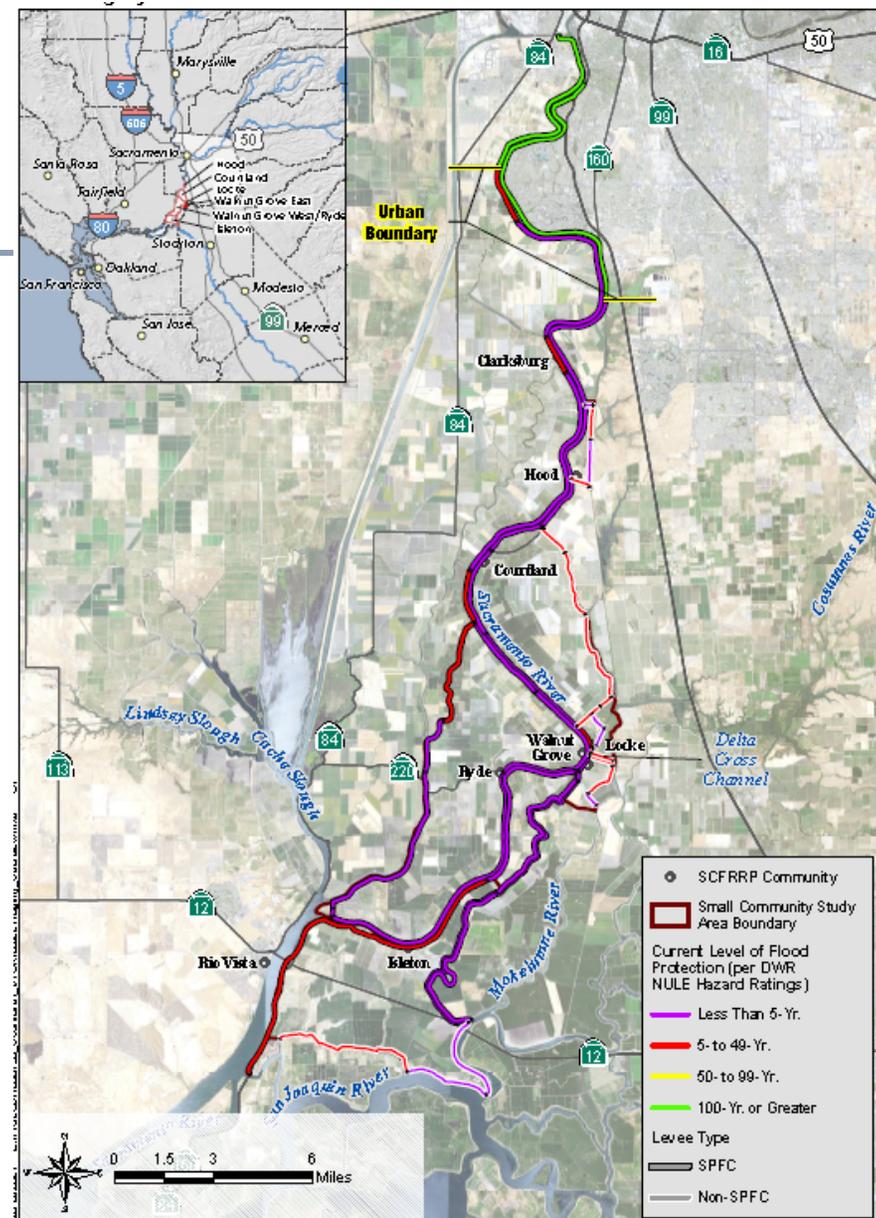


Typical Levee Performance Curve for Different Levee Segments Protecting Delta Legacy Communities per DWR Hazard Ratings

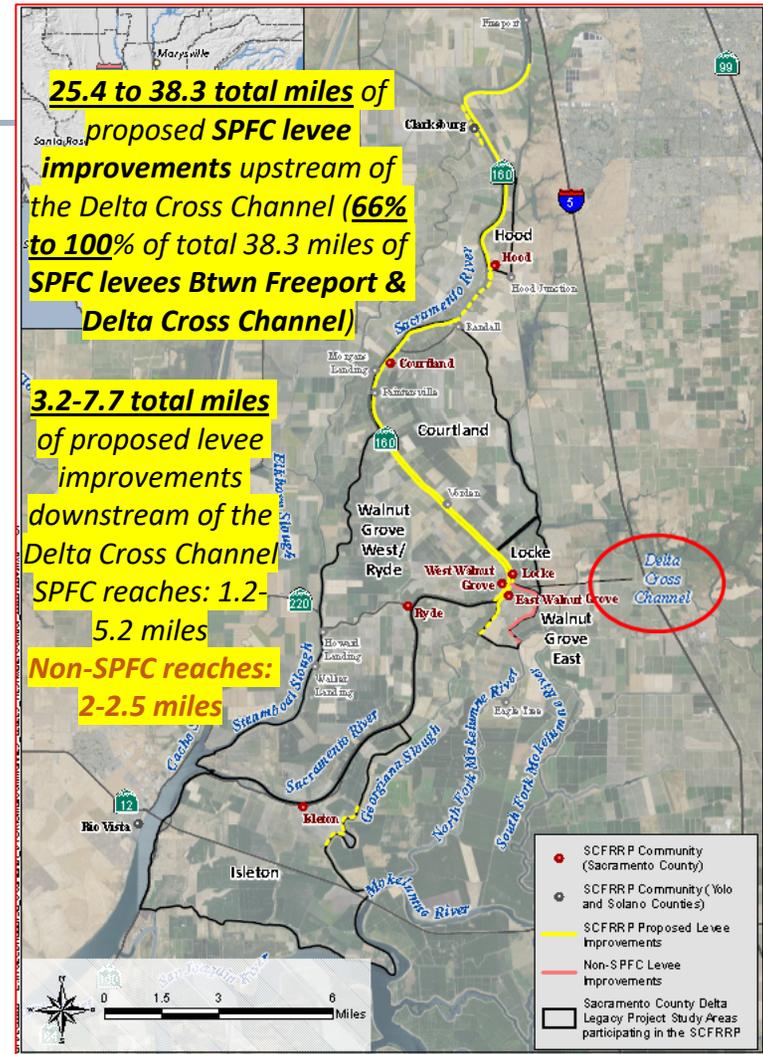
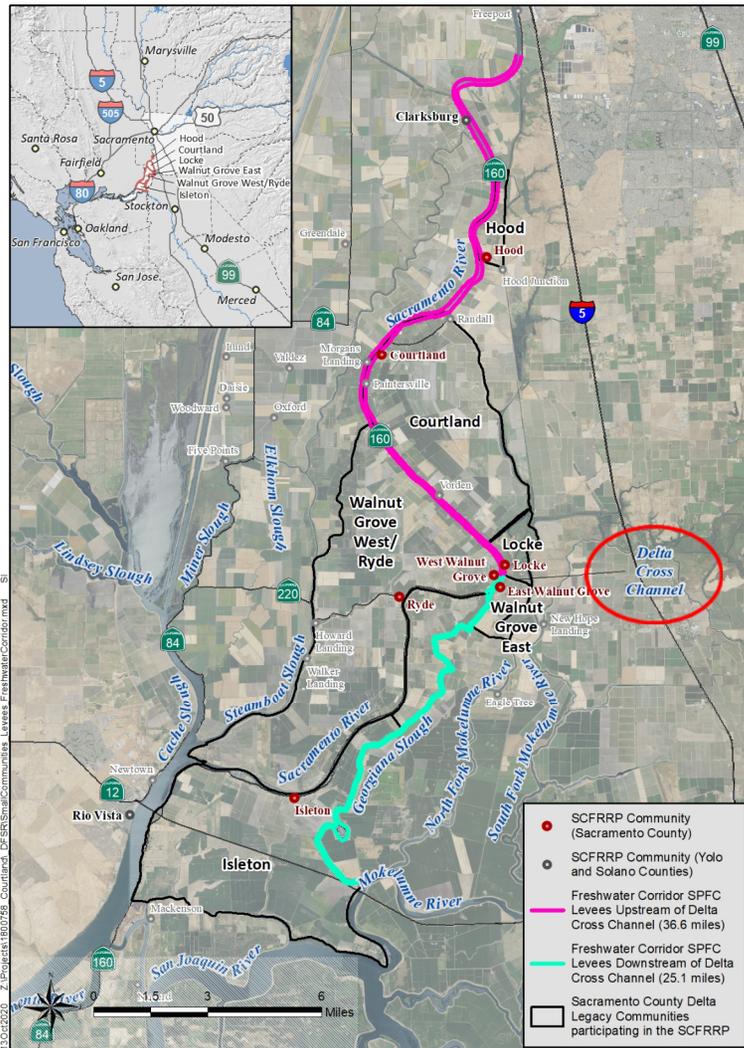
FEMA Gives the North Delta Levees an "F" Grade;
FEMA Assumes the Levees are Non-Existent



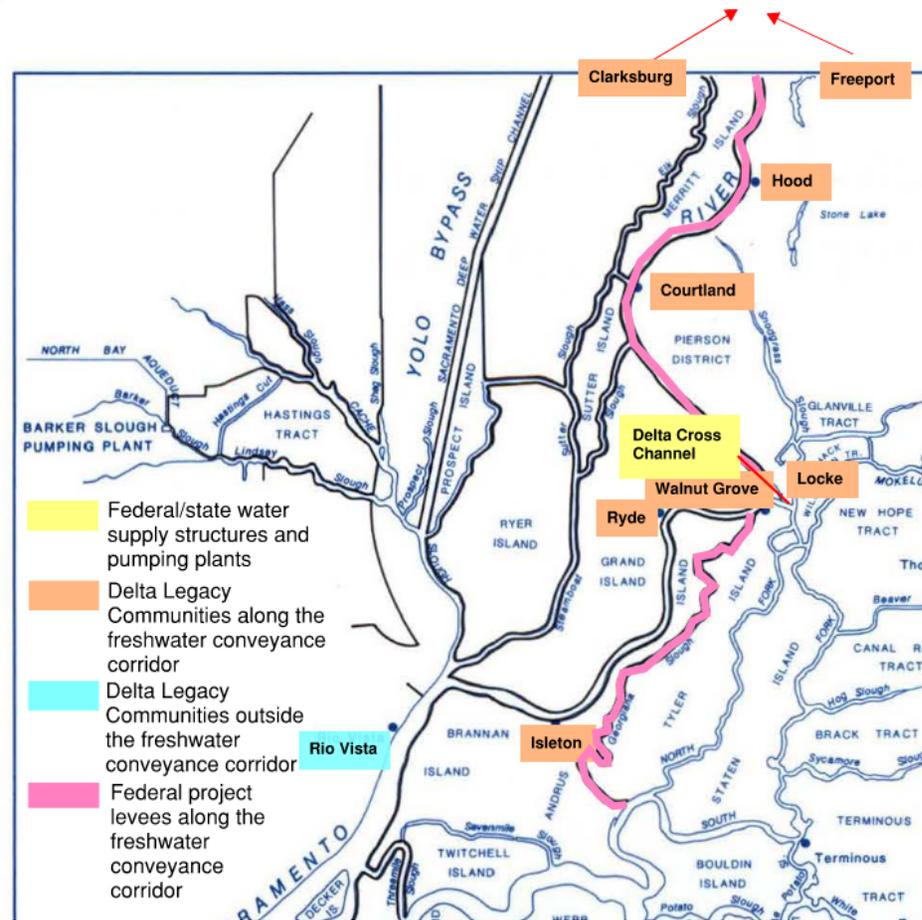
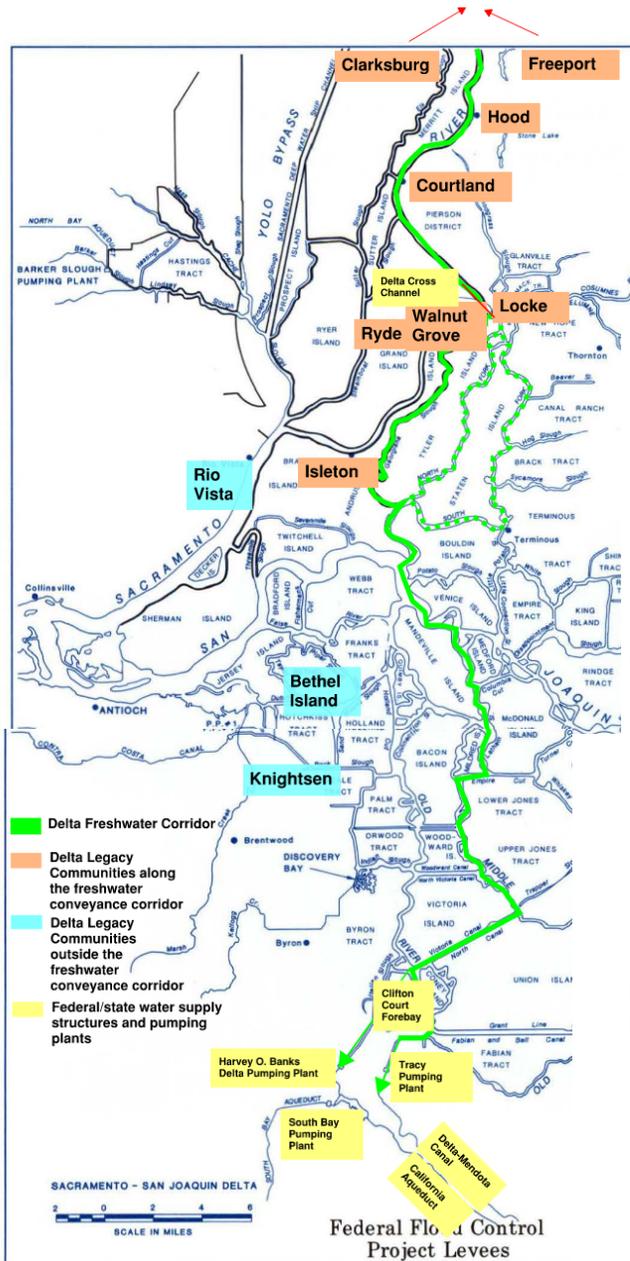
Current Low Levels of Flood Protection for North Delta Legacy Communities per DWR Non-Urban Levee (NULE) Hazard Rating Report Card



Multi-Benefits Include Repairing & Strengthening-in-Place Existing SPFC Levels within Existing Fresh Water Conveyance Corridor w/ or w/o DCA Improvements: Cost-Effective Levee Improvements Improve Resiliency and Reliability of Conveying SWP and CVP Water North of Delta Cross Channel & Reduces Flood Risks



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



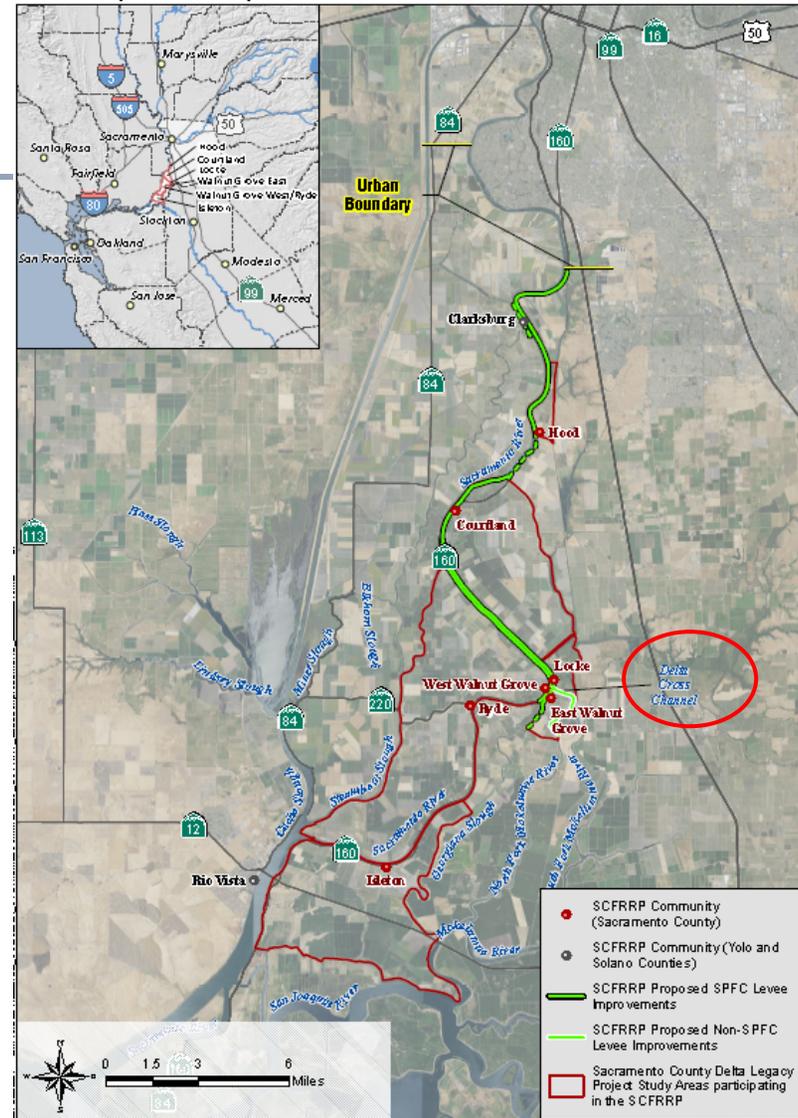
Base Map Source: DWR Delta Atlas July 1995;
SPFC Levees Shown in Black and along Pink Corridor

Combined Levee Improvements & Delta Flow Conveyance Strategy for North Delta

- Repair and Improve Fed/State Levees Now, Prior to or During Delta Conveyance Improvements

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

- Multi-beneficial Alternative to Single-Purpose North Delta DCA Intakes and Tunnel North/Upstream of Delta Cross Channel

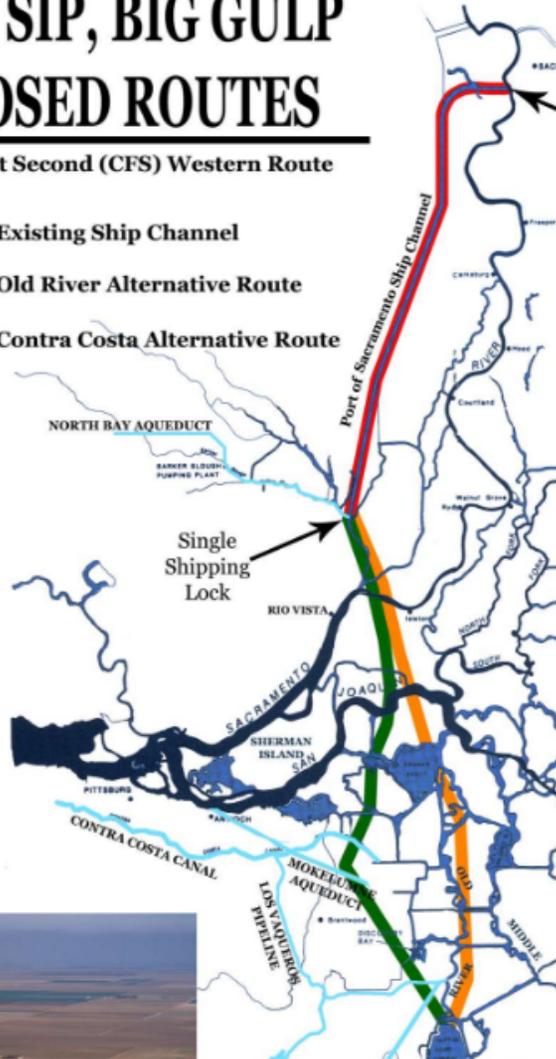


Garamendi's West Side Corridor

LITTLE SIP, BIG GULP PROPOSED ROUTES

3000 Cubic Feet Second (CFS) Western Route

- Existing Ship Channel
- Old River Alternative Route
- Contra Costa Alternative Route

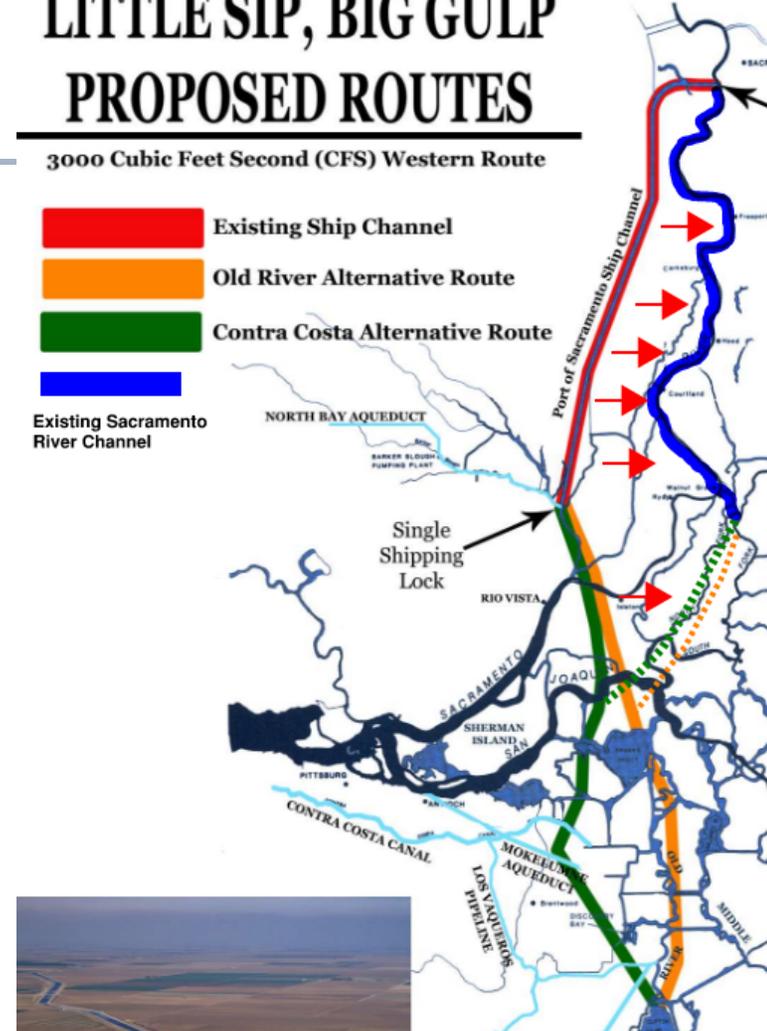


Sacramento River Delta Legacy Community Corridor

LITTLE SIP, BIG GULP PROPOSED ROUTES

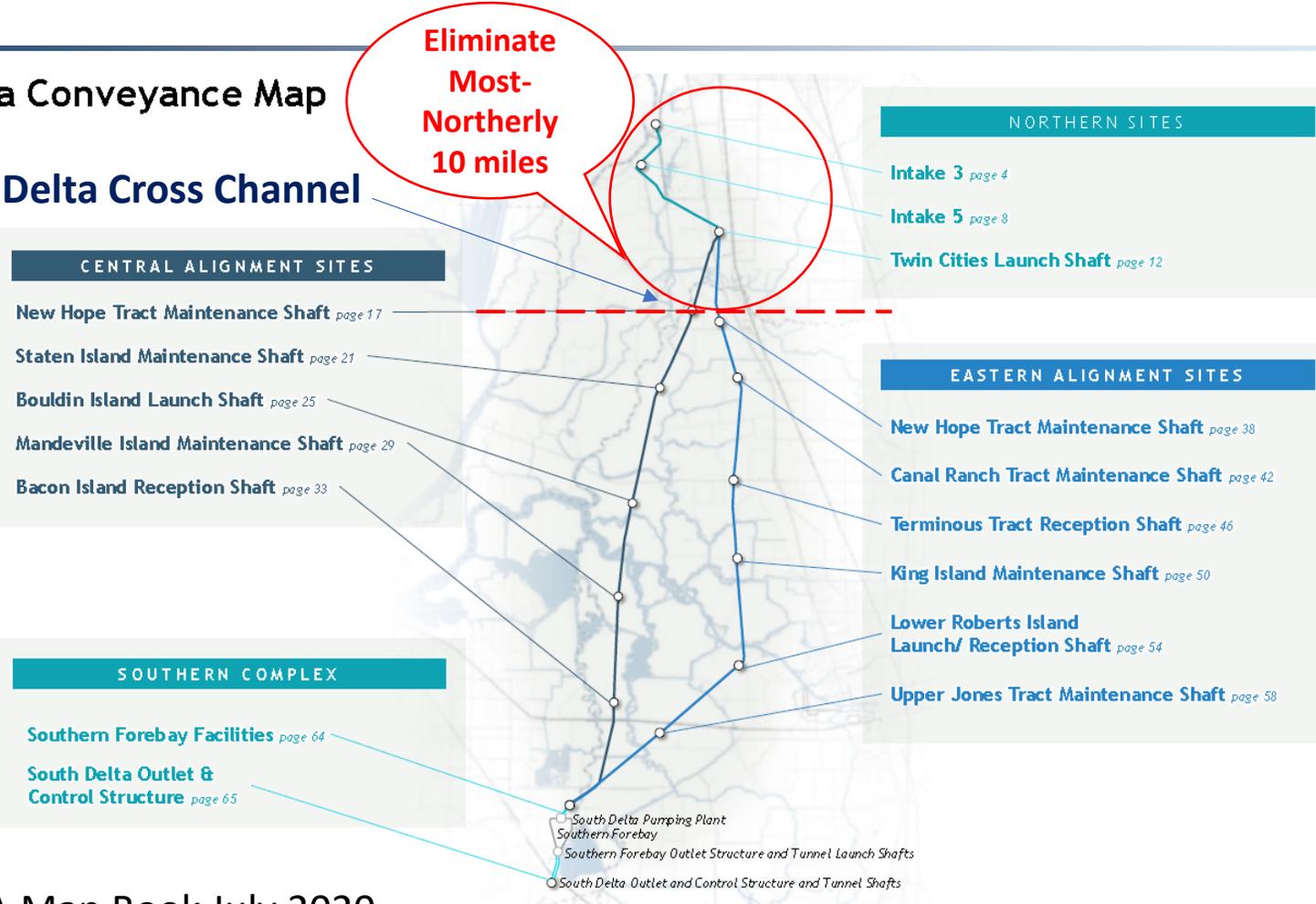
3000 Cubic Feet Second (CFS) Western Route

- Existing Ship Channel
- Old River Alternative Route
- Contra Costa Alternative Route
- Existing Sacramento River Channel



Current DCA Conveyance Components with Either Central or Eastern Tunnel Routes

Delta Conveyance Map



Source: DCA Map Book July 2020

Cost Estimates to Obtain FEMA Certification for Each Sacramento County Delta Legacy Community

Community / Study Area	Estimated Costs for FEMA Certification of Shorter Perimeter Levee Systems (Ring/Cross Levees & Shorter Perimeter Levee Segment Improvements)	Estimated Costs for FEMA Certification of Full, Larger Perimeter Levee Systems, including Non-SPFC Levees within Larger RDs/Study Areas
Hood / MA 9	\$38M-\$45M (cross levee)	\$96M - \$156M
Courtland / RDs 551 & 755	\$33M (ring levee)	\$227M - \$616M
Locke / RD 369	\$16M-\$22M (cross levee)	\$50M - \$76M
East Walnut Grove / portions of RDs 554 & 563	RD 554 FEMA Certification \$29M; and \$4M -\$5M for RD 563 Flood Fight Berm	\$29M for RD 554 portion \$39M for small portion of RD 563
West Walnut Grove & Ryde/ Grand Island – RD 3	\$25M-\$47M (ring levee for Clampett Tract only)	\$375M - \$740M (north of Hwy 220 only)
Sacramento County Delta Legacy Community Totals:	\$150M - \$185M	\$816M – \$1,655M (\$0.82B – \$1.66B)

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

Community - Study Area Reclamation District / Levee Miles	% of Sacramento and Yolo County Sac River Levee Corridor	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	9/38.26 = 24%	\$14.7M/mile - \$41.4M/mile	\$132.3M - \$372.6M
Courtland - RDs 551 & 755 – Pearson Dist.- Randall Is./ 8.52 miles	8.52/38.26 = 22%	\$12.2M/mile - \$47.4M/mile	\$103.9M - \$401.3M
Locke - RD 369 Libby McNeil / 0.96 miles	0.96/38.26 = 3%	\$15.1M/mile - \$32.9M/mile	\$14.5M - \$31.6M
West Walnut Grove - Grand Island – RD 3 / 6.88 miles	6.88/38.26 = 18%	\$6.2M/mile - \$13.9M/mile	\$42.7M - \$95.6M
Left Bank Sac River Levee Btwn Freeport and Steamboat Sl., Incl. Clarksburg / 12.90 miles (max.)	12.9/38.26 = 33%	\$11.6M/mile - \$35.5M/mile	\$149.6M - \$458.0M
Sacramento & Yolo County Sac River – Levee Corridor Totals: 38.26 miles (max.)	38.26/38.26 = 100%	\$11.6M/mile - \$35.5M/mile	\$443.0M - \$1,359.1M vs. DCA 10 Mile Tunnel Segment of \$1,400 M - \$1,840 M (\$140 M – \$184 M/Mile)

Sacramento River Corridor Levee Improvement Costs VS. DCA Tunnel/Intakes in Delta North of Delta Cross Channel

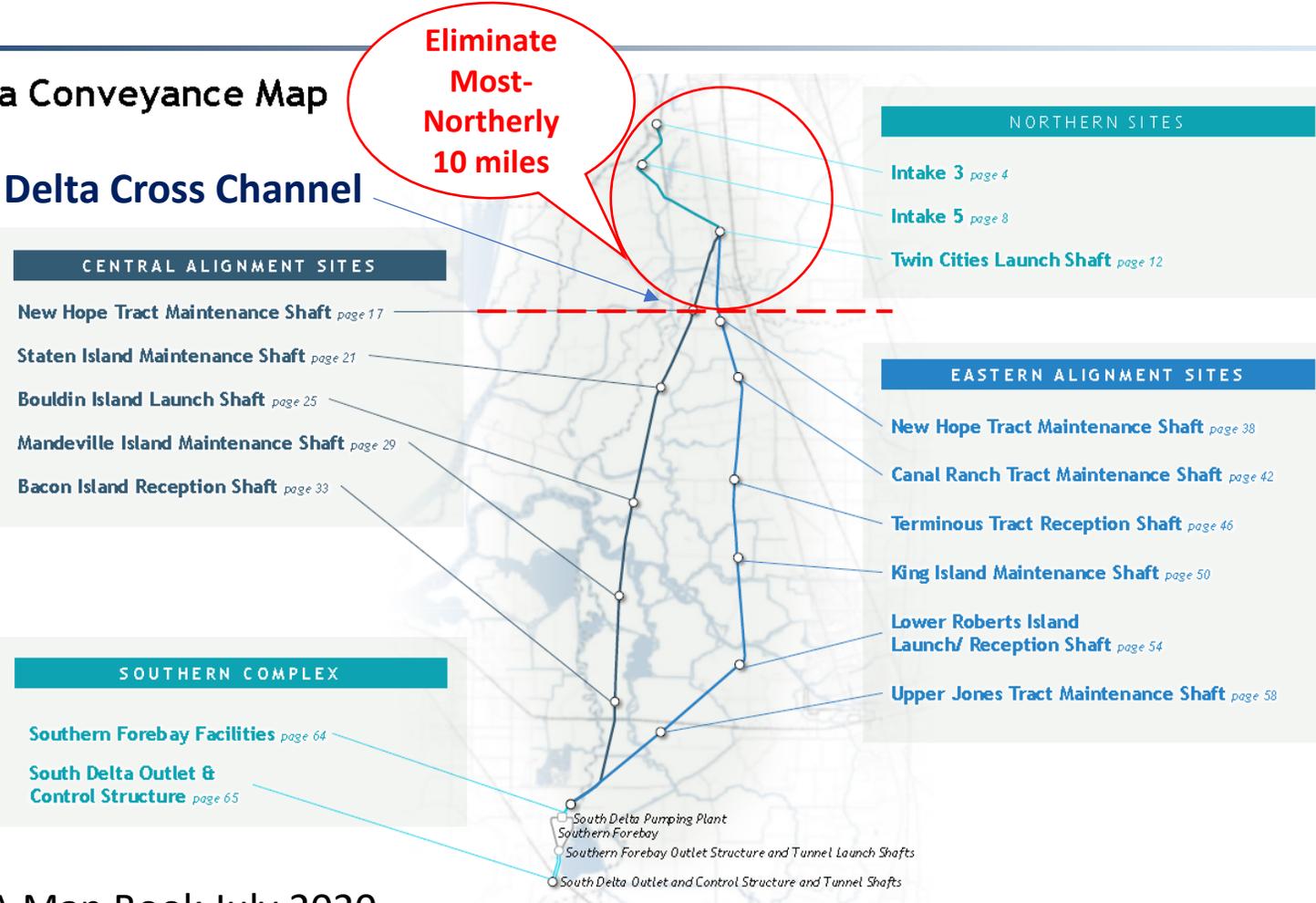
FEMA Certification of Shorter Perimeter Levee Systems (Ring/Cross Levees & Shorter Perimeter Levee Segments Improvements)	FEMA Certification of Full, Larger Perimeter Levee Systems, including Non-SPFC Levee within RDs/Study Areas	Multi-Benefit Sacramento River Corridor SPFC Levee/Conveyance Improvements
\$150M - \$185M	\$816M – \$1,655M	<u>\$443M - \$1,359M</u>

Why expend over \$1.40 Billion to \$1.84 Billion on a single purpose DCA conveyance element when a Multi-Benefit alternative can collectively reduce flood risks to Delta Legacy Communities and improve conveyance resiliency and reliability for less than \$1.4 Billion, utilizing existing/natural infrastructure??

DCA/DWR should consider improving the Sacramento River SPFC levee corridor infrastructure and locate any tunnel elements/intakes further downstream of Delta Cross Channel/Walnut Grove

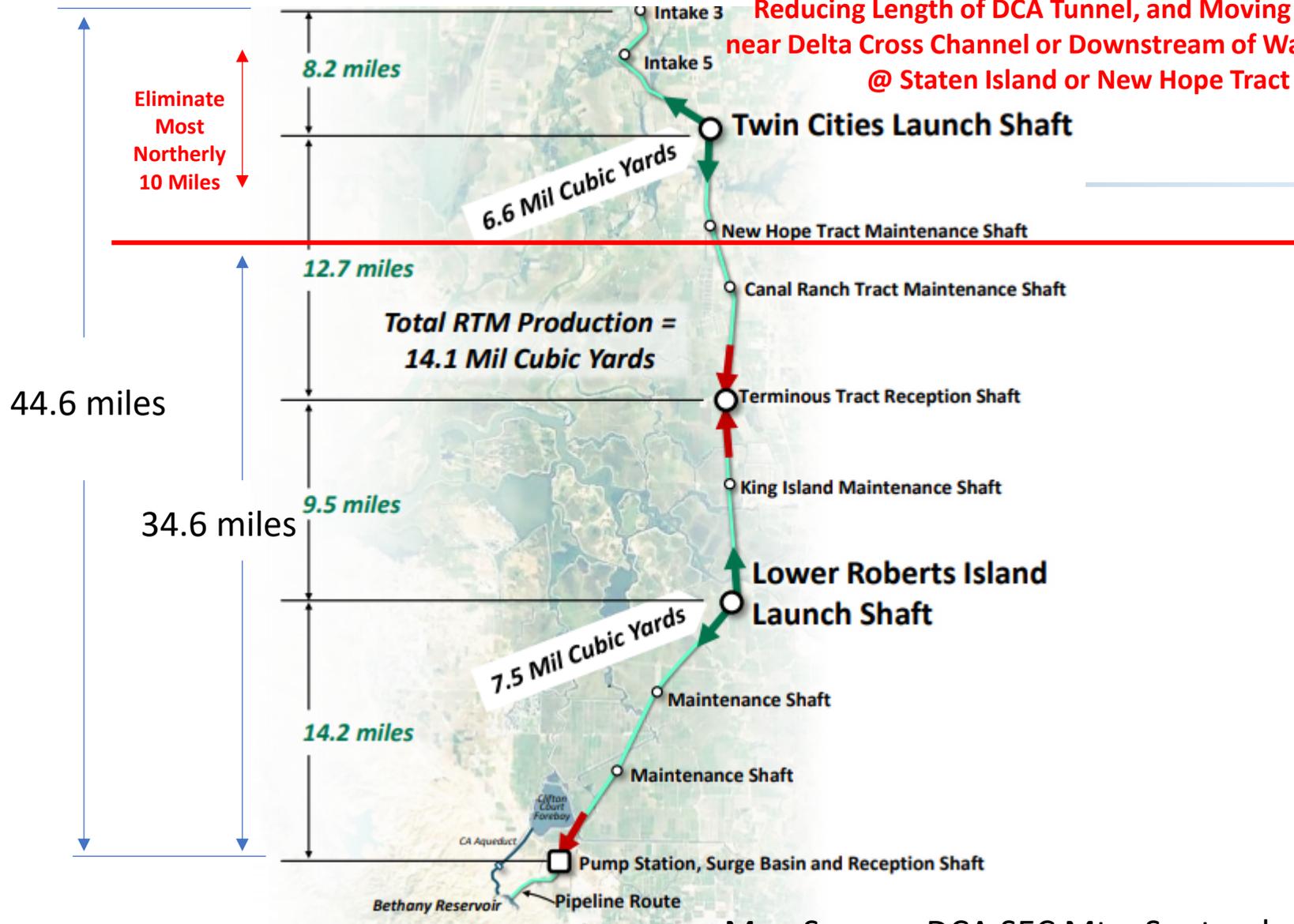
Current DCA Conveyance Components with Either Central or Eastern Tunnel Routes

Delta Conveyance Map



Source: DCA Map Book July 2020

**Cost Reduction of \$1.40B - \$1.84B to DCA by
Reducing Length of DCA Tunnel, and Moving Intake(s)
near Delta Cross Channel or Downstream of Walnut Grove
@ Staten Island or New Hope Tract**



Map Source: DCA SEC Mtg. September 23, 2020

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

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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 State Flood Board, and in-line with **Delta Stewardship Council “Consistency Determination” to protect Delta Legacy Communities**
3. **Delta Legacy Communities Multi-Benefit proposal strategy better, less costly, and more versatile than current, single-purpose DCA 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.)

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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 **just need to be modernized**-in-place to meet current Federal/State 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 DCA)** to help offset costs that will also improve reliability and resiliency in conveying water through the Delta.

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

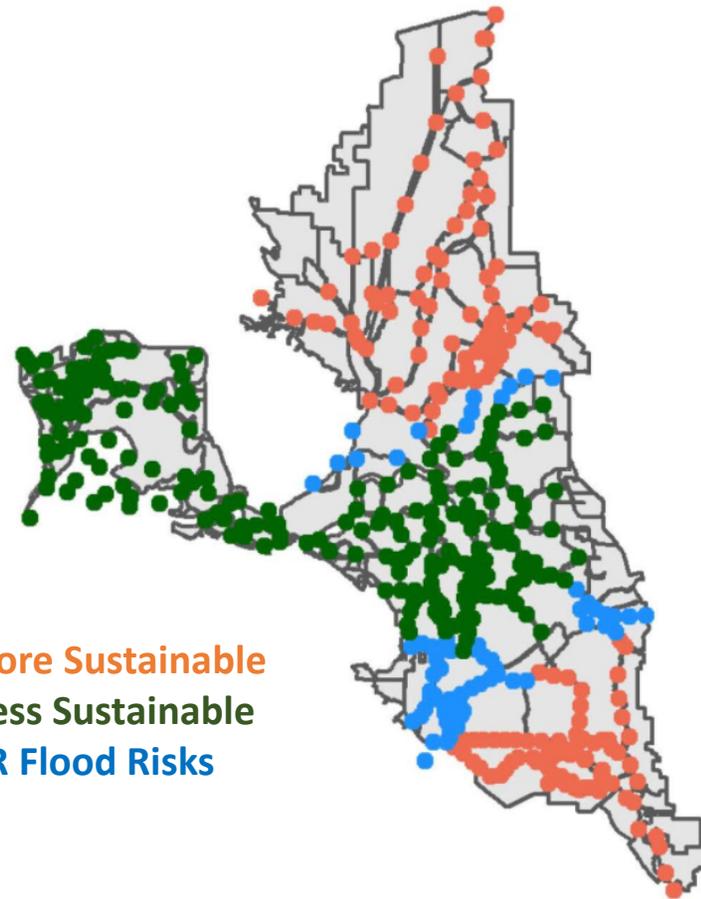
<http://sacdelta.stormready.org>

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

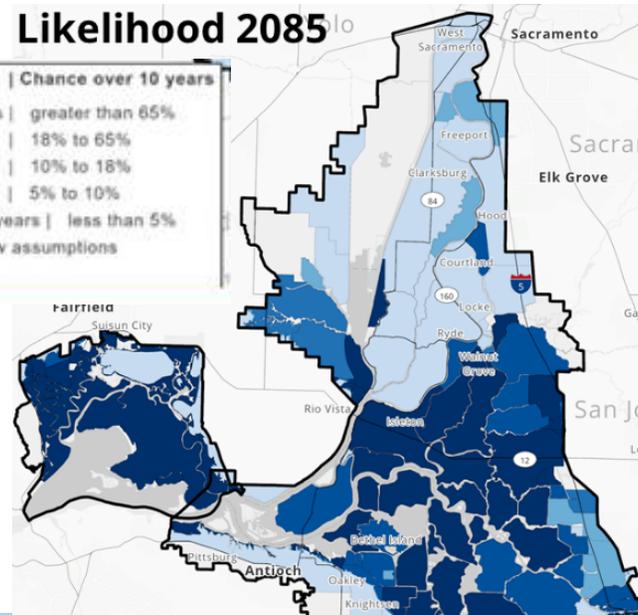
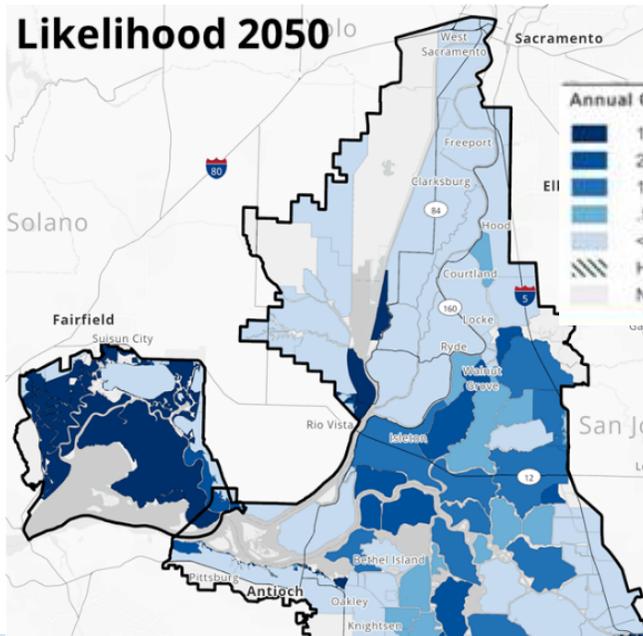
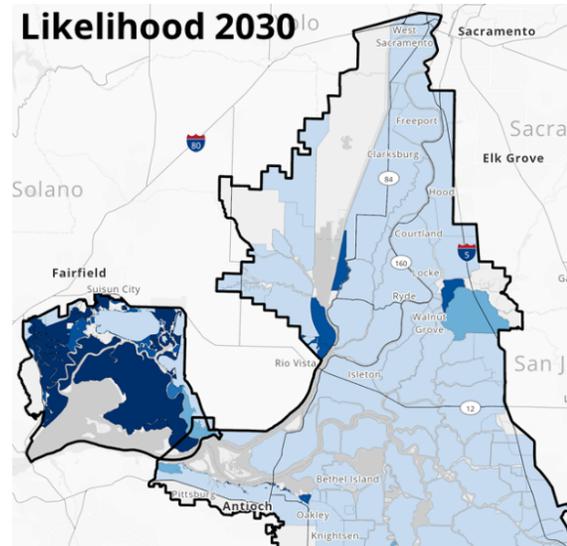
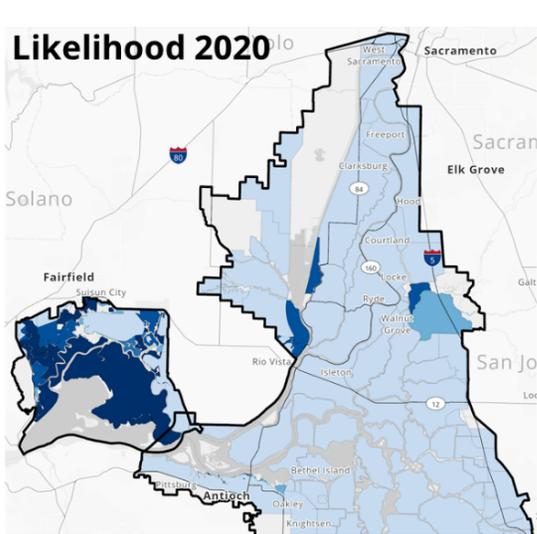


Orange Subject to Riverine Flooding – More Sustainable
Green Subject to SLR and Subsidence - Less Sustainable
Blue Transition Area Btwn Riverine & SLR Flood Risks

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

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

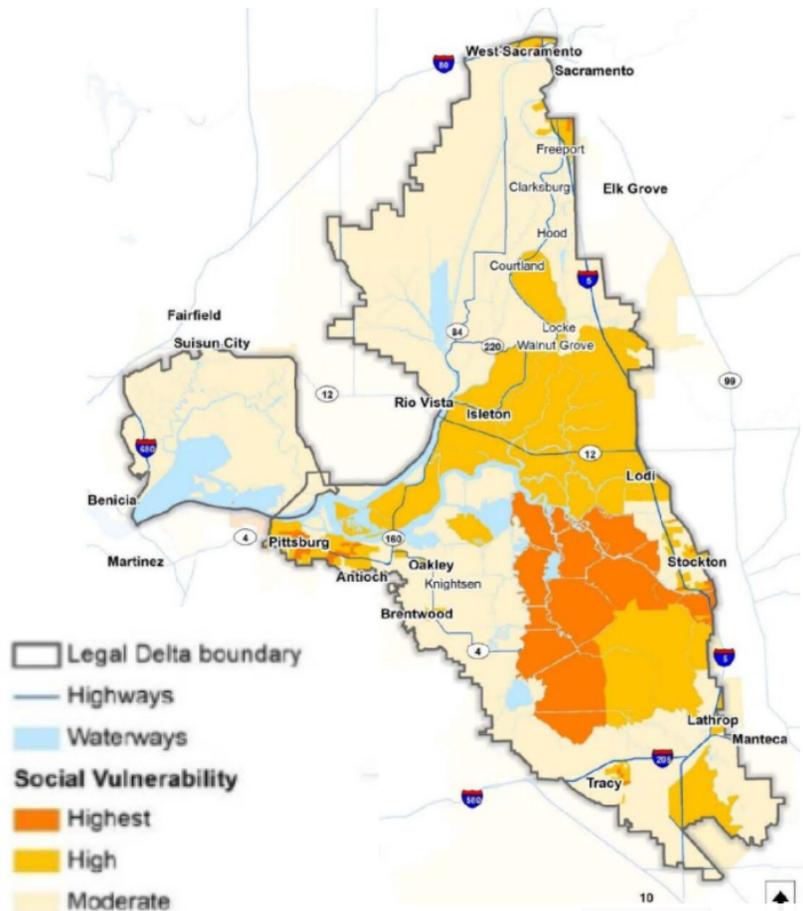
Source: Delta Adapts Study – Delta Stewardship Council Jan 2021



Annual Chance	Return Period	Chance over 10 years
10%	less than 10 years	greater than 65%
2-10%	10 to 50 years	18% to 65%
1-2%	50 to 100 years	10% to 18%
.5-1%	100 to 200 years	5% to 10%
<.5%	greater than 200 years	less than 5%
High sensitivity to SJR inflow assumptions		
Not Modeled		

Delta Adapts Study (by DSC)

Populations Vulnerable to Future Flooding



Vulnerable Populations

Social vulnerability index (comprised of 14 indicators):

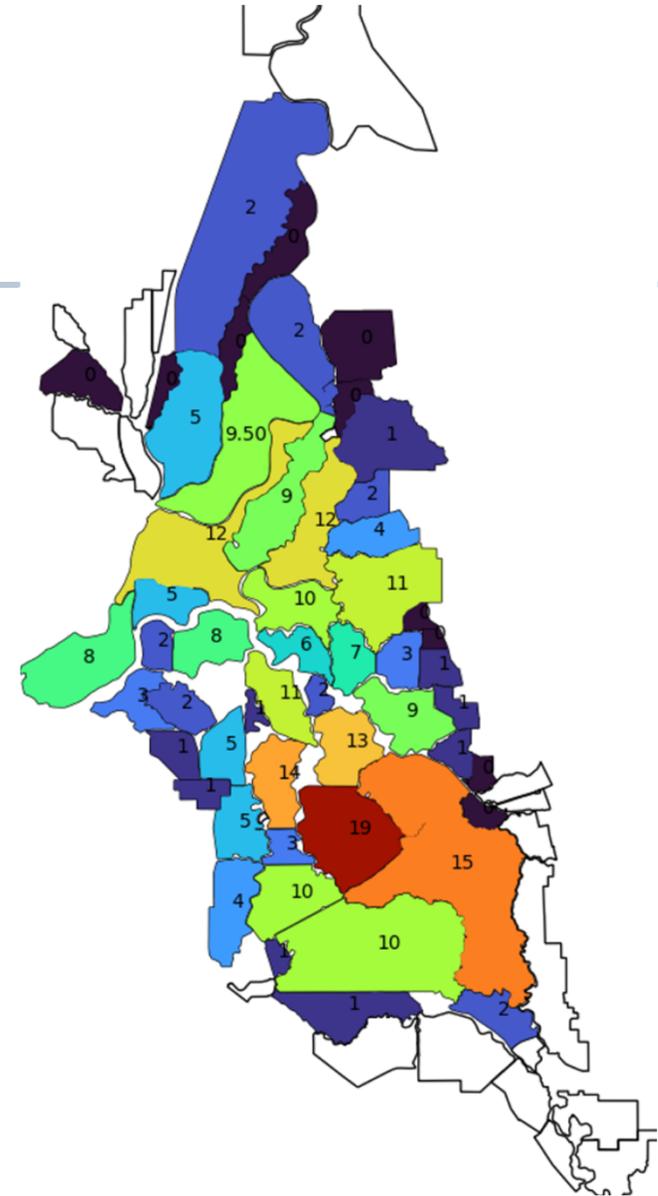
- Young children
- Older adults living alone
- Ability status
- Educational attainment
- Linguistic isolation
- Poverty status
- Race and ethnicity
- Tenancy
- Vehicle access
- Access to health insurance
- Asthma rate
- Cardiovascular rate
- Low birth weight rate
- Food security

Other vulnerable populations:

- Outdoor workers
- Incarcerated populations
- Institutionalized populations
- People experiencing homelessness
- People living in mobile homes

Median Days of Delta Export Disruption for Each Delta Island

- *Levee Breaches in North Delta Pose the Smallest Risks to Interruptions of Delta Exports*
- *DCA Intakes/Tunnel(s) Don't need to Extend to Extreme North Delta as Currently Proposed*
- *Greatest Risks to Disruption of Exports are in Central/South Delta*
- *Tunnel is of Greatest Value in Central/South Delta Where Islands are more Susceptible to Subsidence and Sea Level Rise (SLR)*

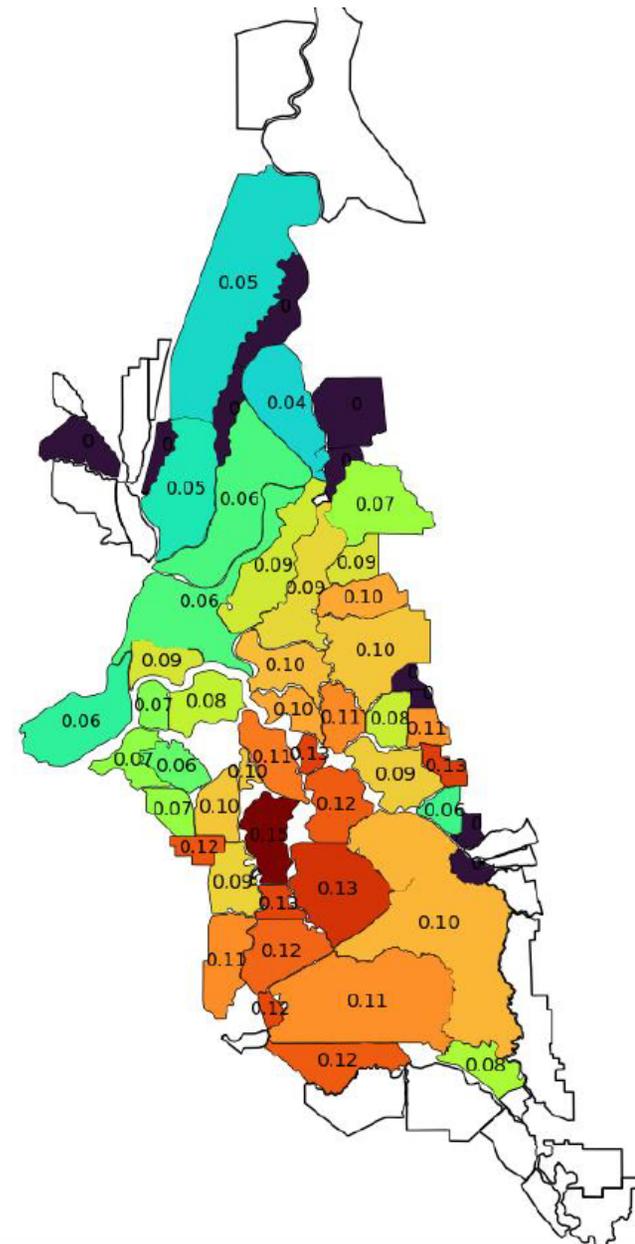


Source: Delta Science Program for Delta Stewardship Prepared by Resource Management Associates, Inc., July 2020

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

(Dark Blue Islands Have Zero Median Disruption Days)

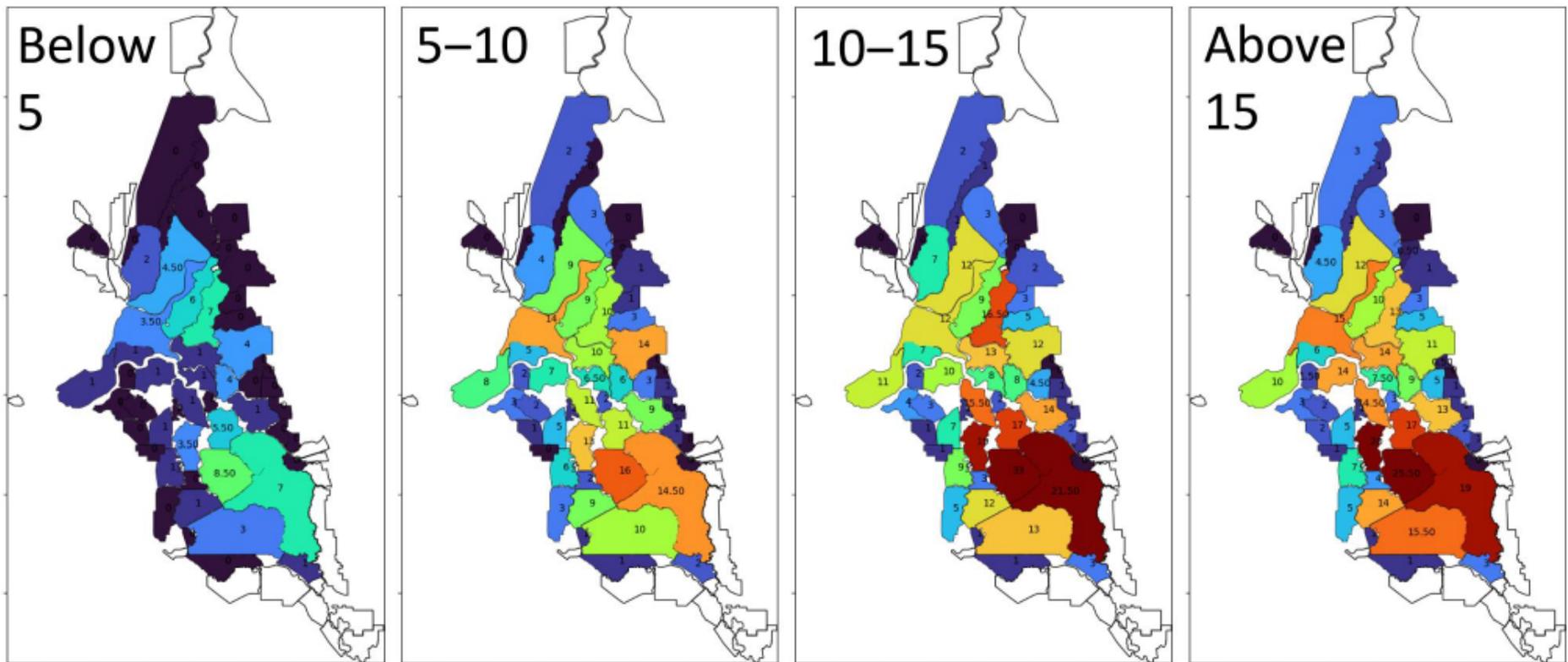
- *Levee Breaches in North Delta Pose the Smallest Risks to Interruptions of Delta Exports*
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- *Greatest Risks to Disruption of Exports are in Central/South Delta*
- *Tunnel is of Greatest Value in Central/South Delta Where Islands are more Susceptible 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

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

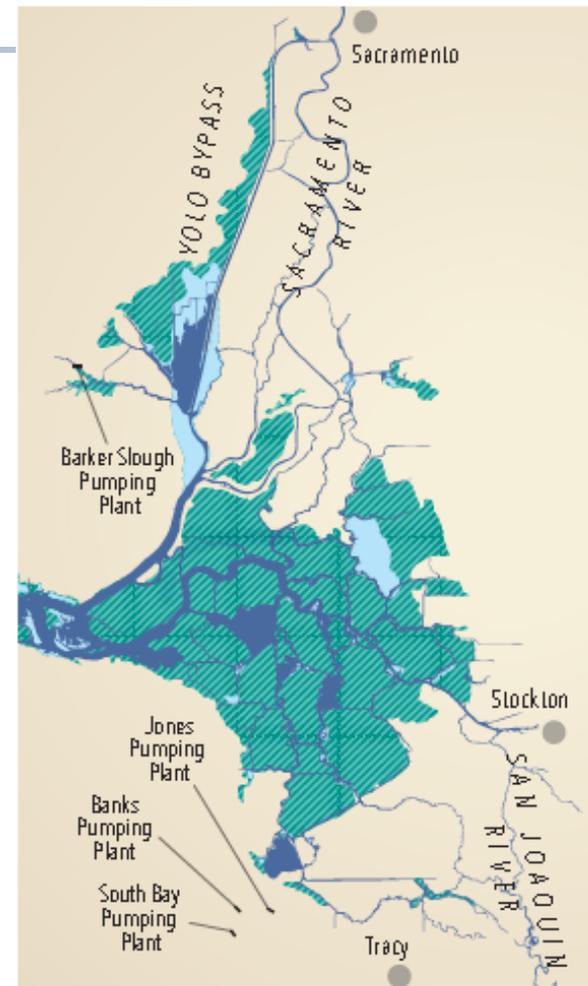
- Improved State/Federal Levees along the Sacramento River Corridor in the North Delta will Substantially Reduce Flood Risks to the Delta Legacy Communities of Freeport, Clarksburg, Hood, Courtland, Locke, Walnut Grove, Ryde, and Isleton. These flood risk reduction measures also reduce the potential liability of the State and DWR 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 @ Staten Island or New Hope Tract 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
- Investing \$\$'s 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 \$0.44B and \$1.36B, which is less than \$1.40B to \$1.84B estimated for the same, parallel reach of the proposed DCA tunnel segments upstream of the Delta Cross Channel.
- 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 considered 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, including, but not limited to, much needed non-SPFC levee and/or channel enhancements in the Central/South Delta

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

Source: California Water Resilience Portfolio – July 2020

Future Flooding Potential with Sea Level Rise

- Flood zone circa 2015
- Flood zone with 5 feet sea level rise (1.5 meters, estimated 2100)
- Open water



Average Annual Flows Utilized and Routed Through Delta

21.8 MAF Inflow

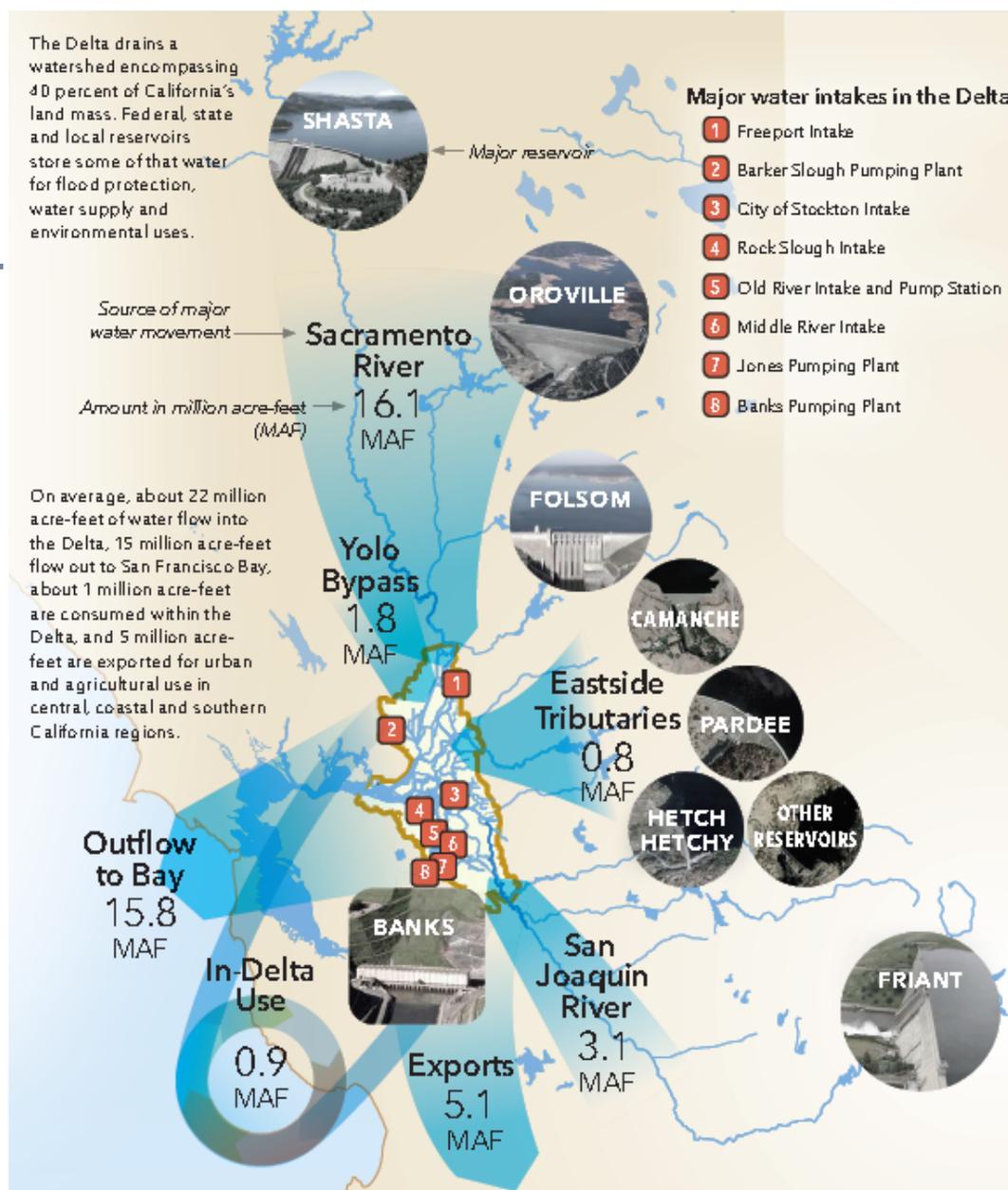
- 15.8 MAF Outflow to Bay

- 0.9 MAF In-Delta Use

5.1 MAF Avail. for Exports

Source: California Water Resilience Portfolio – July 2020

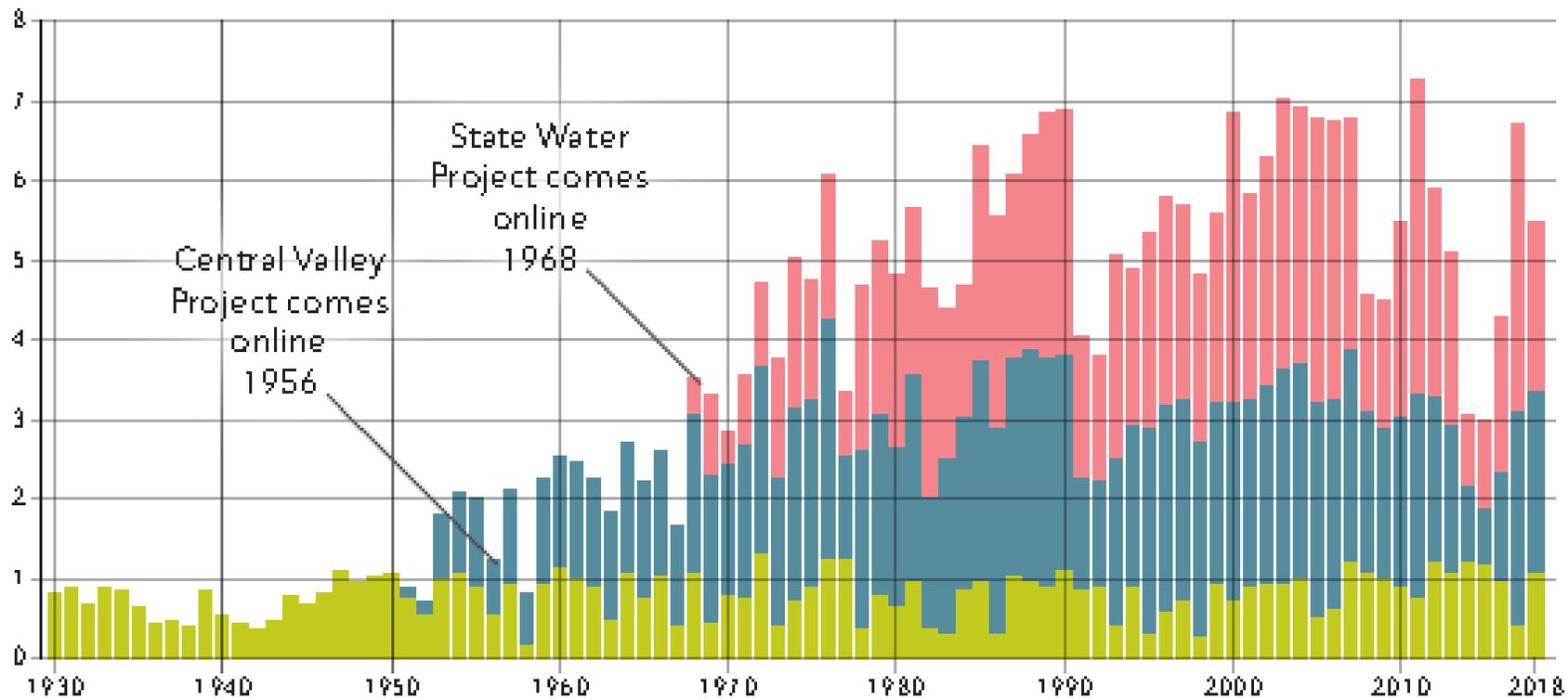
Note: During Drought Conditions Delta Inflow Values are Substantially Reduced in Comparison to Reductions of Delta Exports



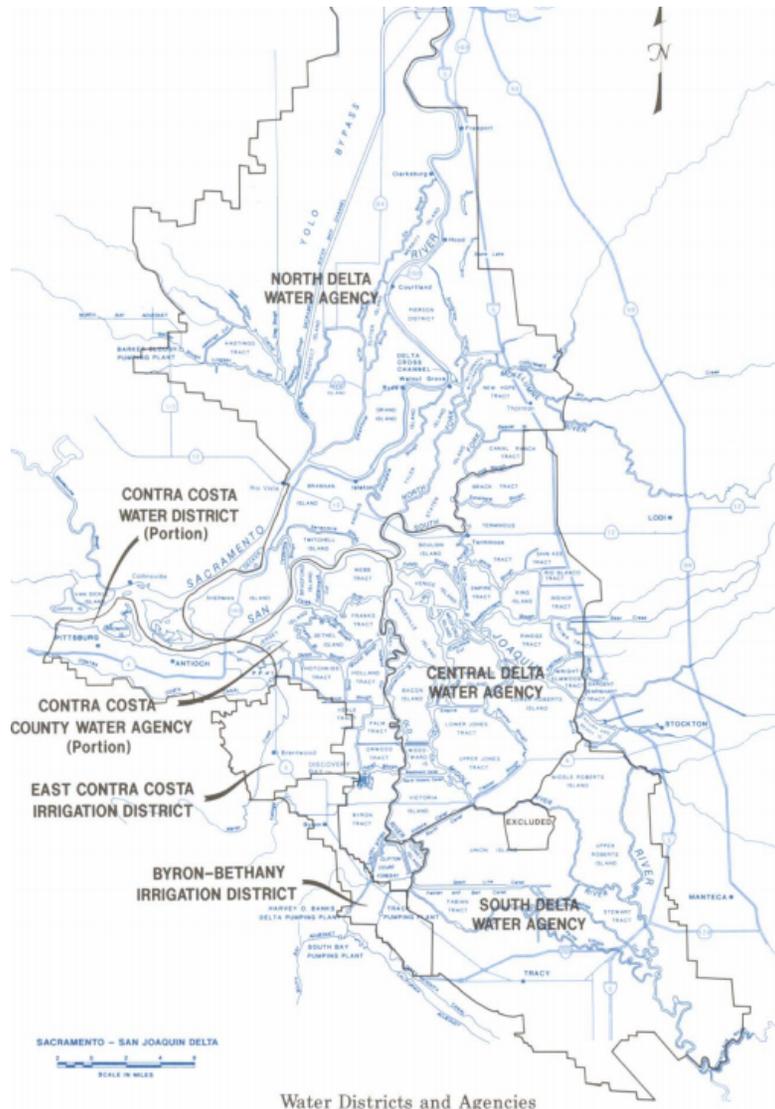
Historic Water Consumption Demands of Water Flowing Within and Through the Delta

Major uses of water that flows to the Delta, from 1930-present

In millions of acre-feet ■ In-Delta use ■ Central Valley Project (CVP - Federal) ■ State Water Project (SWP - State of California)



Source: California Water Resilience Portfolio – July 2020



Water Districts and Agencies

Map Source: DWR Delta Atlas July 1995

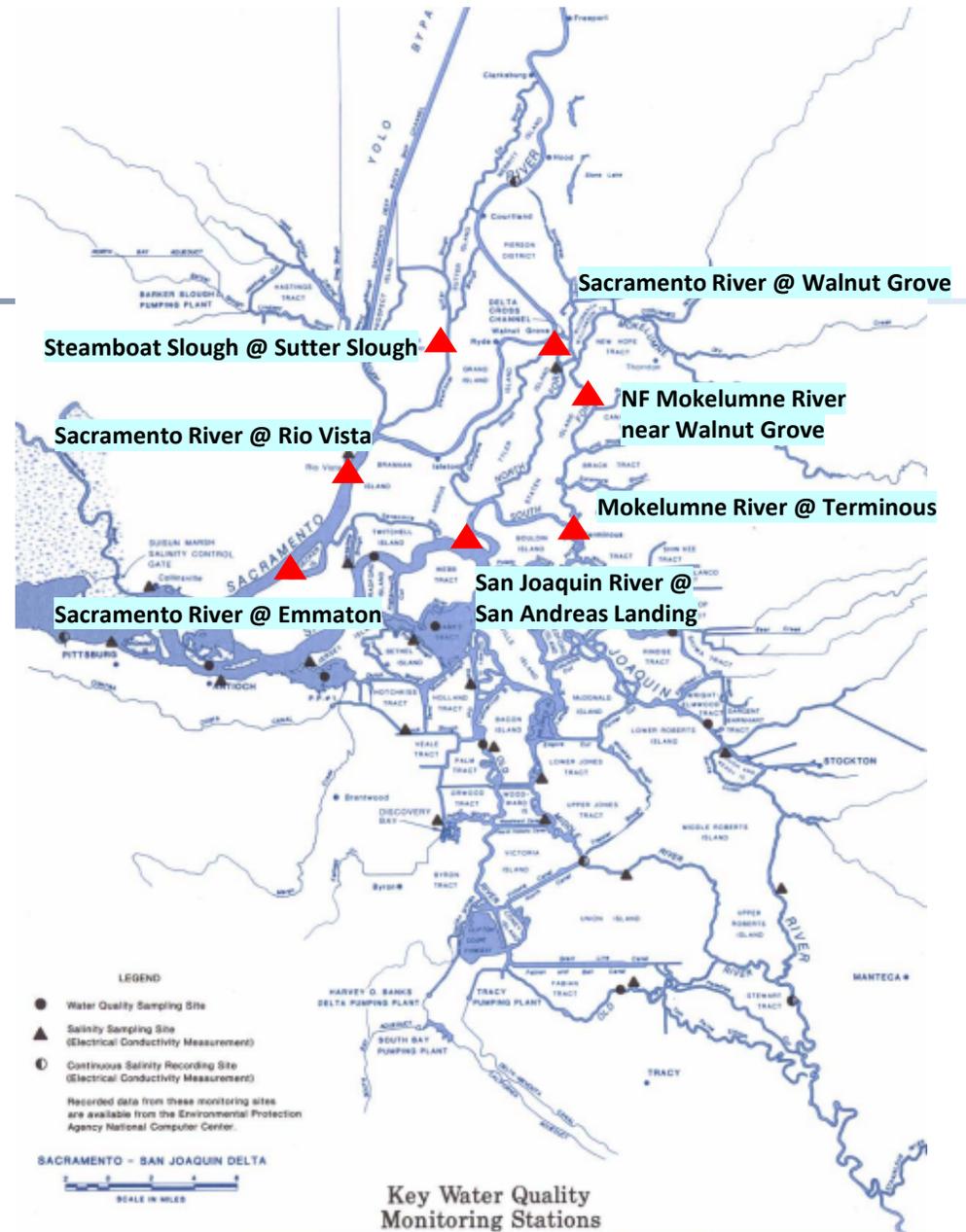
Water Agencies/Districts in Delta

- 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

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

Preliminary Project Benefits

SWP Reliability and Resilience Compared to Future Conditions

Without Project may result in ~300,000 AF to 1 MAF reduction in SWP supplies

CLIMATE RESILIENCY

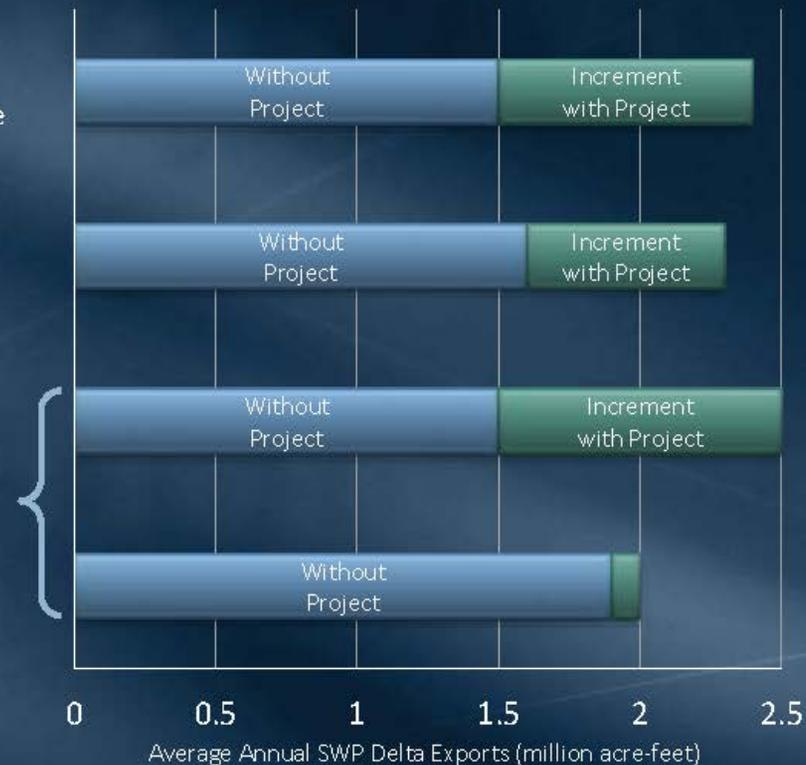
Protect up to ~900 TAFY under extreme sea level rise

SEISMIC RESILIENCY

Protect or preserve up to ~700 TAFY under seismic risks and Delta island flooding

WATER SUPPLY RELIABILITY OPERATIONAL RESILIENCY

Protect or provide ~100 TAFY to ~1000 TAFY
More restrictive South Delta
Increased Delta Outflow Requirements



TAFY = Thousand acre-feet per year on average

Note: Project has potential to increase SWP reliability or mitigate losses under many plausible future risk scenarios

Bay-Delta Committee

Item 6a Slide 14

September 22, 2020

Source: DCA SEC Mtg Sept 22, 2020

DCA Construction Cost Estimates for Tunnel Segments and Contingencies

ITEM	VALUE
CONSTRUCTION¹	\$ 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 Oversight	\$ 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.

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 contractor 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 oversight costs

Categories of Soft Costs

DCO OVERSIGHT		1.5% OF CONSTRUCTION
<ul style="list-style-type: none"> • Engineering Standards Compliance • Program Controls Monitoring (Schedule and Budget) 	<ul style="list-style-type: none"> • Invoice Processing and Payment • Start-up and Commissioning Support • Environmental Monitoring 	
PROGRAM MANAGEMENT OFFICE		3.5% OF CONSTRUCTION
<ul style="list-style-type: none"> • Executive Office • Executive Support (HR, Legal, Audits, Treasury) 	<ul style="list-style-type: none"> • Program Controls (Inc. Procurement) • Shared Professional Services (Safety, Permitting, Real Estate, Quality, Sustainability, Outreach) 	
ENGINEERING MGT, DESIGN, AND CONSTRUCTION MGT		20% OF CONSTRUCTION
<ul style="list-style-type: none"> • Project Management • Design Services thru Construction Closeout • Field Investigations and Temporary Easements • Independent Technical Reviews 	<ul style="list-style-type: none"> • Construction Project Management • Construction Oversight Services • Off-site/ Factory Inspections and Validations • Commissioning and Start-up 	
PERMITTING AND AGENCY COORDINATION		0.5% OF CONSTRUCTION
<ul style="list-style-type: none"> • Permit fees 	<ul style="list-style-type: none"> • Agency fees 	
LAND ACQUISITION:		2.5% OF CONSTRUCTION
<ul style="list-style-type: none"> • Easements 	<ul style="list-style-type: none"> • Land purchase 	



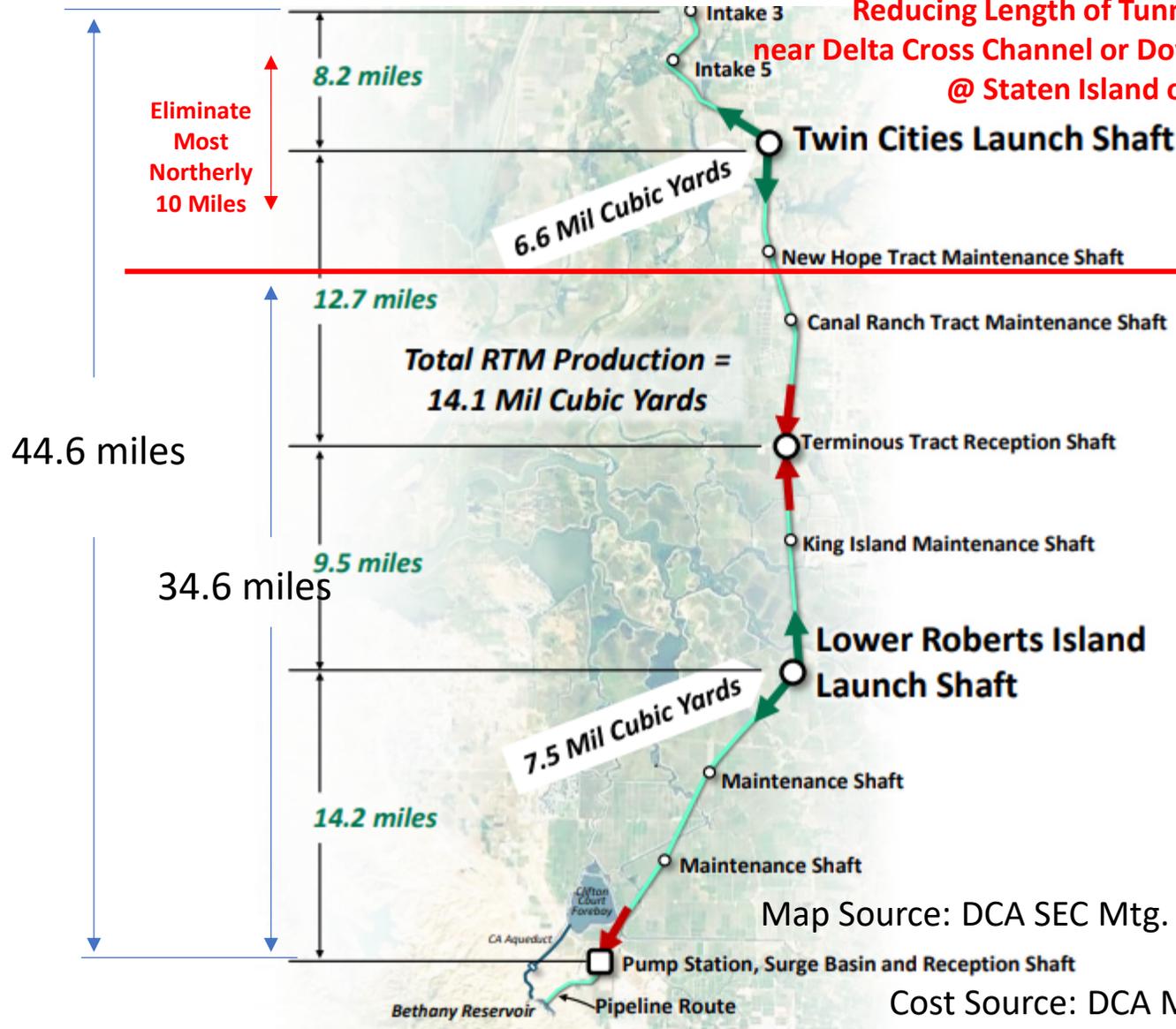
8/20/2020

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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/East of Walnut Grove @ Staten Island or New Hope Tract



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

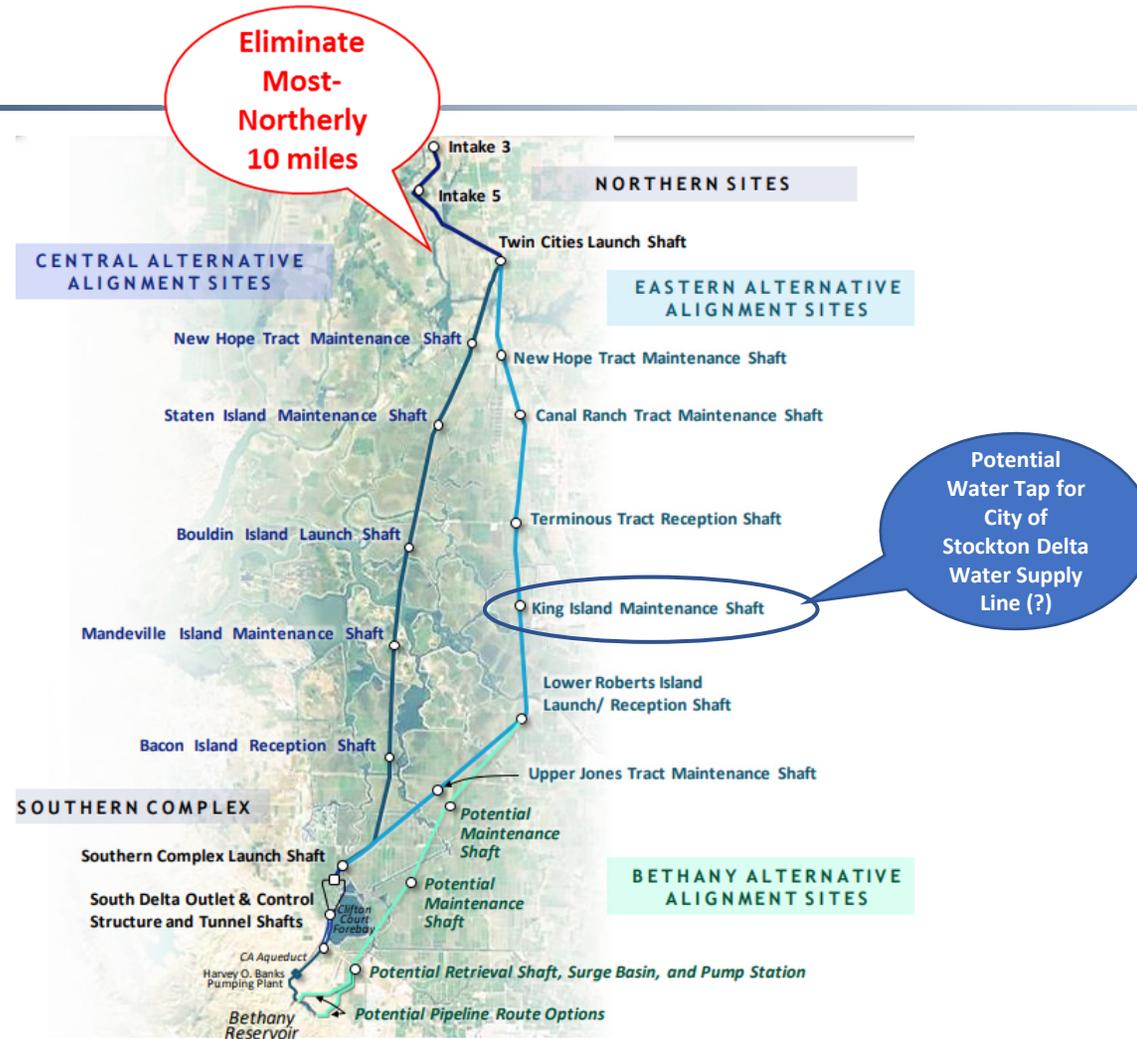
22.4% x \$6.262B/Tunnel = **\$1.40 Billion** for 10 Miles of Tunnel/Shaft Construction

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