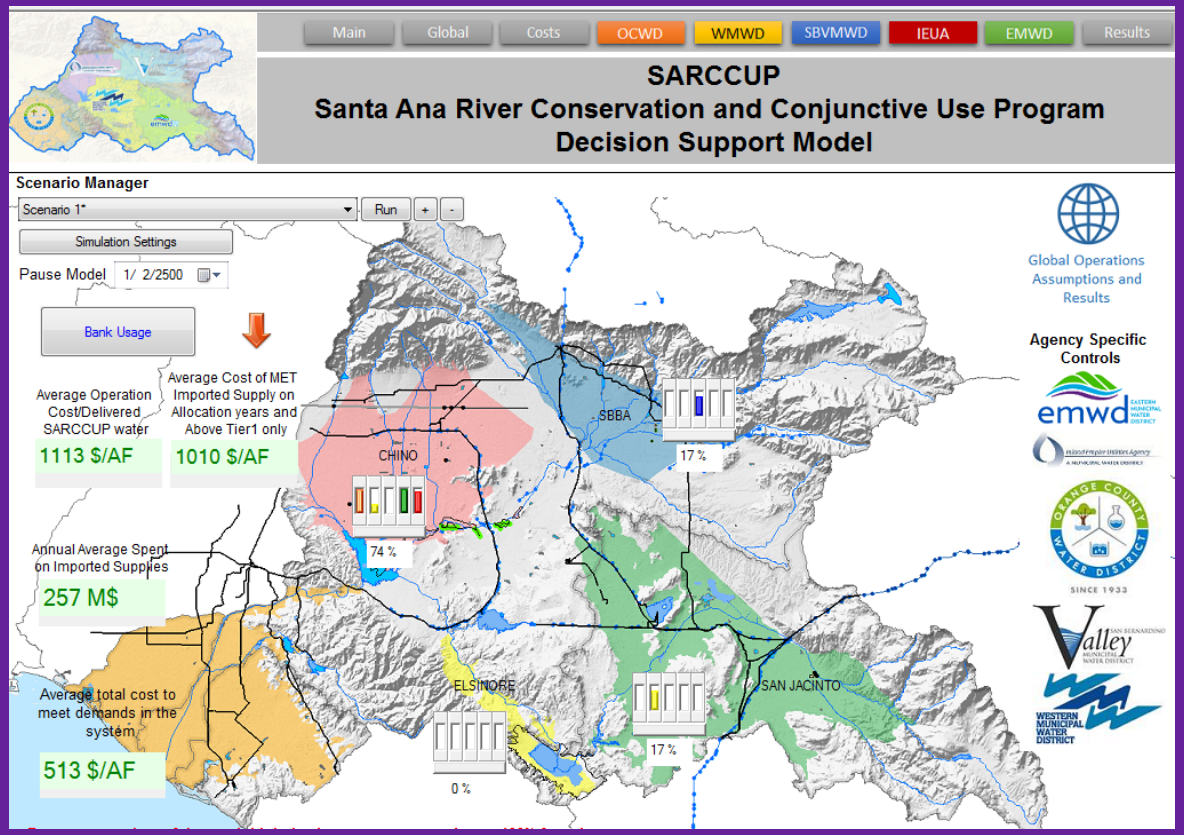
Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) Decision-Support Model



DSM Summary

PA-23 Committee Briefing

January 26, 2017

ch2m SM

Santa Ana River Conservation and Conjunctive Use Program – Project Schedule Updates

SAWPA

Presenters:
Scott Goldman
Brian Dietrick

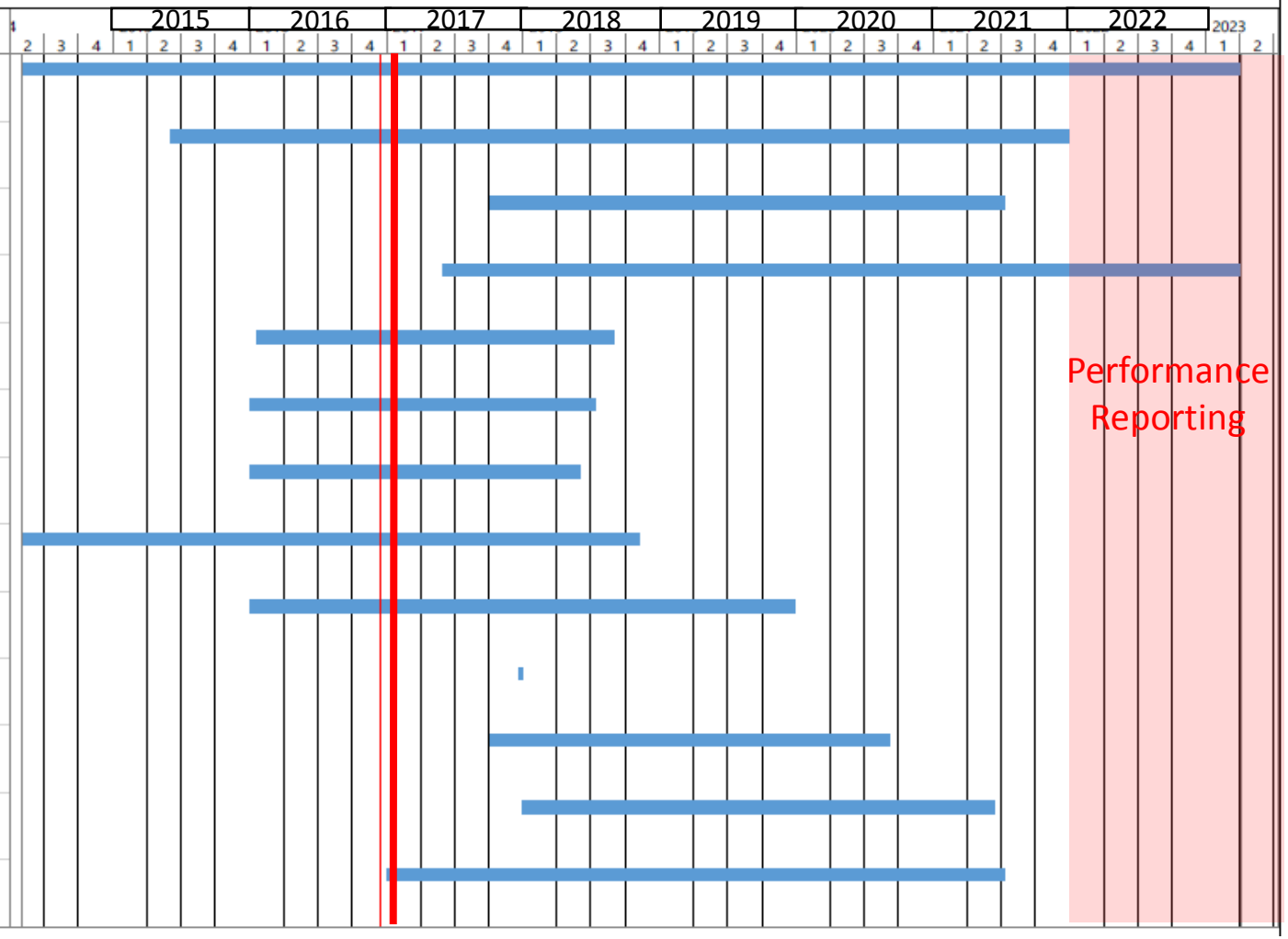
January 26, 2017

RMC water and environment
WOODARD &CURRAN
National Experience. Local Focus.

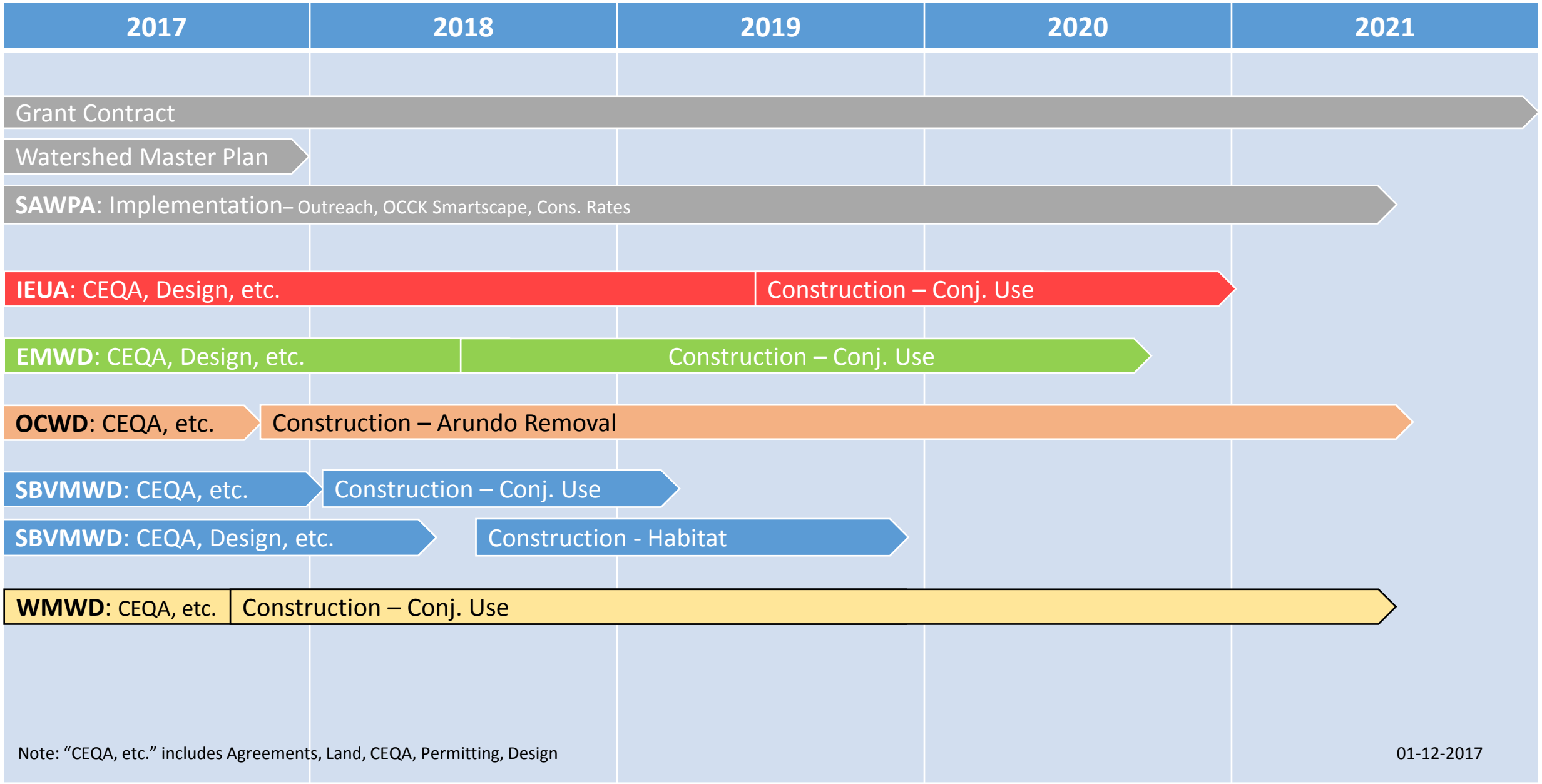
Detailed Project Schedule Roll-Up

Santa Ana River Conservation & Conjunctive Use Program (SARCCUP) Schedule

ID	Task Name	Start	Finish
1	SARCCUP	Thu 5/1/14	Mon 4/3/23
2	Task 1: Project Management	Mon 6/1/15	Mon 12/27/21
25	Task 2: Labor Compliance	Thu 10/5/17	Wed 7/7/21
31	Task 3: Reporting	Wed 5/31/17	Mon 4/3/23
59	Task 4: Land Purchase/Easement	Mon 1/18/16	Thu 8/30/18
68	Task 5: Feasibility Studies	Fri 1/1/16	Thu 7/12/18
75	Task 6: CEQA Documentation	Fri 1/1/16	Thu 5/31/18
93	Task 7: Permitting	Thu 5/1/14	Wed 11/7/18
99	Task 8: Design	Fri 1/1/16	Wed 12/25/19
130	Task 9: Project Monitoring Plan	Thu 12/21/17	Thu 12/28/17
137	Task 10: Construction Contracting	Thu 10/5/17	Wed 9/2/20
149	Task 11: Construction Administration	Thu 12/28/17	Wed 6/9/21
156	Task 12: Construction/Implementation	Mon 1/2/17	Wed 7/7/21



SARCCUP Schedule Roll-Up (By Agency)



Note: "CEQA, etc." includes Agreements, Land, CEQA, Permitting, Design

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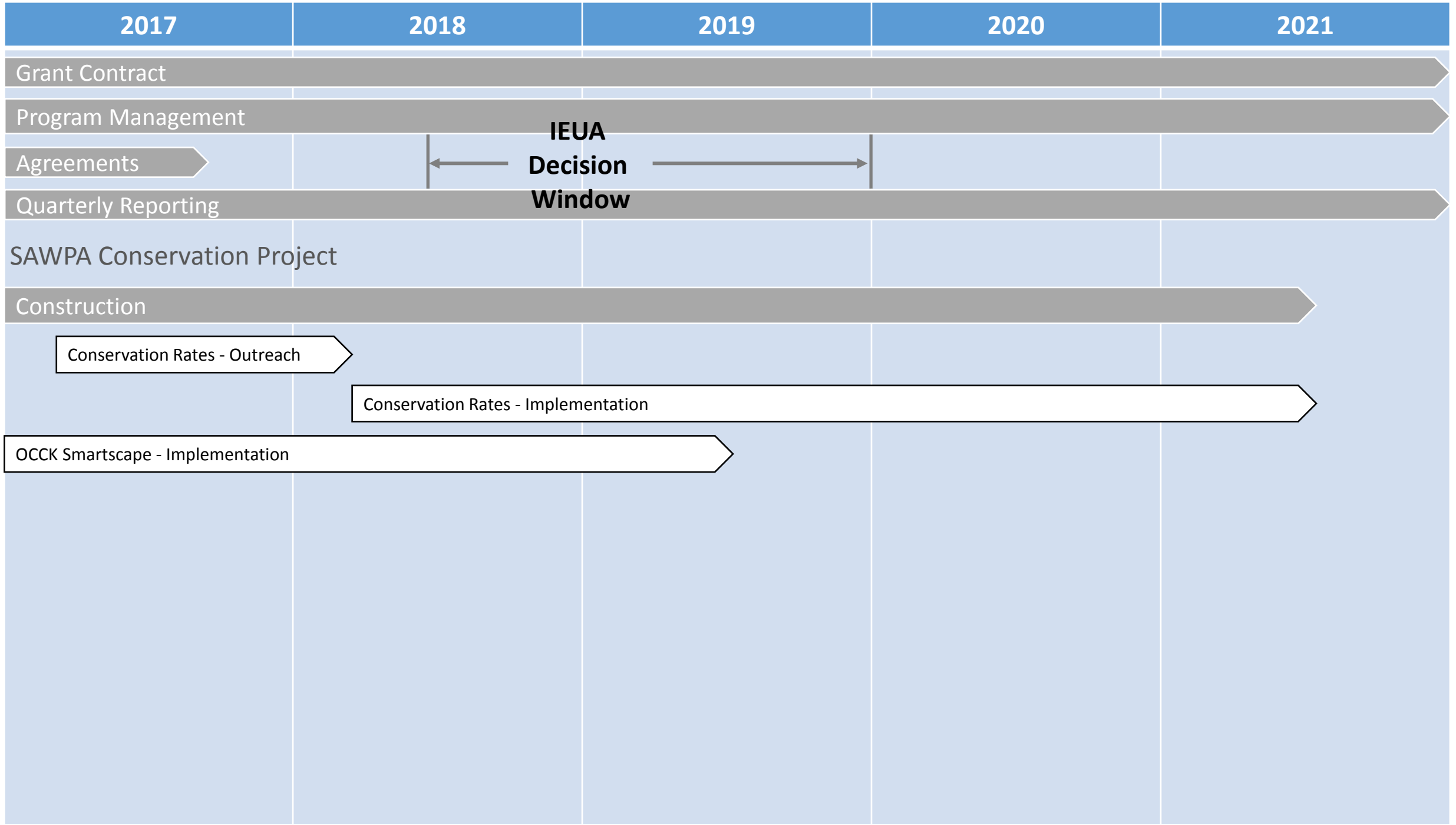
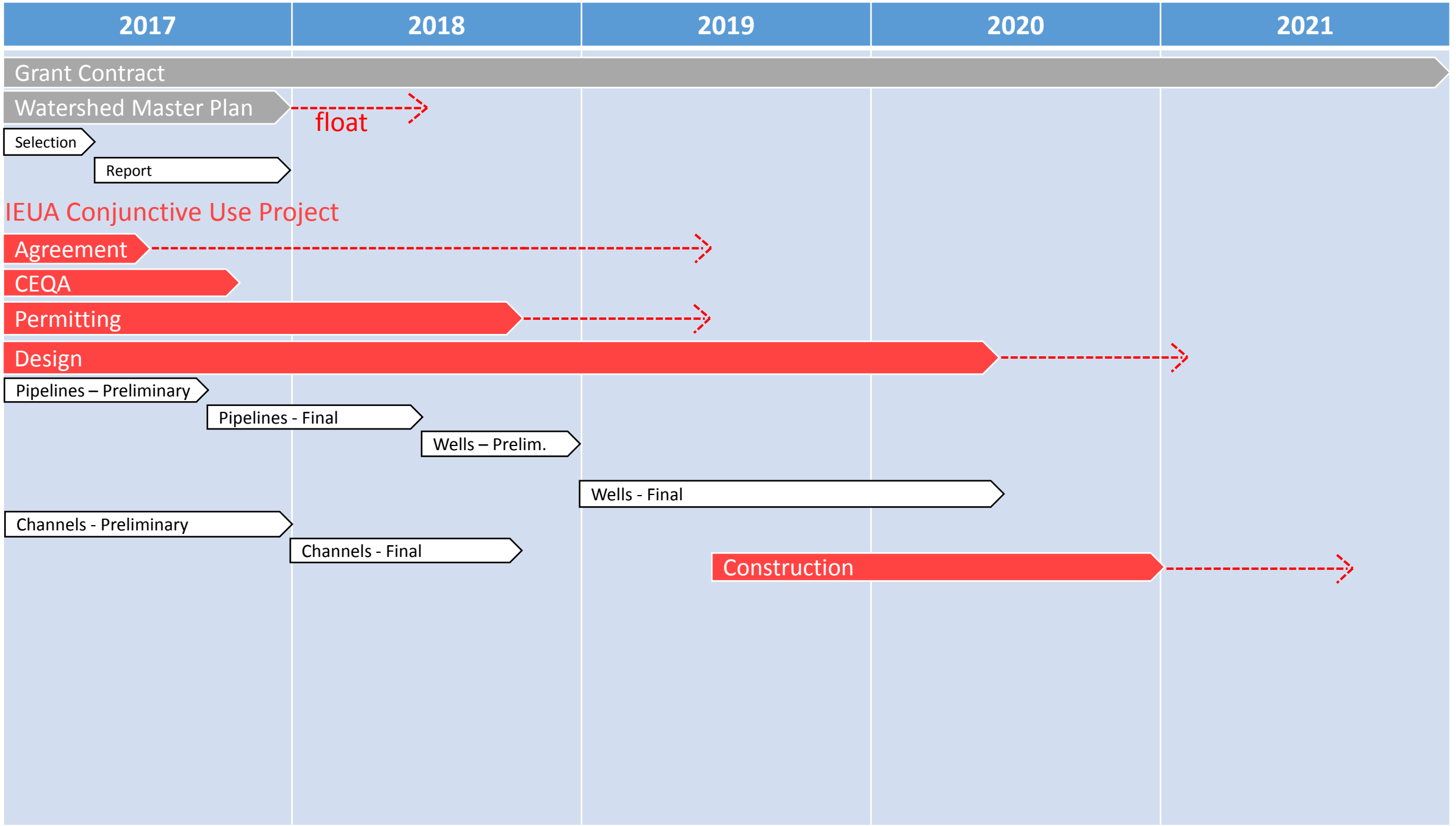
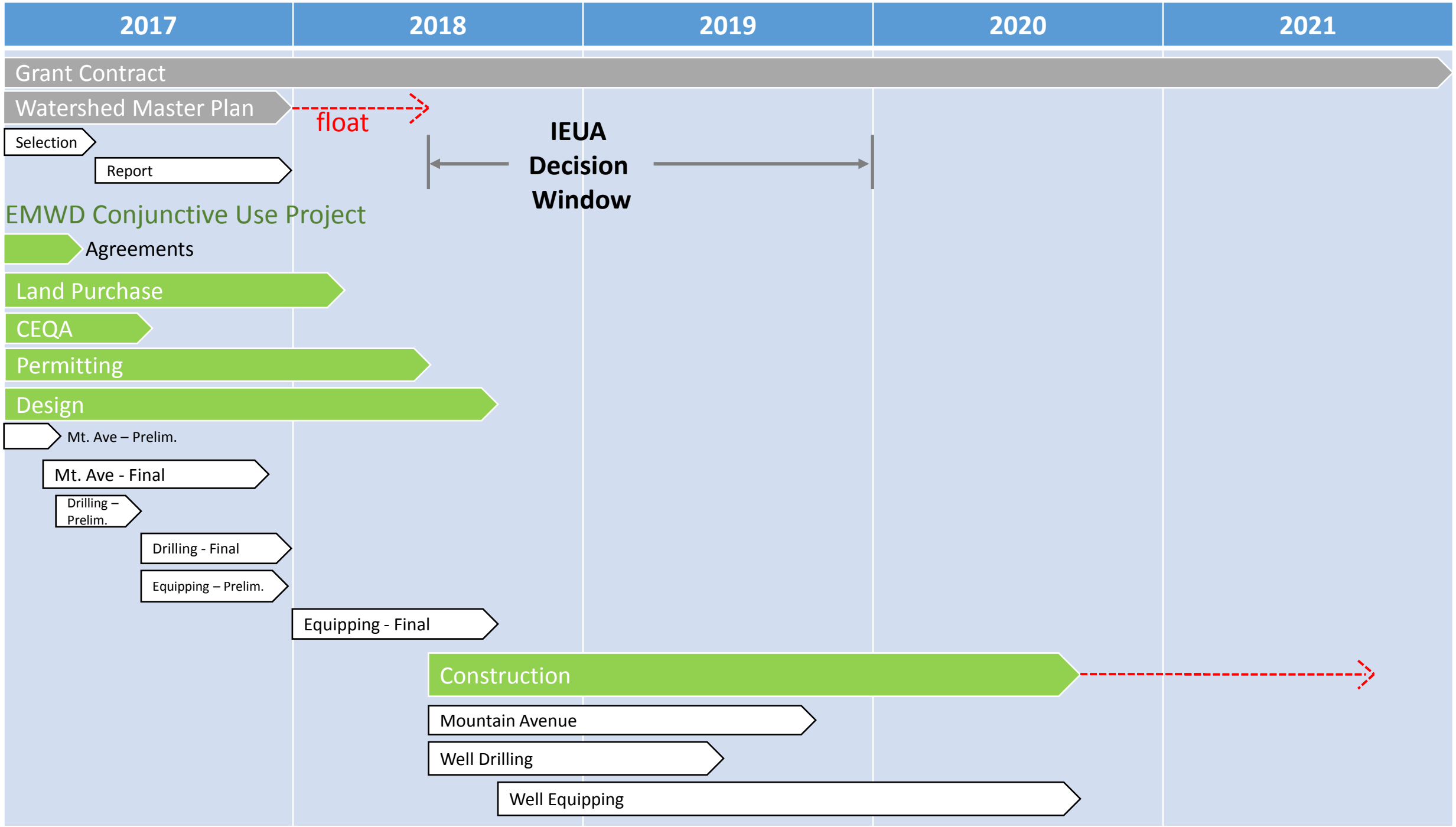

2017
2018
2019
2020
2021
Grant Contract
Program Management
Agreements
IEUA
Decision
Window
Quarterly Reporting
SAWPA Conservation Project
Construction
Conservation Rates - Outreach
Conservation Rates - Implementation
OCCK Smartscape - Implementation


2017
2018
2019
2020
2021
Grant Contract
Watershed Master Plan
float
Selection
Report
IEUA Conjunctive Use Project
Agreement
CEQA
Permitting
Design
Pipelines – Preliminary
Pipelines - Final
Wells – Prelim.
Wells - Final
Channels - Preliminary
Channels - Final
Construction


2017
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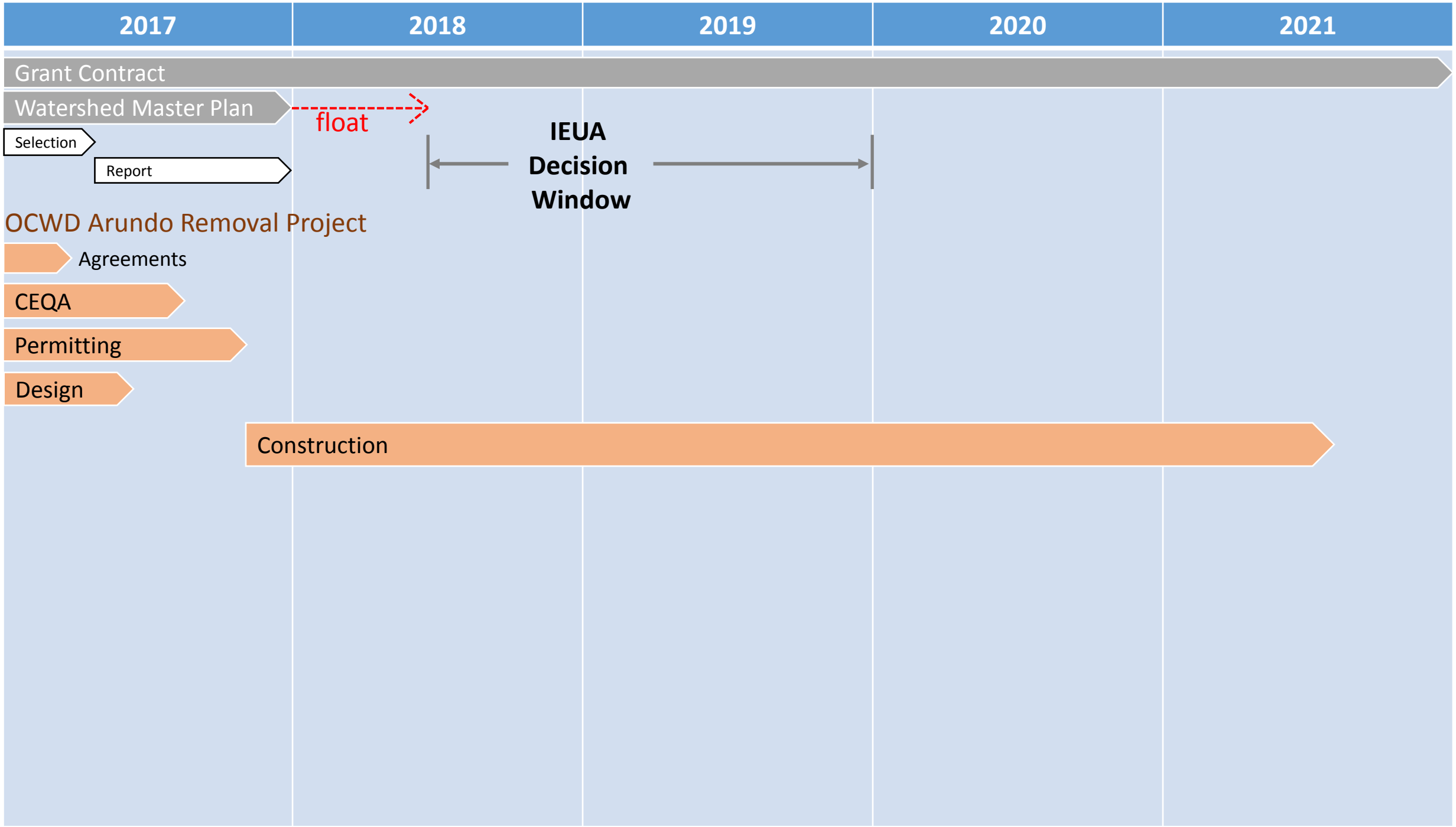
2020
2021
Grant Contract
Watershed Master Plan
float
Selection
Report
IEUA
Decision
Window
EMWD Conjunctive Use Project
Agreements
Land Purchase
CEQA
Permitting
Design
Mt. Ave – Prelim.
Mt. Ave - Final
Drilling – Prelim.
Drilling - Final
Equipping – Prelim.
Equipping - Final
Construction
Mountain Avenue
Well Drilling
Well Equipping


2017
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2021
Grant Contract
Watershed Master Plan
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Selection
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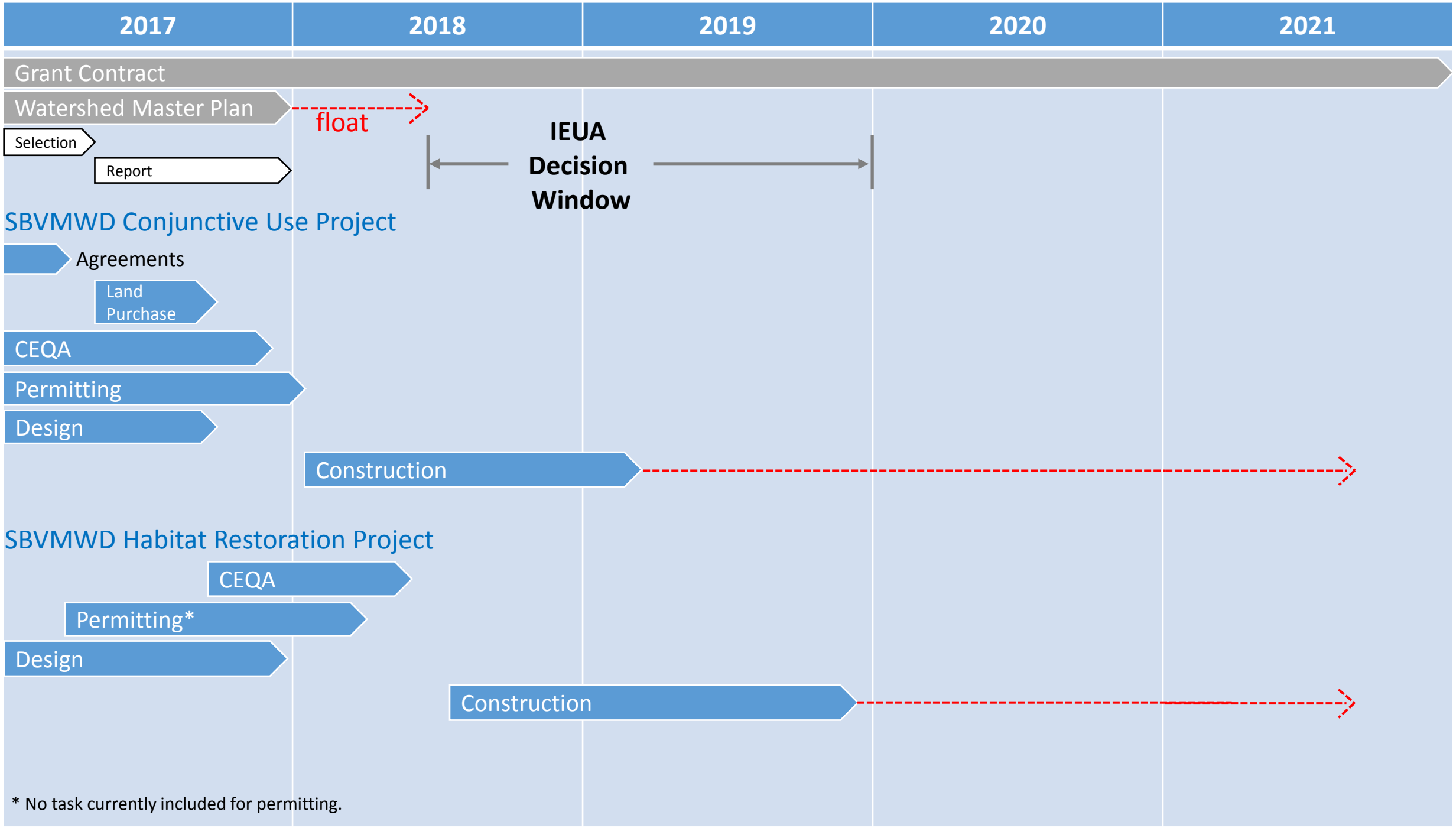
Decision
Window
OCWD Arundo Removal Project
Agreements
CEQA
Permitting
Design
Construction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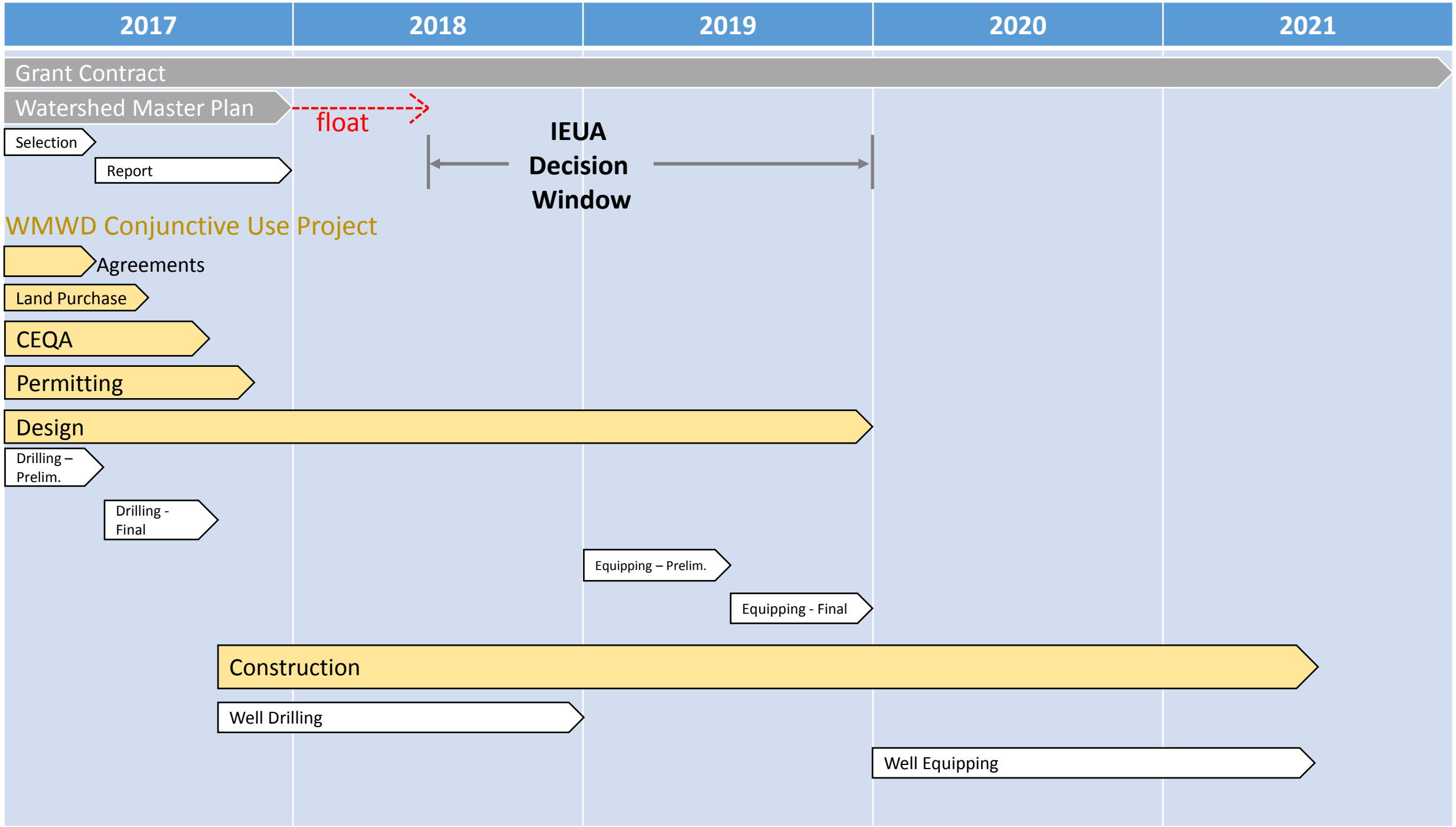
Grant Contract
Watershed Master Plan
float
Selection
Report
IEUA
Decision
Window
SBVMWD Conjunctive Use Project
Agreements
Land
Purchase
CEQA
Permitting
Design
Construction
SBVMWD Habitat Restoration Project
CEQA
Permitting*
Design
Construction
* No task currently included for permitting.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Watershed Master Plan
float
Selection
Report
IEUA
Decision
Window
WMWD Conjunctive Use Project
Agreements
Land Purchase
CEQA
Permitting
Design
Drilling –
Prelim.
Drilling -
Final
Equipping – Prelim.
Equipping - Final
Construction
Well Drilling
Well Equipping

Santa Ana River Conservation and Conjunctive Use Program – Project Schedule Updates

SAWPA

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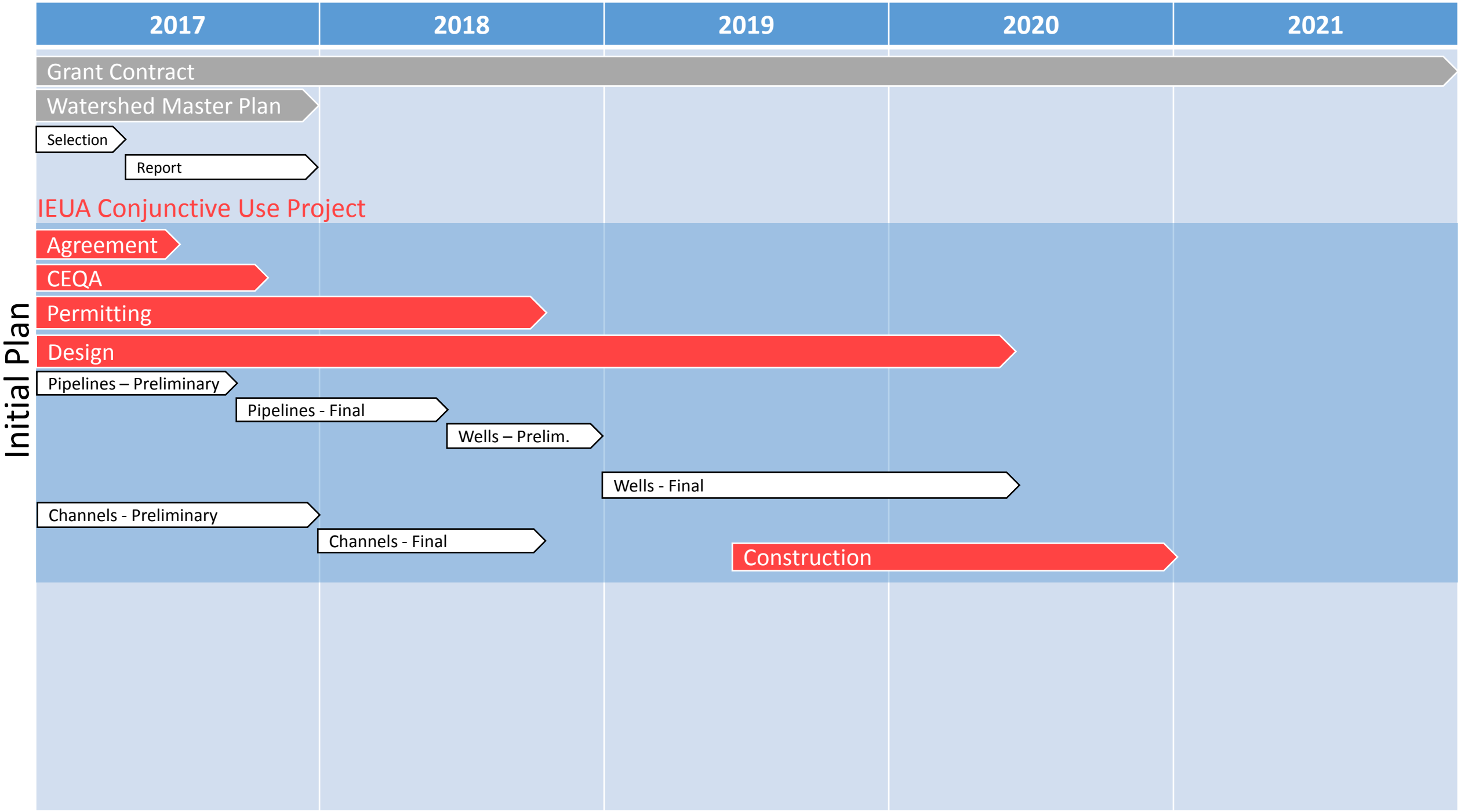
January 26, 2017

RMC water and environment
WOODARD &CURRAN
National Experience. Local Focus.

Backup: Progression of IEUA for Initial Plan vs. Potential Alternative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Design
Pipelines – Preliminary
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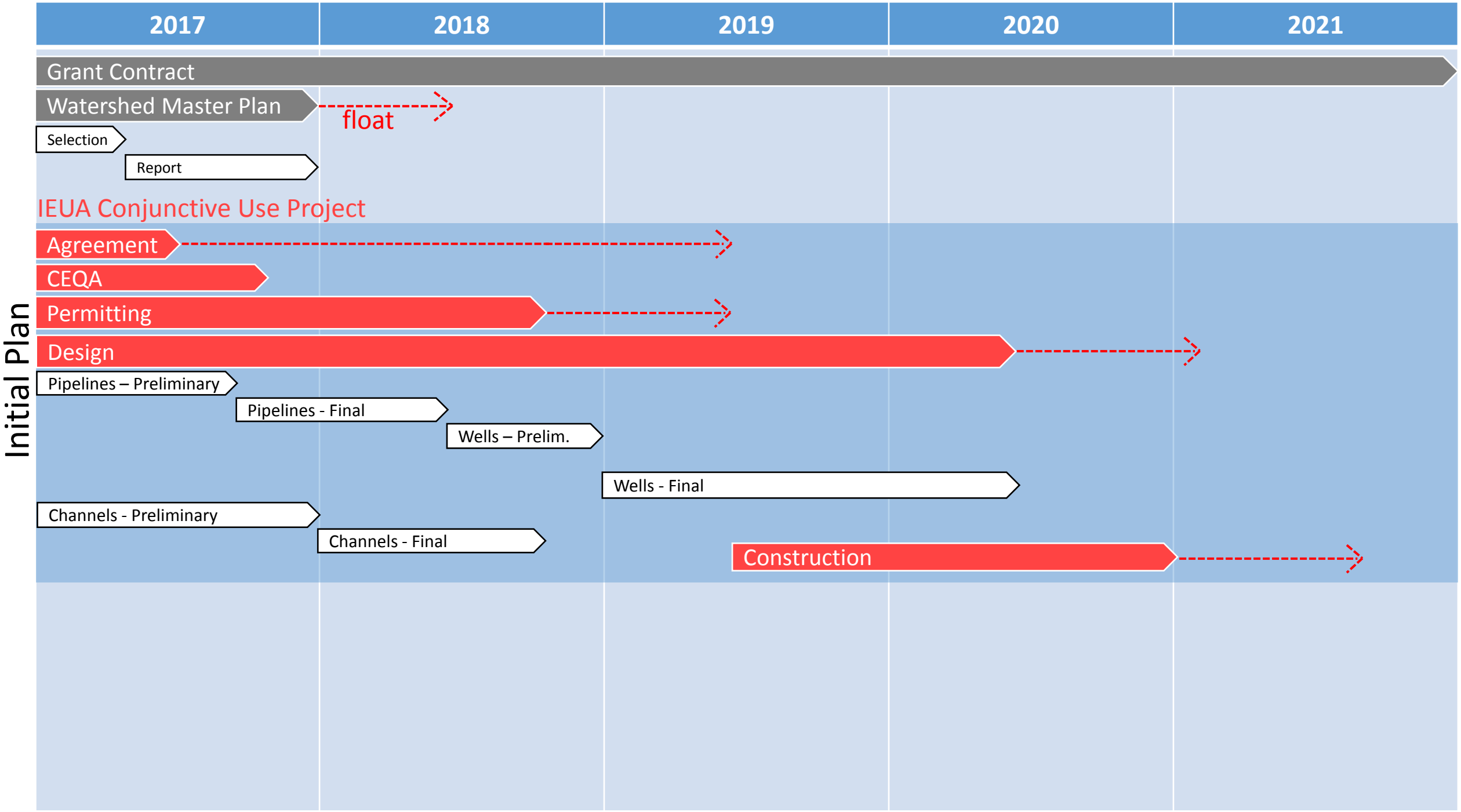
Wells - Final
Channels - Preliminary
Channels - Final
Construction
Initial Plan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Agreement
CEQA
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Design
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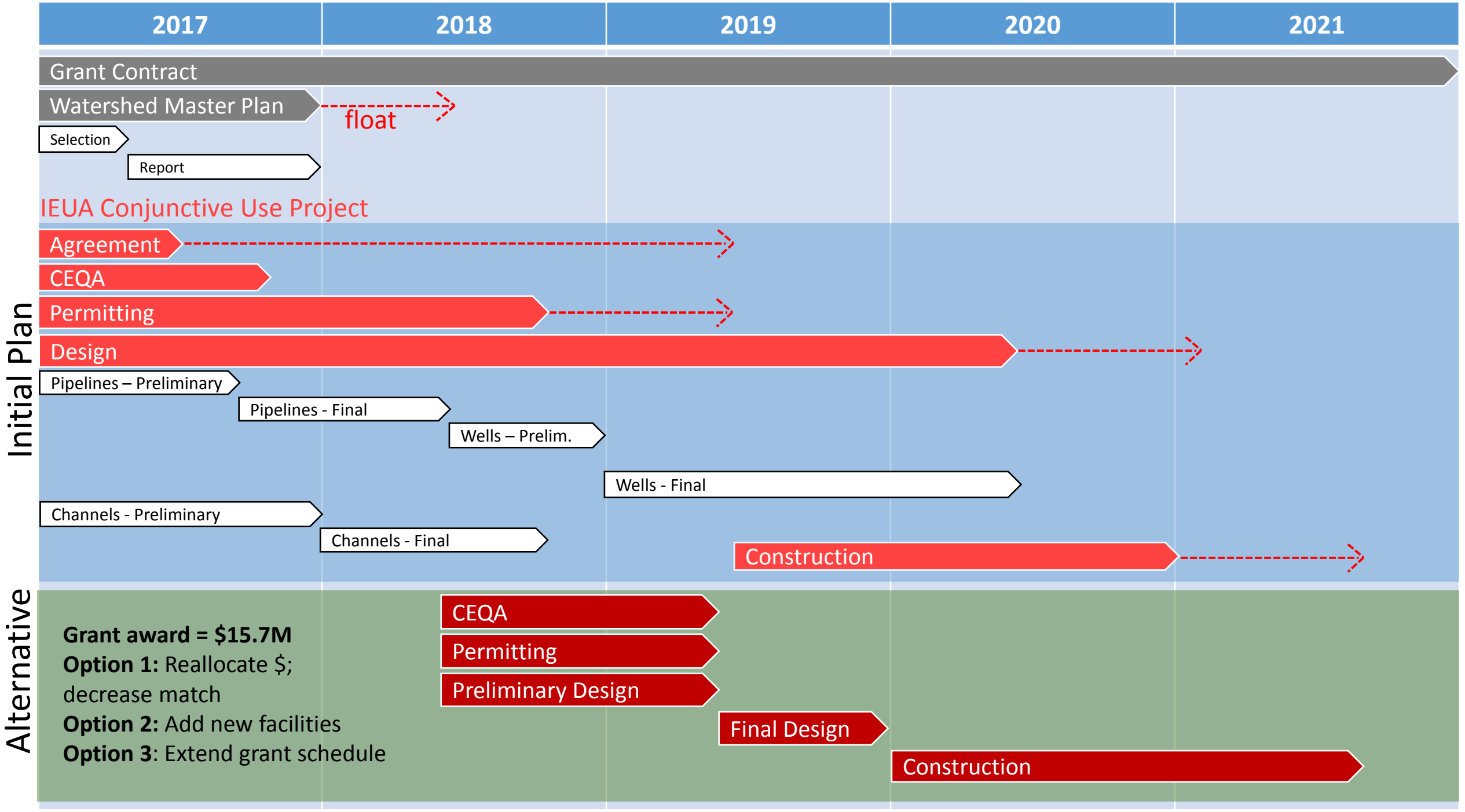
Wells - Final
Channels - Preliminary
Channels - Final
Construction
Initial Plan


2017
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Agreement
CEQA
Permitting
Design
Pipelines – Preliminary
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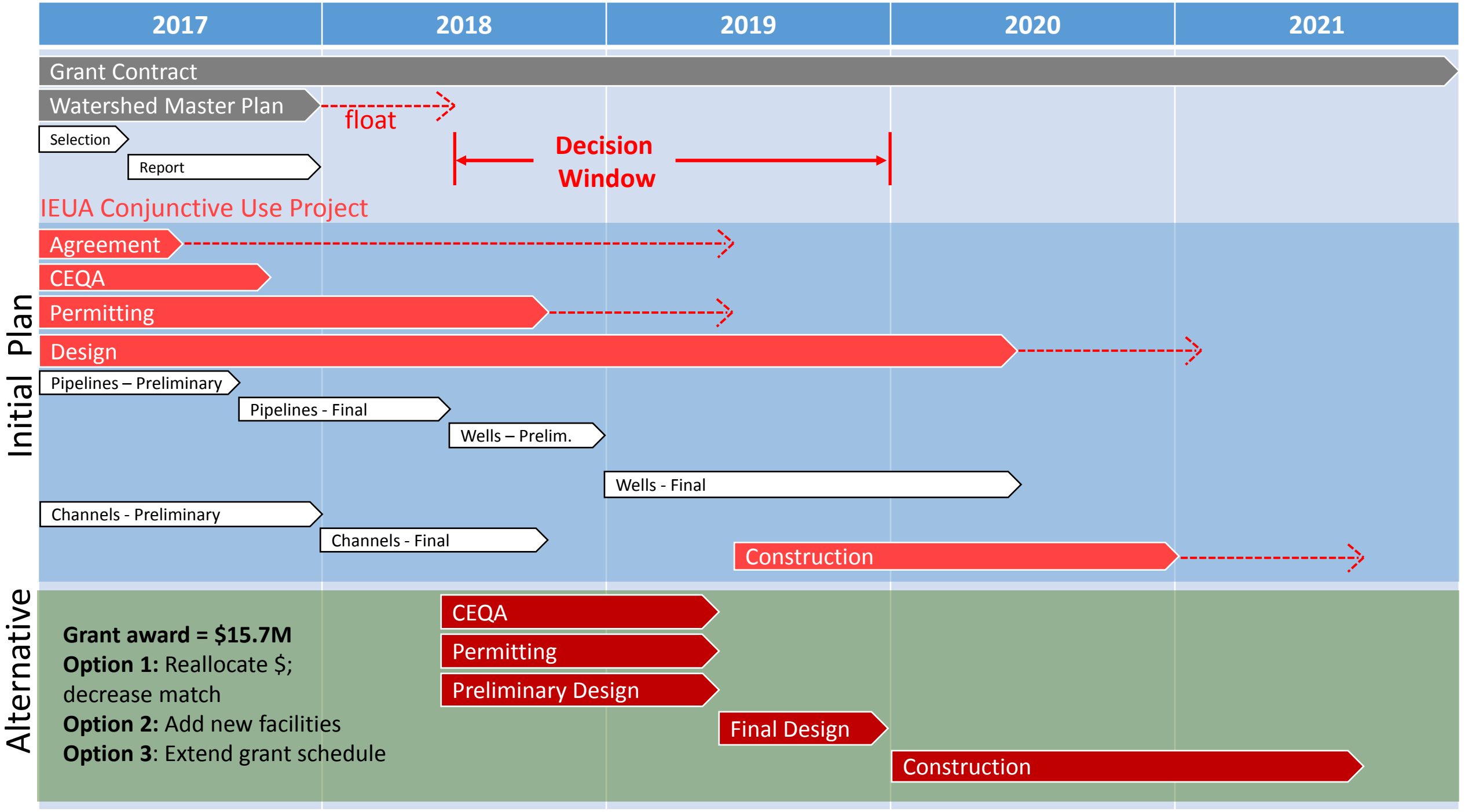
Wells - Final
Channels - Preliminary
Channels - Final
Construction
Initial Plan
Alternative
Grant award = $15.7M
Option 1: Reallocate $; decrease match
Option 2: Add new facilities
Option 3: Extend grant schedule
CEQA
Permitting
Preliminary Design
Final Design
Construction


2017
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2021
Grant Contract
Watershed Master Plan
float
Selection
Report
Decision Window
IEUA Conjunctive Use Project
Initial Plan
Agreement
CEQA
Permitting
Design
Pipelines – Preliminary
Pipelines - Final
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Wells - Final
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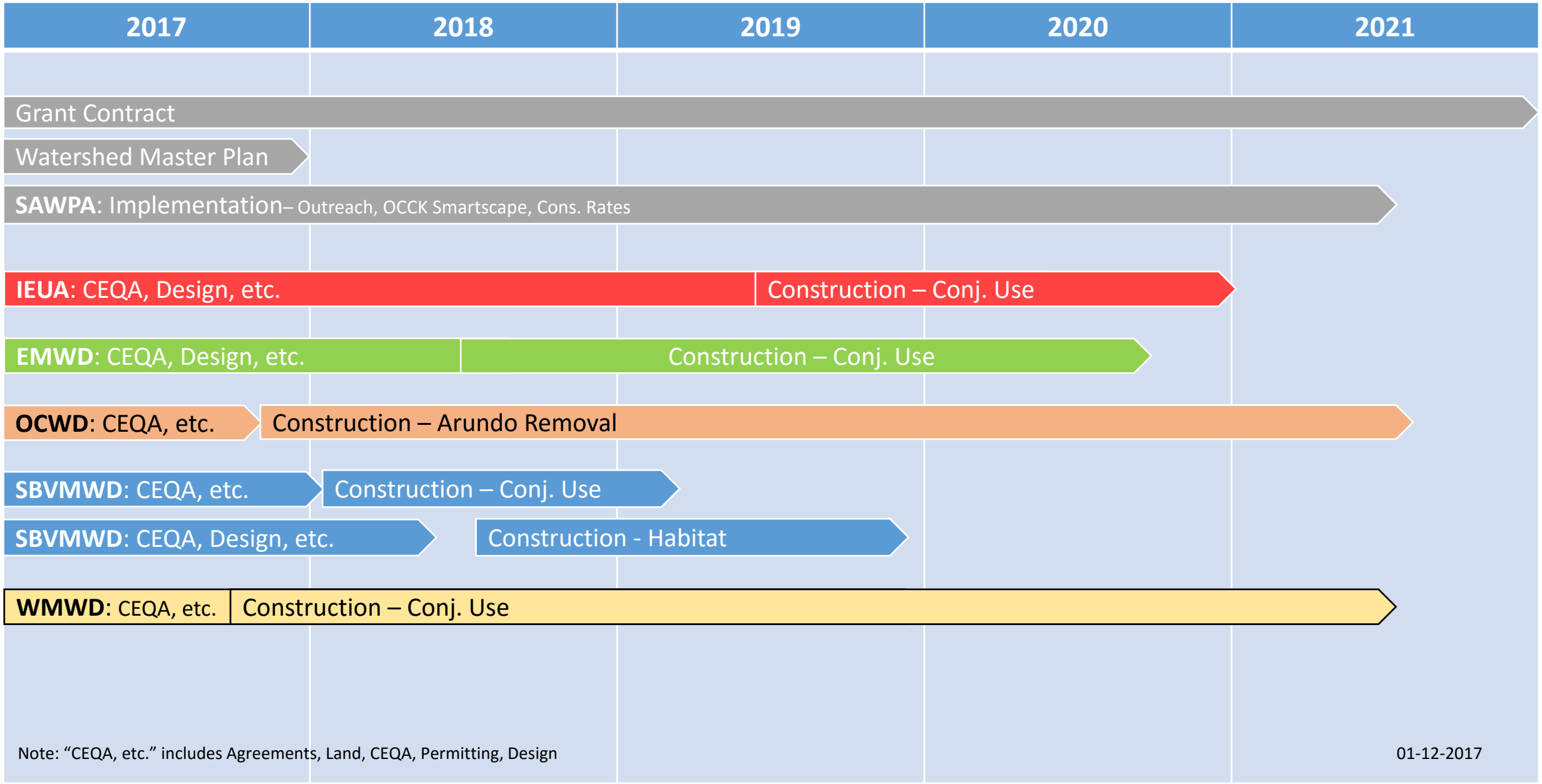
Permitting
Preliminary Design
Final Design
Construction

SARCCUP Schedule Roll-Up (By Agency)

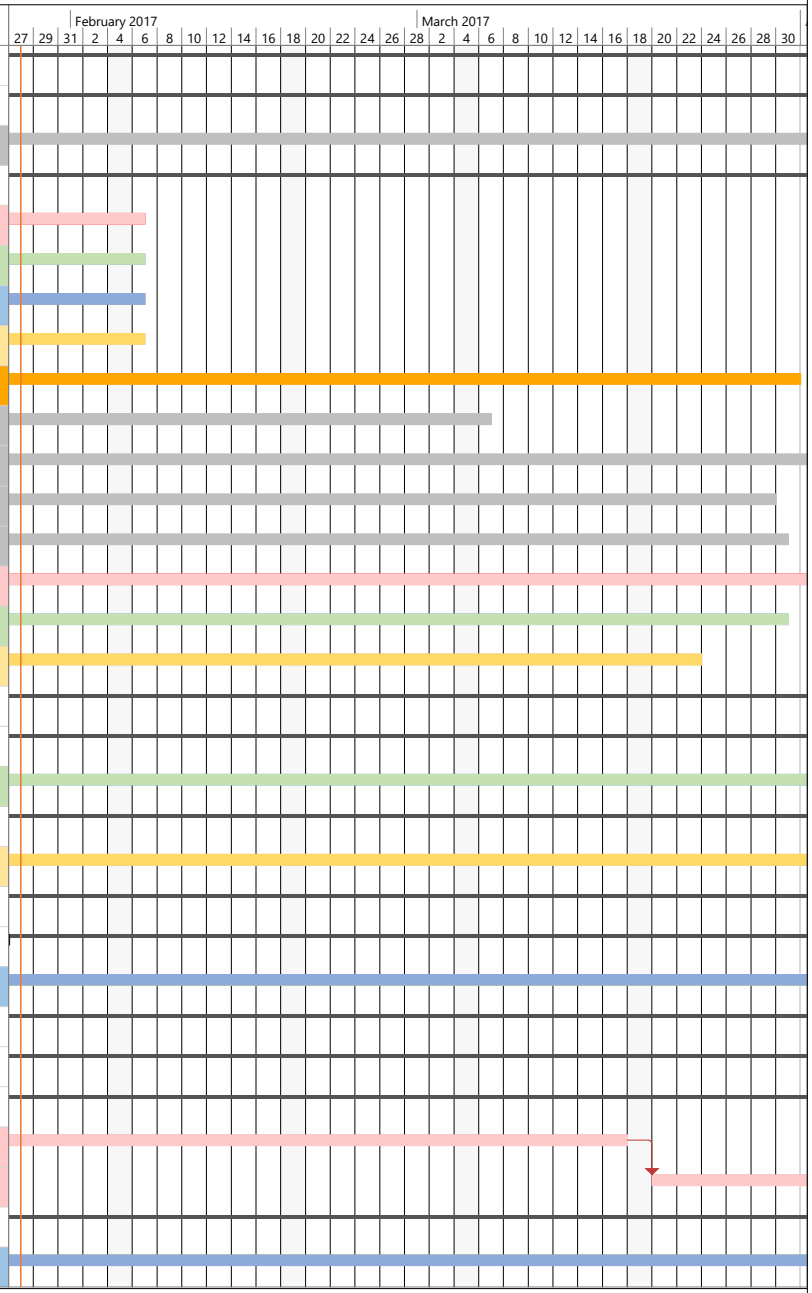


Note: "CEQA, etc." includes Agreements, Land, CEQA, Permitting, Design

01-12-2017

Santa Ana River Conservation & Conjunctive Use Program (SARCCUP) Schedule - Two-Month Look-Ahead

ID	Task Name	Lead Agency
1	**SARCCUP**	
2	**Task 1: Project Management**	
3	Task 1.1: Grant Admin & Invoicing	SAWPA
8	Task 1.6: Agreements	
10	*SAWPA-IEUA Sub-Agreement*	IEUA
11	*SAWPA-EMWD Sub-Agreement*	EMWD
12	*SAWPA-SBVMWD Sub-Agreement*	SBVMWD
13	*SAWPA-WMWD Sub-Agreement*	WMWD
14	*SAWPA-OCWD Sub-Agreement*	OCWD
15	*SAWPA-OC Coastkeeper Sub-Agreement*	SAWPA
16	*SAWPA-Retail Agency Sub-Agreements for Water Rates*	SAWPA
17	*SARCCUP Operating Agreement*	SAWPA
18	*SARCCUP Financing Agreement*	SAWPA
21	*IEUA and Chino Basin Watermaster Agreement*	IEUA
22	*EMWD and Hemet San Jacinto Watermaster Agreement*	EMWD
24	*WMWD-EVMWD Agreement*	WMWD
59	**Task 4: Land Purchase/Easement**	
60	Task 4.1: EMWD Land Purchase/Easement	
62	*Well Drilling Three Wells - ROW Acqusition*	EMWD
66	Task 4.3: WMWD Land Purchase/Easement	
67	*Conjunctive Use Water Bank Facilities (Elsinore Basin) - Property Acquisition: Well Sites*	WMWD
68	**Task 5: Feasibility Studies**	
71	Task 5.2: SARCCUP Analyze Overall System	
72	*Analyze/Optimize Watershed For All Project Components*	SBVMWD
75	**Task 6: CEQA Documentation**	
76	Task 6.1: Programmatic CEQA	
77	*6.1.1: Program EIR*	
80	Administrative/Screencheck Draft EIR	IEUA
81	Publish Public Draft EIR	IEUA
88	Task 6.2: SBVMWD CEQA	
89	*Conjunctive Use Water Bank Facilities (San Bernardino Basin) - CEQA & Certification*	SBVMWD



Project: SARCCUP Schedule_9Jan17_critical path
Date: Thu 1/12/17

Summary
Project Summary
Manual Task
Manual Summary Rollup
SAWPA
IEUA
EMWD
SBVMWD
WMWD
OCWD

Santa Ana River Conservation & Conjunctive Use Program (SARCCUP) Schedule - Two-Month Look-Ahead

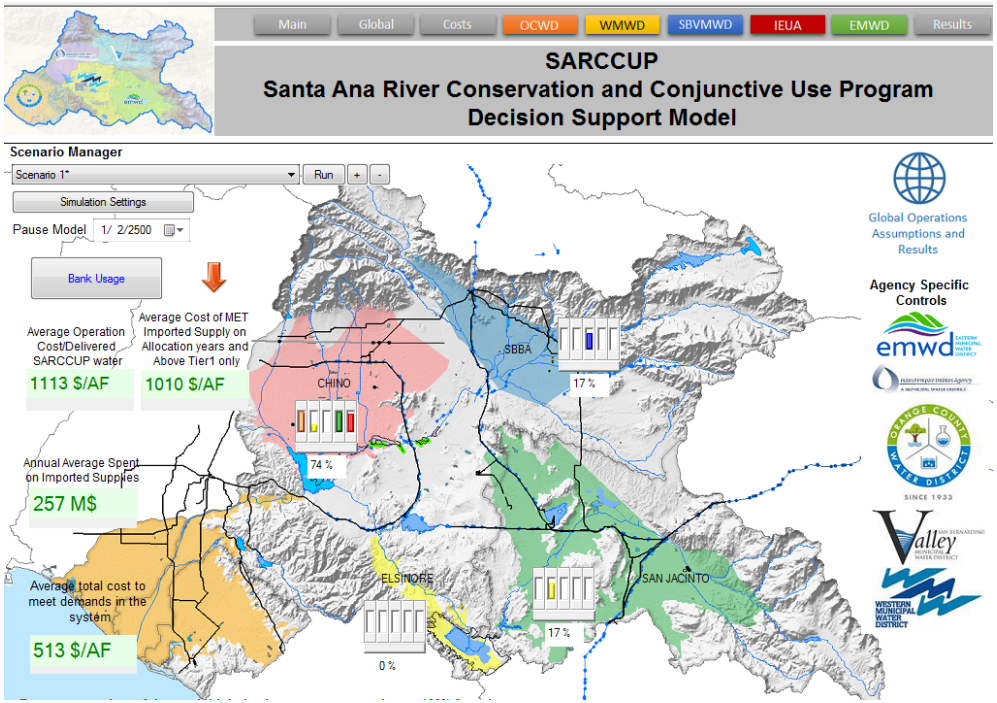
ID	Task Name	Lead Agency
91	Task 6.3: EMWD CEQA	
92	*Conjunctive Use Water Bank Facilities (San Jacinto Basin) - CEQA & Certification*	EMWD
93	**Task 7: Permitting**	
94	Conjunctive Use Water Bank Facilities (Chino Basin)	IEUA
96	Conjunctive Use Water Bank Facilities (San Bernardino Basin)	SBVMWD
97	Conjunctive Use Water Bank Facilities (Elsinore Basin)	WMWD
98	Arundo Removal	OCWD
99	**Task 8: Design**	
100	Task 8.1: Chino Basin CUP	
101	*Baseline & Azusa-Devil Canyon Pipeline & Connections - Consultant Selection*	IEUA
104	*Well Modifications - Site Selection*	IEUA
109	*Channel Diversions - Final Design*	IEUA
110	Task 8.2: San Jacinto Basin	
111	*Mountain Avenue West Recharge Facilities - Preliminary Design*	EMWD
112	*Mountain Avenue West Recharge Facilities - Final Design*	EMWD
113	*Well Drilling Three Wells - Preliminary Design*	EMWD
116	Task 8.3: San Bernardino Basin Area CUP	
117	*Construction Documents (Design)*	SBVMWD
118	Task 8.4: Elsinore Basin CUP	
119	*Well Drilling - Preliminary Design*	WMWD
123	Task 8.5: Habitat Improvement	
124	*Task 8.5.1: Arundo Donal Removal*	
125	Restoration Integrated Design/Planning/Bio Surveys	OCWD
126	Finalize Removal Areas	OCWD
127	*Task 8.5.2: Sucker Habitat*	
128	Establish Mitigation Bank	SBVMWD
129	Restoration Integrated Design/Planning/Bio Surveys	SBVMWD
156	**Task 12: Construction/Implementation**	
181	Task 12.6: Water Use Efficiency Implementation	
184	OCCK Smartscape Implementation	SAWPA

Project: SARCCUP Schedule_9Jan17_critical path
Date: Thu 1/12/17

Summary
Project Summary
Manual Task
Manual Summary Rollup
SAWPA
IEUA
EMWD
SBVMWD
WMWD
OCWD

Goals and Objectives

- Maximize the storage of wet year imported water supplies to produce “dry year yield”
- Simulate operations and demonstrate the aggregate yield and water supply reliability generated by the SARCCUP
- Decision Support Model to simulate anticipated operations of the proposed SARCCUP facilities, identify constraints and facilities,
- Optimize operations and quantify the benefits and **costs**

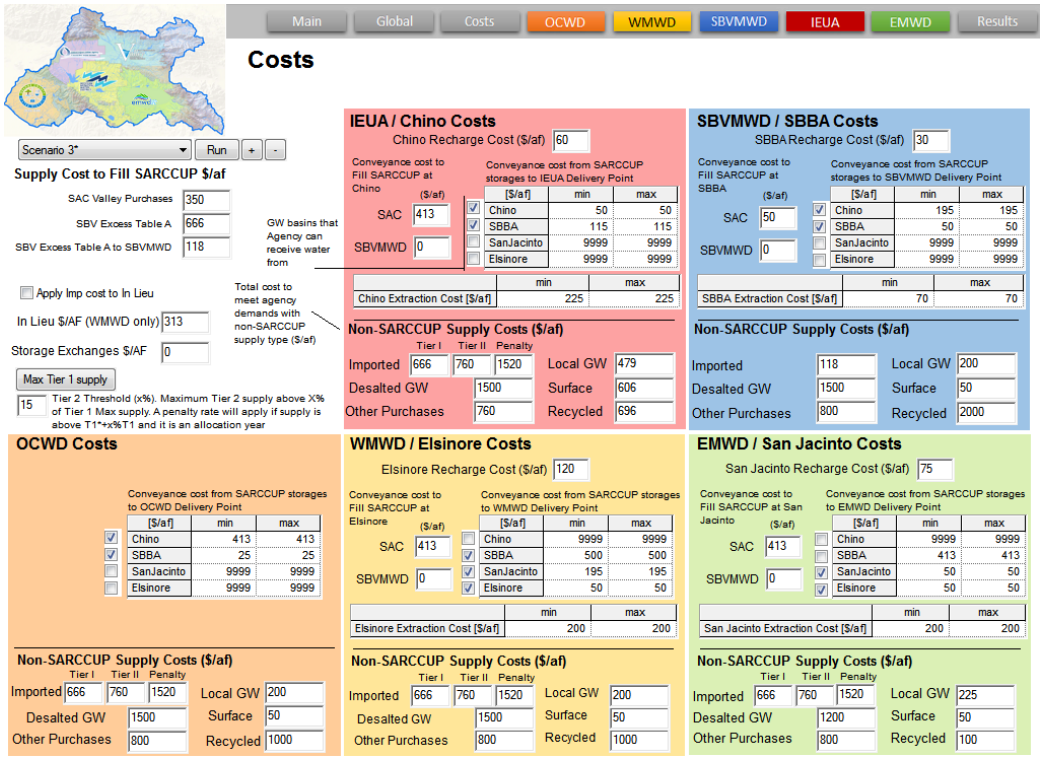


Major Assumptions of SARCCUP Scenarios

- Baseline
  - No SARCCUP, existing imported supply reliability
- Scenario 1 – SARCCUP under Existing Conditions
  - SARCCUP operations, existing Delta infrastructure and regulations,
- Scenario 2 – SARCCUP with California Water Fix
  - SARCCUP operations, CWF infrastructure and regulations
- Scenario 3 – SARCCUP with Climate Change
  - SARCCUP operations, future climate change around mid-century
- Scenario 4 – SARCCUP with recycled water exchanges to OCWD
  - SARCCUP operations, IEUA delivers recycled water to OCWD in exchange for OCWD's SARCCUP groundwater supply in Chino

Cost Assumptions

- Supply Costs:
  - Sacramento Valley Water Purchases
    - To SBVMWD @ $400/AF
    - To MWD @ $750/AF
  - SBVMWD Surplus @ MWD Tier 1 Rate, $666/AF
- Recharge Costs:
  - Varies by Basin, $30-120/AF
- Extraction Costs:
  - Varies by Basin, $70-225/AF
- Delivery Costs:
  - Varies by source/delivery point; $25-400/AF
- Exchange Costs:
  - Storage exchanges @ $0/AF
  - In-lieu @ $313/AF (treatment surcharge for WMWD)



DSM Cost Inputs

Main | Global | Costs | OCWD | WMWD | SBVMWD | IEUA | EMWD | Results

Costs

Scenario 3* | Run | + | -

Supply Cost to Fill SARCCUP $/af

SAC Valley Purchases	350
SBV Excess Table A	666
SBV Excess Table A to SBVMWD	118

GW basins that Agency can receive water from

☐ Apply Imp cost to In Lieu

In Lieu $/AF (WMWD only)	313
Storage Exchanges $/AF	0

Max Tier 1 supply

15 Tier 2 Threshold (x%). Maximum Tier 2 supply above X% of Tier 1 Max supply. A penalty rate will apply if supply is above T1*+x%T1 and it is an allocation year

Total cost to meet agency demands with non-SARCCUP supply type ($/af)

IEUA / Chino Costs

Chino Recharge Cost ($/af) 60

Conveyance cost to Fill SARCCUP at Chino ($/af)

SAC	413
SBVMWD	0

Conveyance cost from SARCCUP storages to IEUA Delivery Point

	[$/af]	min	max
☑	Chino	50	50
☑	SBBA	115	115
☐	SanJacinto	9999	9999
☐	Elsinore	9999	9999

	min	max
Chino Extraction Cost [$/af]	225	225

Non-SARCCUP Supply Costs ($/af)

	Tier I	Tier II	Penalty		
Imported	666	760	1520	Local GW	479
Desalted GW	1500			Surface	606
Other Purchases	760			Recycled	696

SBVMWD / SBBA Costs

SBBA Recharge Cost ($/af) 30

Conveyance cost to Fill SARCCUP at SBBA ($/af)

SAC	50
SBVMWD	0

Conveyance cost from SARCCUP storages to SBVMWD Delivery Point

	[$/af]	min	max
☑	Chino	195	195
☑	SBBA	50	50
☐	SanJacinto	9999	9999
☐	Elsinore	9999	9999

	min	max
SBBA Extraction Cost [$/af]	70	70

Non-SARCCUP Supply Costs ($/af)

Imported	118			Local GW	200
Desalted GW	1500			Surface	50
Other Purchases	800			Recycled	2000

OCWD Costs

Conveyance cost from SARCCUP storages to OCWD Delivery Point

	[$/af]	min	max
☑	Chino	413	413
☑	SBBA	25	25
☐	SanJacinto	9999	9999
☐	Elsinore	9999	9999

Non-SARCCUP Supply Costs ($/af)

	Tier I	Tier II	Penalty		
Imported	666	760	1520	Local GW	200
Desalted GW	1500			Surface	50
Other Purchases	800			Recycled	1000

WMWD / Elsinore Costs

Elsinore Recharge Cost ($/af) 120

Conveyance cost to Fill SARCCUP at Elsinore ($/af)

SAC	413
SBVMWD	0

Conveyance cost from SARCCUP storages to WMWD Delivery Point

	[$/af]	min	max
☐	Chino	9999	9999
☑	SBBA	500	500
☑	SanJacinto	195	195
☑	Elsinore	50	50

	min	max
Elsinore Extraction Cost [$/af]	200	200

Non-SARCCUP Supply Costs ($/af)

	Tier I	Tier II	Penalty		
Imported	666	760	1520	Local GW	200
Desalted GW	1500			Surface	50
Other Purchases	800			Recycled	1000

EMWD / San Jacinto Costs

San Jacinto Recharge Cost ($/af) 75

Conveyance cost to Fill SARCCUP at San Jacinto ($/af)

SAC	413
SBVMWD	0

Conveyance cost from SARCCUP storages to EMWD Delivery Point

	[$/af]	min	max
☐	Chino	9999	9999
☐	SBBA	413	413
☑	SanJacinto	50	50
☑	Elsinore	50	50

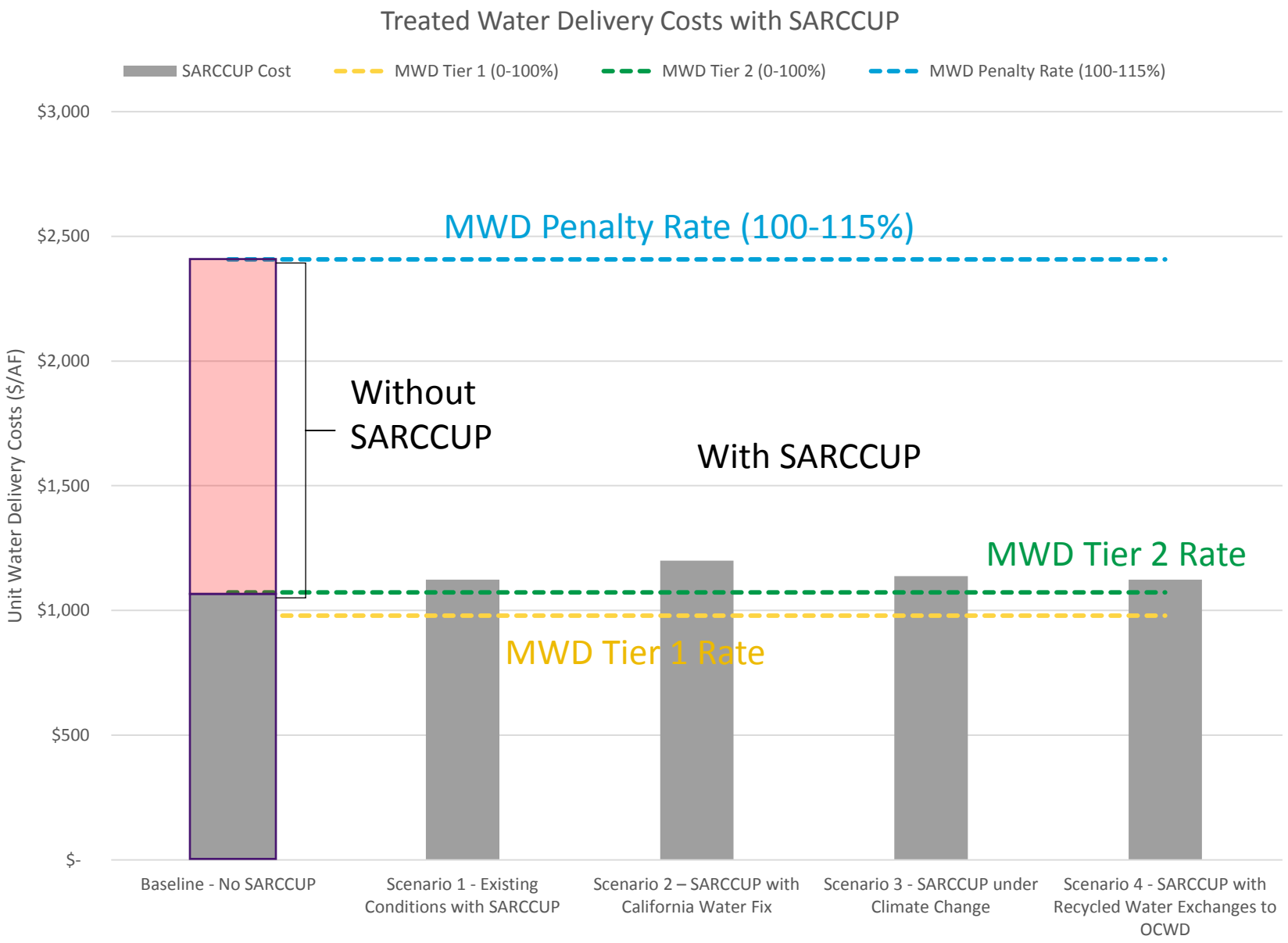
	min	max
San Jacinto Extraction Cost [$/af]	200	200

Non-SARCCUP Supply Costs ($/af)

	Tier I	Tier II	Penalty		
Imported	666	760	1520	Local GW	225
Desalted GW	1200			Surface	50
Other Purchases	800			Recycled	100

Preliminary SARCCUP Cost Results (Treated)

What is the cost of SARCCUP water and how does it compare to the cost of water without SARCCUP? How does the California Water Fix impact SARCCUP?



SARCCUP Facility Usage

Where are the "bottlenecks" in SARCCUP, if any? What recharge/extraction facilities would be required to alleviate specific bottlenecks?
Where in the watershed does extra recharge or extraction capacity exist without new facilities?

- Recharge facility usage
  - Surplus recharge capacity exists in many basins, especially **SBBA and Chino**
  - Only **San Jacinto Basin** recharge approaches capacity limits
- Extraction facility usage
  - Surplus extraction capacity exists in **SBBA and Elsinore** basins
  - **Chino and San Jacinto** extraction capacities are fully utilized, but are sufficient to manage delivery under current sized SARCCUP bank
  - Extraction capacity would need to increase if SARCCUP bank increased
- Conveyance facility usage
  - Regional conveyance does not appear to limit operations
  - **48" Baseline Feeder Extension** not likely needed (for Phase 1) given recent optimization results

Connections for Direct Delivery

To SARCCUP Agency	From Agency System/GW Basin			
	Elsinore GW Basin	Chino GW Basin	SBBA GW Basin	San Jacinto GW Basin
OCWD	Dual use ASR wells to Temescal Creek to SAR	South Pressure Zone Extraction Wells to SAR	SBBA Extraction Wells 48 inch baseline feeder extension Devil Canyon –Azuza Pipe Yorba Linda Feeder or SAR	San Jacinto Extraction Wells CRA or San Jacinto creek
WMWD	Dual use ASR wells	Chino Desalter	RPU Wells unused capacity/West Riverside Canal	CRA or San Jacinto Creek San Jacinto Extraction Wells Potable pipe network
IEUA	x	South Pressure Zone Extraction Wells, Member Agency Wells	SBBA Extraction Wells 48 inch baseline feeder extension	x
SBVMWD	x	48 inch baseline feeder extension	SARCCUP Wells RPU Wells MWDSC Inland Feeder	x
EMWD	x	x	Alabama Pipe Central Feeder Inland Feeder	San Jacinto Extraction Wells

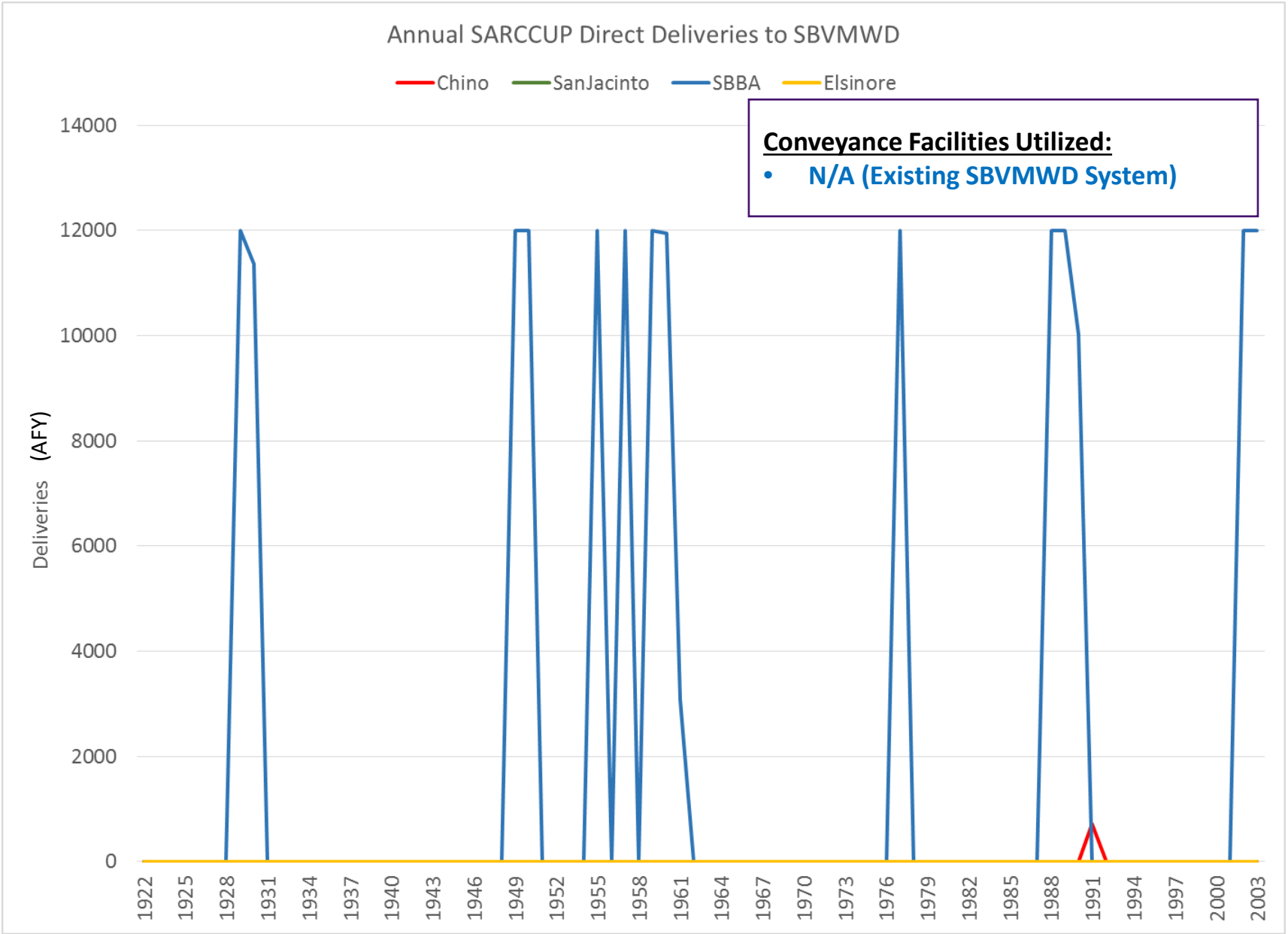
SARCCUP project facilities:

- Dual use ASR wells
- South Pressure zone extraction wells
- 48 inch Baseline Feeder extension
- SBBA extraction wells
- Alabama St pipeline/Redlands PS
- San Jacinto extraction wells

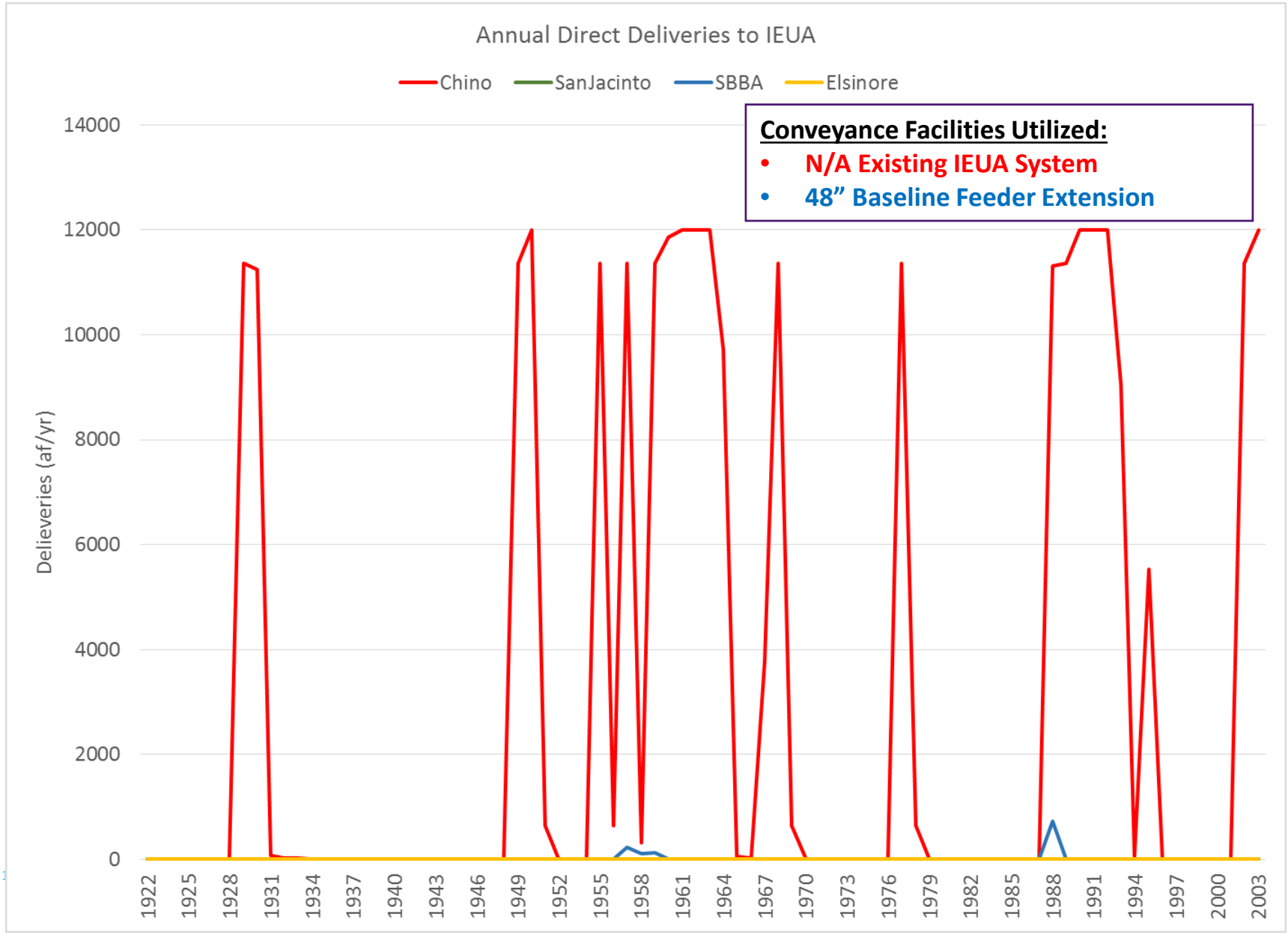
Regional Conveyance – Agency Review in Process

- Are the identified facilities capable of conveying simulated quantities?
- Conveyance will likely be during May through September
- Given the conveyance flows, are all of the facilities needed? What if conveyance flows were doubled?

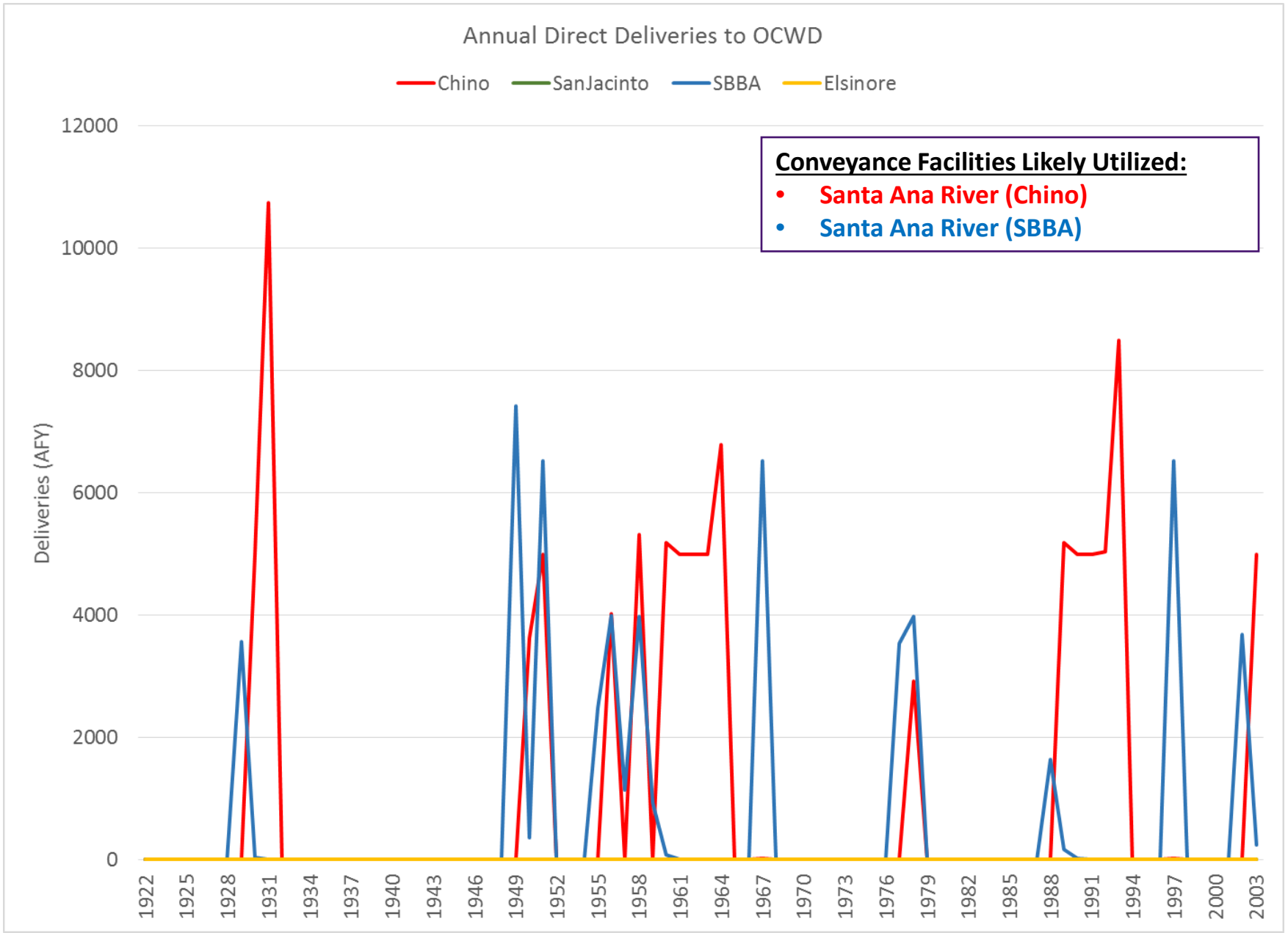
SARCCUP Direct Deliveries to SBVMWD



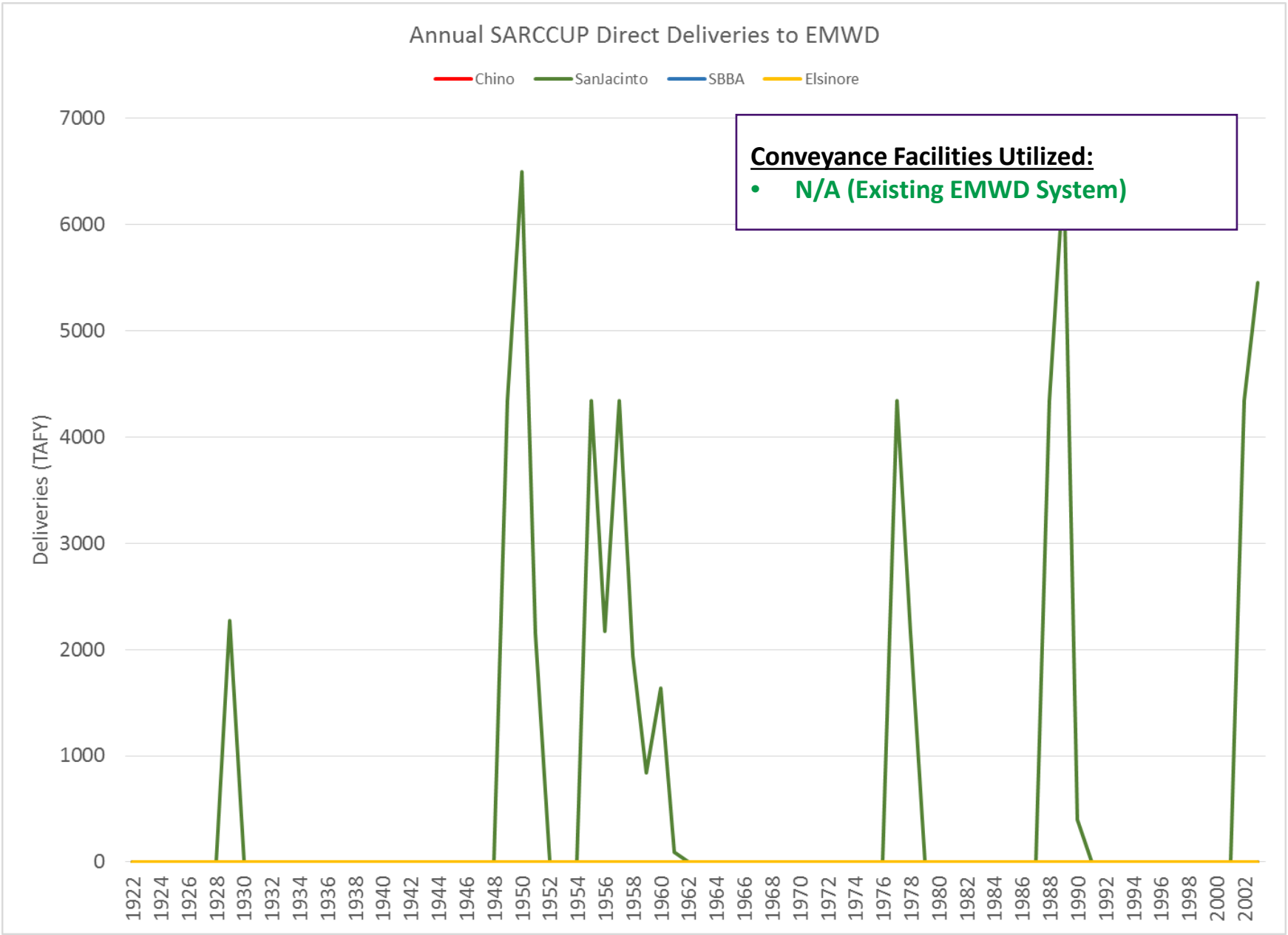
SARCCUP Direct Deliveries to IEUA



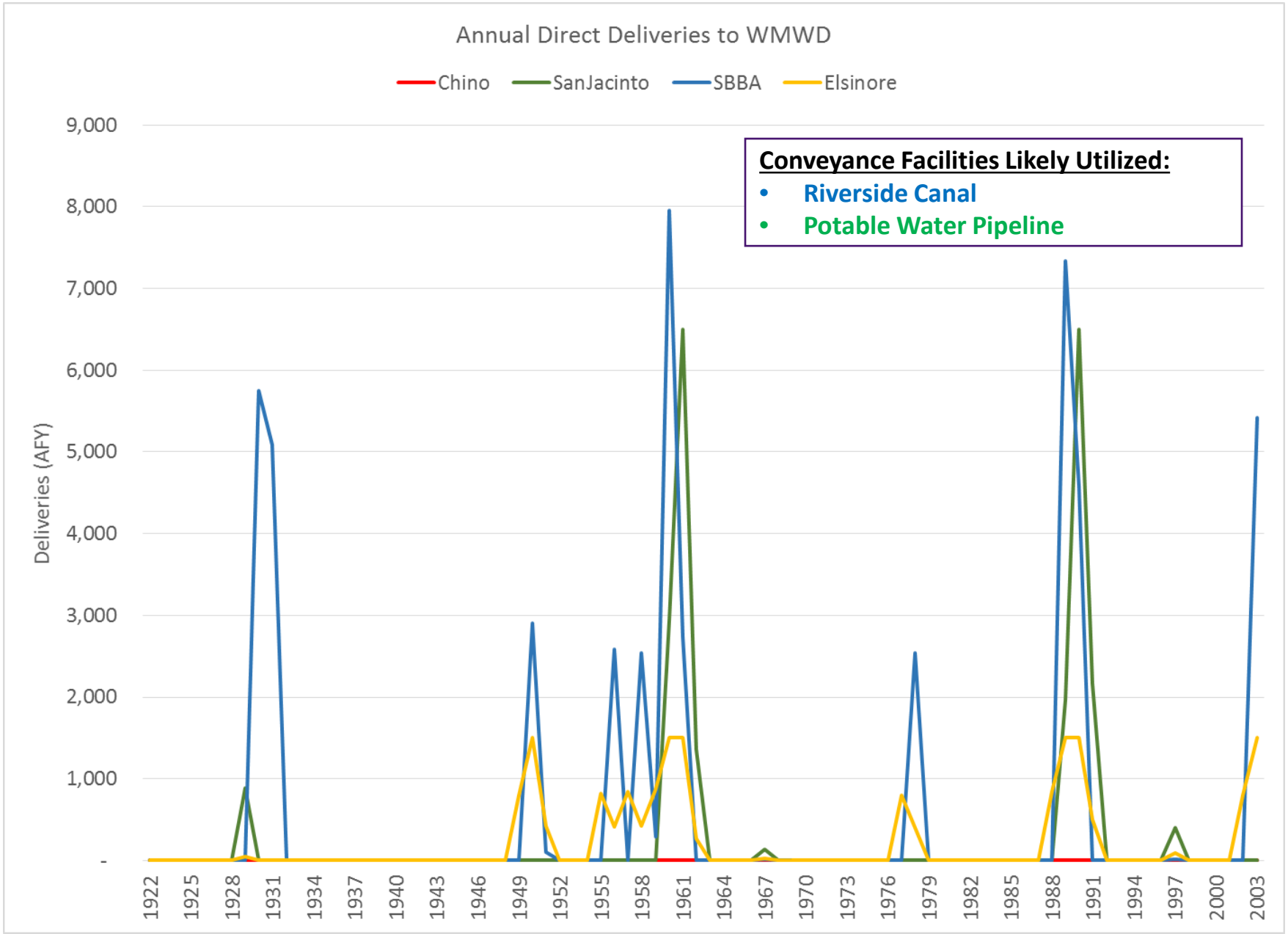
SARCCUP Direct Deliveries to OCWD



SARCCUP Direct Deliveries to EMWD



SARCCUP Direct Deliveries to WMWD



Remaining Work and Schedule

- Final cost and conveyance reviews
- Final DSM simulations
- Draft model documentation (January 31)
- Draft Master Plan scope of work (January 31)
- Final model documentation and Master Plan scope of work (February 21)

Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) Decision-Support Model

Questions?

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Uncertainties and Future Work

- Uncertainties
  - Cost
    - Purchase cost of wet and above normal year Sacramento Valley transfer supply
    - Future of MWD penalty rate tiers and enforcement
  - Operations
    - MWD allocation timing and frequency based on simplified model
    - Some recharge, extraction, and conveyance capacities have not been confirmed
- Future Work
  - Refine scenarios and assumptions ??
  - Documentation
  - Support model for Master Plan

MWD Projected Rates

Rates & Charges Effective January 1st	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tier 1 Supply Rate ($/AF)	$156	$201	$209	$214	$226	$238	$245	$250	$261	$273	$285
Tier 2 Supply Rate ($/AF)	$290	$295	$295	$295	$295	$295	$295	$295	$295	$295	$295
System Access Rate ($/AF)	$259	$289	$299	$320	$335	$358	$383	$412	$440	$469	$499
Water Stewardship Rate ($/AF)	$41	$52	$55	$59	$60	$61	$61	$62	$62	$62	$62
System Power Rate ($/AF)	$138	$124	$132	$145	$162	$178	$187	$193	$198	$204	$210
Full Service Untreated Volumetric Cost ($/AF)											
Tier 1	$594	$666	$695	$738	$783	$835	$876	$917	$961	$1,008	$1,056
Tier 2	$728	$760	$781	$819	$852	$892	$926	$962	$995	$1,030	$1,066
Treatment Surcharge ($/AF)	$348	$313	$320	$315	$309	$288	$288	$288	$288	$288	$288
Full Service Treated Volumetric Cost ($/AF)											
Tier 1	$942	$979	$1,015	$1,053	$1,092	$1,123	$1,164	$1,205	$1,249	$1,296	$1,344
Tier 2	$1,076	$1,073	$1,101	$1,134	$1,161	$1,180	$1,214	$1,250	$1,283	$1,318	$1,354
Readiness-to-Serve Charge ($M)	$153	$135	$140	$143	$148	$156	$168	$182	$196	$211	$228
Capacity Charge ($/cfs)	$10,900	$8,000	$8,700	$9,000	$9,300	$9,700	$10,000	$10,500	$11,100	$11,100	$11,300

SARCCUP DSM Cost Network

SARCCUP DSM COST NETWORK

DRAFT	1/10/2017

Recharge Cost ($/AF)

MWD Tier 1 untreated rate

From	To	Supply	Conveyance	Recharge	Total
SBVMWD Table A	SBBA	$ 666		$ 30	$ 696
SBVMWD Table A	Chino	$ 666		$ 40	$ 706
SBVMWD Table A	Elsinore	$ 666		$ 250	$ 916
SBVMWD Table A	San Jacinto	$ 666		$ 75	$ 741
SWP Transfer	SBBA	$ 350	$ 50	$ 30	$ 430
SWP Transfer	Chino	$ 350	$ 413	$ 40	$ 803
SWP Transfer	Elsinore	$ 350	$ 413	$ 250	$ 1,013
SWP Transfer	San Jacinto	$ 350	$ 413	$ 75	$ 838

Estimated wet year Sacramento Valley purchase

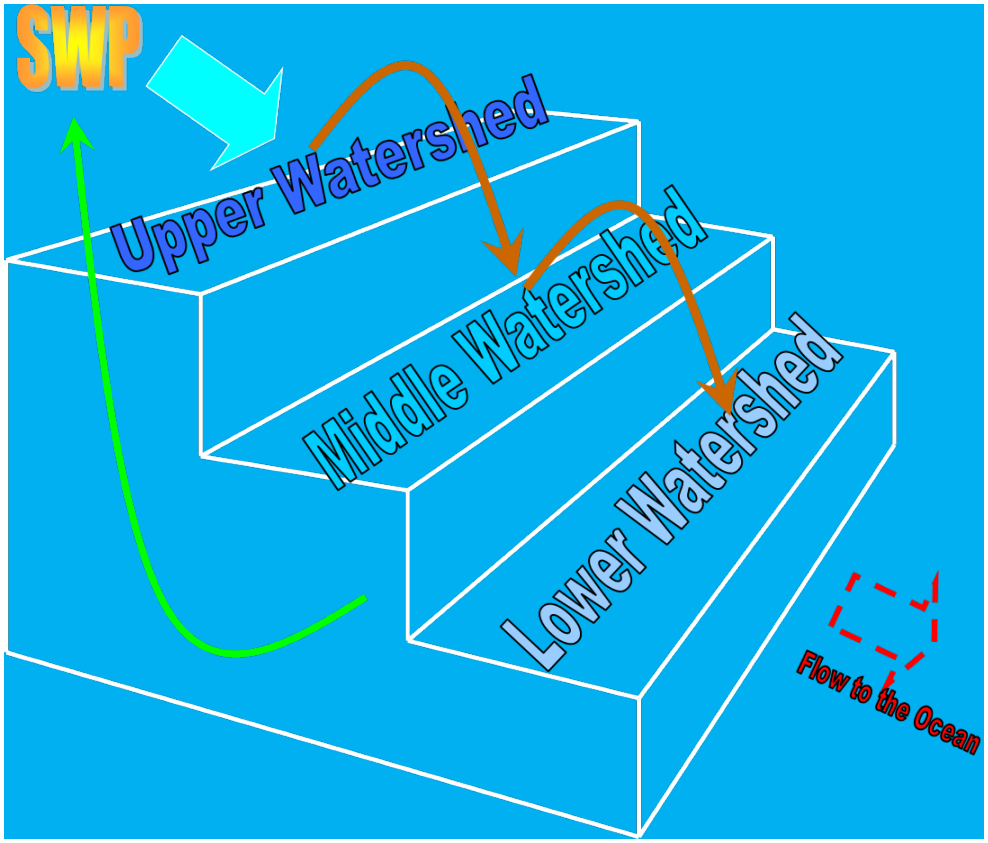
MWD System Access + Power rate

Delivery Cost ($/AF)

From	To	Extraction	Conveyance	Wheeling	Total
SBBA	SBVMWD	$ 70	$ 50	$ -	$ 120
SBBA	IEUA	$ 70	$ 50	$ 10	$ 130
SBBA	WMWD	$ 70	$ 185	$ 10	$ 265
SBBA	EMWD				$ -
SBBA	OCWD	$ 70	$ 65	$ -	$ 135
Chino	SBVMWD	$ 225	$ 185	$ 10	$ 420
Chino	IEUA	$ 225	$ 50	$ -	$ 275
Chino	WMWD				$ -
Chino	EMWD				$ -
Chino	OCWD	$ 225	$ 413	$ -	$ 638
Elsinore	SBVMWD				$ -
Elsinore	IEUA				$ -
Elsinore	WMWD	$ 200	$ 50	$ -	$ 250
Elsinore	EMWD				$ -
Elsinore	OCWD				$ -
San Jacinto	SBVMWD				$ -
San Jacinto	IEUA				$ -
San Jacinto	WMWD	$ 200	$ 185	$ 10	$ 395
San Jacinto	EMWD	$ 200	$ 50	$ -	$ 250
San Jacinto	OCWD			$ -	$ -

What if OCWD were to only receive Recycled Water via the Santa Ana River?

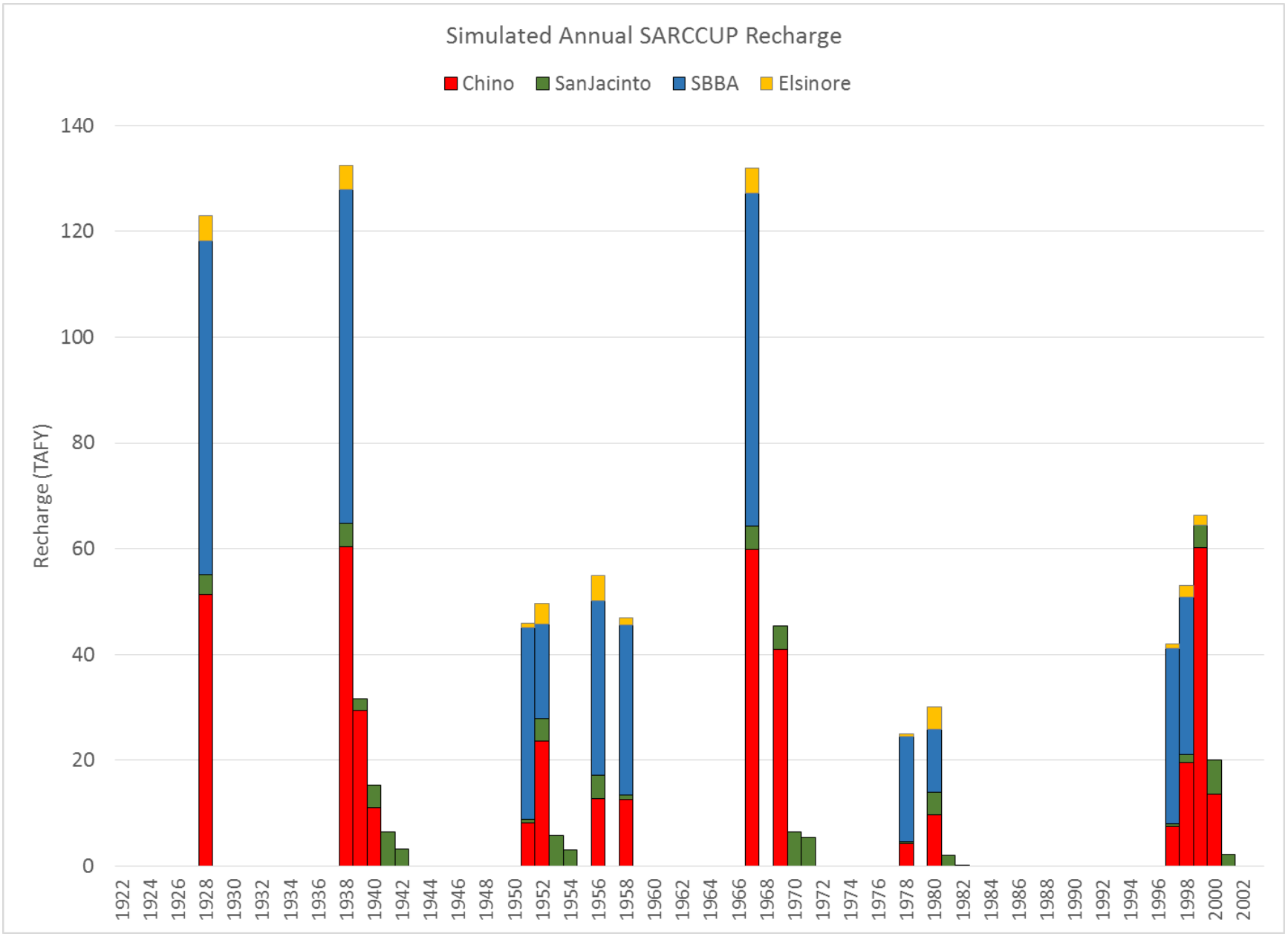
- Current Scenario
  - SARCCUP operations, IEUA delivers recycled water to OCWD in exchange for OCWD's SARCCUP groundwater supply in Chino
  - Limited to approximately 10-50 TAFY due to available IEUA delivery capability and OCWD imported water demand
  - Limited benefit likely due to 1-for-1 exchange assumptions
- Revised Scenario
  - Investigating broader upper watershed contribution of recycled water supply to OCWD
  - **IN PROGRESS and REVIEW**



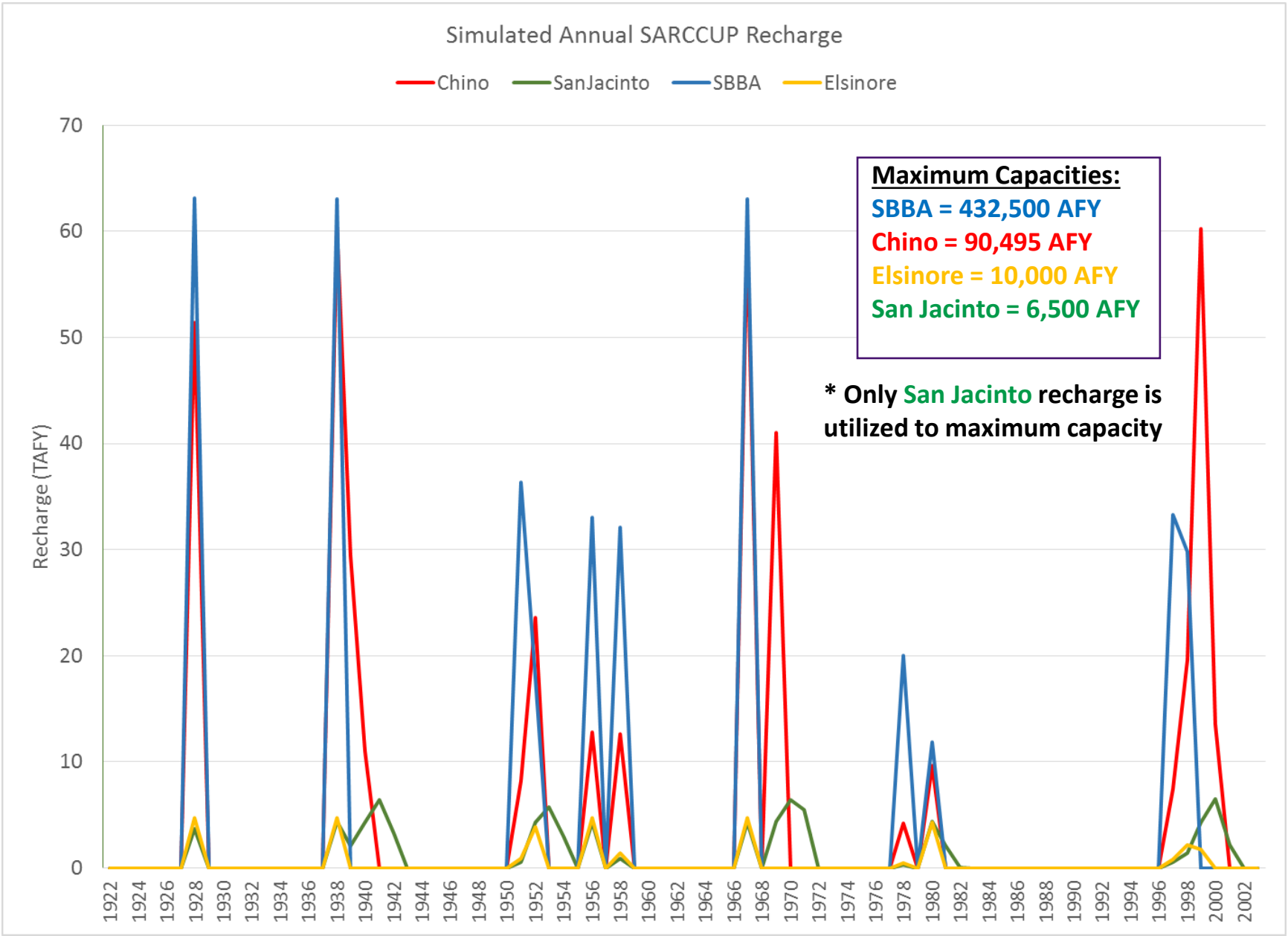
Major Assumptions of SARCCUP Scenarios

- Baseline
  - No SARCCUP, existing imported supply reliability
- Scenario 1 – SARCCUP under Existing Conditions
  - SARCCUP operations, existing Delta infrastructure and regulations,
- Scenario 2 – SARCCUP with California Water Fix
  - SARCCUP operations, CWF infrastructure and regulations
- Scenario 3 – SARCCUP with Climate Change
  - SARCCUP operations, future climate change around mid-century
- Scenario 4 – SARCCUP with recycled water exchanges to OCWD
  - SARCCUP operations, IEUA delivers recycled water to OCWD in exchange for OCWD's SARCCUP groundwater supply in Chino

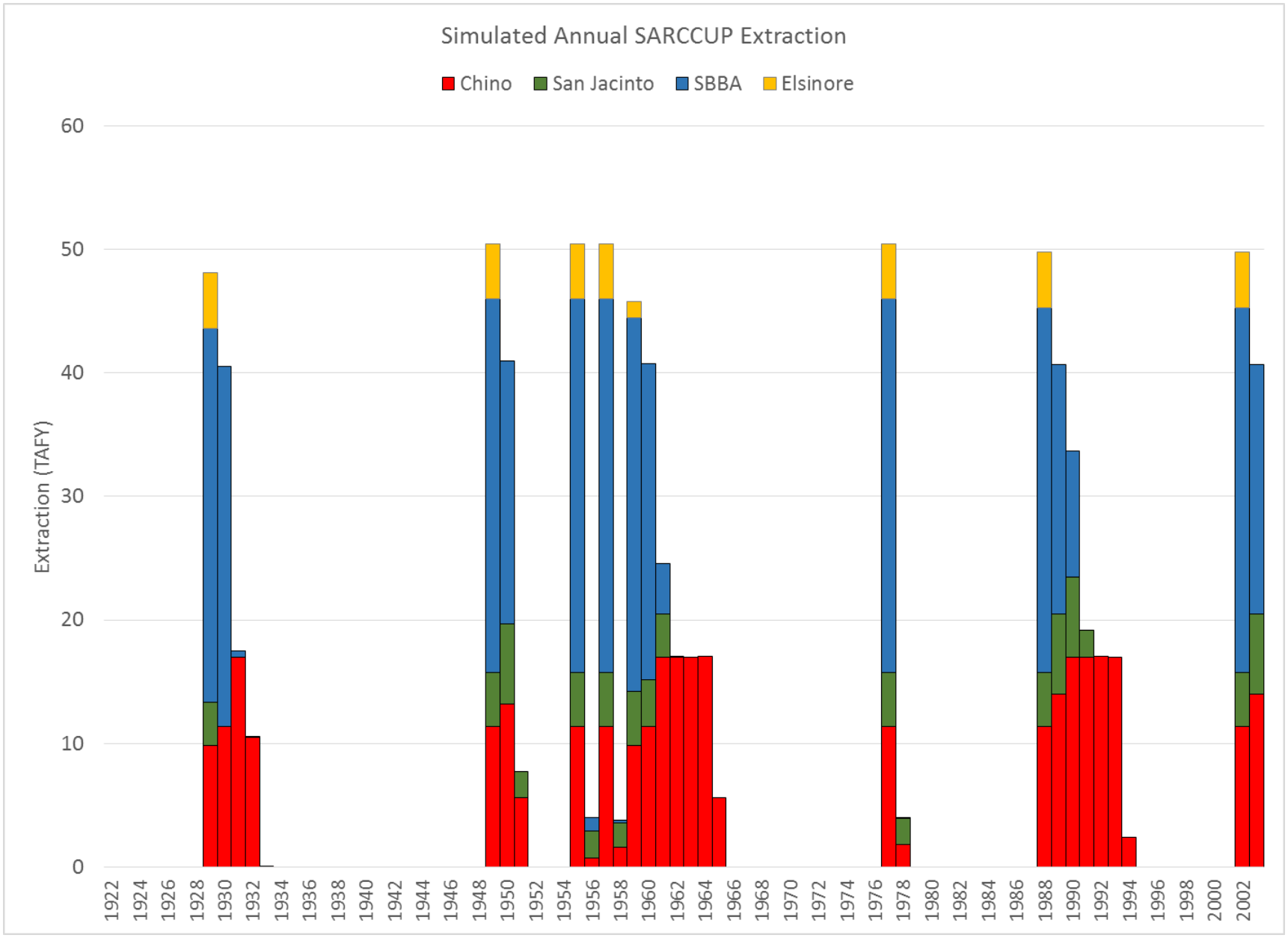
Simulated Annual Recharge Volumes



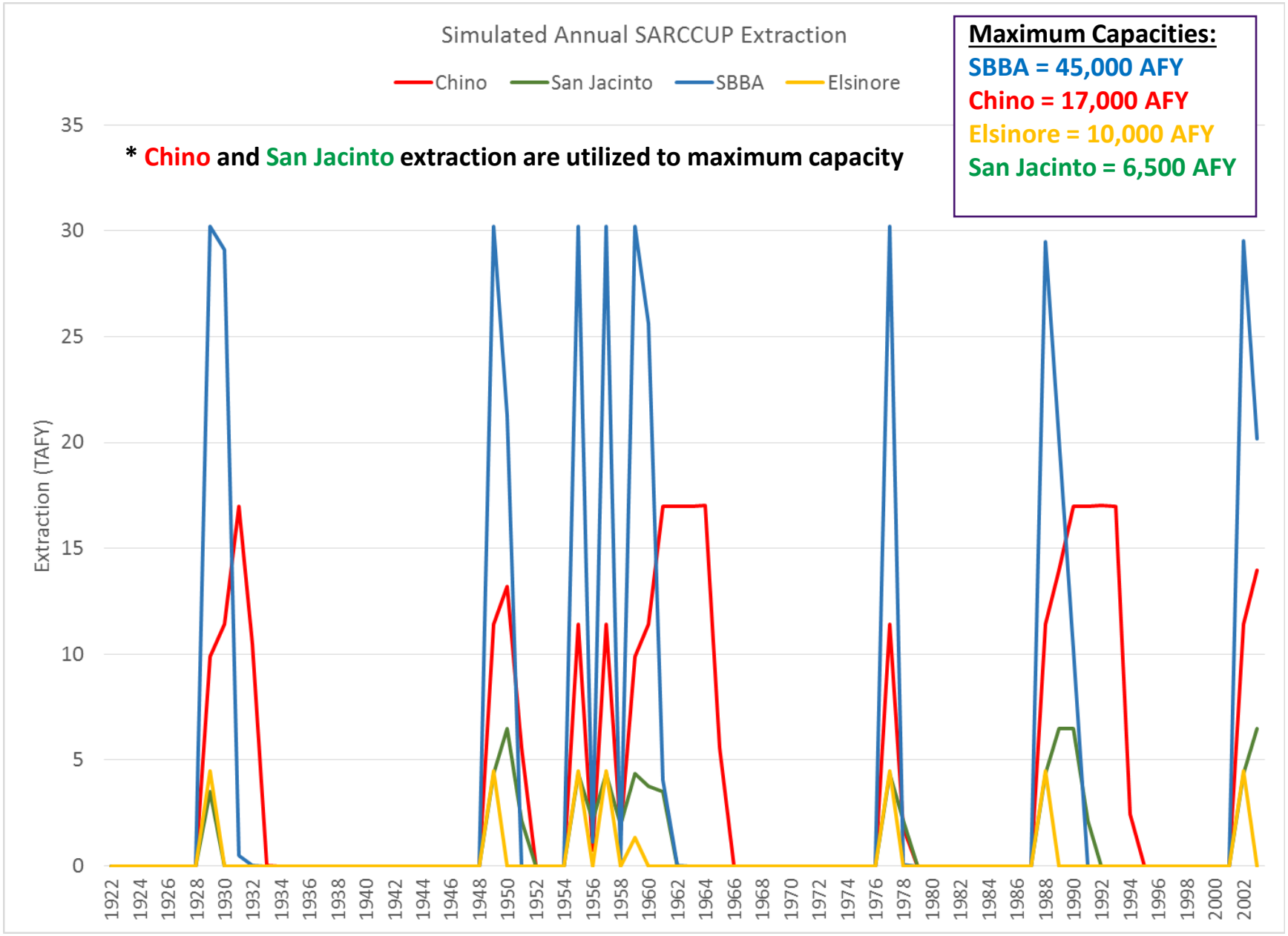
Simulated Annual Recharge by Basin



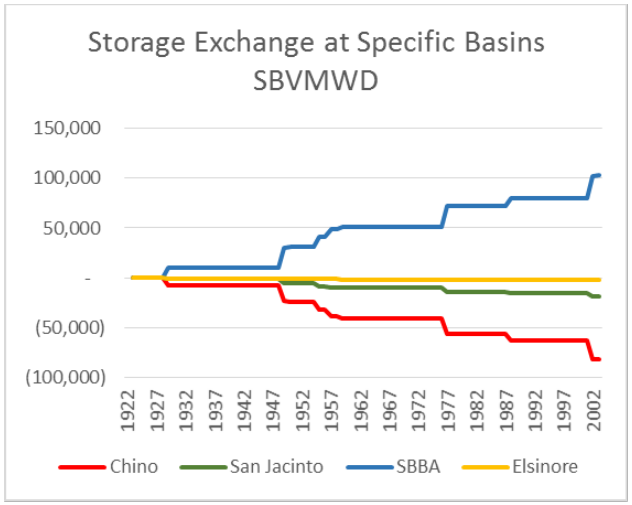
Simulated Annual Extraction Volumes

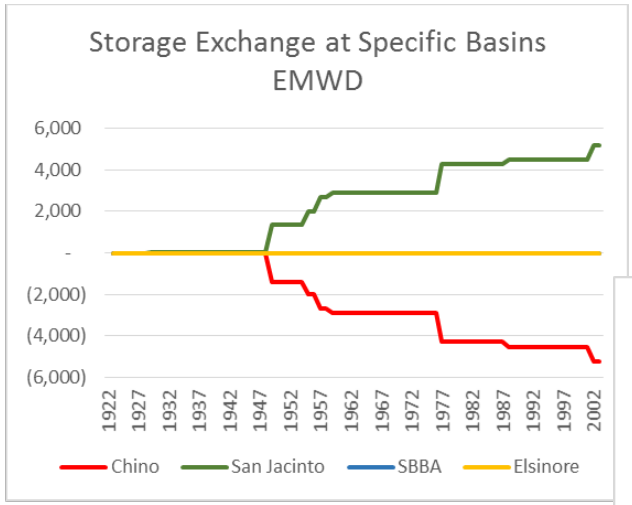


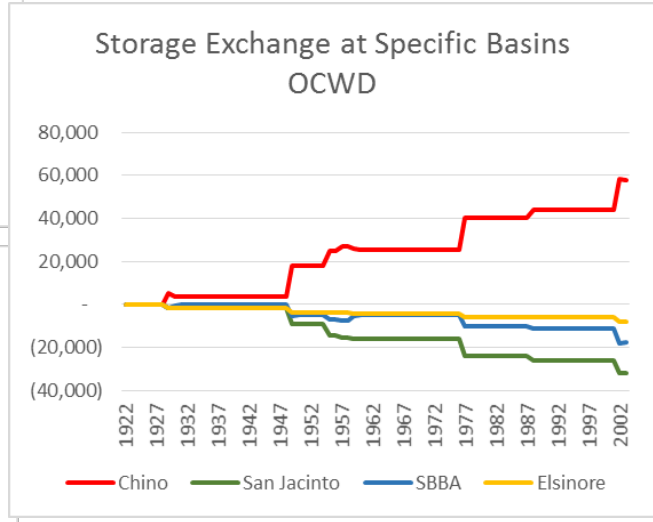
Simulated Annual Extraction by Basin

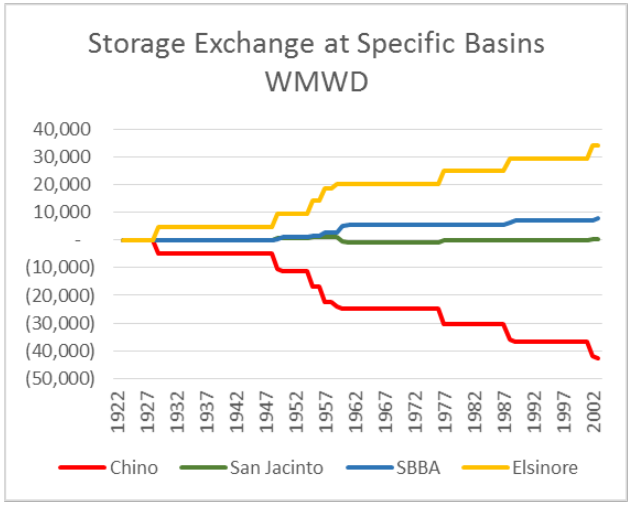


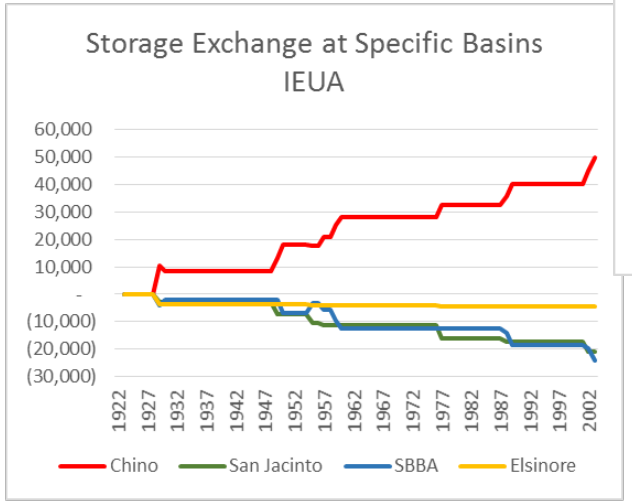
Substantial Storage Exchanges to Facilitate "Balancing" (Optimization)











Chino San Jacinto SBBA Elsinore

Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) Decision-Support Model

Questions?

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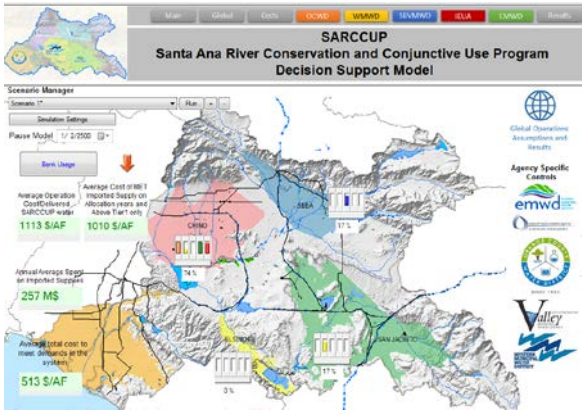
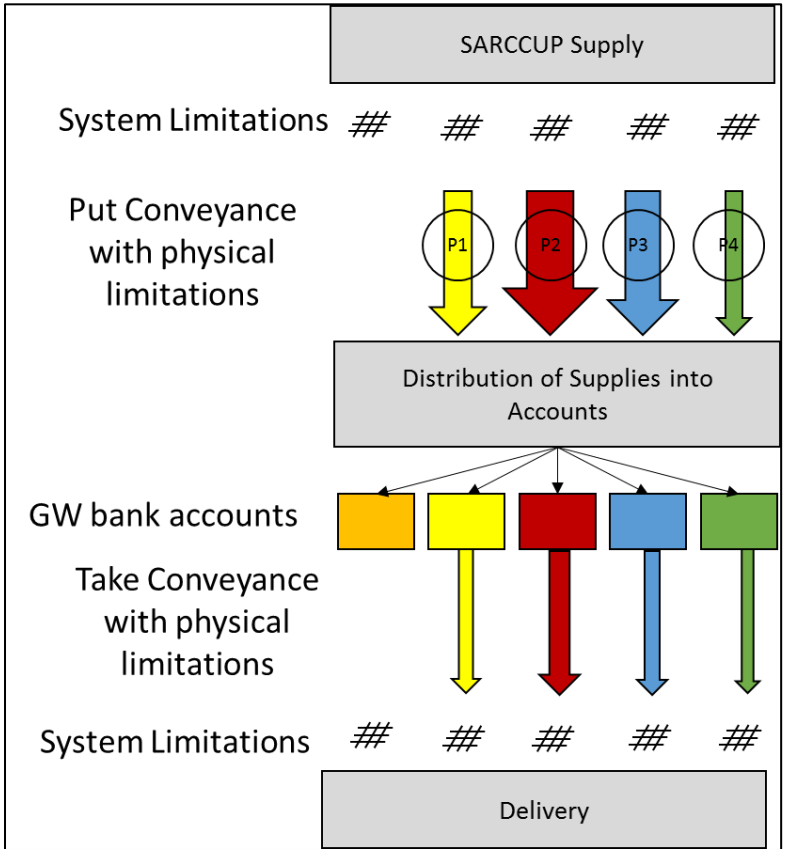
Decision Support Model Overview

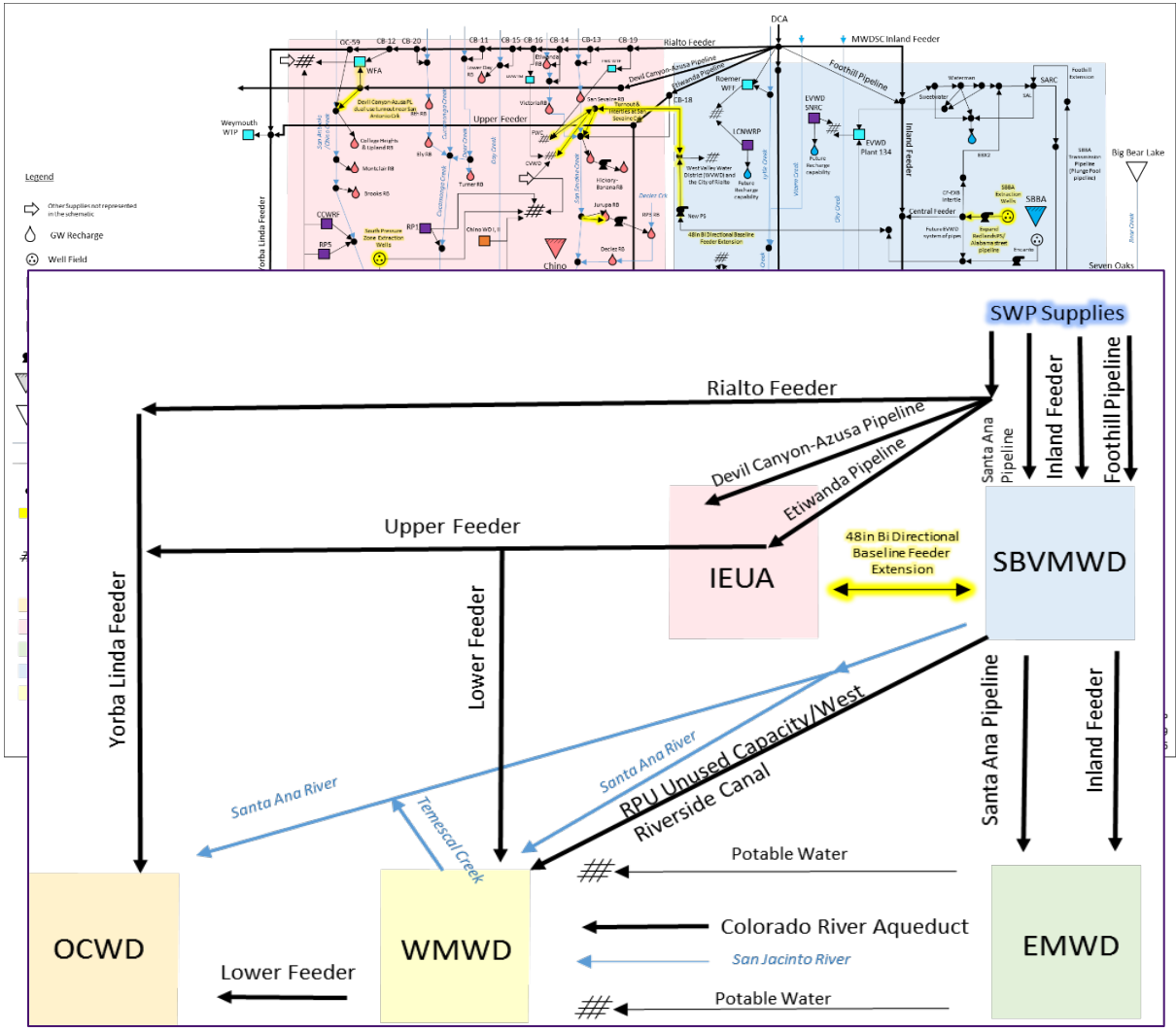
- GoldSim Modeling Platform
- System Description
- System Operations
  - Future Agency Water Supplies and Demands
  - Availability of Supply for SARCCUP
  - Timing of SARCCUP Extraction
  - Recharge and Extraction (put/take)
  - Groundwater Storage and Accounting
  - SARCCUP Deliveries
- Cost and Optimization Approach





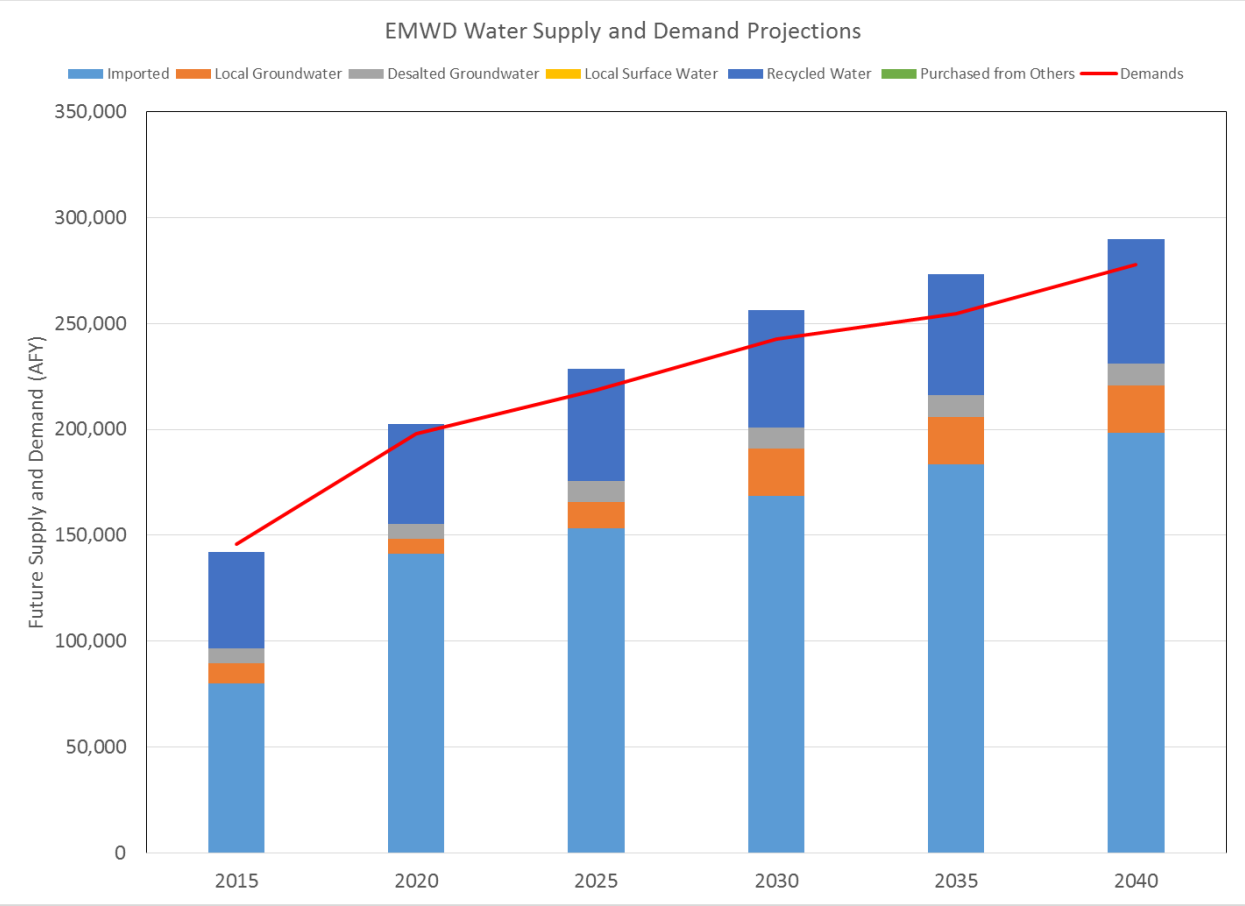
SARCCUP DSM System Representation

- Simplified network of system includes:
  - Service areas for SBVMWD, IEUA, EMWD, WMWD, and OCWD
  - Imported and local supplies
  - Demands
  - Groundwater basins
  - Regional conveyance
  - Recharge and extraction facilities
  - Proposed SARCCUP facilities



Projection of Future Baseline Water Supply and Demands

- Data collected from 2015 UWMPs for each agency
- Mostly reconciled with additional agency review
- Supply in excess of demands was assumed not needed – imported supply decreased

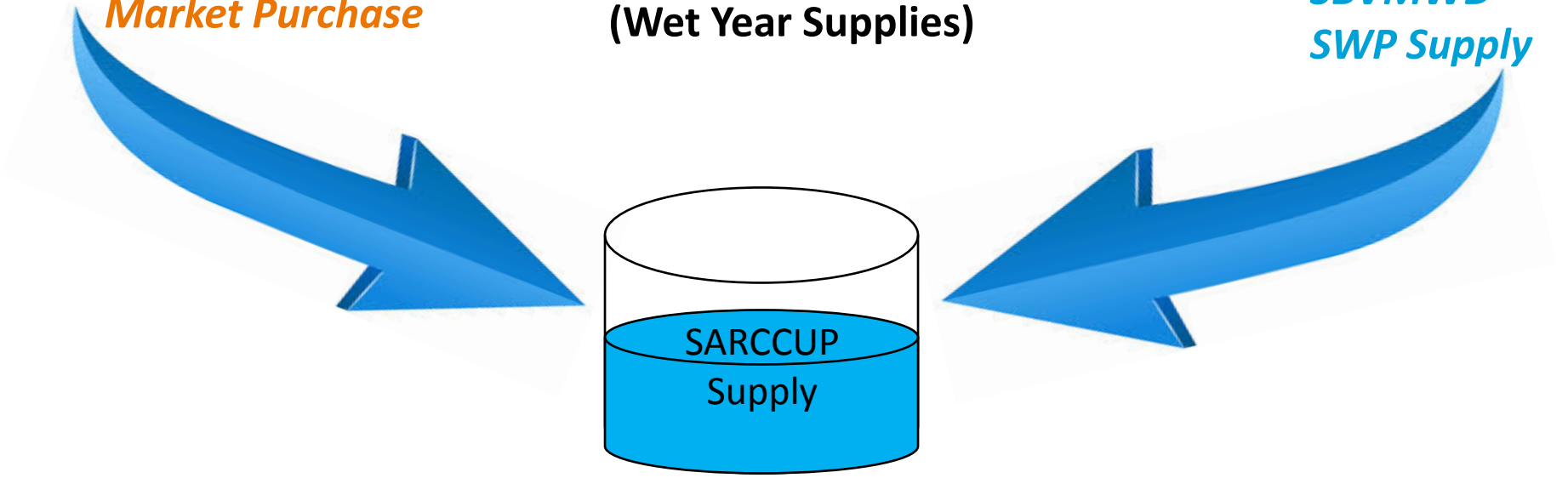


Available Supply for SARCCUP

SWP Transfer Market Purchase

Two Sources of Supply Available (Wet Year Supplies)

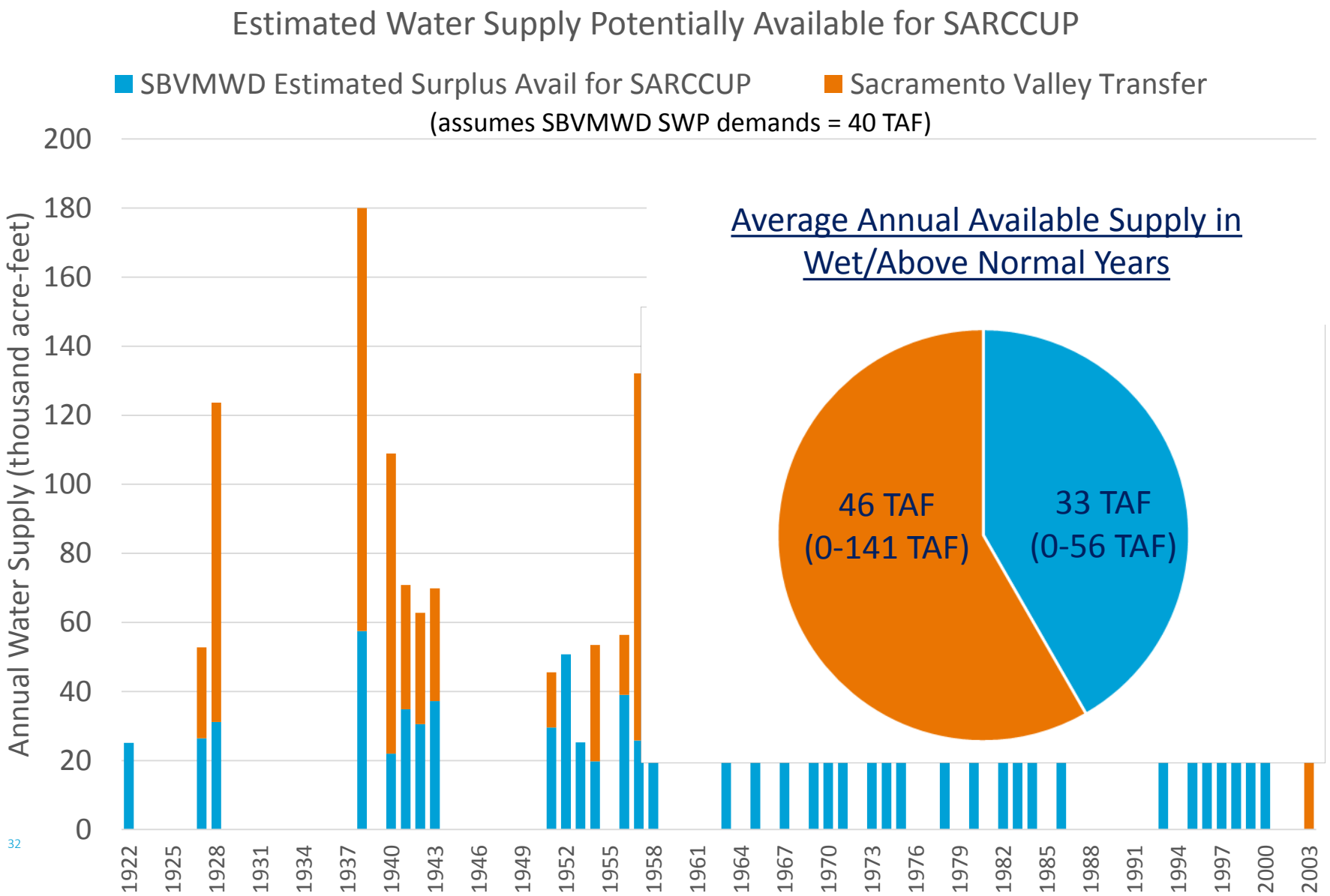
Surplus SBVMWD SWP Supply



- Delta and SWP transfer supply conveyance derived from the CALSIM II studies and an offline Delta transfer analysis tool
- Assumes SARCCUP supplies have priority access to SWP available conveyance

- SBVMWD demands for SWP water are assumed to be 30-40 TAF
- SWP allocation above this amount is potentially available for SARCCUP
- Hydrological-climatological conditions for water years 1922-2003 are assumed consistent with the CALSIM II simulation period

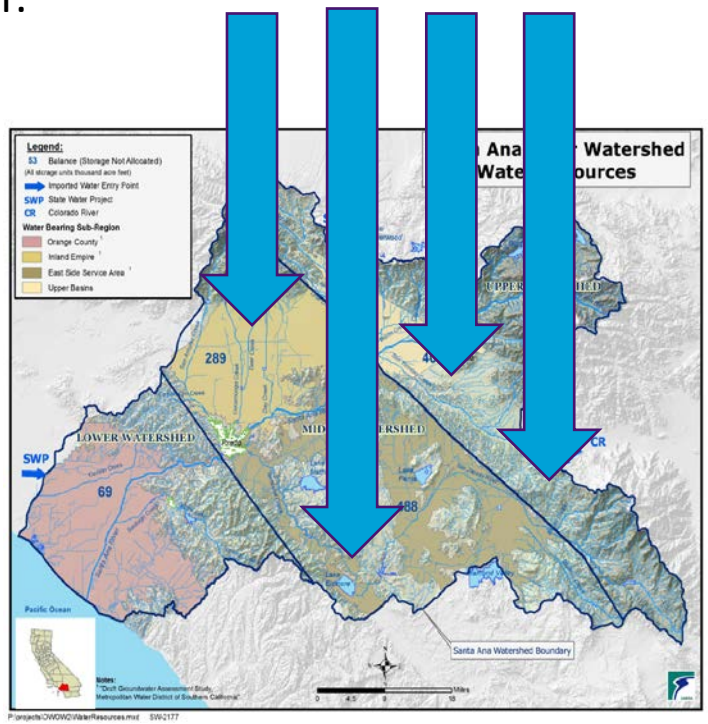
Estimated Water Supply Potentially Available for SARCCUP



SARCCUP Recharge

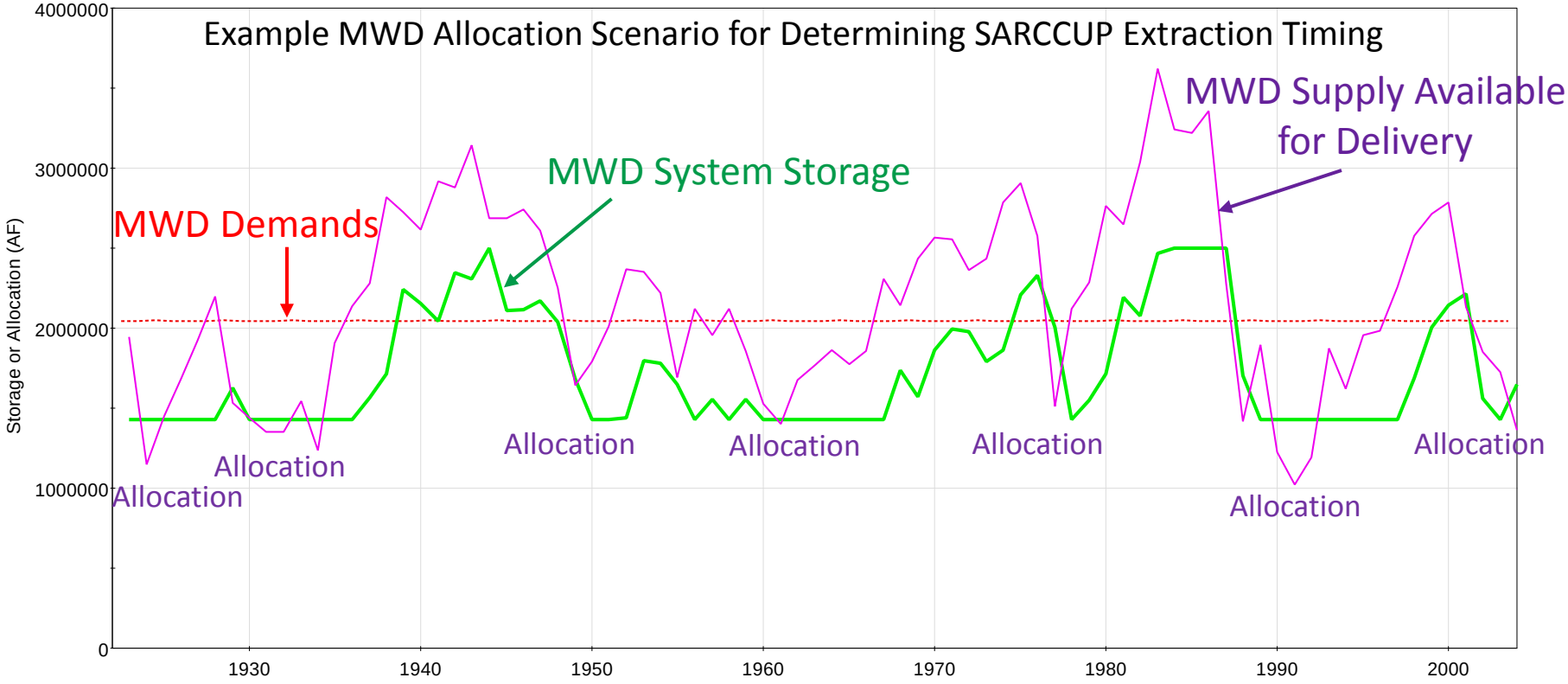
- Recharge of SARCCUP GW bank a function of:
  - Recharge capacity
  - Available GW bank storage
- Water conveyed to specific GW basin as a function of:
  - Recharge cost
  - Current storage in SARCCUP bank
- Recharge divided equally among 5 agencies in each GW basin
- “Basin management factor” estimated at 5% of recharge volume

Imported Supply Available to SARCCUP

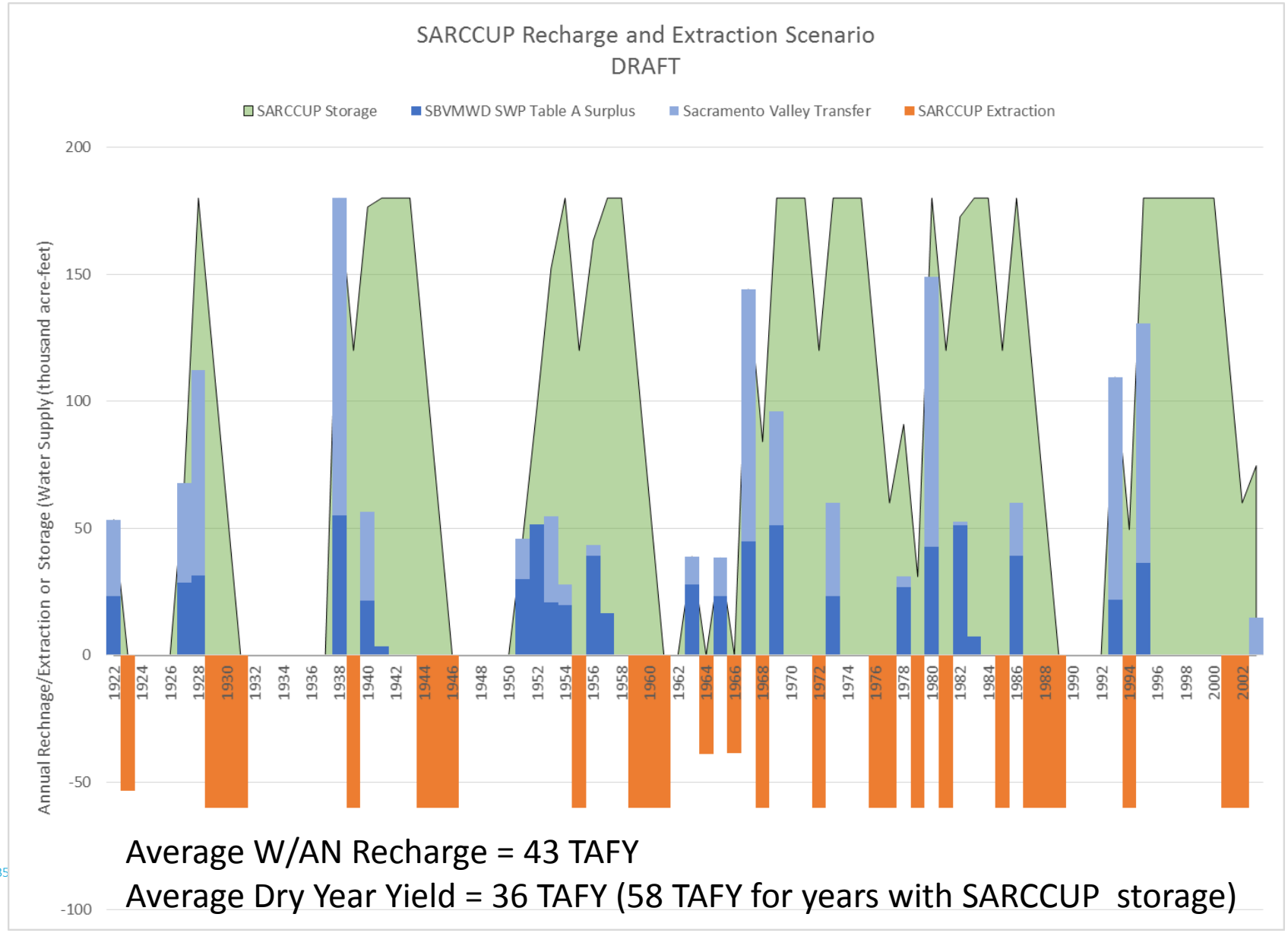


SARCCUP Extraction

- SARCCUP extraction designed to operate as a dry-year yield program
  - Extractions are linked to MWD Allocation years (consistent with MWD's extraordinary supply definition)
- Limited by extraction capacity in each specific basin
  - Up to 60,000 AF/YR (180,000 AF over 3 years)



Example SARCCUP Recharge and Extraction Operation



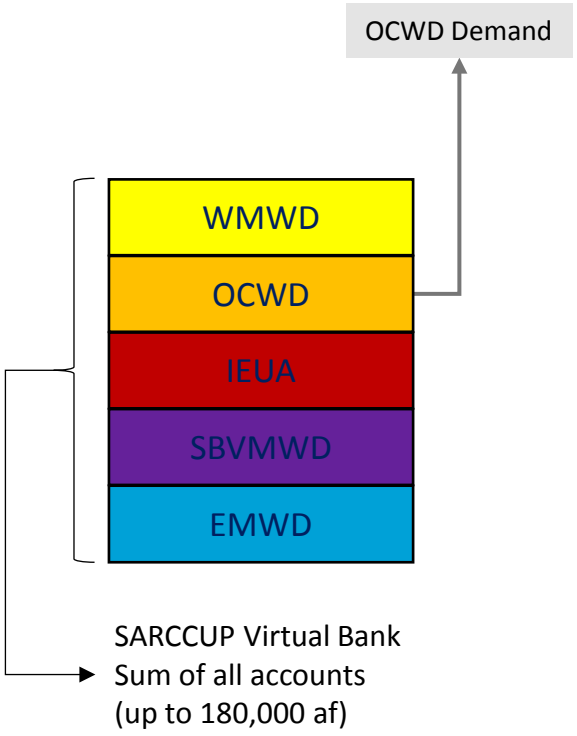
Average W/AN Recharge = 43 TAFY

Average Dry Year Yield = 36 TAFY (58 TAFY for years with SARCCUP storage)

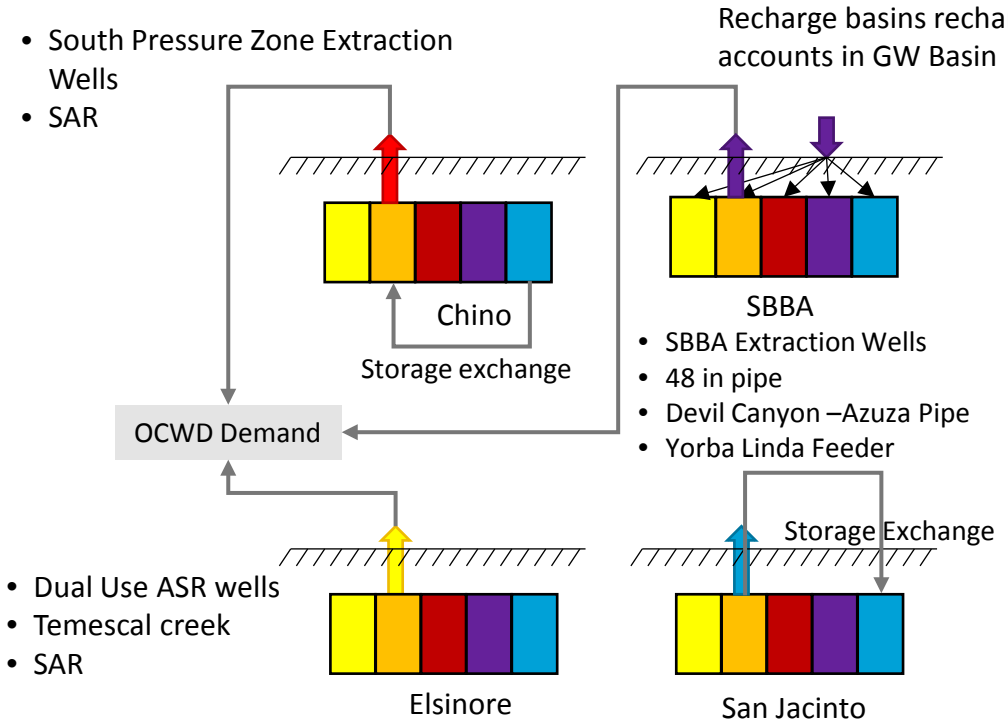
Groundwater Storage and Accounting

- Maximum SARCCUP storage capacity of 180,000 AF
- Both “Integrated” and “Basin Specific” SARCCUP accounts
- Each SARCCUP agency can track amount AND location of stored water

SARCCUP Integrated Account



SARCCUP Basin Specific Accounts

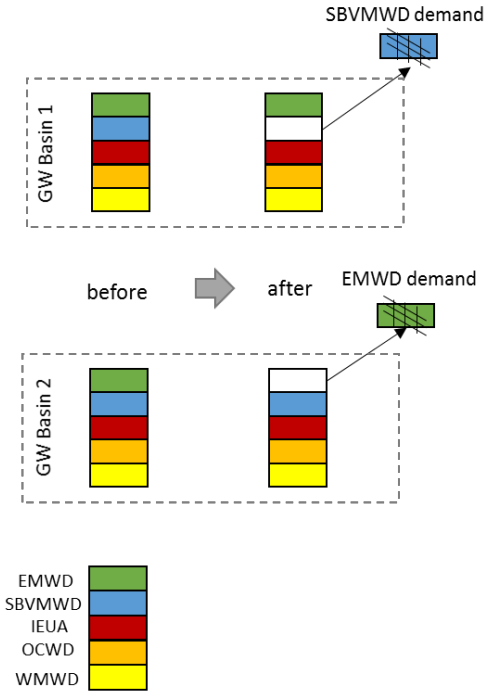


Explicit accounting and tracking of multiple SARCCUP banks and storages accounts. Need in lieu exchanges in order to deliver all SARCCUP supply.

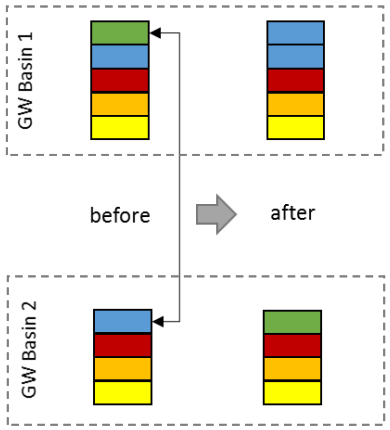
Delivery of SARCCUP Stored Water

- Three types of delivery mechanisms
  - ***Direct Delivery*** – Physical movement of water from basin to agency ($$$)
  - ***Storage Exchange*** – Simple exchange, or "re-coloring", of water in storage ($)
  - ***In-lieu Exchange*** – Exchange of non-SARCCUP supply from one agency to SARCCUP supply of another agency ($$)

a) Direct Delivery

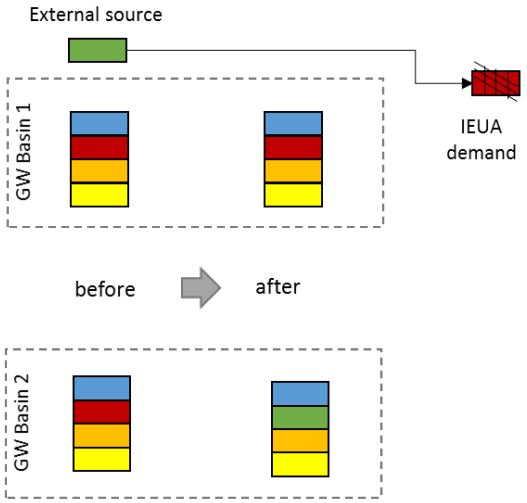


b) Storage Exchanges



Exchange between SBVMWD and EMWD
Case: EMWD doesn't have enough volume on GWBasin 2 but has on GW Basin 1. EMWD starts a transfer with SBVMWD to increase its volume on Basin 2. EMWD transfers its Basin 1 water to Basin 2 using SBVMWD water as exchange mechanism. Total volume can't change.

c) In-Lieu Exchanges



Exchange between IEUA and EMWD
Case: EMWD doesn't have enough volume on GWBasin 2 or any other storage. EMWD has access to some external source and can use that as an exchange to water that it will use from IEUA in the GW Basin 2. The external water source cannot go to SARCCUP storage because it would change the total SARCUPP volume stored.

Connections for Direct Delivery

To SARCCUP Agency	From Agency System/GW Basin			
	Elsinore GW Basin	Chino GW Basin	SBBA GW Basin	San Jacinto GW Basin
OCWD	Dual use ASR wells to Temescal Creek to SAR	South Pressure Zone Extraction Wells to SAR	SBBA Extraction Wells 48 inch baseline feeder extension Devil Canyon –Azuza Pipe Yorba Linda Feeder or SAR	San Jacinto Extraction Wells CRA or San Jacinto creek
WMWD	Dual use ASR wells	Chino Desalter	RPU Wells unused capacity/West Riverside Canal	CRA or San Jacinto Creek San Jacinto Extraction Wells Potable pipe network
IEUA	x	South Pressure Zone Extraction Wells, Member Agency Wells	SBBA Extraction Wells 48 inch baseline feeder extension	x
SBVMWD	x	48 inch baseline feeder extension	SARCCUP Wells RPU Wells MWDSC Inland Feeder	x
EMWD	x	x	Alabama Pipe Central Feeder Inland Feeder	San Jacinto Extraction Wells

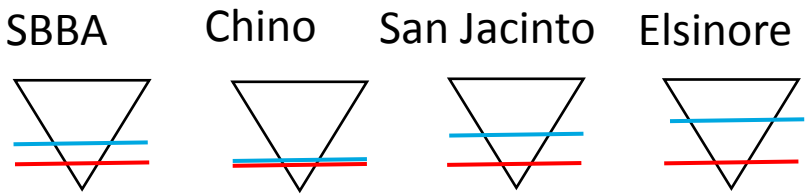
SARCCUP project facilities:

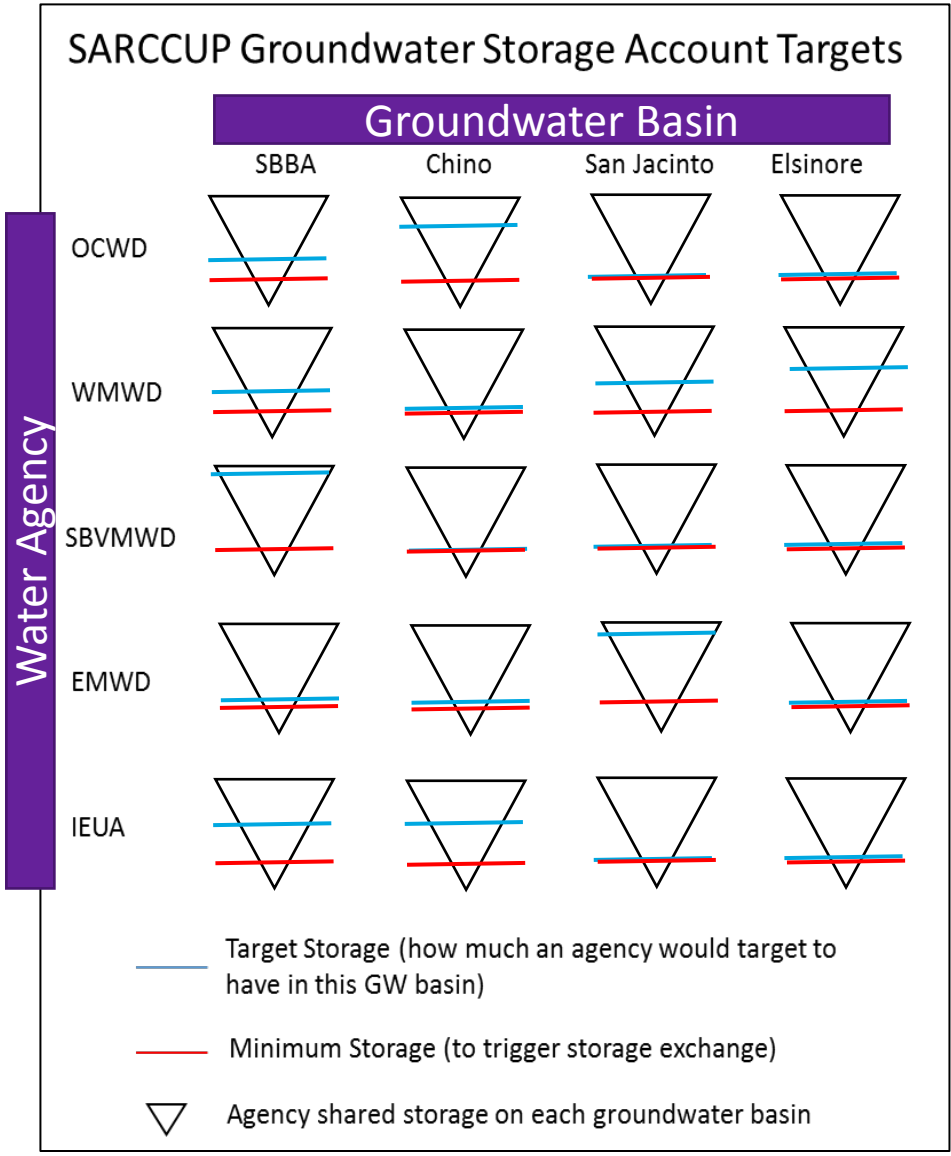
- Dual use ASR wells
- South Pressure zone extraction wells
- 48 inch Baseline Feeder extension
- SBBA extraction wells
- Alabama St pipeline/Redlands PS
- San Jacinto extraction wells

Groundwater Storage and Accounting

- Storage targets set for each agency in each basin based on cost optimization
- Storage exchanges will occur to attempt to achieve “optimal” storage balancing for each agency

Target storage distribution in each basin:





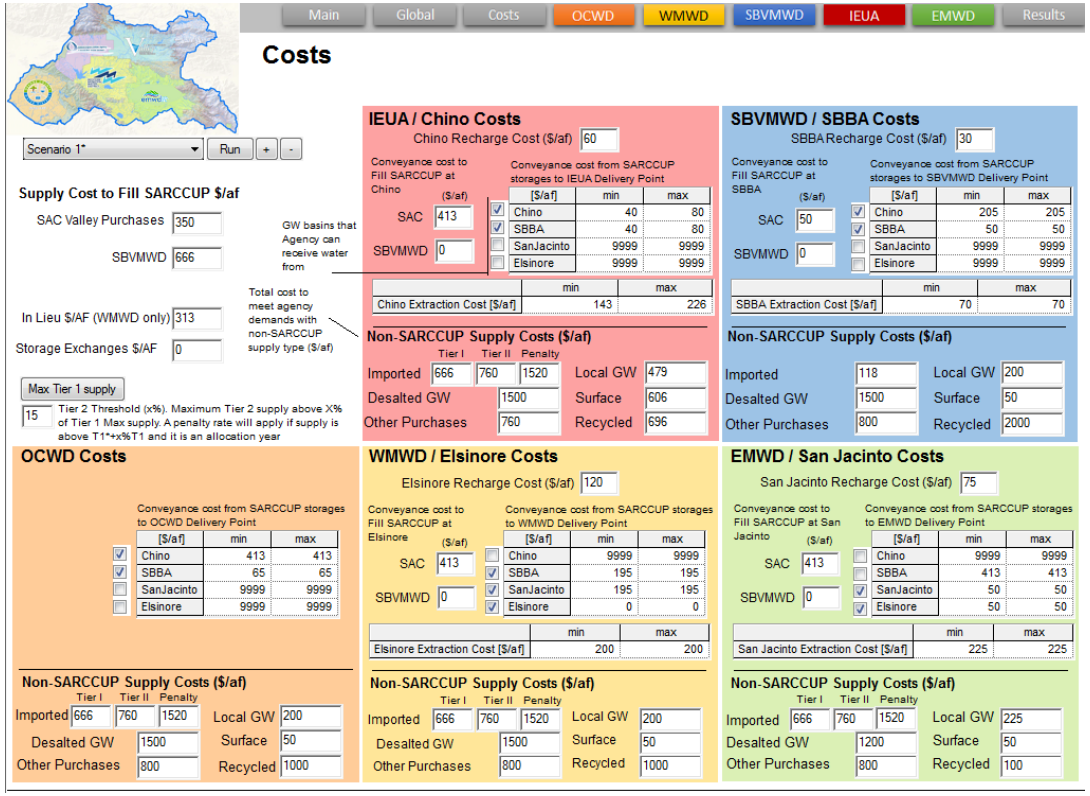
Optimizing Operations of SARCCUP

- Objective
  - Minimize net cost of delivery of SARCCUP supply to agencies
- SARCCUP Costs
  - Cost of Purchased Supply +
  - Cost of Recharge Conveyance +
  - Cost of Recharge +
  - Cost of Extraction +
  - Cost of Delivery Conveyance or Wheeling +
  - Cost of Exchanges

Total SARCCUP Cost /
Total SARCCUP Deliveries
=
SARCCUP Unit Cost
(or postage stamp rate)

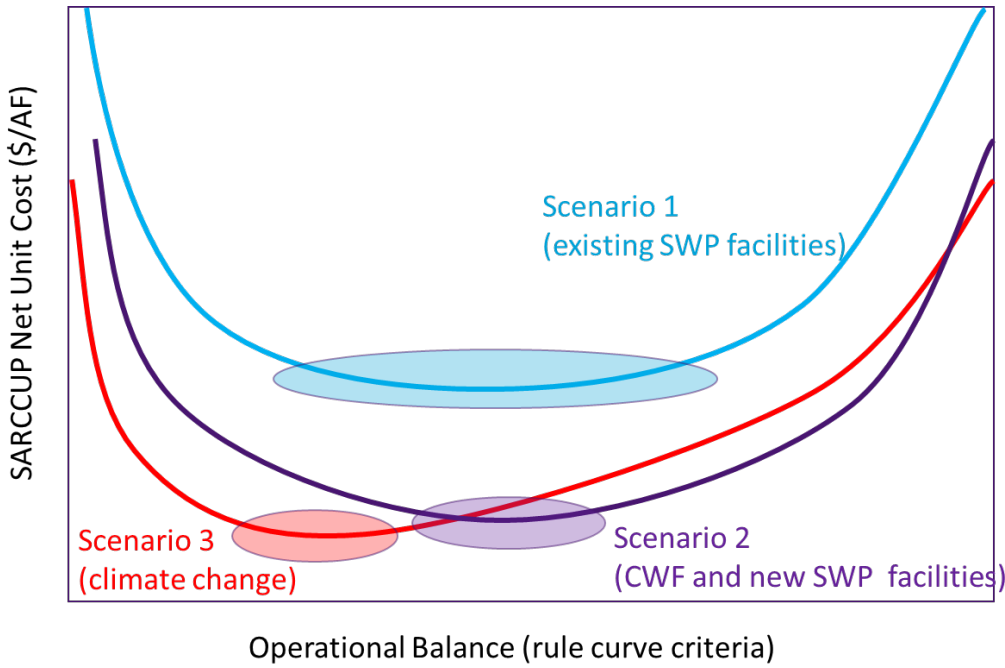
Cost Assumptions

- Supply Costs:
  - Sacramento Valley Water Purchases
    - To SBVMWD @ $400/AF
    - To MWD @ $750/AF
  - SBVMWD Surplus @ MWD Tier 1 Rate, $666/AF
- Recharge Costs:
  - Varies by Basin, $30-120/AF
- Extraction Costs:
  - Varies by Basin, $70-225/AF
- Delivery Costs:
  - Varies by source/delivery point; $40-400/AF
- Exchange Costs:
  - Storage exchanges @ $0/AF
  - In-lieu @ $313/AF (treatment surcharge for WMWD)



Optimization through Rule-Based Criteria

- Optimization through Rule-Based Criteria
  - Rules with variable criteria (target storage levels) are established … and optimized
  - Similar to development of “reservoir rule curves”
- Storage Rule Curves
  - Target SARCCUP bank storage distribution for each agency
  - Threshold bank volume that will trigger storage exchanges
  - Threshold bank volume that will limit storage exchanges
- GoldSim optimization methods to identify range of “optimal rule curves” to minimize SARCCUP unit cost



Model Dashboards – The User Interface