Bureau of Reclamation
Mid-Pacific Region

California Department
of Water Resources

Upper San Joaquin River Basin Storage Investigation

Workshop 4

February 11, 2003

Workshop Purpose and Objectives

- Summarize and Discuss Initial Surface Storage Options Screening Report
- Introduce Functional Equivalence Framework and Continuation Criteria
- Review Preliminary Results of Storage Options Modeling
- Discuss Next Steps

Workshop #4

Agenda

- Welcome and Meeting Overview
- In-Progress Phase I Report
- Functional Equivalence and Continuation Criteria
- Modeling Assumptions
- Preliminary Results of Operations Modeling
- Next Steps

Participation Principles

- Participate – Attend the workshops
- Learn – Learn about resources, people, roles, and process
- Represent – Bring issues and interests forward from others whose interests you share
- Cooperate – Work with others in the workshops to share information and consider options
- Educate – Report back to others who share your interests

Workshop Ground Rules

- **Commit to Being Fully Present**
  - No cell phones, pagers, voicemail, etc.
  - Ask for what you need from the meeting process and participants
- **Honor Our Time Limits**
  - Keep comments and discussion concise
  - Stay focused on the topic – Use the parking lot for other issues
- **Respect Each Other**
  - Listen carefully to other participants
  - Respond to ideas and issues, not individuals
- **Support Constructive Discussion**
  - Suggest improvements and solutions
  - Build on others' ideas – Use "and" instead of "but"

Parking Lot

- Describe how this Investigation interrelates with other programs (groundwater and watershed) — Ongoing Coordination
- Interact with FWUA/NRDC process. Define the relationship/match of objectives with the goals of the Friant/NRDC discussions — When Friant/ NRDC Reports are available
- TMDL requirements — Phase II Objectives

Parking Lot (continued)

- Investigate the re-operation of Friant
- Include information regarding Metropolitan Water District's/ Friant Water Users regional exchanges
- Consider channel maintenance and floodplain integrity
- Assume Fish and Game code Section 5937 will be honored
  - Currently in litigation, can not be included until the litigation is completed

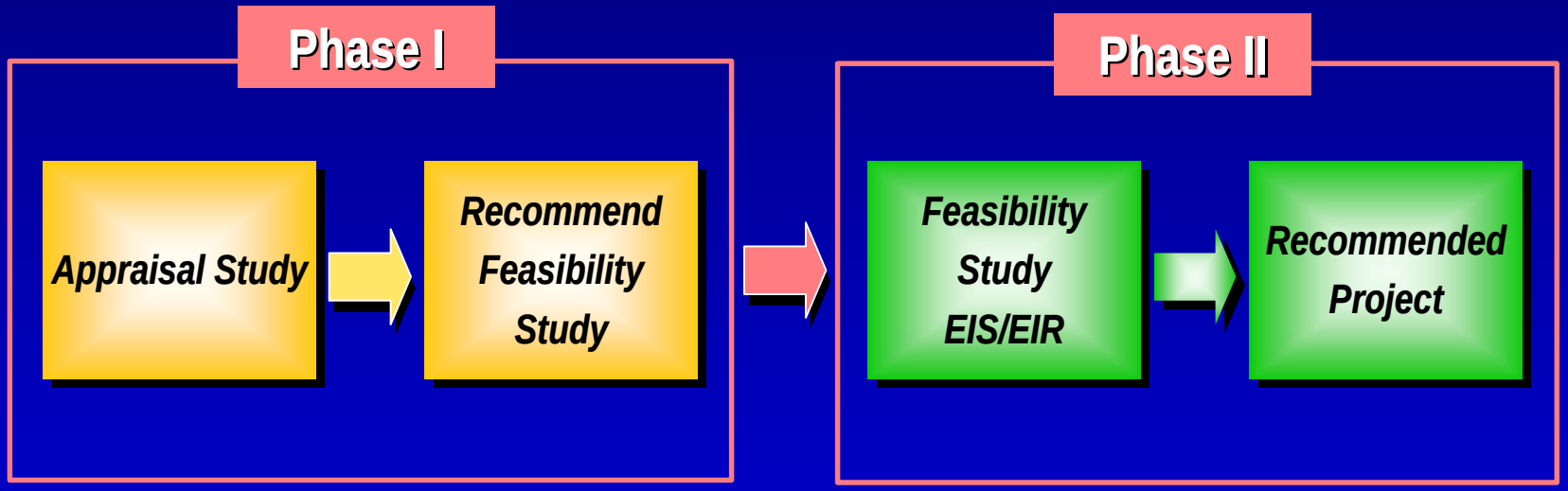
As part of Conjunctive Mgmt. analysis

Phase II

STUDY AREA

- Upper San Joaquin River Basin
  - Headwaters to the Merced River
- Eastern San Joaquin Valley
  - CVP Friant Division
  - Groundwater basin

UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION – A Two-Phase Investigation Approach



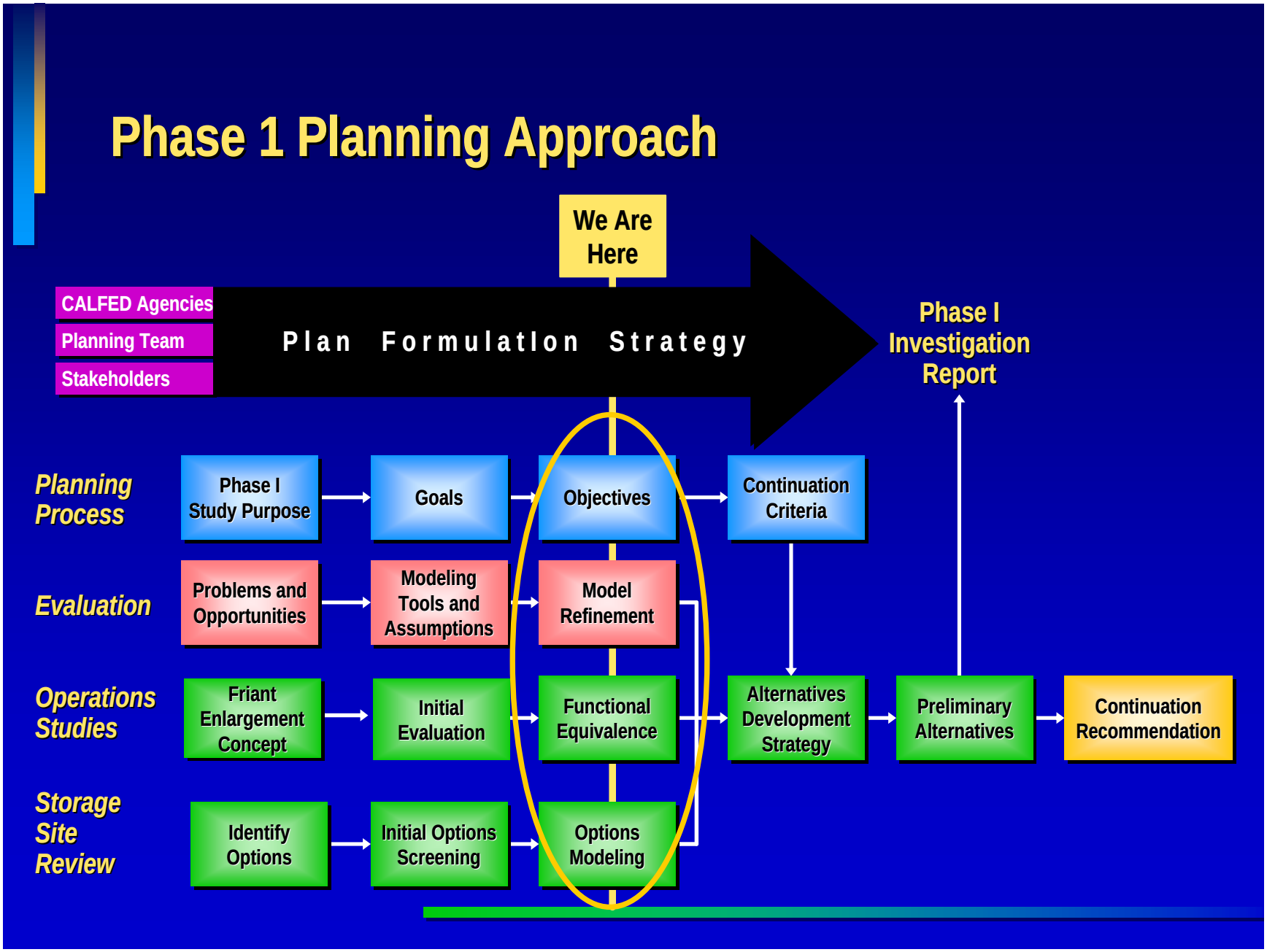
Investigation Goals and Phase 1 Purpose Statement

- **CALFED Goals for Upper San Joaquin River Basin Storage**
  - Contribute to restoration of San Joaquin River
  - Improve water quality in San Joaquin River
  - Facilitate conjunctive water management and water exchanges

- **Phase 1 Study Purpose Statement**

  "Determine if CALFED agencies should pursue a water storage feasibility study that could meet the CALFED goals for Upper San Joaquin River Basin Storage and assist in solving other regional problems."

Phase 1 Planning Approach



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Review and Comment Process

- **Review Process**
  - **Draft materials from team to participants**
  - **Workshop discussion**
  - **Review comments from participants to team**
  - **Document review at key milestones**
    - Problems and Opportunities – Workshop #2
    - In-Progress Phase 1 Report -- currently
    - Draft Phase 1 Report -- Mid-2003
- **Roles**
  - **Participants provide oral and written comments**
  - **Team incorporates comments or provides rationale for alternate approach or strategy**

Objective for Phase 1 Investigation Report

Information to support Phase 2 study decisions

- **Scope of investigation**
  - Problems and opportunities
  - Planning approach
- **Range of initial alternatives**
  - Screen surface storage options and estimate costs
  - Identify potential benefits of new storage
  - Define project objectives
- **Support recommendation on Phase 2 study**

In-Progress Phase 1 Investigation Report

Purpose and Scope of the Report

- Verify water resources problems and opportunities
- Review planning approach
- Initial screening of potential surface storage options
- Modeling approach and initial evaluations
- Future versions to include:
  - Model Results
  - Estimated Project Costs
  - Potential Benefits

In-Progress Phase 1 Investigation Report

Existing and Future Conditions

- **Water Supply Facilities and Operations**
  - Friant Division contract types
  - Friant Dam operations
  - Groundwater conditions
- **Assumptions regarding future actions**
  - Conjunctive management
  - Demand management
  - Transfers

In-Progress Phase 1 Investigation Report

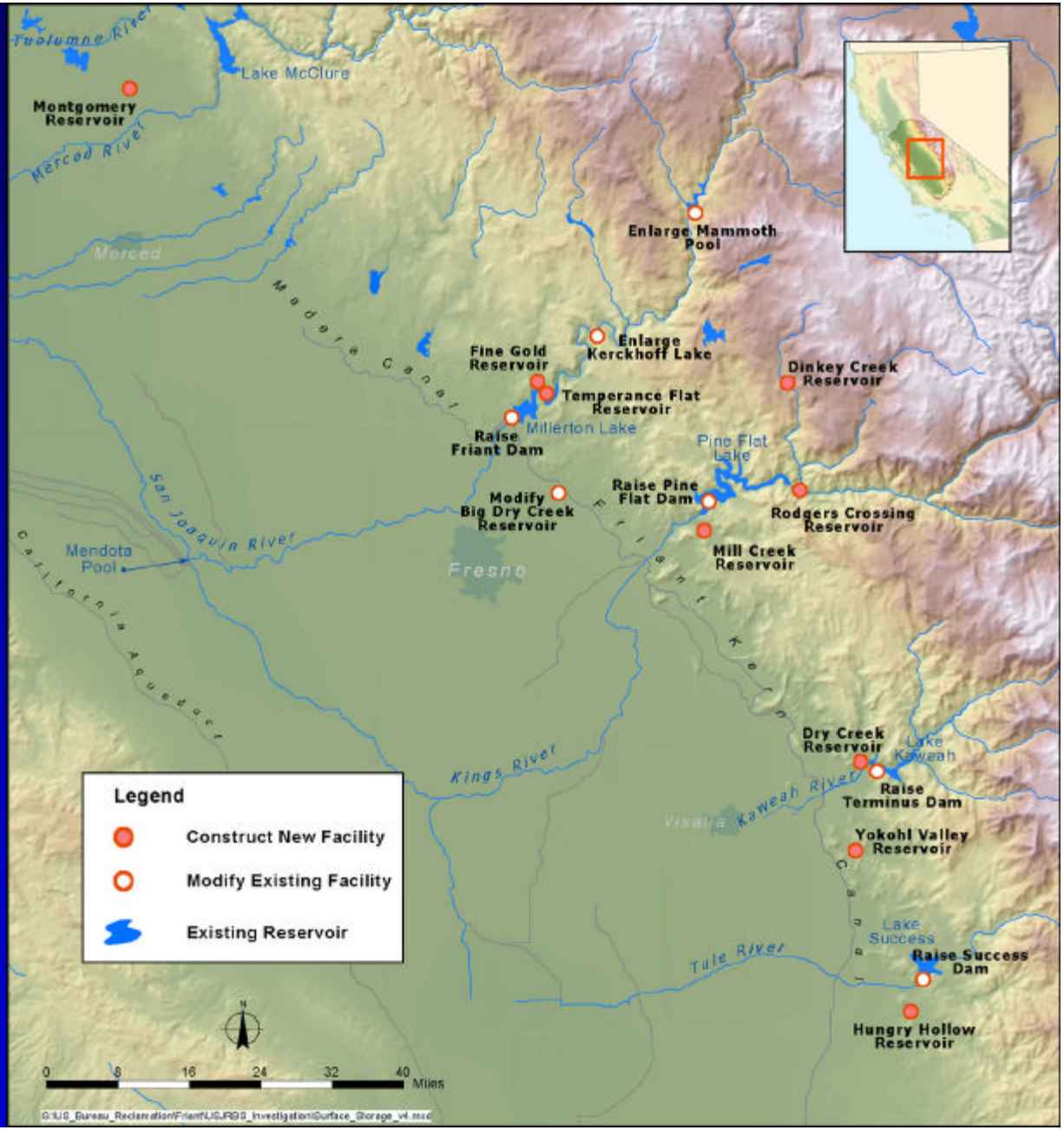
Water Resources Problems and Opportunities

- **Problems**
  - San Joaquin River Ecosystem
  - San Joaquin River Water Quality
  - Water Supply Reliability

- **Opportunities**
  - Flood Control
  - Hydropower
  - Recreation
  - Delta Inflows

INITIAL STORAGE SITES CONSIDERED

- **Reviewed previous studies**
  - USBR
  - DWR
  - Local Agencies
  - NRDC/FWUA



Characteristics of Surface Storage Options

- **San Joaquin River Upstream of Friant Dam**
  - Similar to expansion of Millerton Lake
  - Includes pumped storage upstream of Millerton Lake
- **Exchange with Millerton Lake Water**
  - Pre-deliver water from Millerton Lake
  - Store water in other watershed to replace Millerton deliveries
- **Off-Canal Storage**
  - Gravity or pumped storage from Friant -Kern Canal

Surface Storage Options
Overview of Phase 1 Approach

- **Review each surface storage option**
  - Constructability
  - Accomplishment
  - Cost
  - Participants
- **Carry retained options forward for further study**

Initial Engineering Review

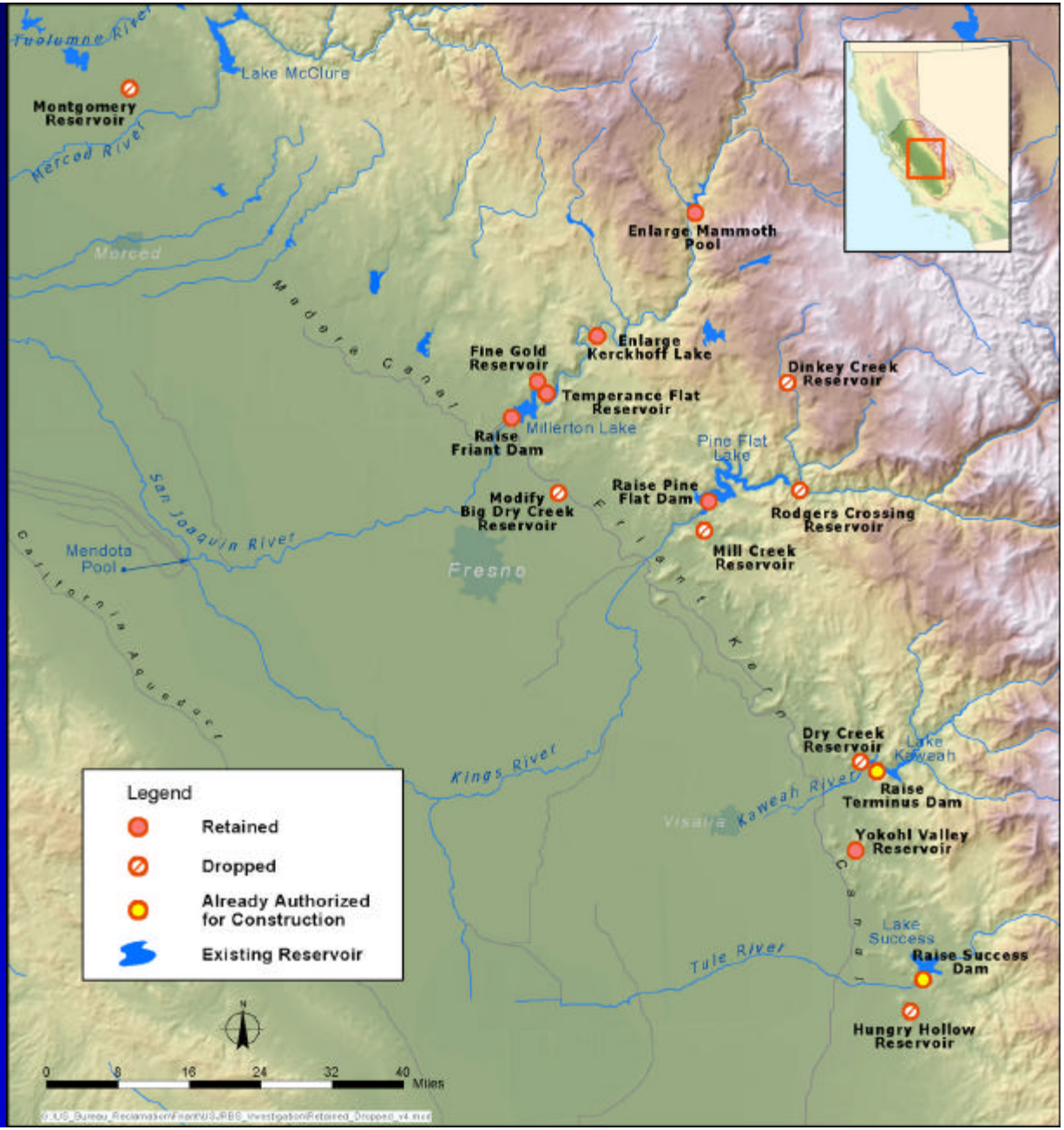
- **Reviewed previous studies**
  - Configurations, water sources, and uses
- **Preliminary field visits**
  - Site access, construction staging, borrow
  - Seismic and geologic conditions
- **Identified major features**
  - Reviewed designs relative to current standards
  - Updating quantities and cost**s**

Initial Environmental Review

- **Reviewed previous studies and other literature**
  - Specific features that would be affected
  - Potential environmental conditions
- **Preliminary field visits**
- **Identified major environmental issues**
  - Botany, wildlife, aquatic biology, land use, recreation, cultural resources
- **Considered opportunities for mitigation**

STORAGE SITE INITIAL SCREENING RESULTS

- 16 Sites Identified
- 2 Sites Already Authorized for Construction
- 7 Sites Dropped
- 7 Sites Retained



Storage Site Initial Screening Results

Sites Upstream of Friant Dam

Storage Option	Results	Comments
Raise Friant Dam	Retained	
Fine Gold Creek Reservoir	Retained	Pumped storage
Temperance Flat Reservoir	Retained	Dam site at RM 279
Kerckhoff Enlargement	Retained	Identified during Temperance Flat review
Enlarge Mammoth Pool	Retained	

Storage Site Initial Screening Results

Exchange with Millerton Lake

Storage Option	Results	Comments
Montgomery Reservoir	Dropped	Water quality concerns
Raise Pine Flat Dam	Retained	
Mill Creek Reservoir	Dropped	Environmental concerns
Rodgers Crossing Reservoir	Dropped	Recreation and other environmental concerns
Dinkey Creek Reservoir	Dropped	Environmental concerns
Dry Creek Reservoir	Dropped	Environmental concerns

Storage Site Initial Screening Results
Off-Canal Storage

Storage Option	Results	Comments
Big Dry Creek Flood Control Basin	Dropped	Retrofit of existing facility
Yokohl Valley Reservoir	Retained	Pumped storage from Friant Kern Canal
Hungry Hollow Reservoir	Dropped	Foundation and environmental concerns

Next Steps in Options Screening

- Operations Study
- Cost Review
- Implementation Considerations

Comments on In-Progress Report

- Problems and Opportunities
- Description of Study Area
- Planning Approach
- Options Screening

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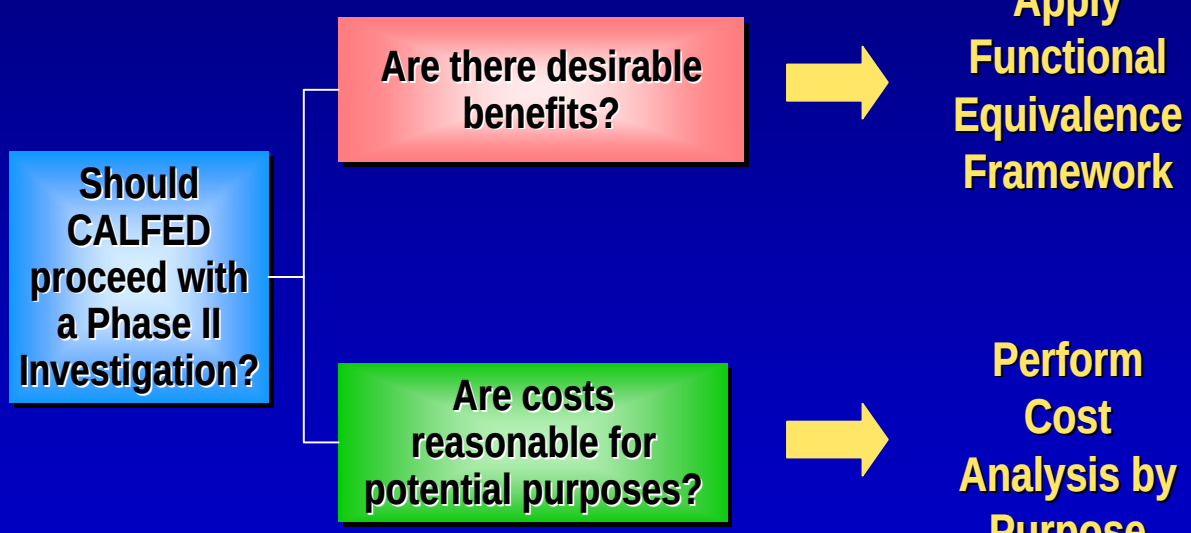
Continuation Criteria

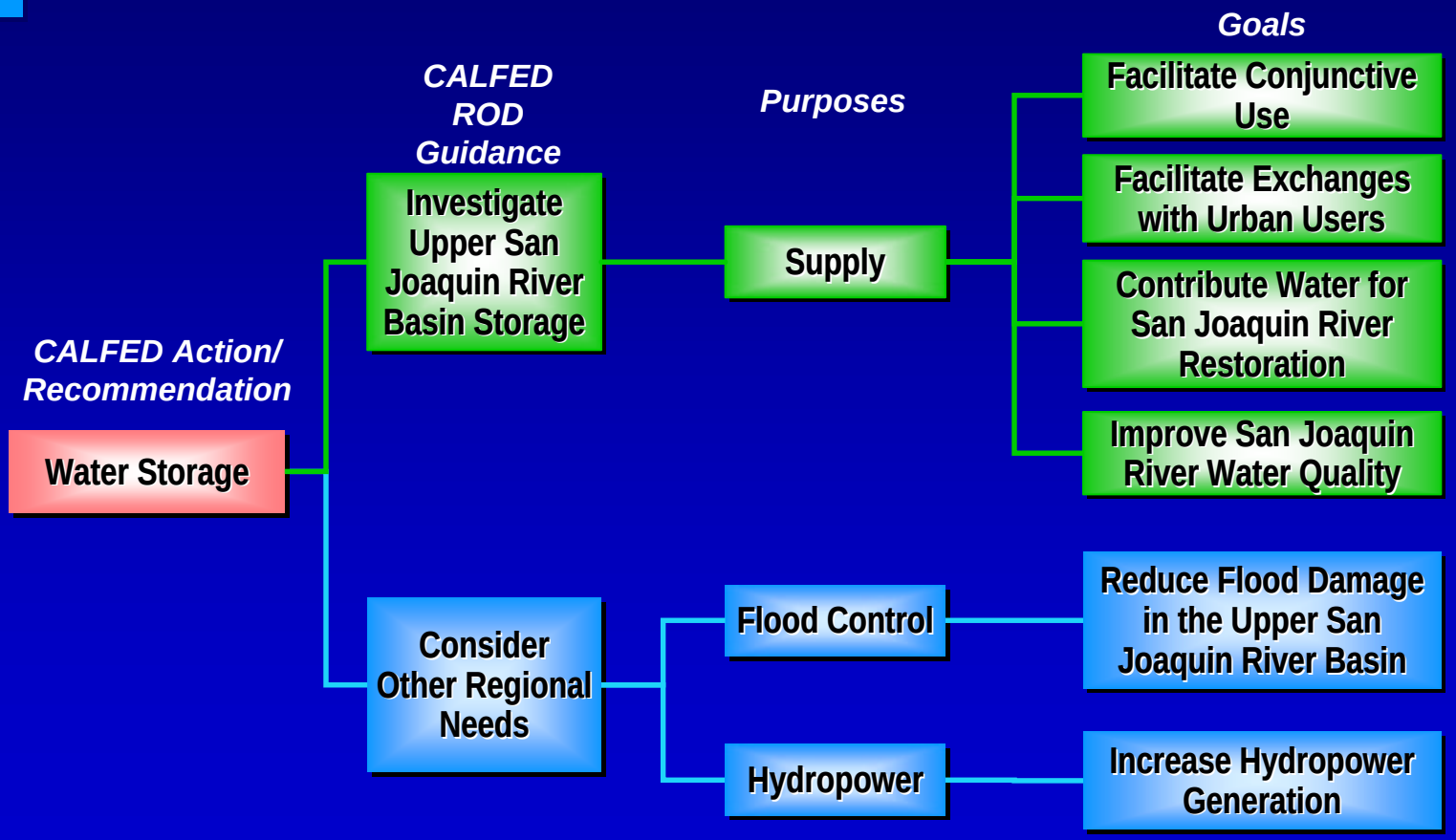


What is Functional Equivalence?

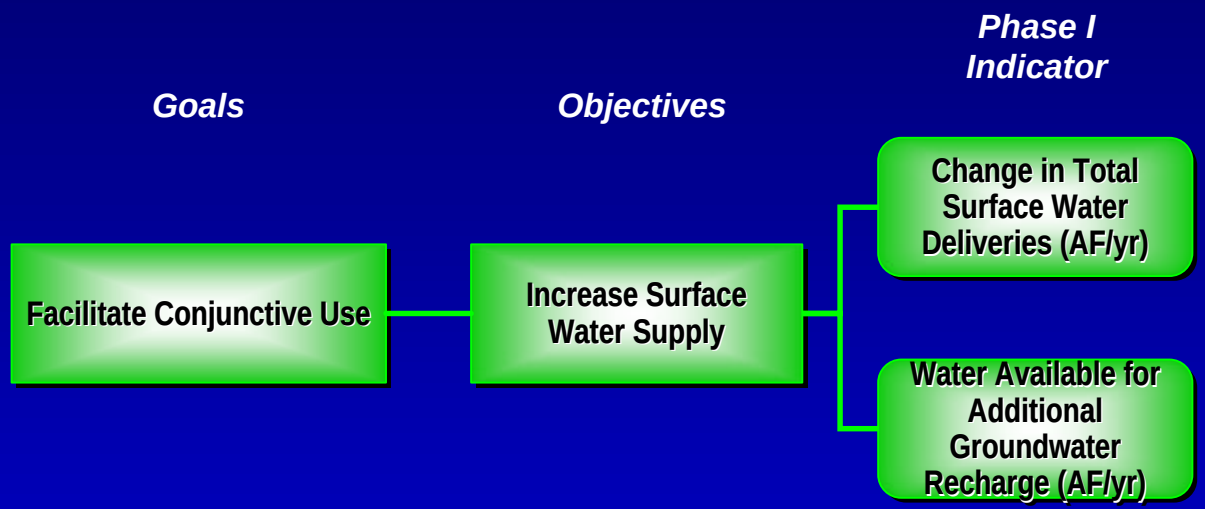
A framework to:

- **Identify desired accomplishments**
  - Derived from ROD Guidance and Goals
- **Organize results of operational studies**
- **Compare options and develop alternatives**

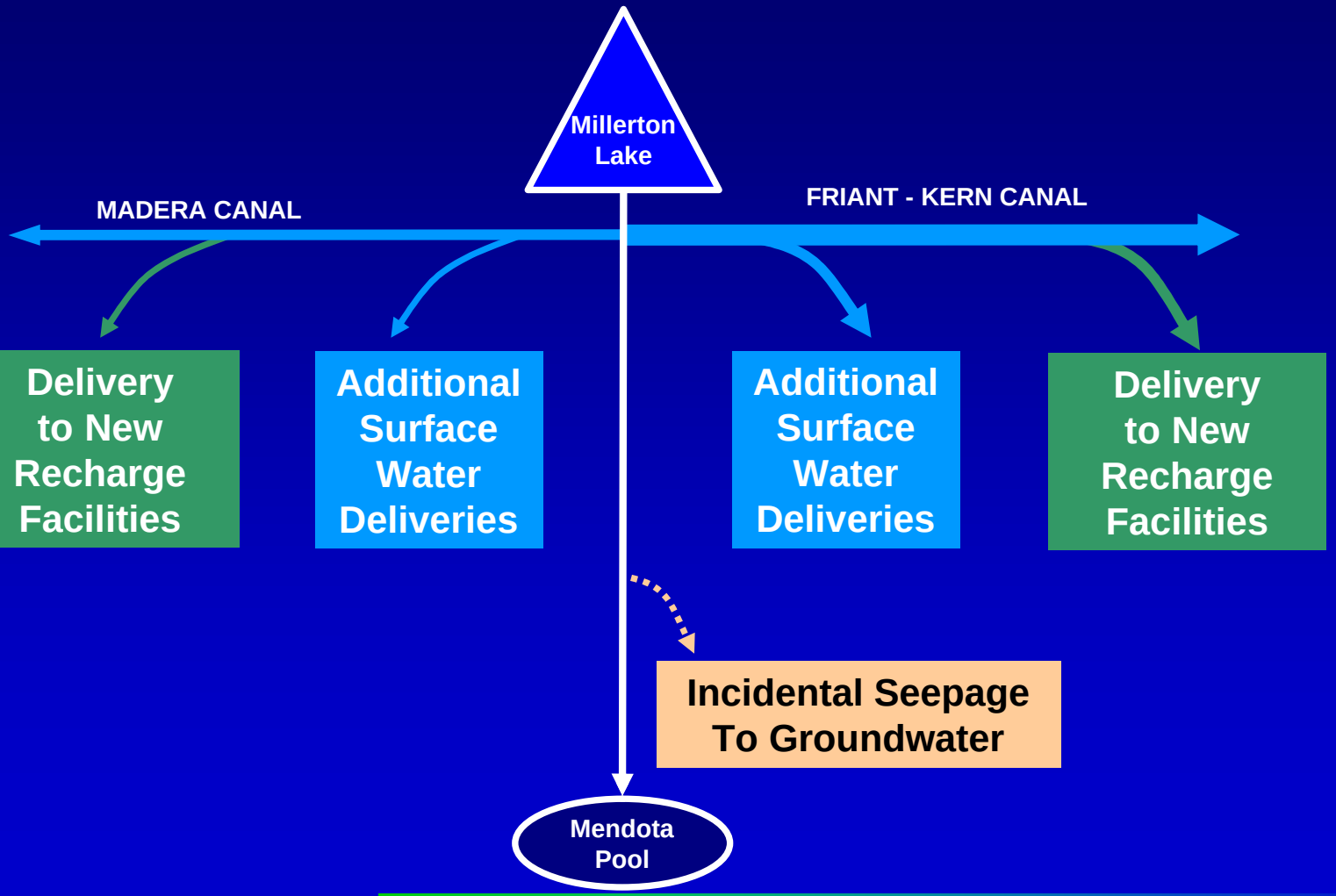
Developing Functional Equivalence Framework
CALFED Guidance



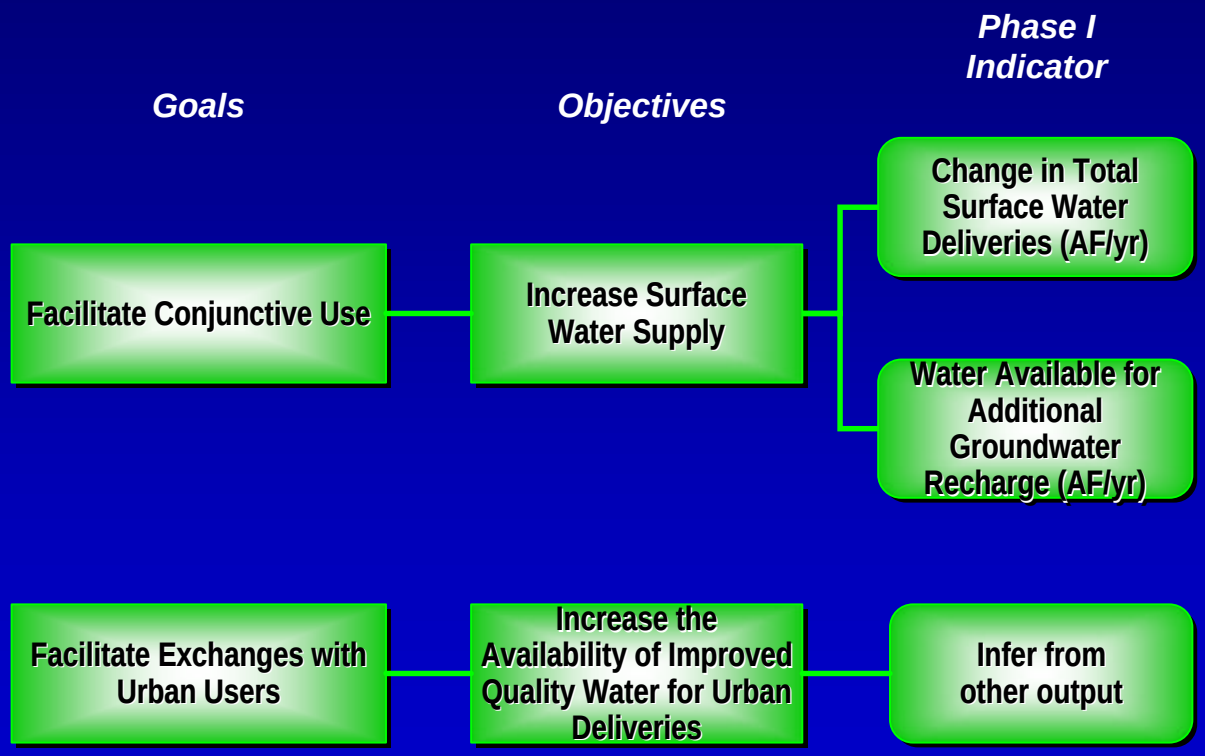
Measuring Functional Equivalence



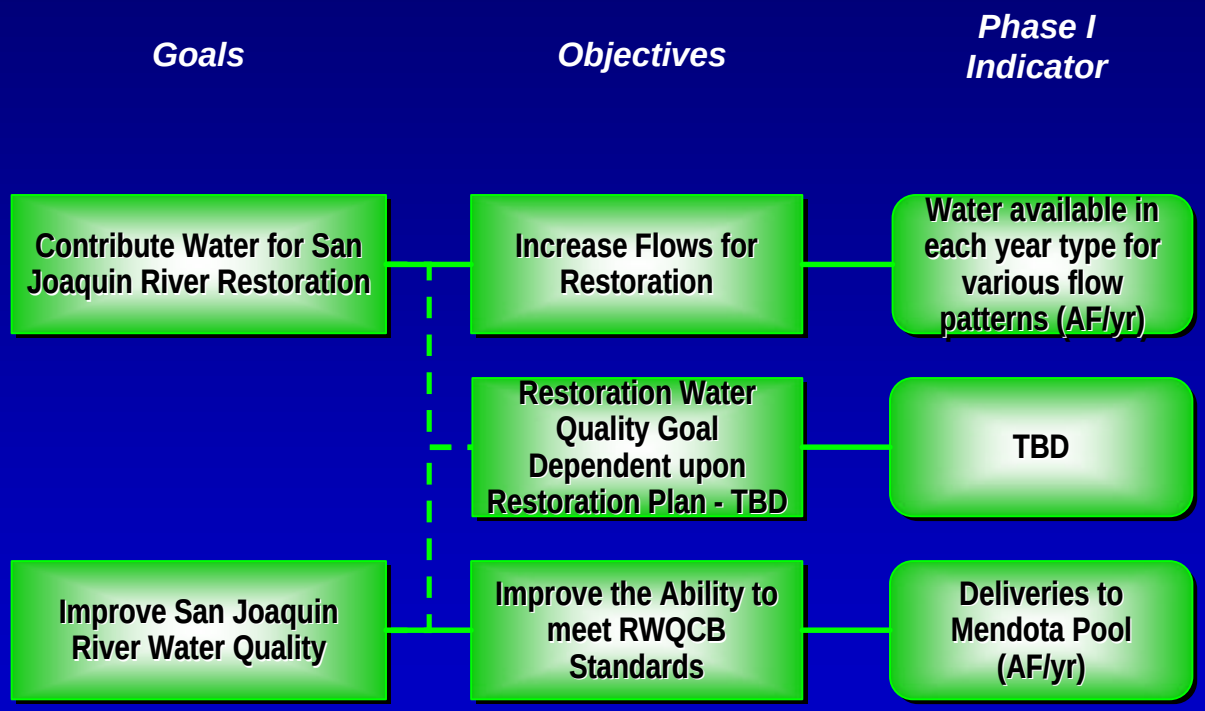
Indicators of Conjunctive Use Opportunities



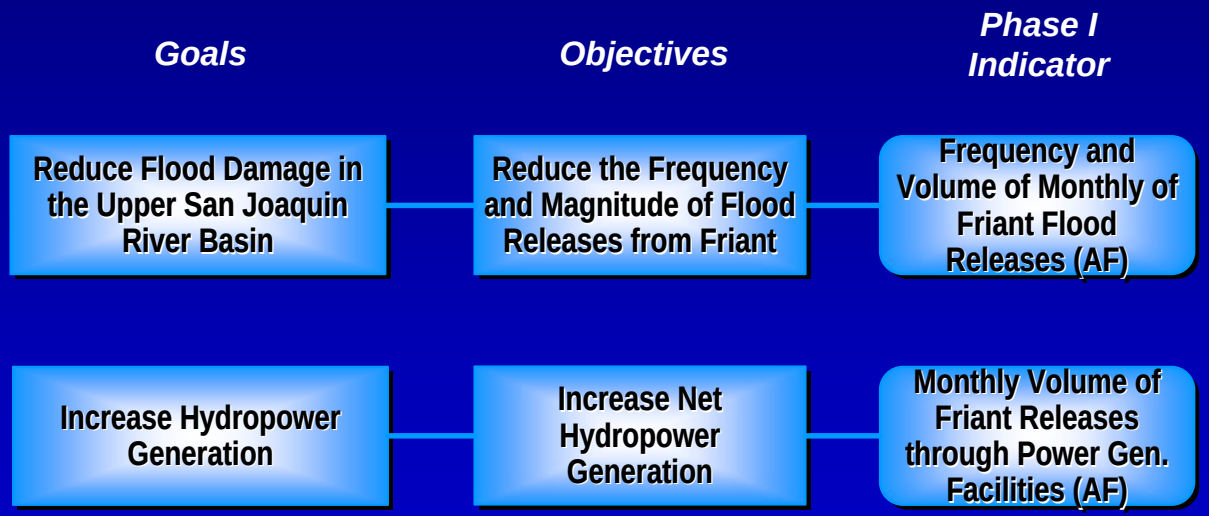
Measuring Functional Equivalence



Measuring Functional Equivalence (continued)



Measuring Functional Equivalence (continued)



Applying the Functional Equivalence Framework

Application of the framework enables

- Measurement of accomplishments
- Identification of desirable benefits
- Comparison of options

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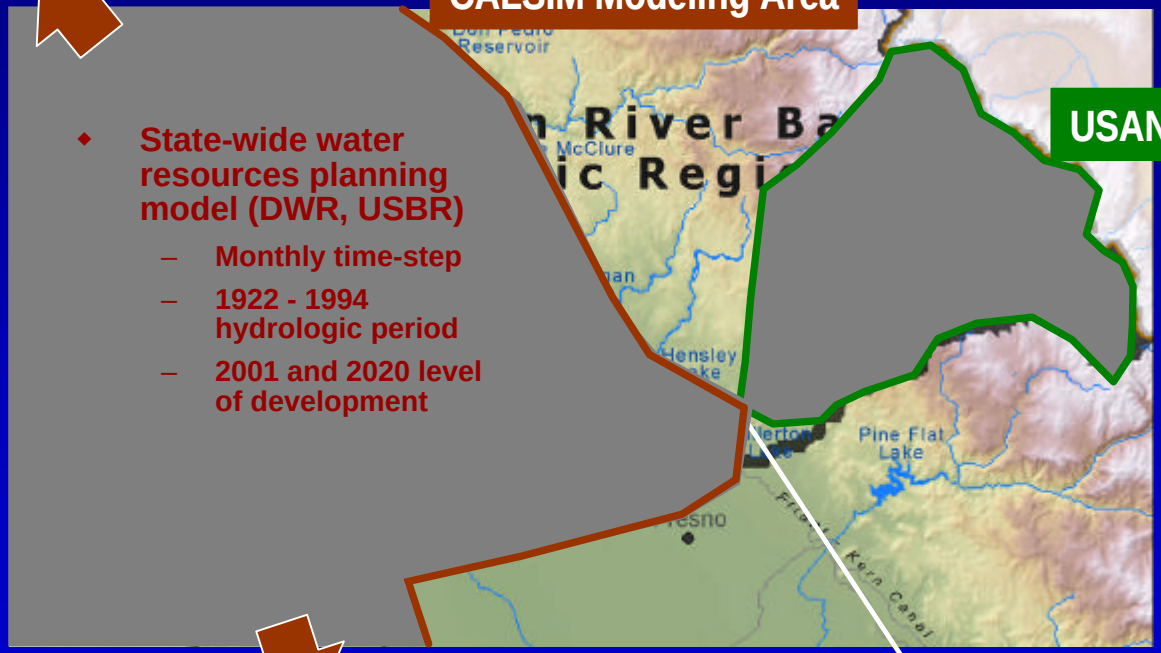
Modeling for Phase 1 Investigation

Hydrologic Modeling Tools

Delta and Sacramento Valley

CALSIM Modeling Area



- State-wide water resources planning model (DWR, USBR)
  - Monthly time-step
  - 1922 - 1994 hydrologic period
  - 2001 and 2020 level of development

USAN Modeling Area

- Upper basin operation model (USBR)
  - Daily time-step
  - Generate inflows to Millerton Lake

Hand-off point: Millerton Lake

CA Aqueduct and Southern California

Modeling for Phase 1 Investigation

Modeling Tasks

- **CALSIM Improvements**
  - Millerton Lake Operations
- **Benchmark Study for Phase 1 Investigation**
- **Single-Purpose Analysis for Storage Options**

Modeling for Phase 1 Investigation

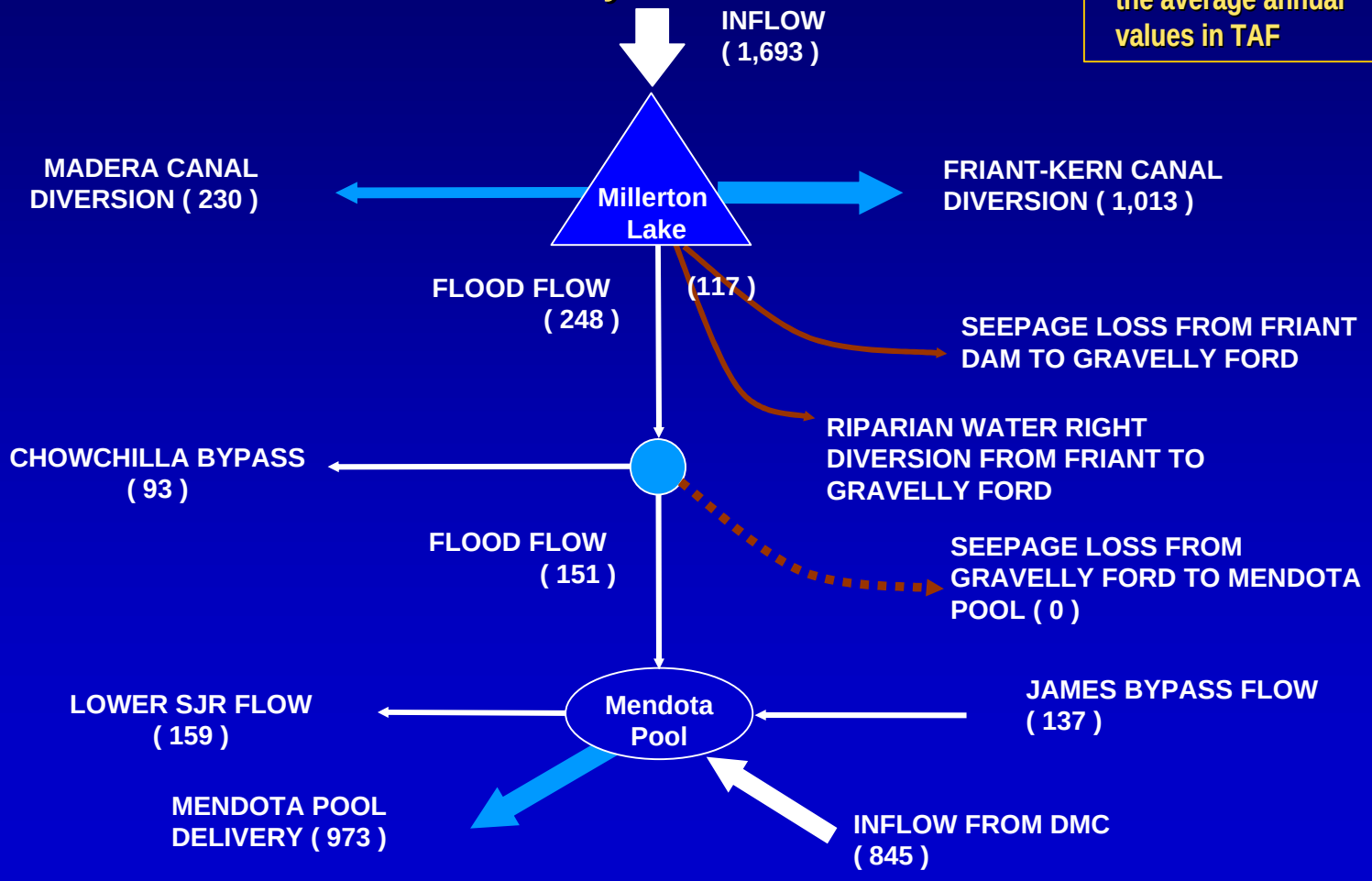
Millerton Lake CALSIM Improvement – Highlights

- **Dynamic water supply allocation**
  - **Class 1, Class 2, and 215 water**
  - **Based on available water supply**
  - **Updated monthly from March through June**
- **Pre-release for snowmelt runoff**
  - **Based on seasonal runoff forecast**
  - **Updated monthly from February through June**
- **Simulation compares favorably to historical operation**
  - **Appropriate for use as benchmark**

Modeling for Phase 1 Investigation

Phase 1 Benchmark Study

Numbers shown are the average annual values in TAF



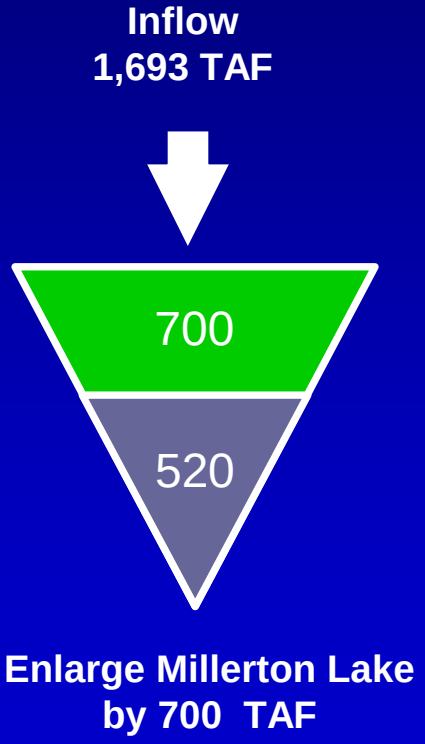
Modeling for Phase 1 Investigation

Single Purpose Analyses

- **Operate to address one goal only**
  - Water Supply (WS)
  - Water Quality (WQ)
  - Restoration Flow (RF)
- **Same water supply allocation logic as benchmark**
- **For WQ and RF, maximize annual river release and maintain long-term annual average canal delivery by year type.**
- **Based on existing conditions and honoring current laws, rules, and regulations.**

Single Purpose Analysis

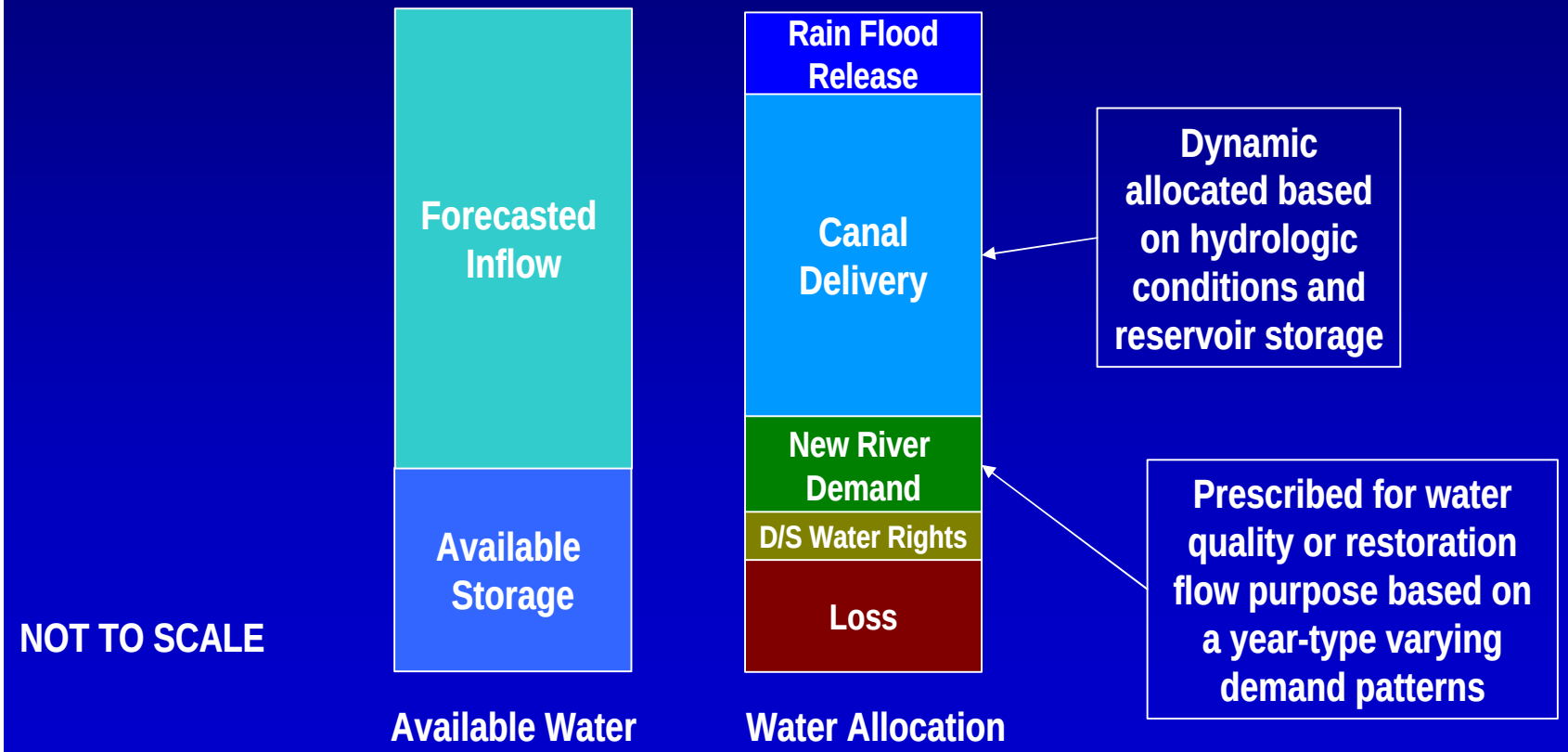
Example: Friant-700 Option



- **Friant Enlargement Concept (Friant-700 Option)**
  - Increase Millerton Lake by 700 TAF
  - Simulate operations with additional storage
  - Identify how problems and opportunities could be addressed
  - Use results to guide definition of “Functional Equivalence”

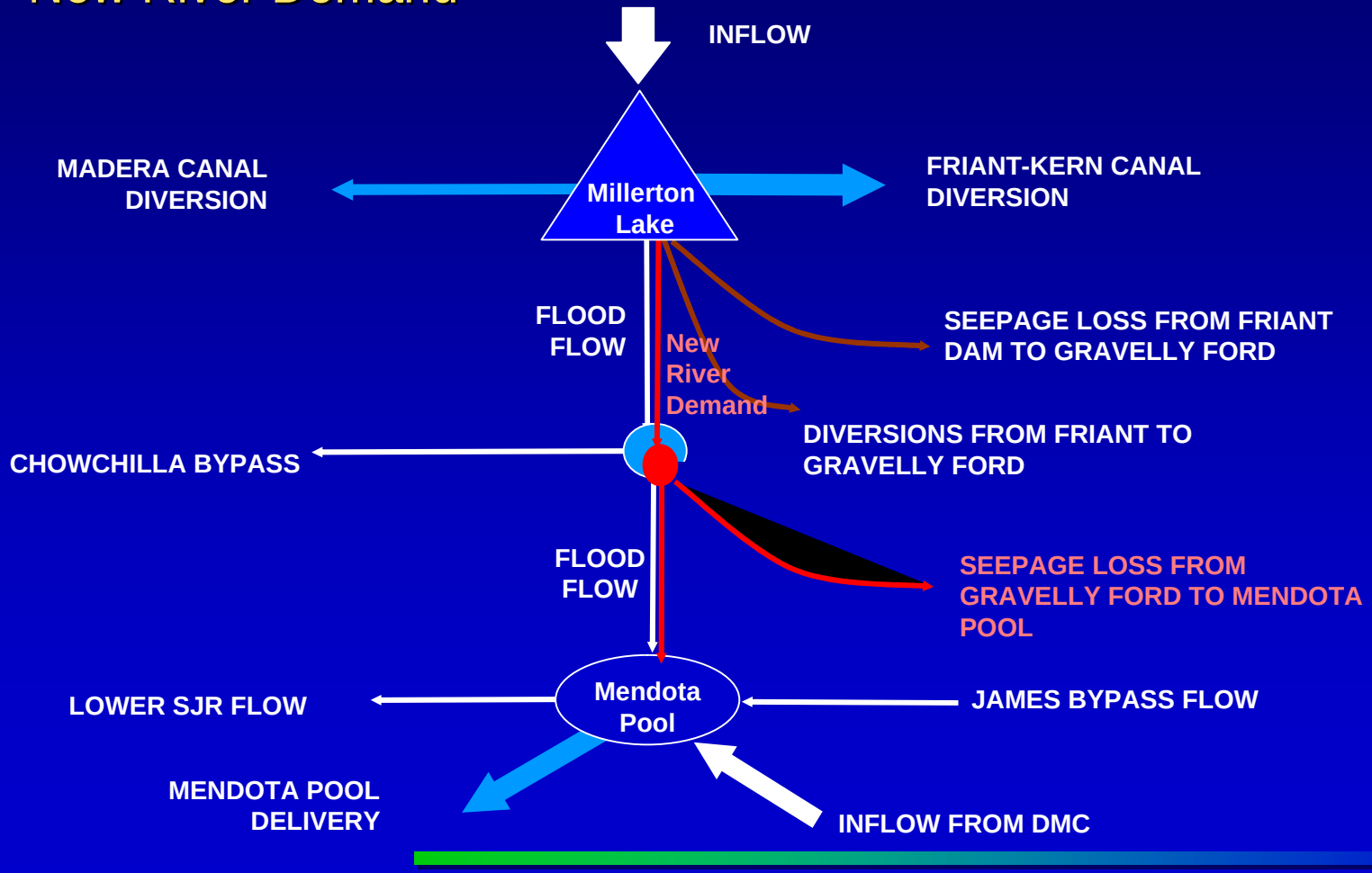
Single Purpose Analysis

Example: Friant-700 Option – Millerton Lake Water Budget (Annual Reservoir)



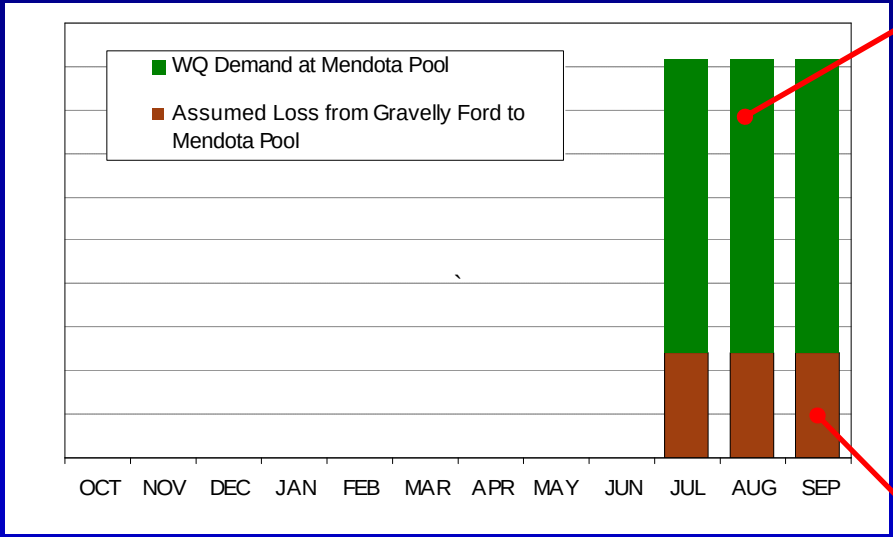
Single Purpose Analysis – Assumptions

New River Demand



Single Purpose Analysis – Assumptions

New River Demand Pattern Example – Water Quality



Year-type varying demand based on a evenly distributed pattern from July through September

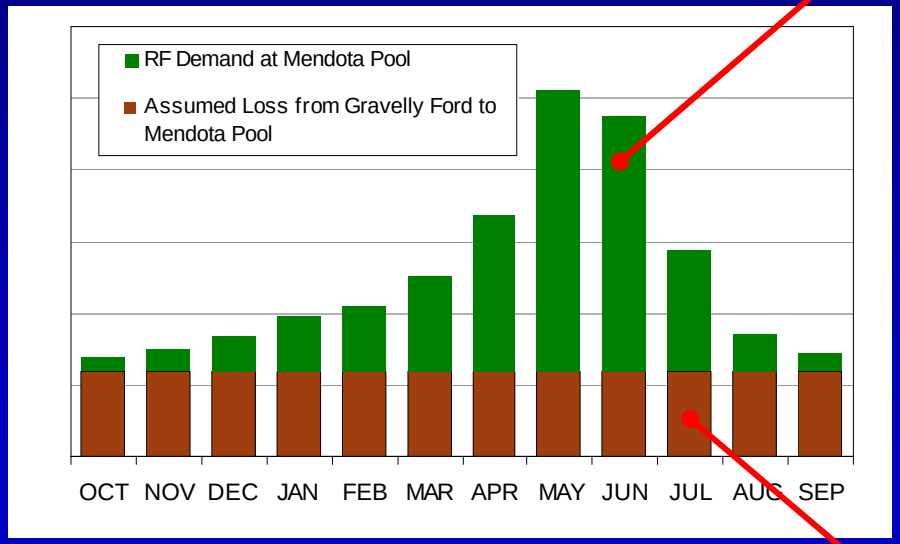
New River Demand at Friant Dam

Assumed constant loss rate (12 TAF per month) for the reach from Gravelly Ford to Mendota Pool for all year types.

Single Purpose Analysis – Assumptions

New River Demand Pattern Example – River Restoration

Year-type varying demand based on the San Joaquin River unimpaired flow distribution pattern



New River Demand at Friant Dam

Assumed constant loss rate (6 TAF per month) for all year types

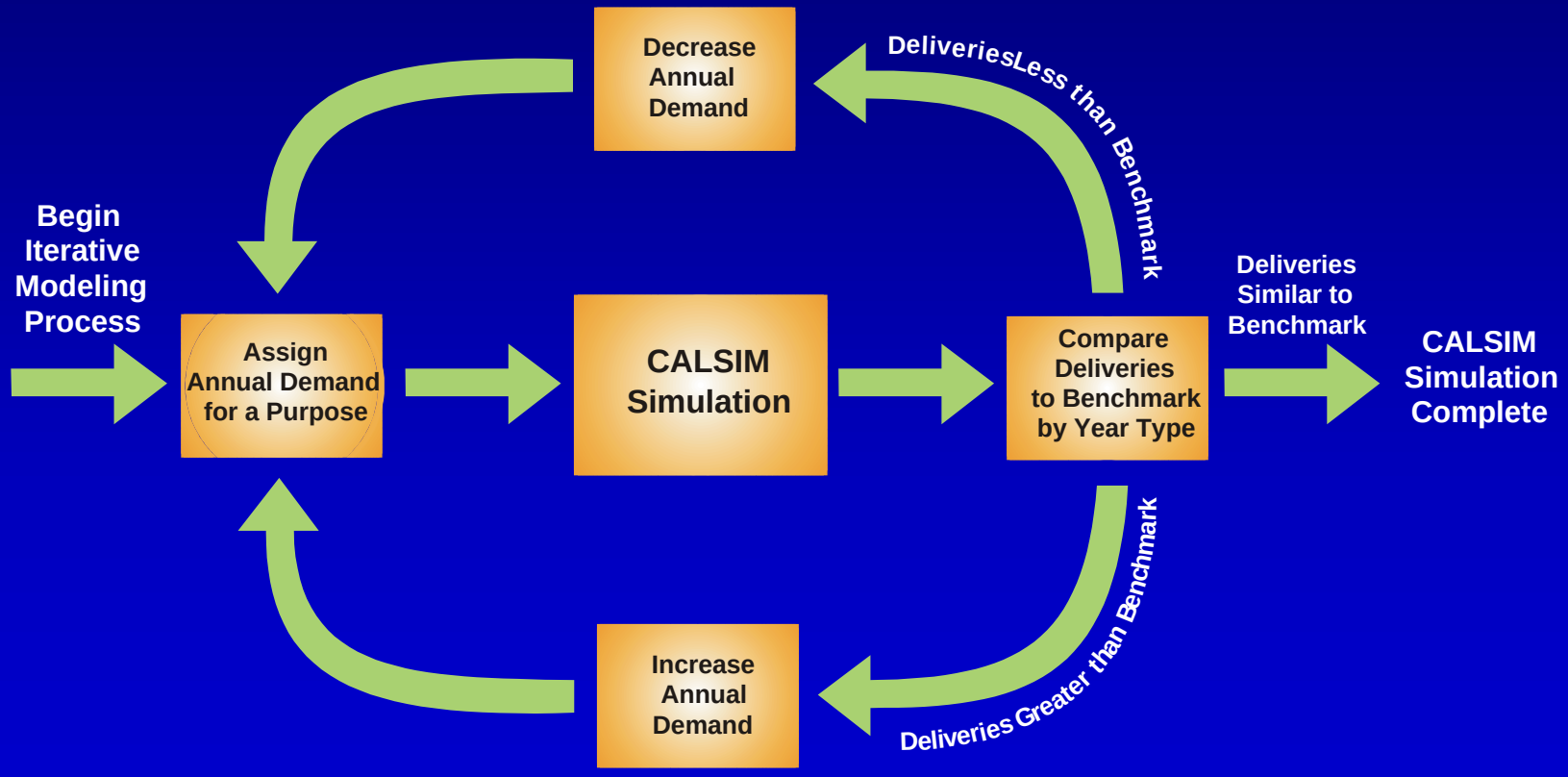
Single Purpose Analysis – Procedure

Example: Friant-700 Option

Scenario	Friant Unit Delivery	Water Quality Demand	Restoration Flow Demand
Benchmark	Allocations based on a 520 TAF storage	No	No
Water Supply (WS)	Allocations based on a 1,220 TAF storage	No	No
Water Quality (WQ)	Constrained by Average annual total delivery by year type from Benchmark Study	Maximize Annual Demand by Year Type through an Iterative Process	No
Restoration Flow (RF)	Constrained by Average annual total delivery by year type from Benchmark Study	No	Maximized Annual Demand by Year Type through an Iterative Process

Single Purpose Analysis – Procedure

Iterative Process for Single Purposes – WQ and RF



Modeling Assumptions

Summary

- **Most materials presented in previous workshops**
  - Modeling tools used in Phase 1 Investigation
  - CALSIM improvement for Friant Dam operation
  - Objective and framework for single purpose analysis in Phase 1 Investigation

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Single Purpose Analysis (Preliminary Results)

Subjects of Result Summary

- **Potential accomplishments in WS, WQ and RF single-purposes**
- **Friant Dam operation (water allocations)**
- **Potential system impacts**
  - Mendota Pool Supply and Delivery
  - Flood Releases at Friant Dam and Mendota Pool
- **Example: Friant-700 Option (Friant Concept)**

Single Purpose Analysis (Preliminary Results)

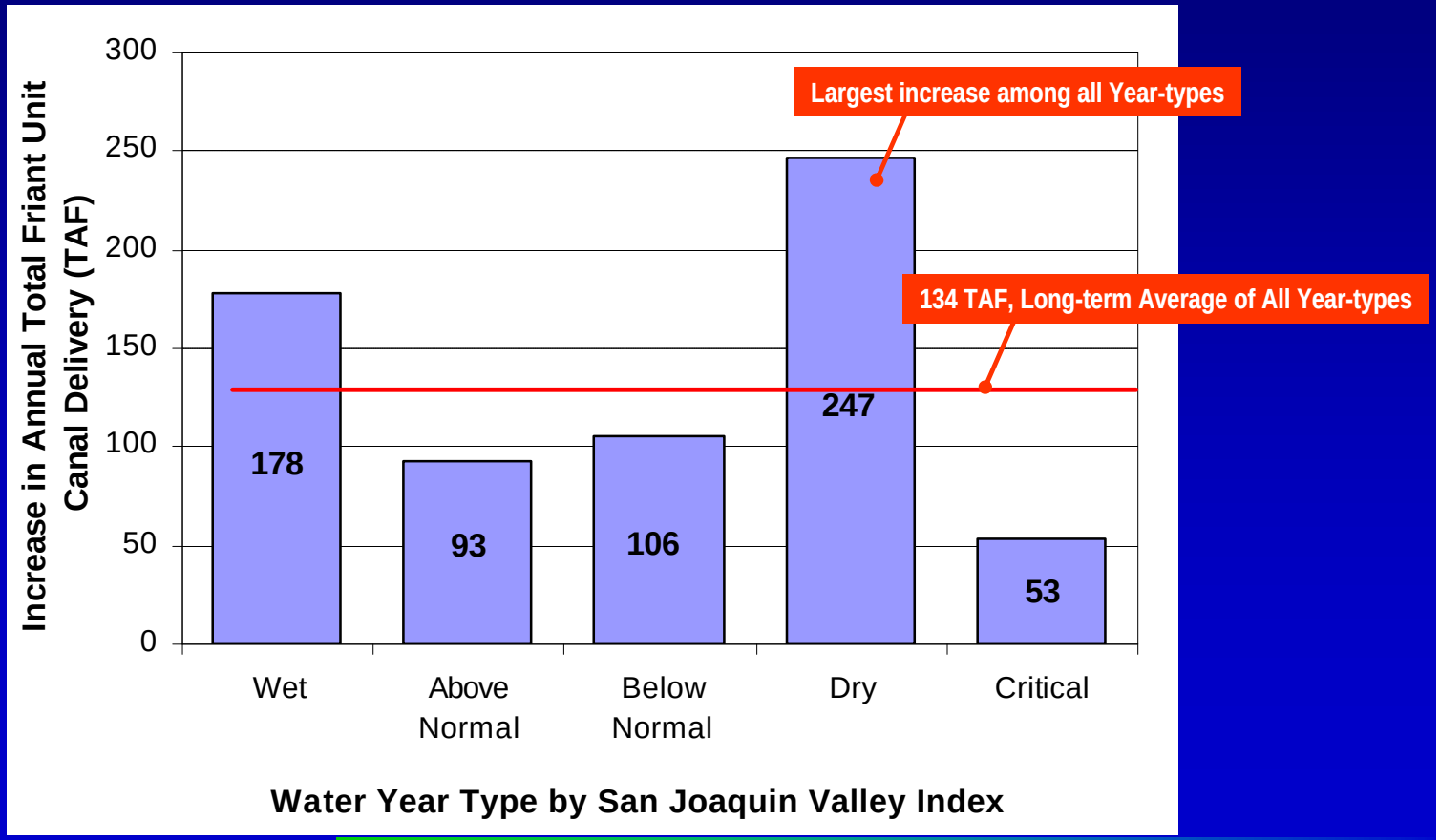
Example: Friant-700 Option – Potential Accomplishments

Scenario	Average Annual Water Allocations for Each Purpose (TAF)		
	Water Supply	Water Quality	Restoration Flow
Benchmark	1,243	0	0
Water Supply	1,377 i.e., + 134 at Friant Dam	0	0
Water Quality	1,252	106 at Mendota Pool distributed uniformly in July through September. i.e., + 134 at Friant Dam	0
Restoration Flow	1,252	0	83 at Mendota Pool distributed in unimpaired flow monthly pattern i.e., + 140 at Friant Dam

Single Purpose Analysis (Preliminary Results)

Example: Friant-700 Option Potential Accomplishments

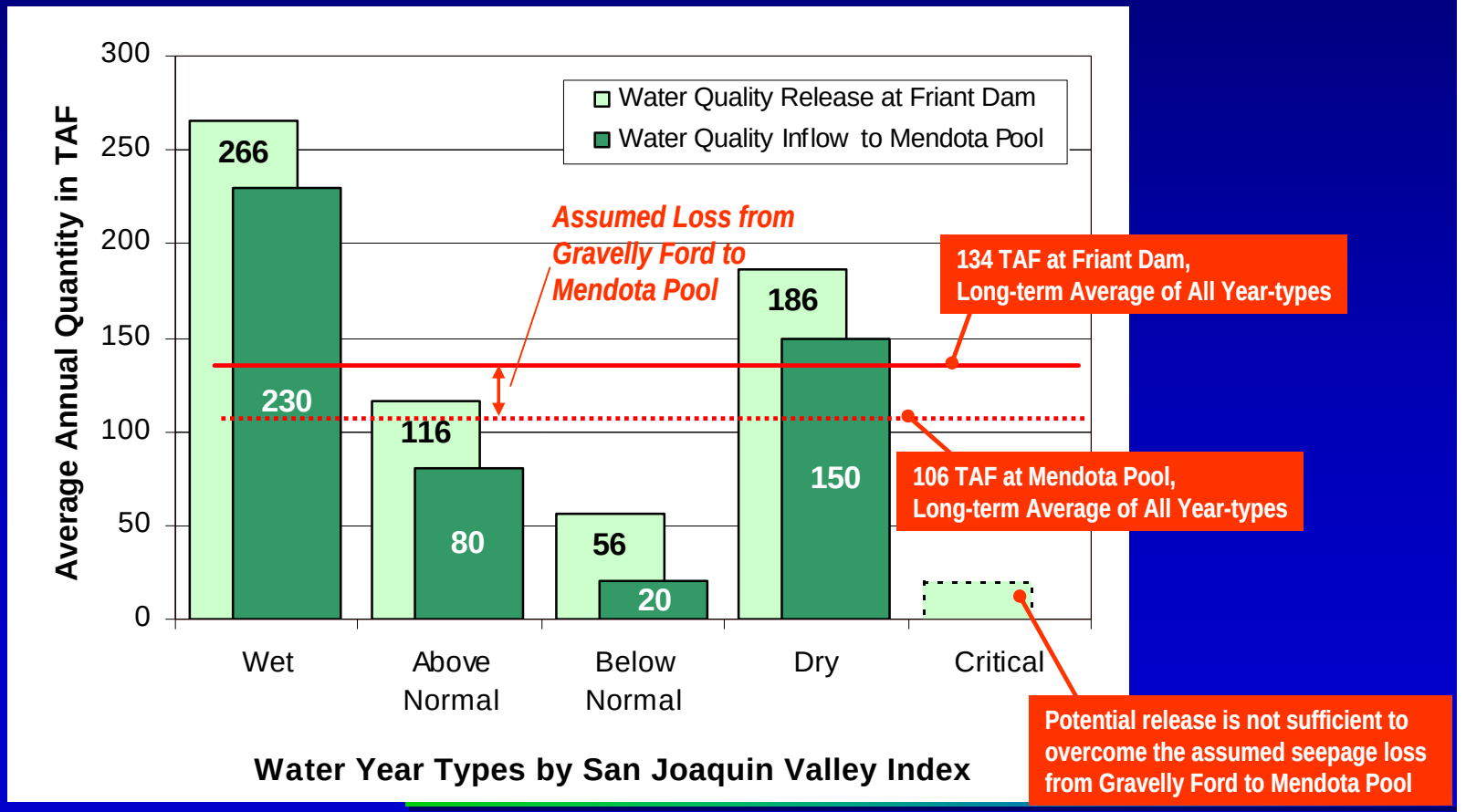
Water Supply Single Purpose



Single Purpose Analysis (Preliminary Results)

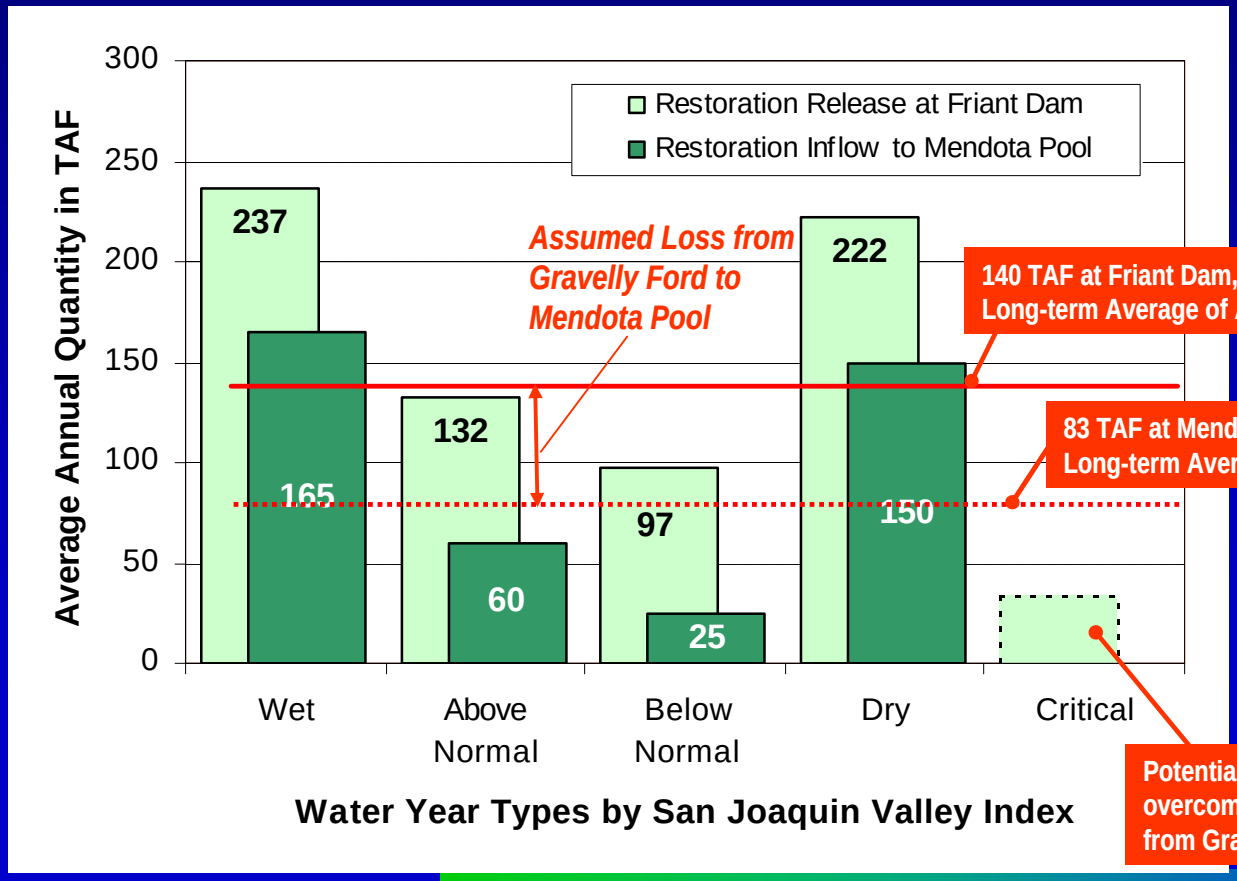
Example: Friant-700 Option Potential Accomplishments

Water Quality Single Purpose



Single Purpose Analysis (Preliminary Results)

Example: Friant-700 Option Potential Accomplishments
Restoration Flow Single Purpose



Single Purpose Analysis (Preliminary Results)

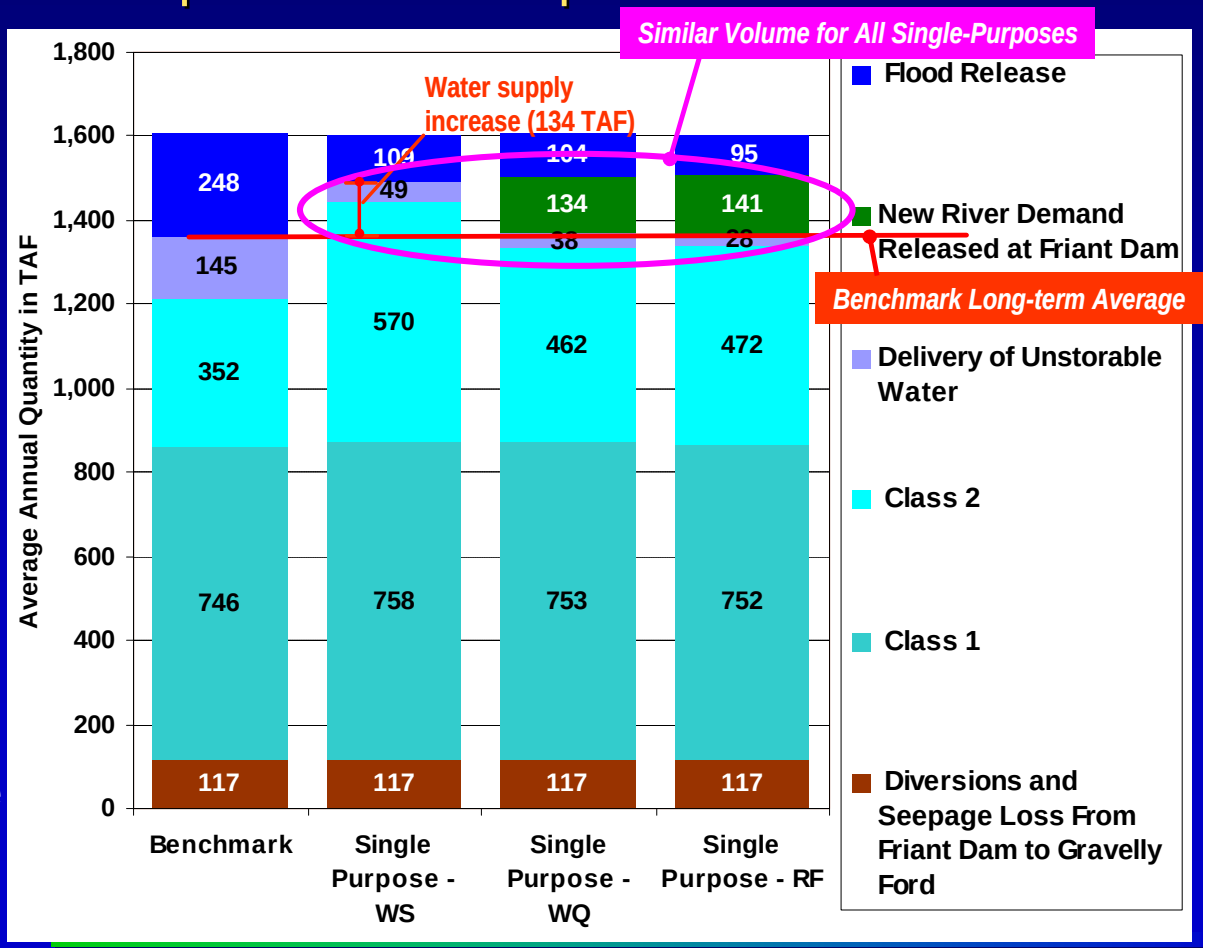
Example: Friant-700 Option – Friant Operation

Inflow
1,693 TAF

700

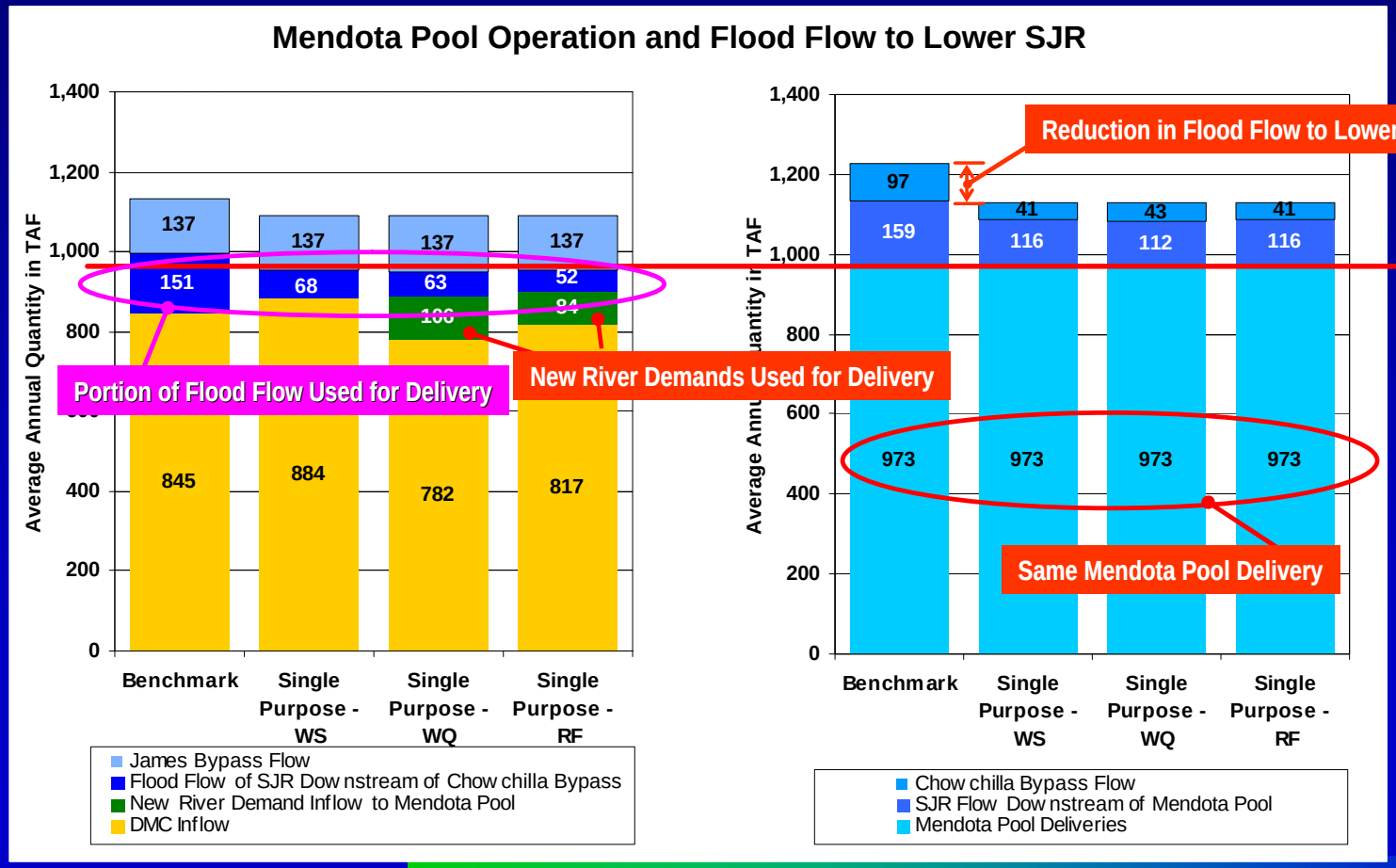
520

Enlarge Millerton Lake by 700 TAF



Single Purpose Analysis (Preliminary Results)

Example: Friant-700 Option – System Impacts



Single Purpose Analysis (Preliminary Results)

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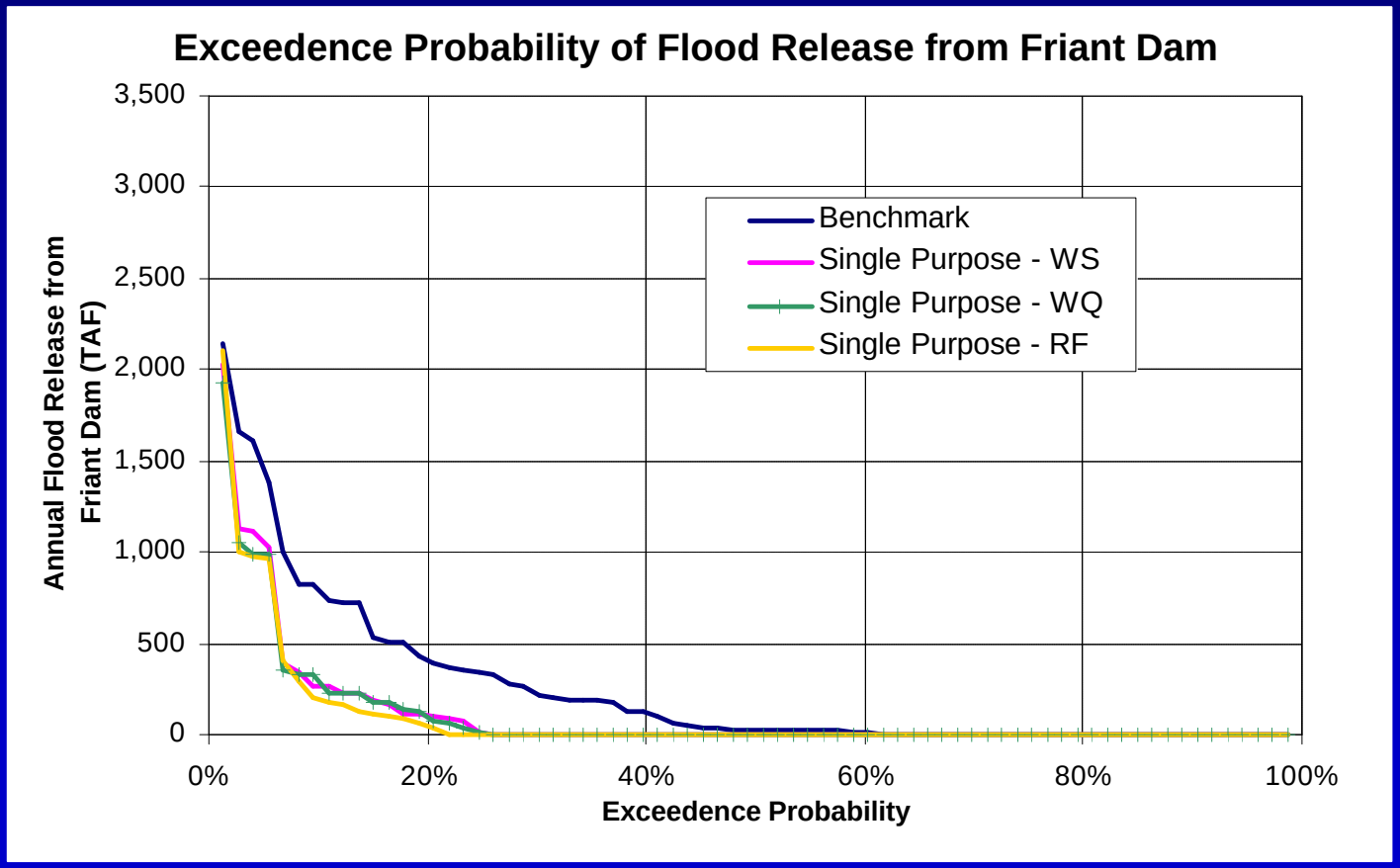

Single Purpose Analysis (Preliminary Results)

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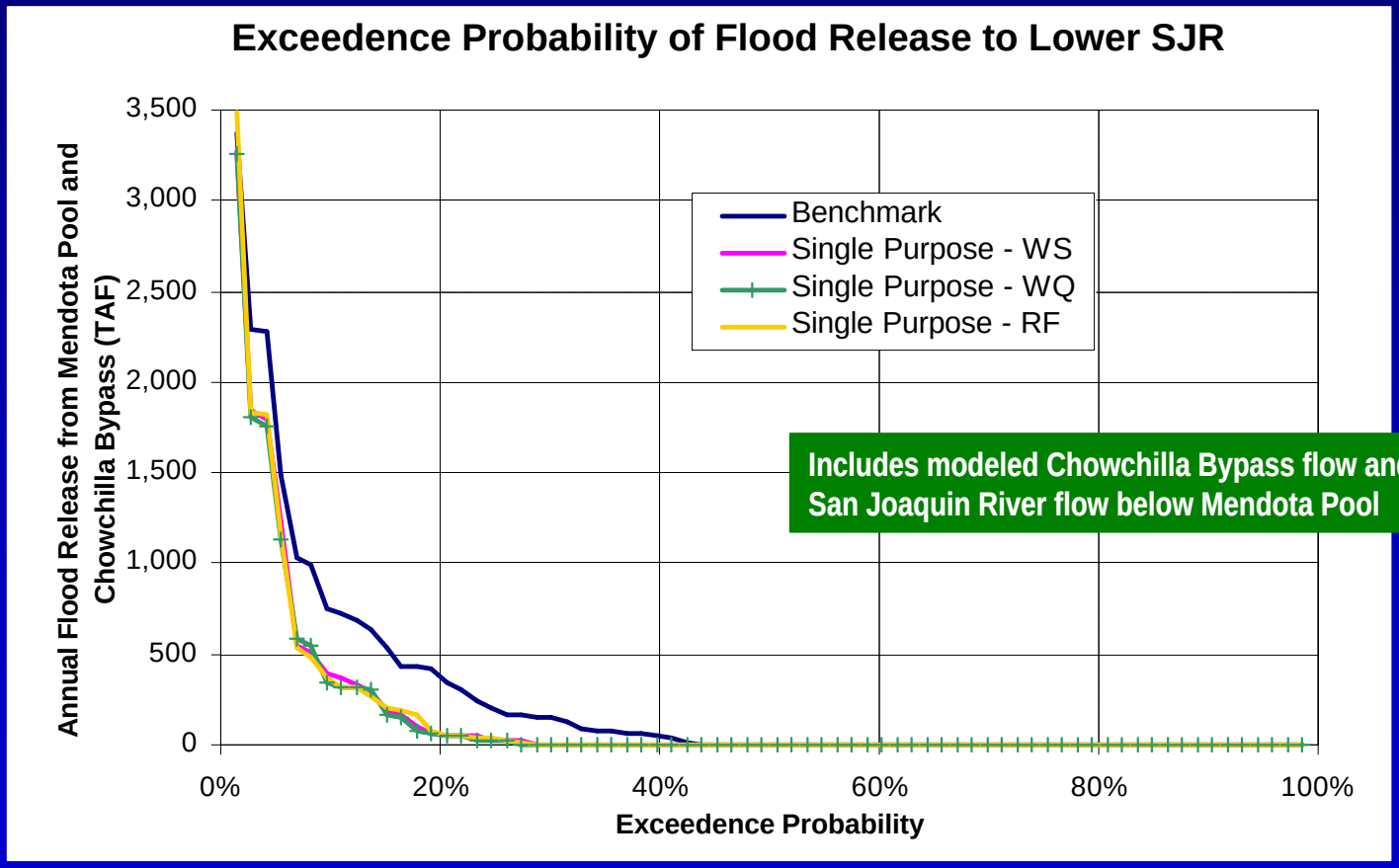


Single Purpose Analysis

Example: Friant-700 Option – Summary

- **Observations on Friant Dam operation**
  - Increases in Class 2 water allocation and reductions in 215 water available
  - Difficulties in supporting new river demands in critical years
- **Potential system impacts**
  - Flood damage reduction
  - Changes in sources of water for Mendota Pool delivery

Single Purpose Analysis (Preliminary Results)

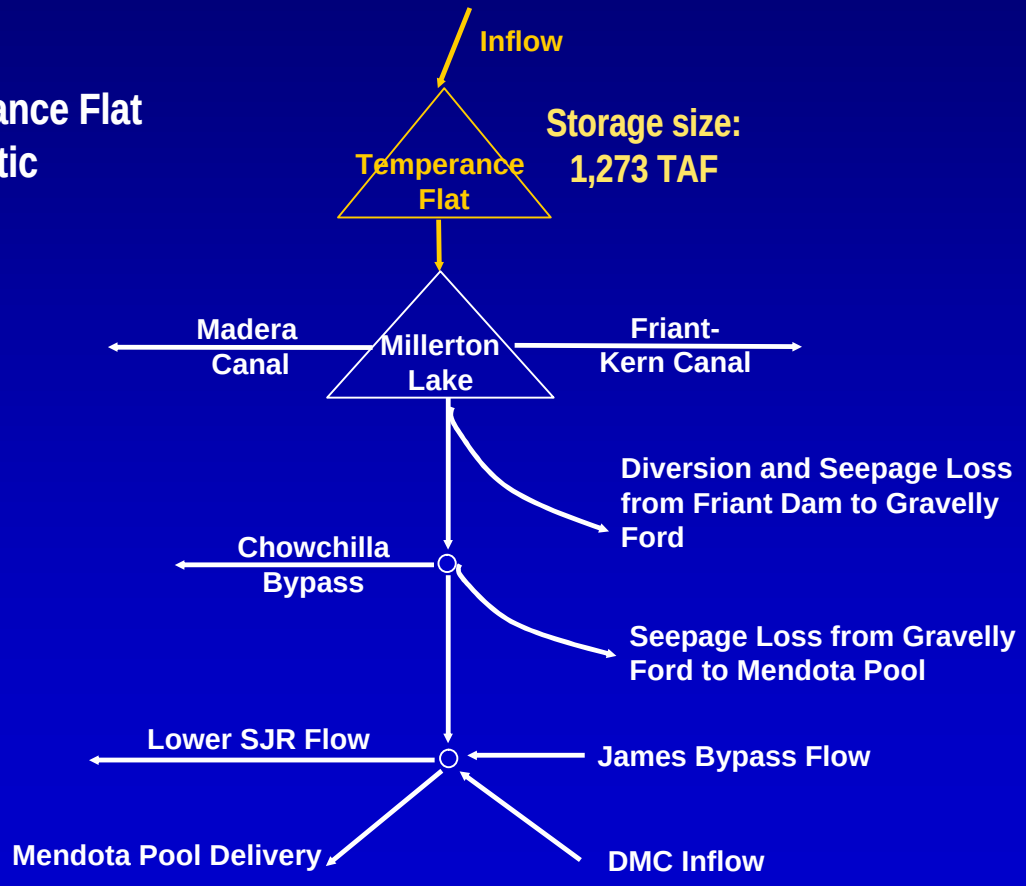
List of Analyzed Storage Options

Category	Storage Options	Size	Single Purpose Analysis		
			WS	RF	WQ
SJR On-Stream	Friant Enlargement	700	Done	Done	Done
		450	Done	In-Progress	In-Progress
		340	Done	In-Progress	In-Progress
		250	Done	In-Progress	In-Progress
		125	Done	In-Progress	In-Progress
	Temperance Flat	1,273	Done	Done	Done
SJR Off-Stream	Fine Gold	800	Done	Done	Done
		350	In-Progress	In-Progress	In-Progress
		133	In-Progress	In-Progress	In-Progress
	Mammoth Pool	35	Done	In-Progress	In-Progress
Friant-Kern Off-Canal	Yokohl Creek	800	Done	Done	Done
		400	Done	Done	Done
Friant-Kern Canal Exchange	Pine Flat	124	Done	In-Progress	In-Progress

Single Purpose Analysis

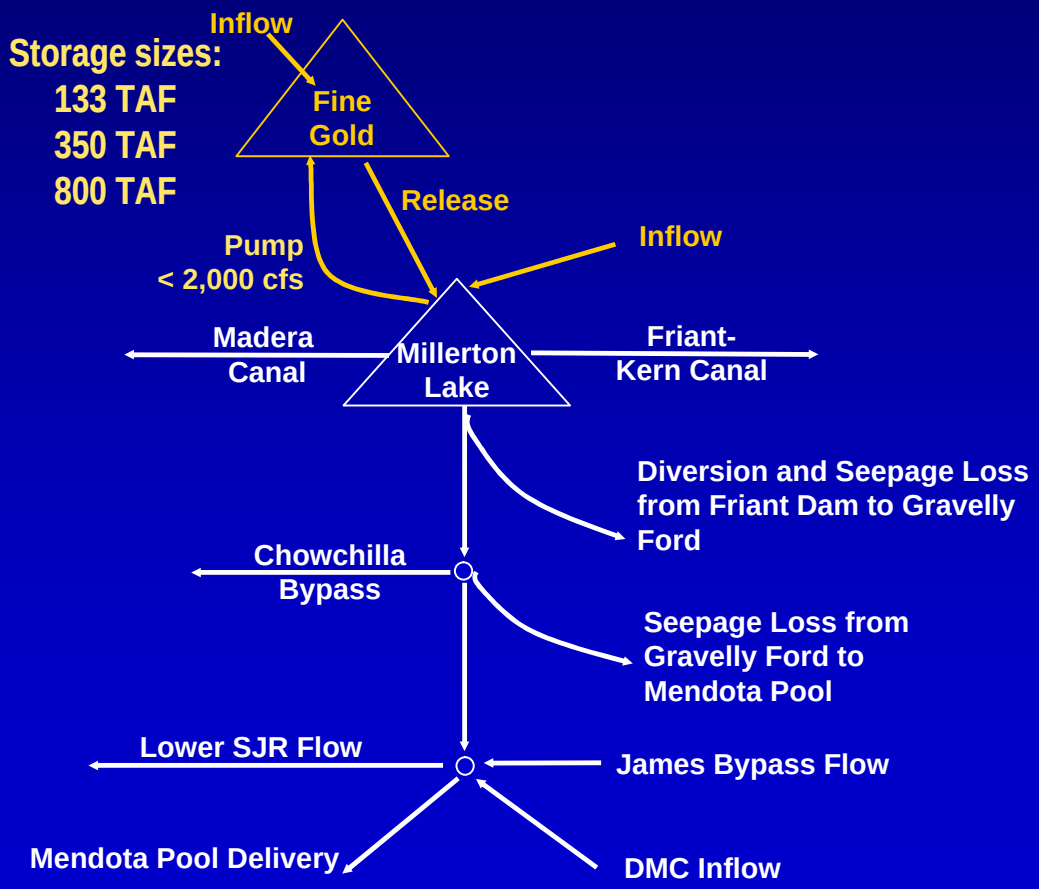
Modeling Options – SJR On-Stream Storage

Temperance Flat Schematic



Single Purpose Analysis

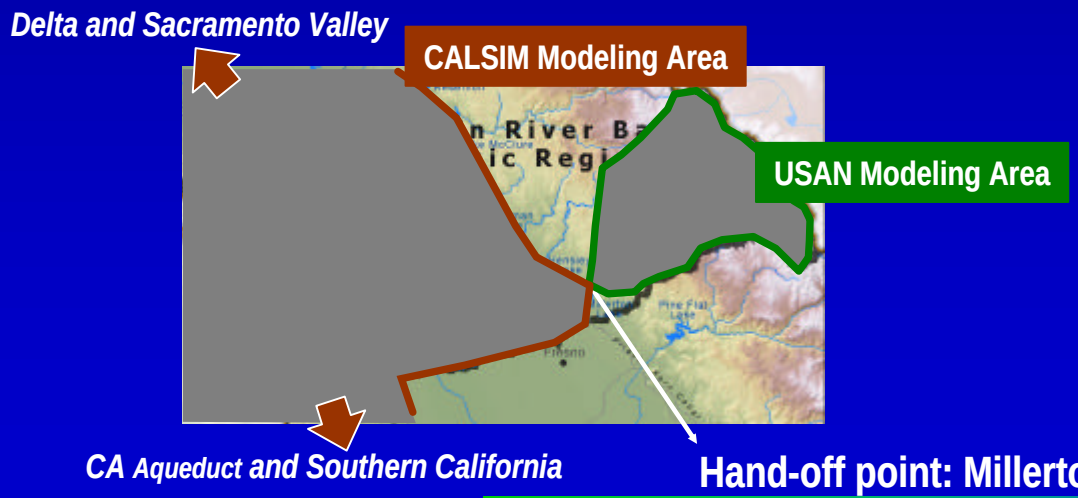
Modeling Options – SJR Off-Stream Pump Storage



Single Purpose Analysis

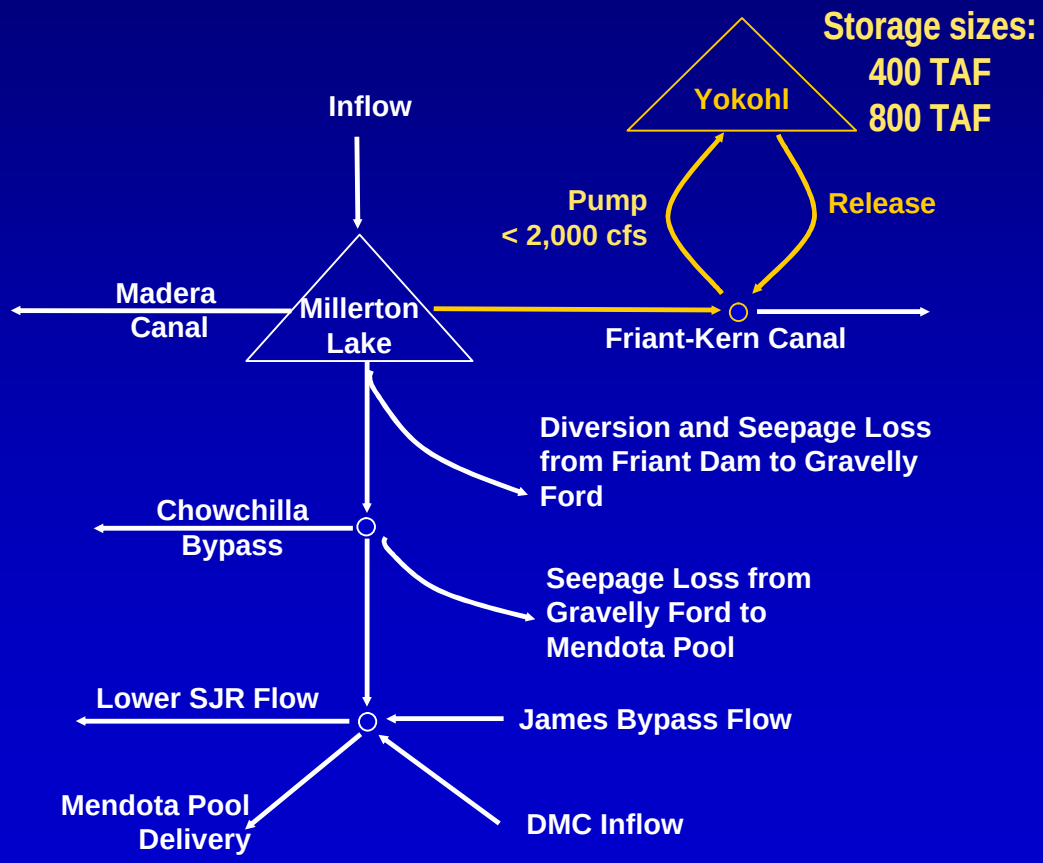
Modeling Options – SJR Off-Stream Storage

- **Mammoth Pool-35 Option**
  - Change in Mammoth Pool storage simulated in USAN
  - Resulting changes in Millerton Lake inflow used in CALSIM
  - Maintain existing operation agreements



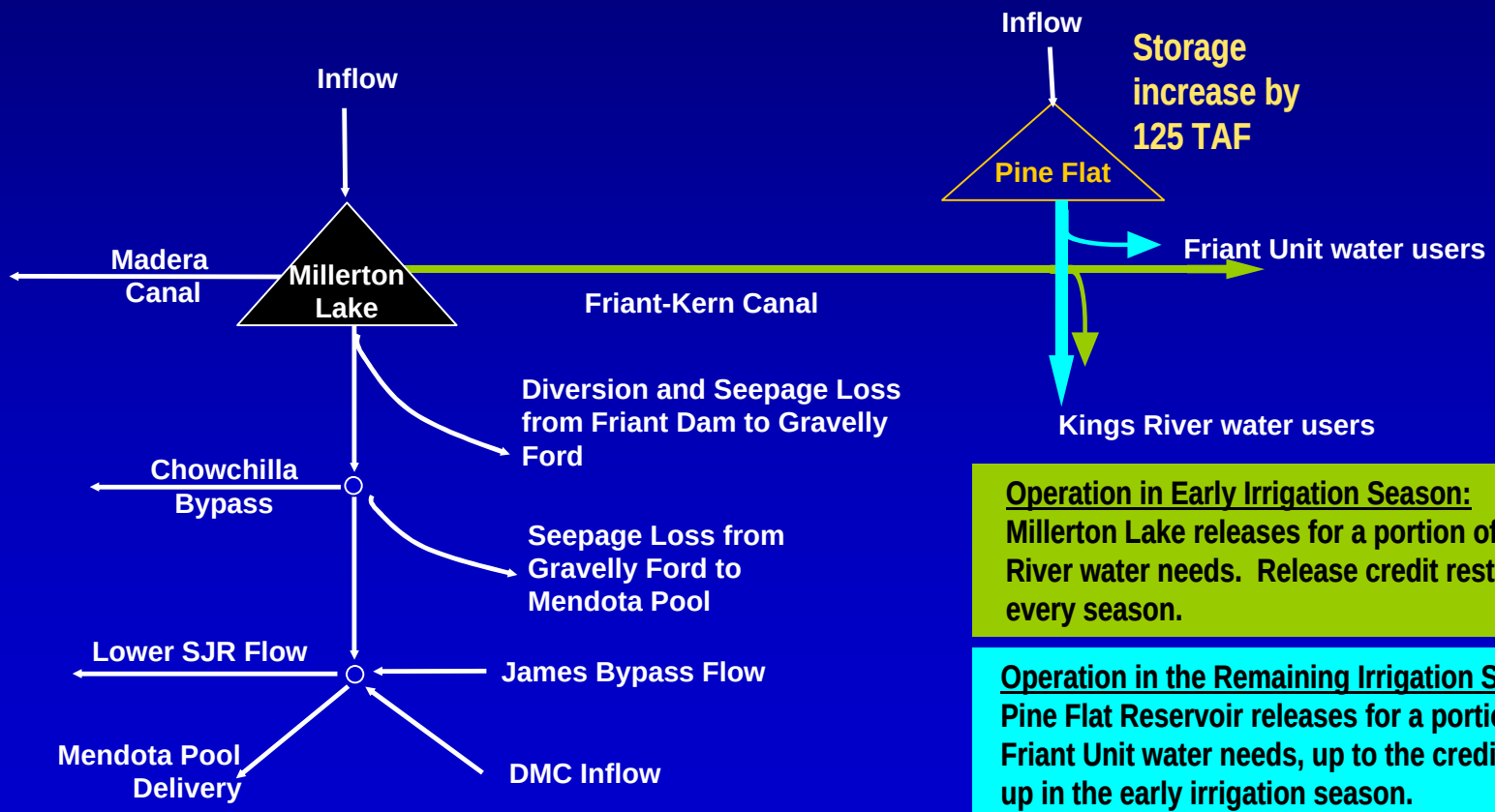
Single Purpose Analysis

Modeling Options – Friant-Kern Off-Canal Pump Storage



Single Purpose Analysis

Modeling Options – Friant-Kern Canal Exchange



Operation in Early Irrigation Season:
Millerton Lake releases for a portion of Kings River water needs. Release credit restarts every season.

Operation in the Remaining Irrigation Season:
Pine Flat Reservoir releases for a portion of Friant Unit water needs, up to the credit built up in the early irrigation season.

Single Purpose Analysis

Modeling Options – Preliminary Findings

- **Observations on Friant Dam operation**
  - Increases in Class 2 water allocation and reductions in 215 water available
  - Difficulties in supporting new river demands in critical years
- **Potential system impacts**
  - Flood damage reduction
  - Changes in sources of water for Mendota Pool delivery

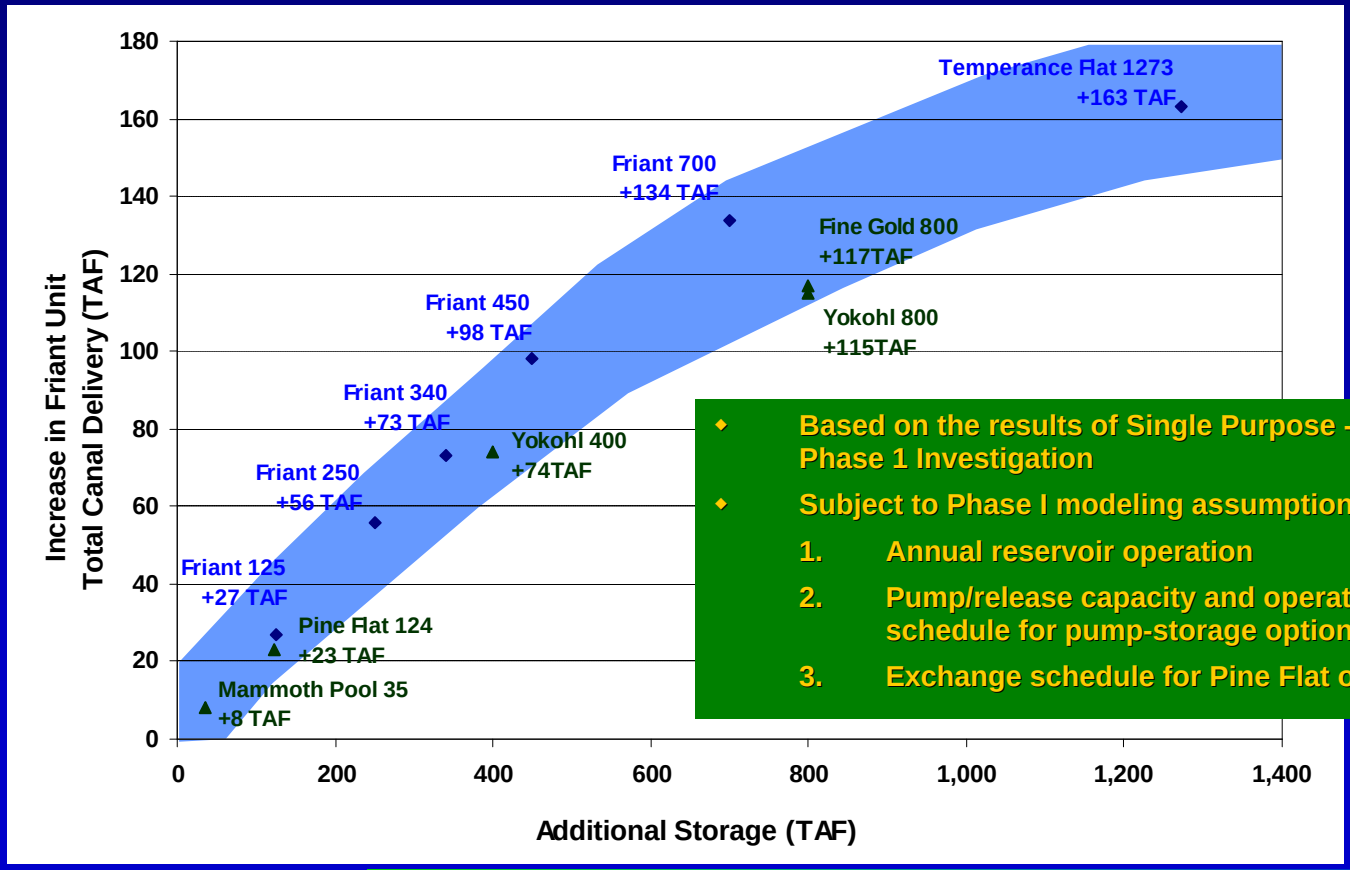
Single Purpose Analysis

Modeling Options – Preliminary Findings (cont.)

- **Comparison of storage options**
  - Quantity of water at Friant Dam is similar for all single-purposes (water supply, water quality, and restoration flow).
  - Use Single Purpose Analysis-WS for each option as an indicator for preliminary comparison of storage options performance.

Single Purpose Analysis

Modeling Options – Preliminary Findings (cont.)



- Based on the results of Single Purpose - WS for Phase 1 Investigation
- Subject to Phase I modeling assumptions:
  1. Annual reservoir operation
  2. Pump/release capacity and operating schedule for pump-storage options
  3. Exchange schedule for Pine Flat option

Modeling for Phase 1 Investigation

Next Steps

- Incorporate carryover storage requirements in Friant operation to facilitate the new river demands in critical years
- Incorporate potential groundwater recharge operation in option evaluation
- Add temperance flat to 2 MAF
- Sensitivity analysis

Workshop #4

Agenda

- Welcome and Meeting Overview
- In-Progress Phase I Report
- Functional Equivalence and Continuation Criteria
- Modeling Assumptions
- Preliminary Results of Operations Modeling
- Next Steps

Next Steps

- **Receive comments on In-Progress Phase 1 Draft Report**
- **Continue single-purpose analyses**
  - Complete remaining options
  - Carry-over storage
  - Additional groundwater recharge
- **Complete cost estimates for storage options**
  - Provide Technical Memoranda to Stakeholders
- **Describe types of benefits for project objectives**
- **Define continuation criteria**

Bureau of Reclamation
Mid-Pacific Region

California Department
of Water Resources

Upper San Joaquin River Basin Storage Investigation

Workshop 4

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