SAN JOAQUIN RIVER RESTORATION PROGRAM

Seepage and Conveyance Technical Feedback Group Meeting

February 12, 2016

Preliminary draft – subject to change

Patti Ransdell

INTRODUCTION

Agenda

- Introductions
- Restoration Program Update
- Almond Root Zone Study
  - Phase 1: Comments and Responses
  - Phase 2: Potential Field Program
- Seepage Projects
  - Process and Status
  - Discussion of Easements
- Fishing Regulations
- Wrap-Up, Action Items

Katrina Harrison

RESTORATION PROGRAM UPDATE

Restoration Flows

- 9,445 Acre-Feet was allocated to the SJRRP
- Releases will start February 15 and target 80 cfs at Gravelly Ford
- SJRRP will make releases to the end of February
- Supports juvenile trap and haul
- March and beyond: SJRRP water is dependent on hydrology and Delta conditions

Compliance Documents

- Draft EA for Salmon Conservation and Research Facility Water Supply Infrastructure Project
  - Comments due February 29, 2016
- Draft EA on Red Top
  - Comments due March 4, 2016
- Draft EA on Unreleased Restoration Flows
  - Comments were due February 8, 2016

Completed Compliance Documents

- Draft EA / FONSI posted for 1-year Recapture at Patterson & Banta-Carbona ID
  - Comments were due January 21, 2016
- FONSI for Tulare Irrigation District Groundwater bank – 11/13/2015
- FONSI for Sycamore Island Pond Isolation Project – 2/1/2016
- FONSI for Eastside Bypass Conveyance Sand Removal – 2/1/2016

Schedule of Key Construction Actions in Framework

2015-2019	2020-2024	2025-2029	2030+
Goal: 1,300 cfs Capacity in all Reaches	**Goal: Increased Capacity**	**Goal: Phase 1Projects Complete**	**Goal: All Remaining Projects Complete**
• Friant-Kern Capacity Restoration • Friant-Kern Canal Reverse Pumps • Madera Canal Capacity Restoration • Mendota Pool Bypass • Temporary Arroyo Canal Screen • Conservation Facility / Hatchery • Seepage Projects to 1,300 cfs	• Financial Assistance for Groundwater Banks • Reach 2B • Arroyo Canal and Sack Dam • Reach 4B Land Acquisition • Seepage Projects to 2,500 cfs • Levee Stability to 2,500 cfs	• Reach 4B • Salt and Mud Sloughs • Chowchilla Bifurcation Structure Improvements (DWR) • Gravel Pit Isolation (DWR) • Seepage Projects to 4,500 cfs • Levee Stability to 4,500 cfs	• Ongoing Operations and Maintenance

Paul Romero

GEOTECHNICAL EVALUATION OF PRIORITY LEVEES

Levee Prioritization Categories

Priority 1	Reach 2A
	Middle Eastside Bypass
	Reach 4A (lower)
Priority 2	Reach 4B2
	Mariposa Bypass
Priority 3	Reach 3
	Reach 4A (upper)
	Reach 5
	Lower Eastside Bypass

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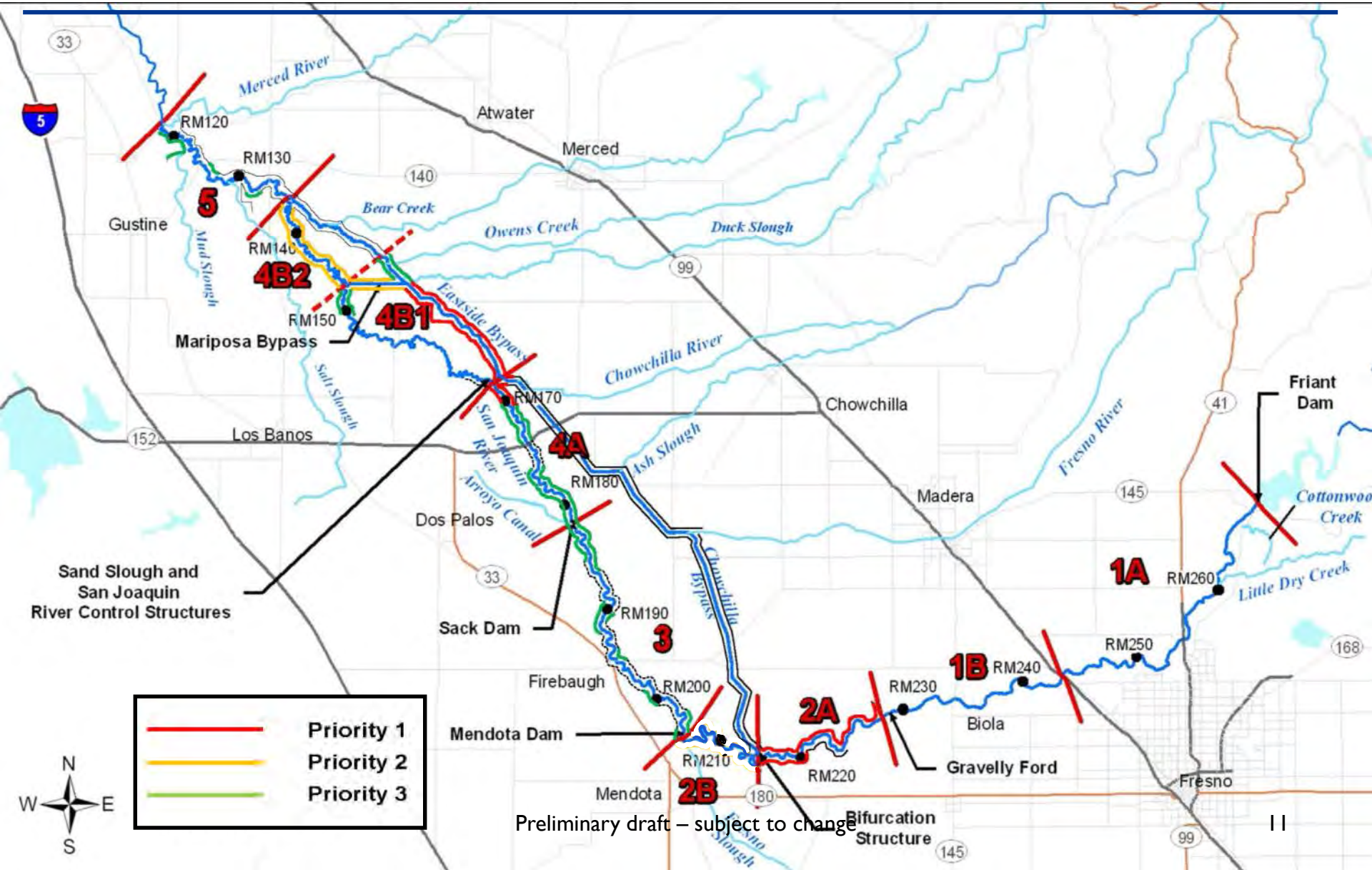
Prioritized Levees



Preliminary draft – subject to change

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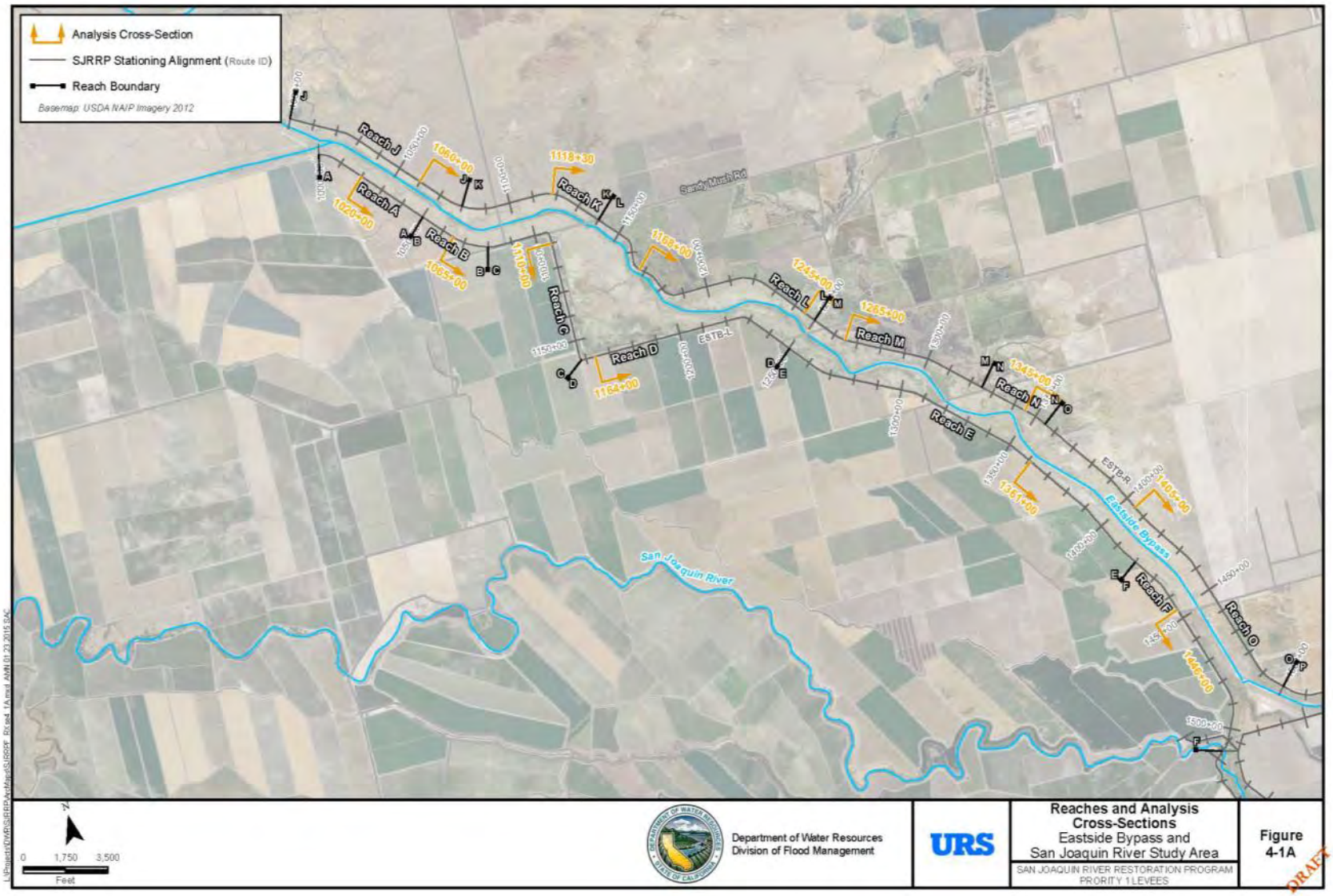
Priority 1 Preliminary Design



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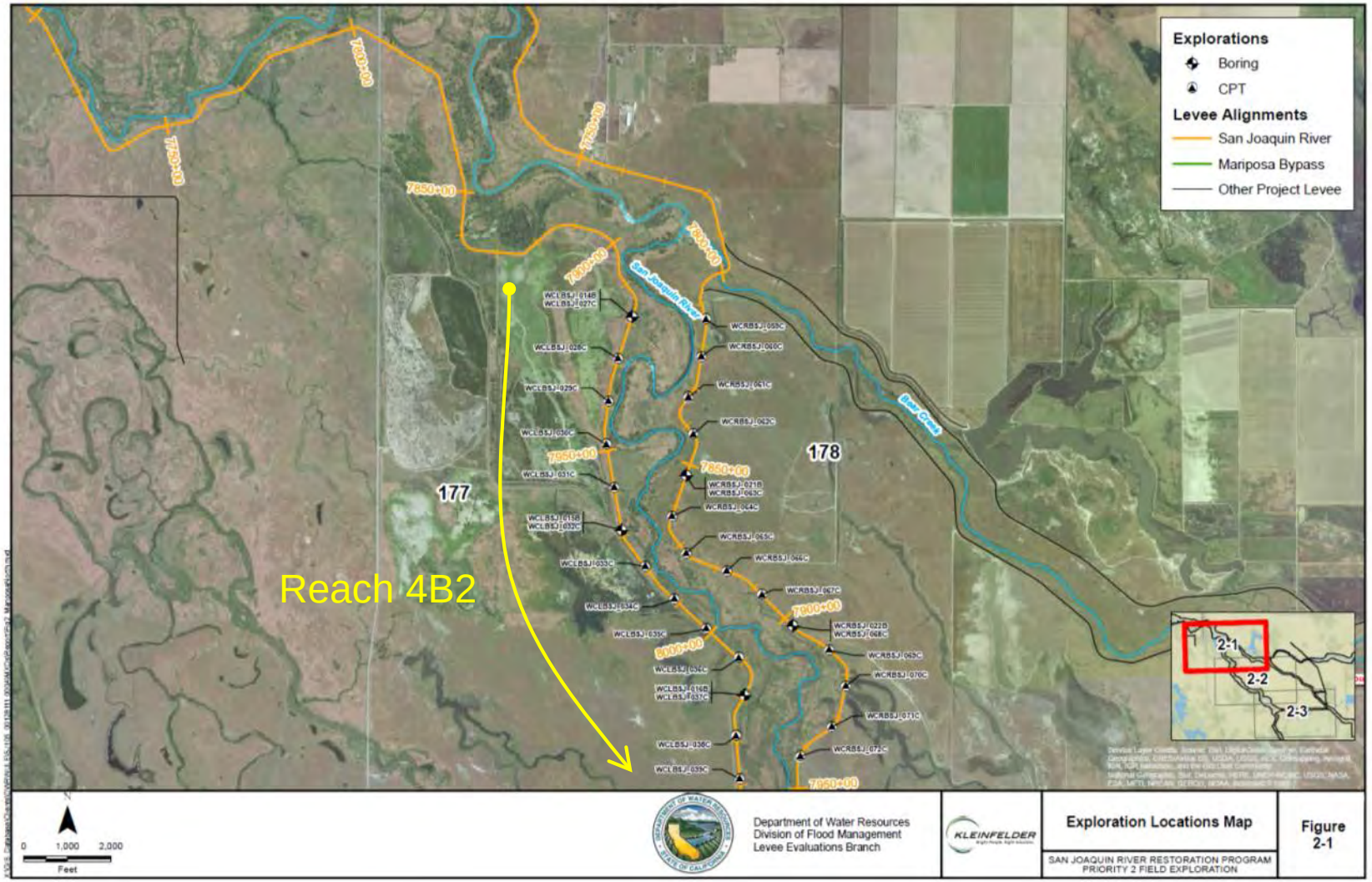
Priority 2 Evaluations



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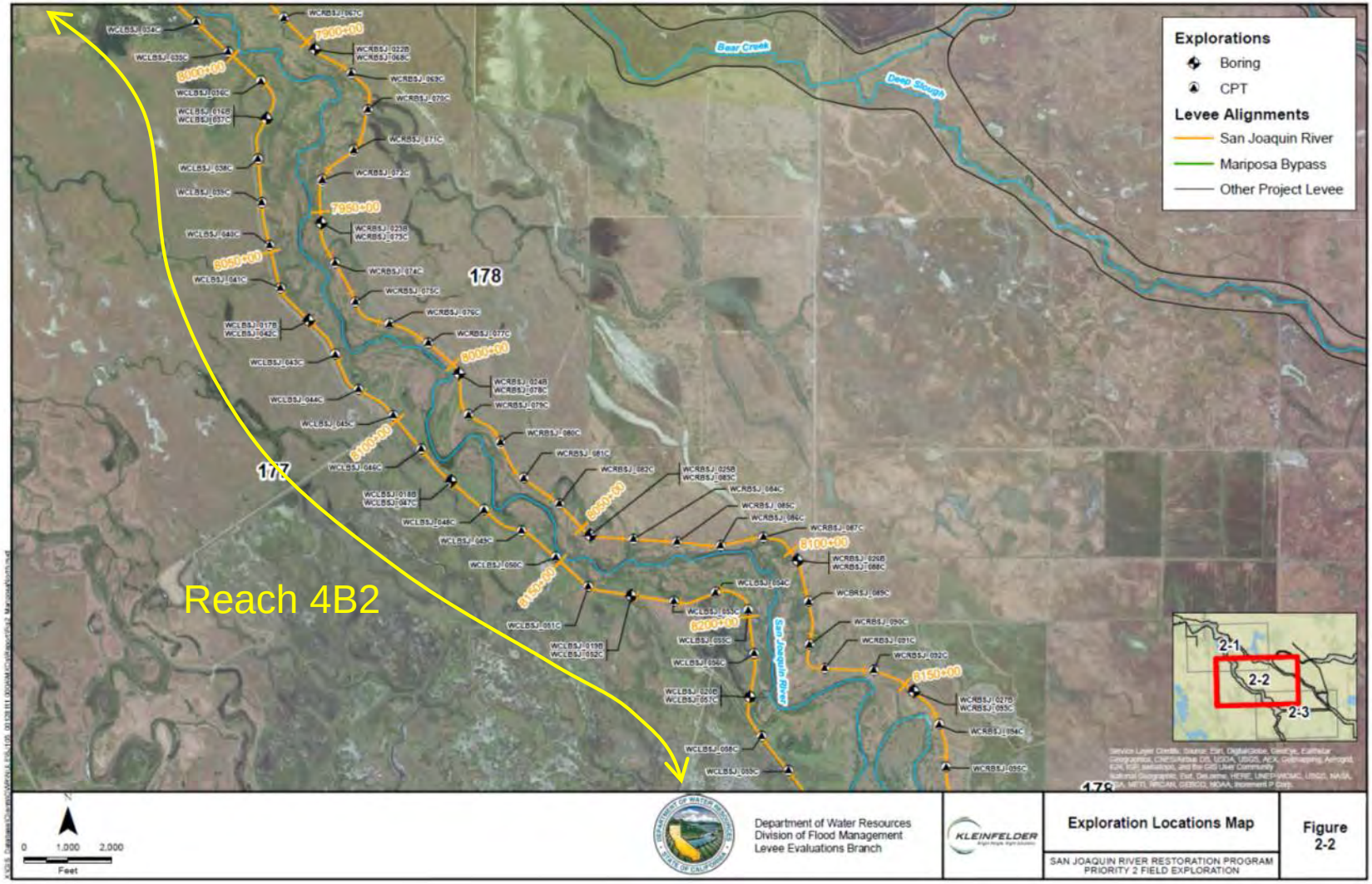
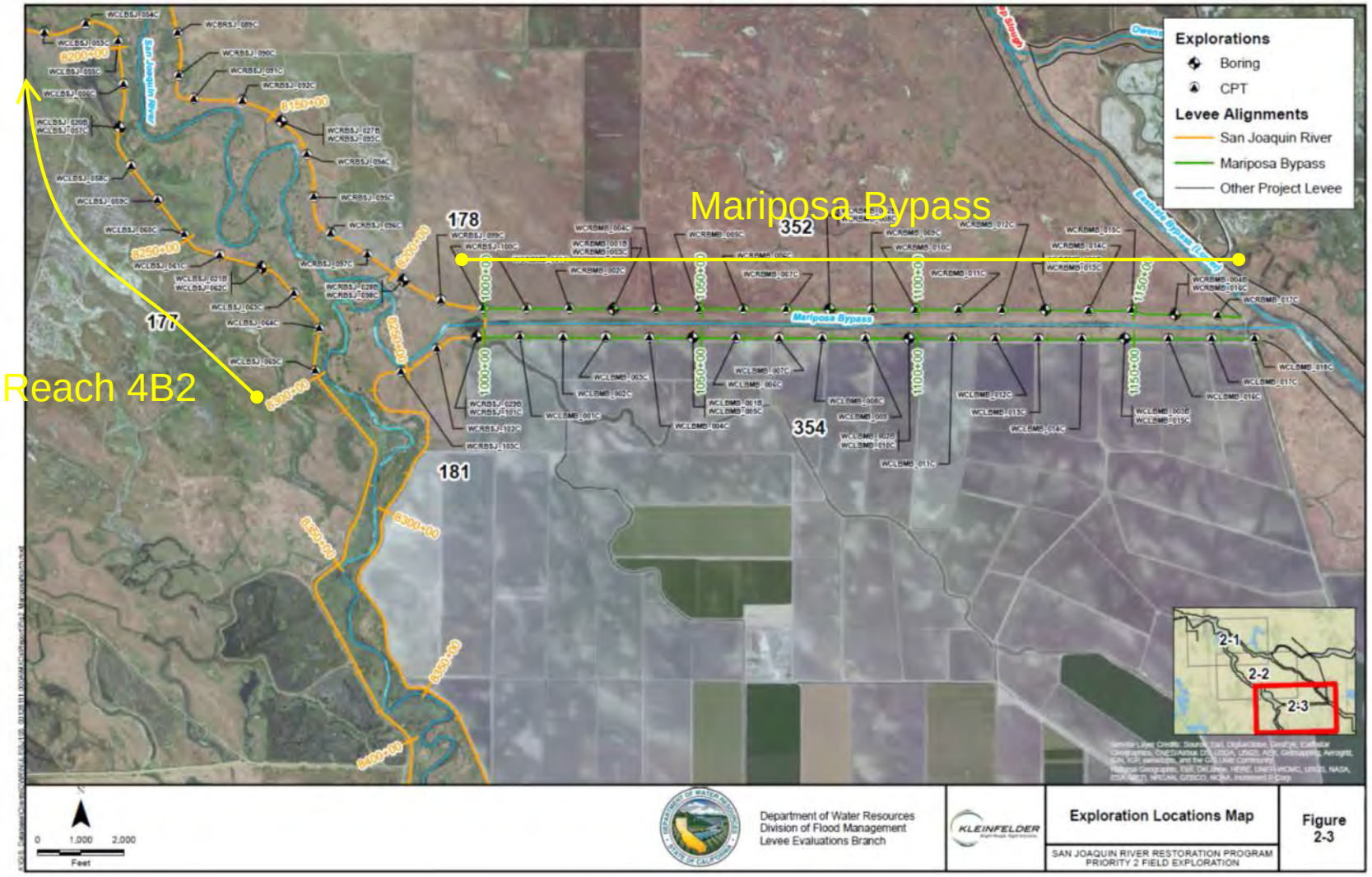
Priority 2 Evaluations



Priority 2 Evaluations



SAN JOAQUIN RIVER RESTORATION PROGRAM

Levee Evaluations Schedule

Priority 1 (Reach O)	
Preliminary Design	2016
Final Design	2017*
Construction Start	2019*
Priority 2 Levees	
Drilling (Phase II)	2016
Geotechnical Conditions Report	2017
Preliminary Design	TBD
Priority 3 Levees	
Drilling	2016 – 2017
Geotechnical Conditions Report	2019

**Need Reach 4B Project preferred alternative*

Mica Heilmann, Stephanie Tillman

ALMOND ROOT ZONE STUDY

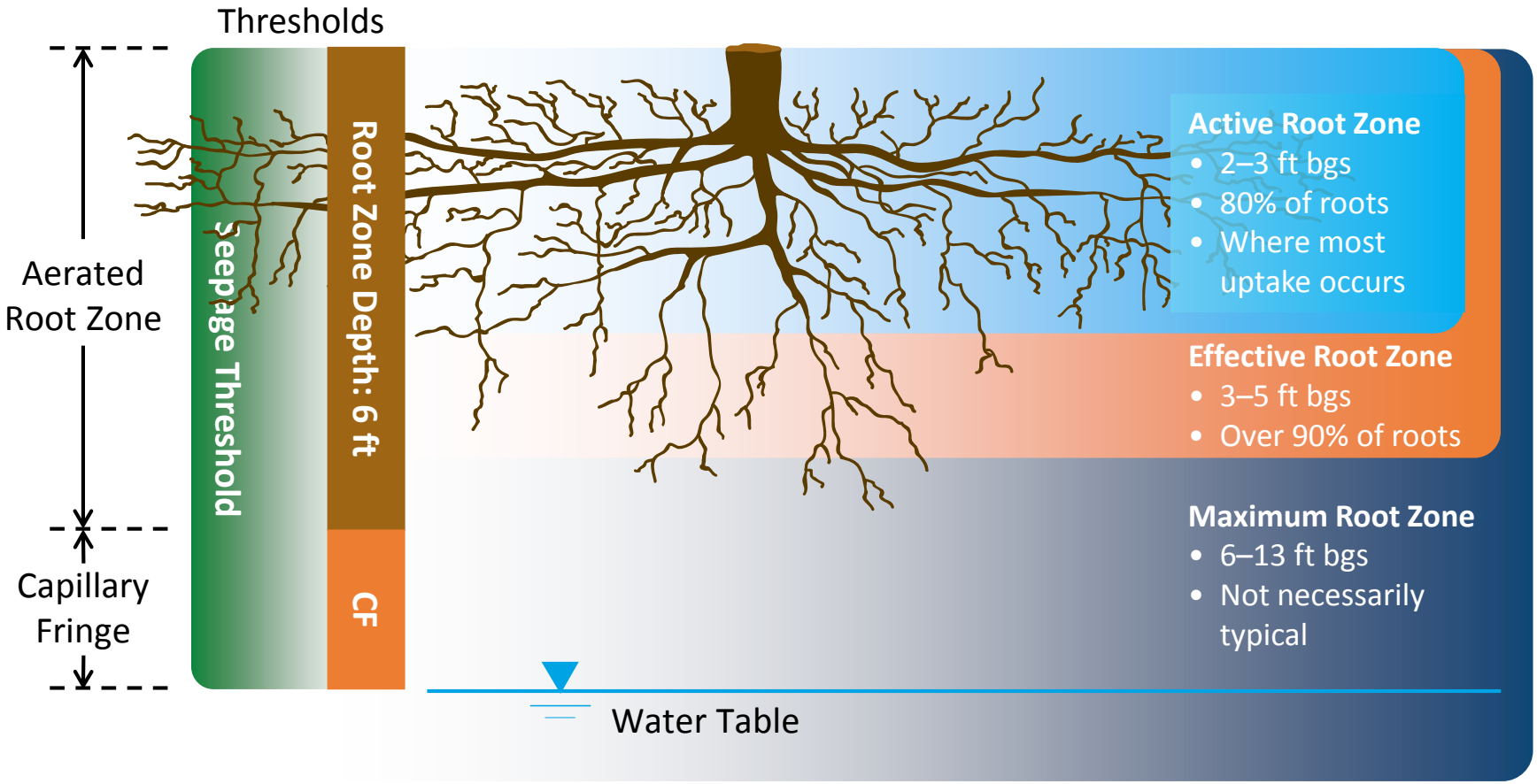
PHASE I SUMMARY

Purpose

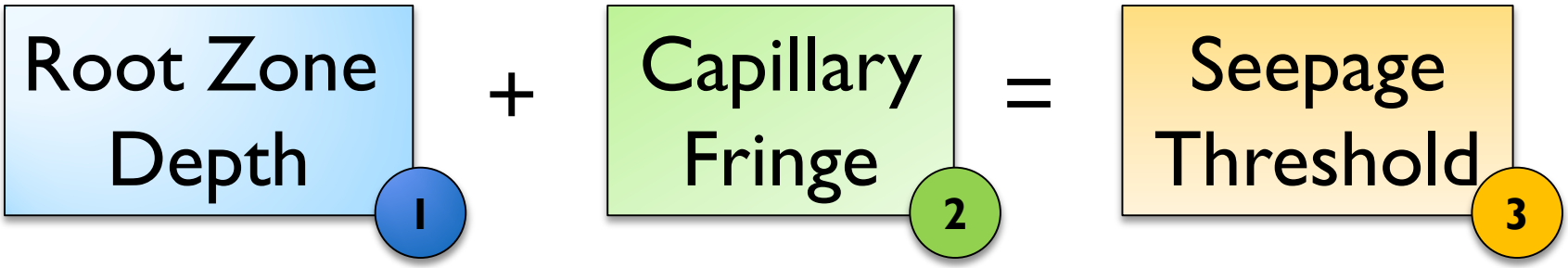
- Continue to uphold the ongoing commitment in the SMP to protect crops from material adverse groundwater seepage impacts
- Set root zones at levels that are protective
- Set root zones at levels supported by science

SAN JOAQUIN RIVER RESTORATION PROGRAM

Root Zone Threshold Terms



Threshold Calculation: Agricultural Practices Method



Background

- Peer review suggested 3.3 – 6.6 feet for effective root zone depth of almonds (2012)
- Changed to 9 feet based on grower comments to enable faster finalization of the SMP
- Almond Root Zone Study performed to gather scientific information

SMP Date	Almond Root Zone (feet)
Draft March 2013	6
June 2013	9
September 2014	9

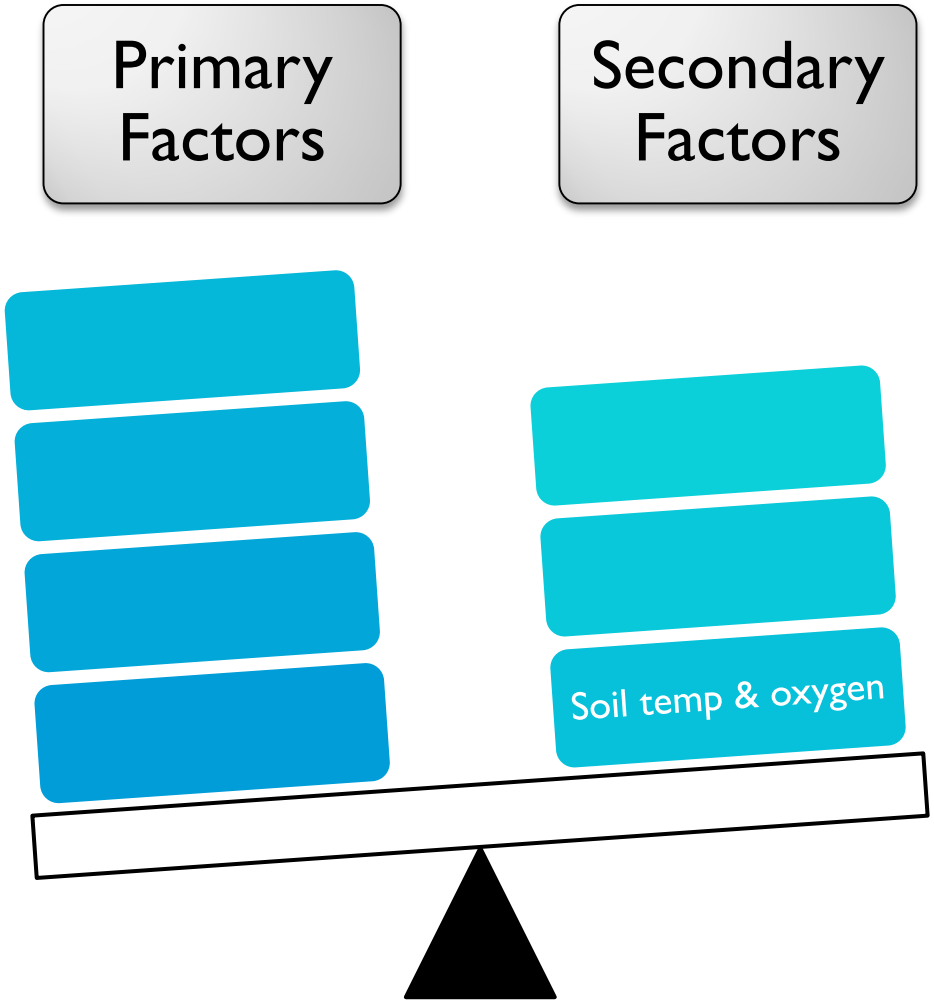
Discussion Plan

- Summary of Phase 1 Study
  - Questions that we sought to answer and what we learned
- Comments and responses
  - Discussion of major themes
- Potential Phase 2 field study
  - Build upon needs identified in Phase 1, if necessary

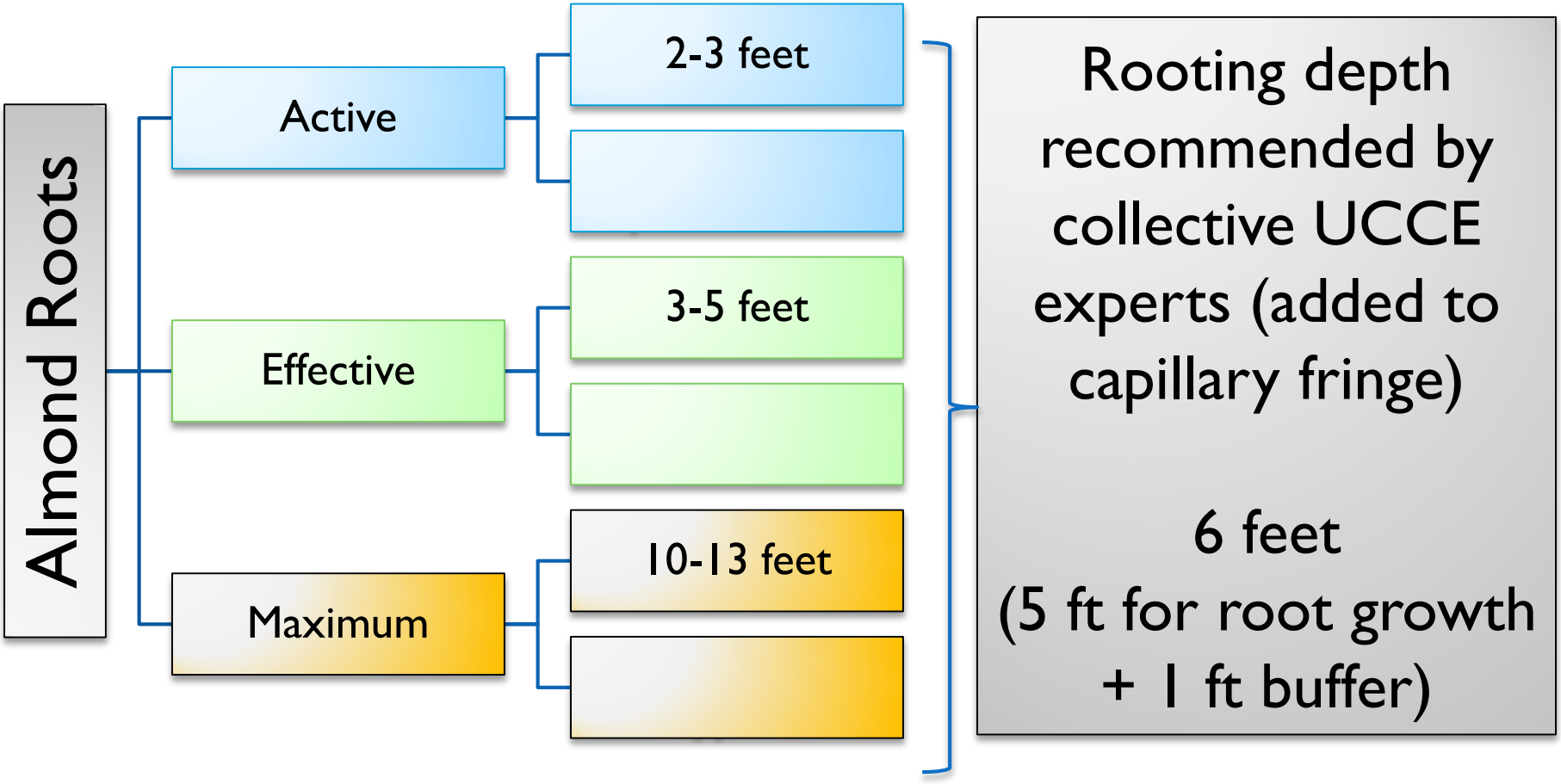
UCCE Extension Advisory Questions

1. Range in almond root depth?
2. Effect of saturation?
3. Minimum age of peak root development?
4. Effect of orchard density on almond root depth?
5. Effect of rootstock on almond root depth?
6. Methods appropriate for studying almond rooting depth?

Question 1: What is the depth of almond roots observed in the field and recommended for production?



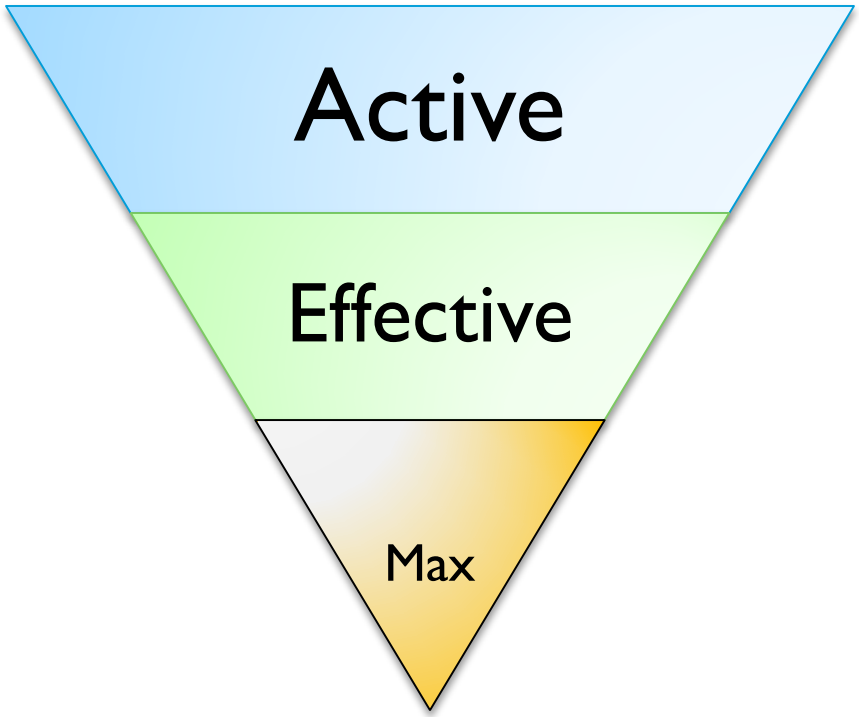
Question 1: What is the depth of almond roots observed in the field and recommended for production? (continued)



Scientific literature & local experts agree. Effective root zone should be used in addition to capillary rise to estimate protected root zone.

Question 2: What is the effect of saturation on the primary root zone and the total root zone?

The effects of anoxic and saline conditions



- Site specific
- Influenced by:
  - Seasonal timing
  - Frequency
  - Duration of saturation
- Research is inadequate to estimate how these factors might interact

Question 3: What is the minimum age of almond trees at which peak root development occurs?

Peak root development likely concurrent with production maturity (fully developed root systems at 7-8 years)

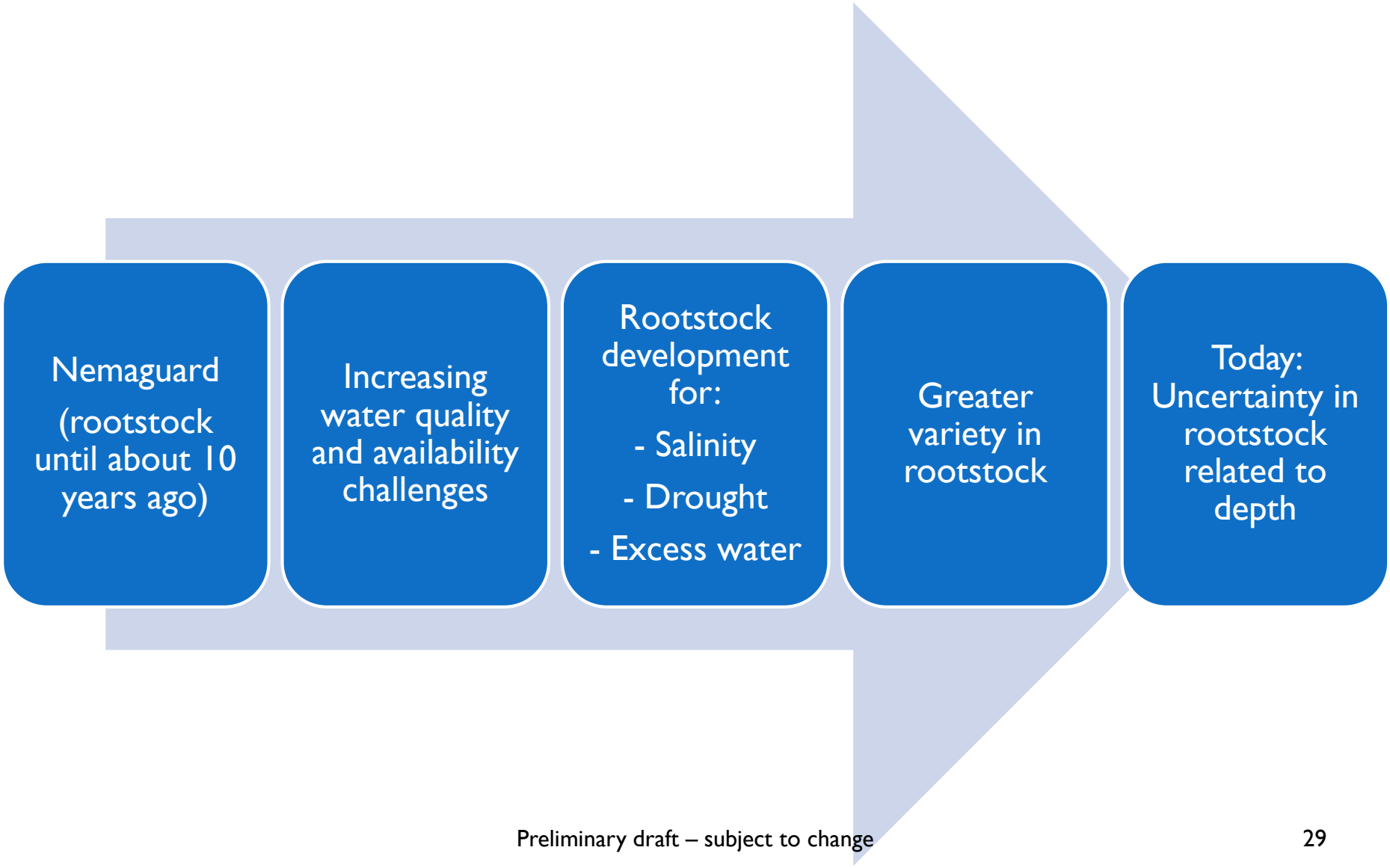
Assumption has not been validated with field studies

- Uncertain
- No long term studies conducted on almond root development in CA to date
- Literature review findings:
  - Root growth does not continue at same rate throughout life of tree
  - Root structure tends to plateau after main structure is achieved
  - Non-woody roots die off and regrow annually; larger structural woody roots live longer

Question 4: What is the effect of orchard density on almond root depth?

- Uncertain
- No studies on root structure and orchard density to date
- Roots likely do not compensate for higher density plantings by growing deeper

Question 5: What is the effect of rootstock on almond root depth?



Question 6: What are appropriate methods of studying root depth

- Low Invasive
  - Hand-Operated Sampling Tubes and Augers
    - Ineffective in compacted/hard pan soils
    - Time consuming
  - Hydraulic Soil Core Sampling
    - Mechanical core sampling
    - Relatively quick
    - Possible in all soil types
    - Safe

Root Zone Study Conclusions

- Phase 1
  - Expert, UCCE, and literature sources converge on recommended effective root zone of 5 feet, operational root zone of 6 feet
    - Root Zone + Capillary Fringe Buffer = Groundwater Threshold
  - Certain root zone seepage effects and dynamics are unknown and site specific data collection is recommended to refine understanding of site specific characteristics and root zones.
  - Methods of study exist for refining understanding of these factors; low invasive techniques are recommended

Mica Heilmann

ALMOND ROOT ZONE STUDY

PHASE I COMMENTS AND RESPONSES

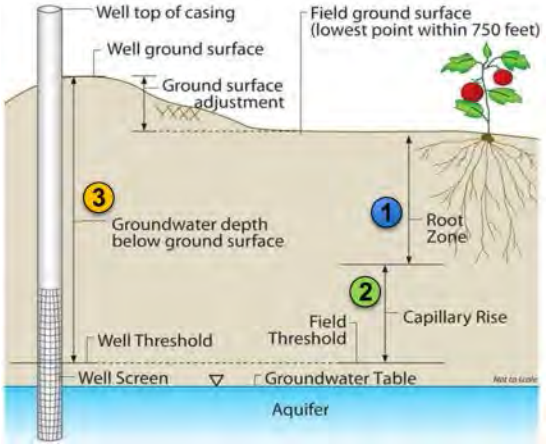
Thank You

- Thank you very much for your comments
- Broad local expertise is much appreciated

Points of Agreement in Comments

- Root zone is not representative of the depth of soil needed to protect roots from saturation and salinity impacts.
  - Additional depth is needed for capillary rise
  - Drainage design criteria must account for the intended drained depth

Root Zone Depth (1) + Capillary Fringe (2) = Seepage Threshold (3)



Points of Agreement in Comments

- Sites vary in characteristics such as water table depth, soil type, and capillary rise.
  - This variability affects almond root depth, and should be considered in determining drainage project design.
- Phytopthora risk should be considered when estimating impacts of seepage on almond roots

Comment Response Summary

5 primary topics of concern

1. Study Plan findings on root zone depth will translate directly to water table depth recommendation
2. General information in Study Plan does not reflect site-specific variability
3. Seepage Management Plan current recommendation had a lot of input. Why is it being revised?
4. Experts did not agree on recommended root zone depth
5. Phytopthora risk associated with saturated soils was not adequately addressed in Study Plan

Responses to Topic #1

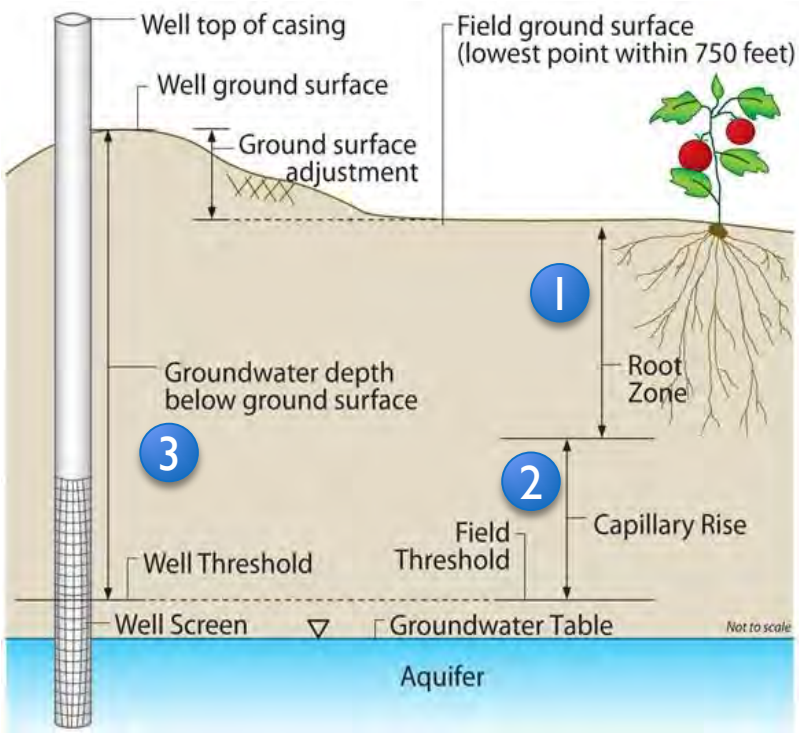
Study Plan findings on root zone depth will translate directly to water table depth recommendation.

- Response
  - Root zone, capillary fringe, seepage threshold, and water table depth are related but not the same and will be clarified
  - Root zone was the main topic of the study effort
    - Aerated depth needed to sustain optimum crop growth
    - Generally considered the effective, not maximum, root zone
    - Not the same as water table depth

Responses to Topic #1 (cont'd)

Root Zone Depth (1) + Capillary Fringe (2) = Seepage Threshold (3)

- Capillary fringe
  - Dependent on soil type
  - Additional buffer between root zone and water table
  - Addressed in SMP Appendix H
- Water table depth
  - Includes aerated root zone and capillary fringe depths



Responses to Topic #2

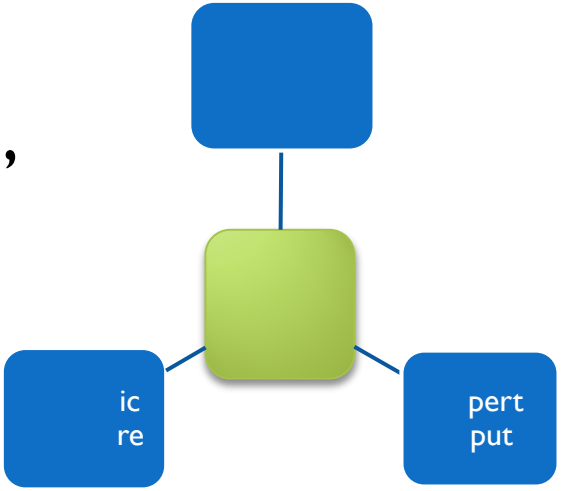
General information in Study Plan does not reflect site-specific variability.

- Response
  - Literature review provided general root zone information to guide study efforts; acknowledged site specific factors
  - Interviewed experts provided more localized, specific experience in the San Joaquin Valley
  - Site specific information intended to be refined for the project by a field study in Phase 2 to better characterize local conditions

Responses to Topic #3

Seepage Management Plan current recommendation had a lot of input. Why is it being revised?

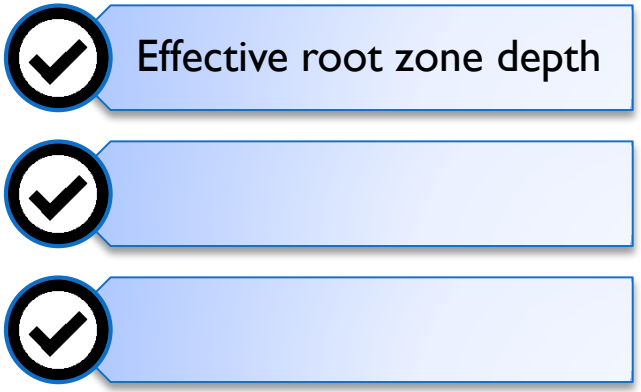
- Response
  - Anecdotal depth of soil for almonds, 4 to 9 feet above water table
  - SMP should provide scientific basis for a threshold
  - Anecdotal evidence contributes, but does not solely form the scientific basis



Responses to Topic #4

Experts did not agree on recommended root zone depth.

- Response: Experts agreed on the following:
  - Effective root zone extends 3-5 feet in depth
  - Root presence and activity diminishes beyond this depth
  - Effective root zone (not maximum) is an appropriate indicator of necessary aerated root zone



Responses to Topic #4 (cont'd)

- Experts expressed concern about capillary fringe
- Capillary fringe is acknowledged to be variable
- Current SMP says 6 inch or 1 foot capillary fringe
- Will revise to represent a broader range in potential capillary fringe

Responses to Topic #5

Phytopthora risk associated with saturated soils was not adequately addressed in Study Plan.

- Concern in saturated soils, especially in spring when flow pulses are anticipated
- Phytopthora was acknowledged but not thoroughly investigated in the Study Plan
- Additional information will be added to the Study Plan to determine at what depth phytopthora can infect plant roots

Conclusions

- General agreement on 6 foot root zone
- Must be combined with a capillary fringe of up to 4 feet depending on site-specific factors
- Groundwater threshold at 6.5 – 10 feet

Conclusions from Comments

- As you know, root zone plus capillary fringe equals threshold
- Capillary fringe was not considered as part of this study, but was mentioned in many comments
- In SMP, capillary fringe is 6 inches or 1 foot
- Reclamation is planning to revise the SMP to clarify that capillary rise may be higher depending on site specific soils

Path Forward

- Responses to comments
  - Handout at today's meeting
- Field program (Phase 2)

Possible 2017 Seepage Management Plan Edits

- Almond Root Zone
  - Current SMP (2016 Restoration Flows): 9 feet
  - Future SMP (2017+ Restoration Flows): 6 feet
- Capillary Fringe
  - Current SMP: 0.5 – 1 foot
  - Future SMP: 0.5 – 4 feet depending on site specific conditions
- Groundwater Threshold Change:
  - 9.5 – 10 feet → 6.5 – 10 feet
  - No change in threshold in silt / clay soil types

Mica Heilmann

PHASE 2 STUDY CONCEPTS

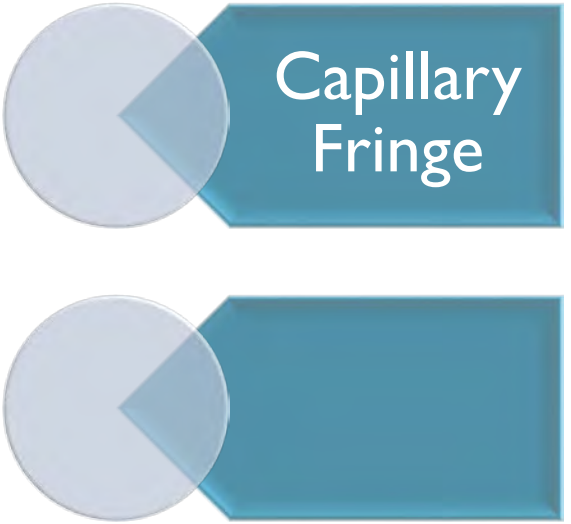
POTENTIAL PHASE 2 FIELD PROGRAM

Potential Phase 2 Study

- Better understand impact of site specific conditions
- Two potential topics of study:
  1. Capillary Fringe: Further refine the understanding of site specific capillary fringe
  2. Almond Root Zone: Field characterization of almond root depth

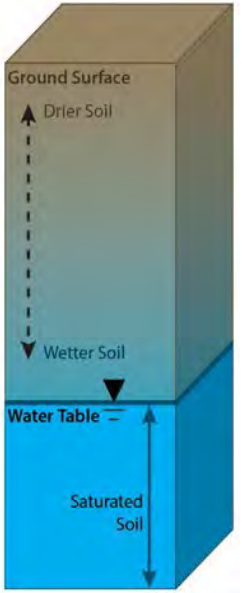
Potential Phase 2 Study

- Potential study topics are not mutually inclusive or exclusive
- Topics are draft concepts only at this point in time
- Reclamation and participating stakeholders may determine that one, none or a combination of both concepts are desired



Site Specific Capillary Fringe Study

- Capillary fringe arose out of Phase 1 efforts as an important topic
- Objectives:
  - Evaluate existing data and literature and identify data gaps that need to be addressed.
  - Develop specific guidelines for the range of capillary fringe in various soils and site conditions, to be used in conjunction with root depth estimates to protect almond roots from seepage in the project area.



Site Specific Root Zone Study

- Root zone information developed in the Phase I efforts would be validated
- Objectives
  - Validate root zones as anticipated by UCCE experts and scientific literature
  - Characterize specific root depths within soil conditions typical of SJRRP area
  - Provide quantitative support for the almond root zone threshold specified in the SMP

Phase 2 Study Concepts

Conceptual approach:

- Evaluate variety of representative soil and/or groundwater conditions
- Low invasive coring method to observe capillary fringe and/or roots in the field

Phase 2 Study Concepts

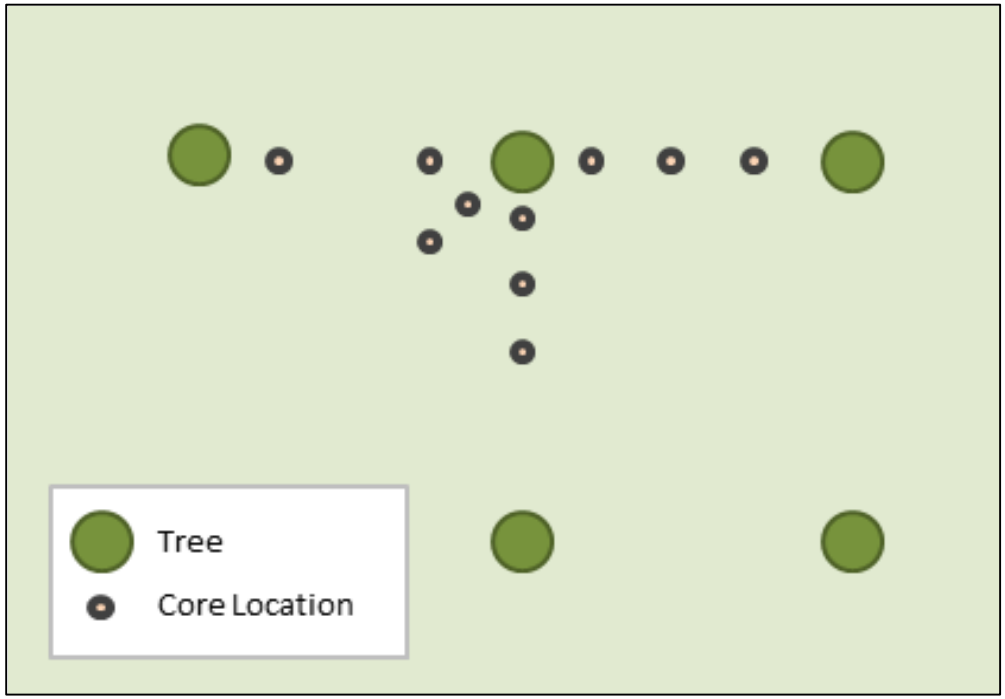
Conceptual approach (cont.):

- Build on existing data
- Obtain robust dataset to characterize the range in variability in root zone and/or capillary fringe

Phase 2 Study Concepts

Example study site

Example layout of core locations within a study site



Next Steps – Phase 2

- Collaboration – We would like to work with you
- Scoping – Get input from growers on how to approach Phase 2
- Application - Determine objectives and refine approaches

Thoughts?

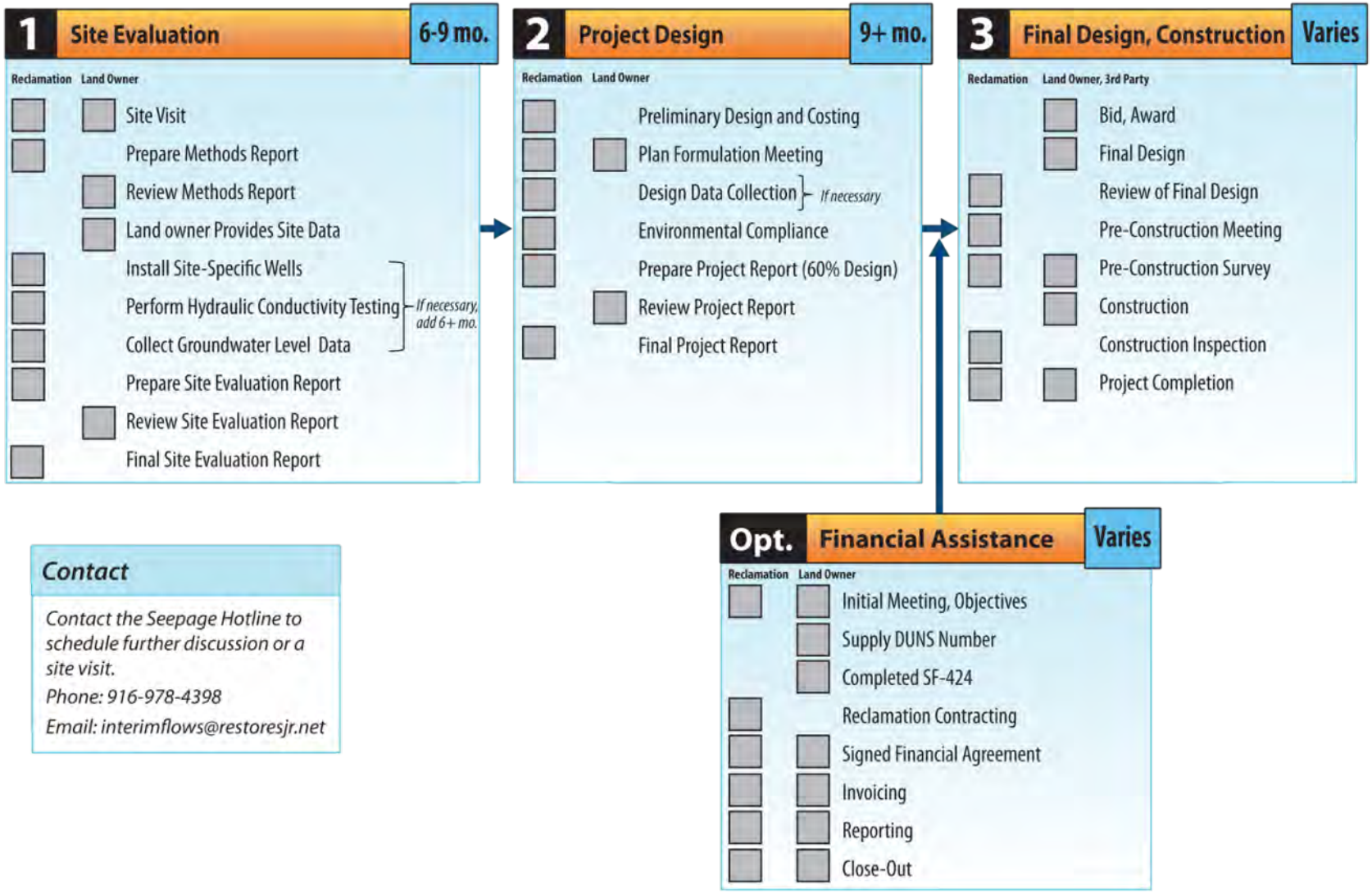
- What do you think?
- Should we do a field study?

Brian Heywood

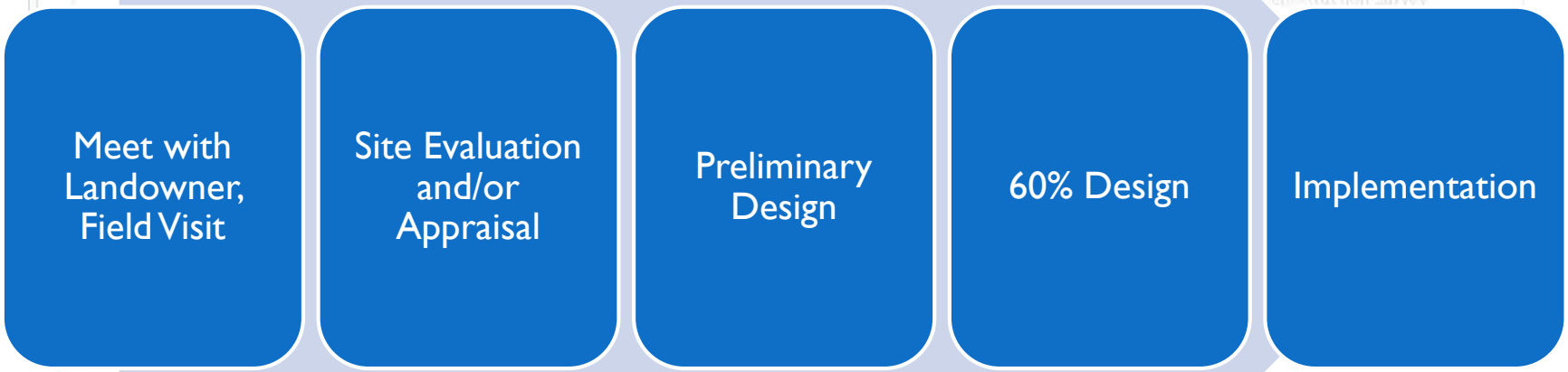
SEEPAGE PROJECT STATUS

SAN JOAQUIN RIVER RESTORATION PROGRAM

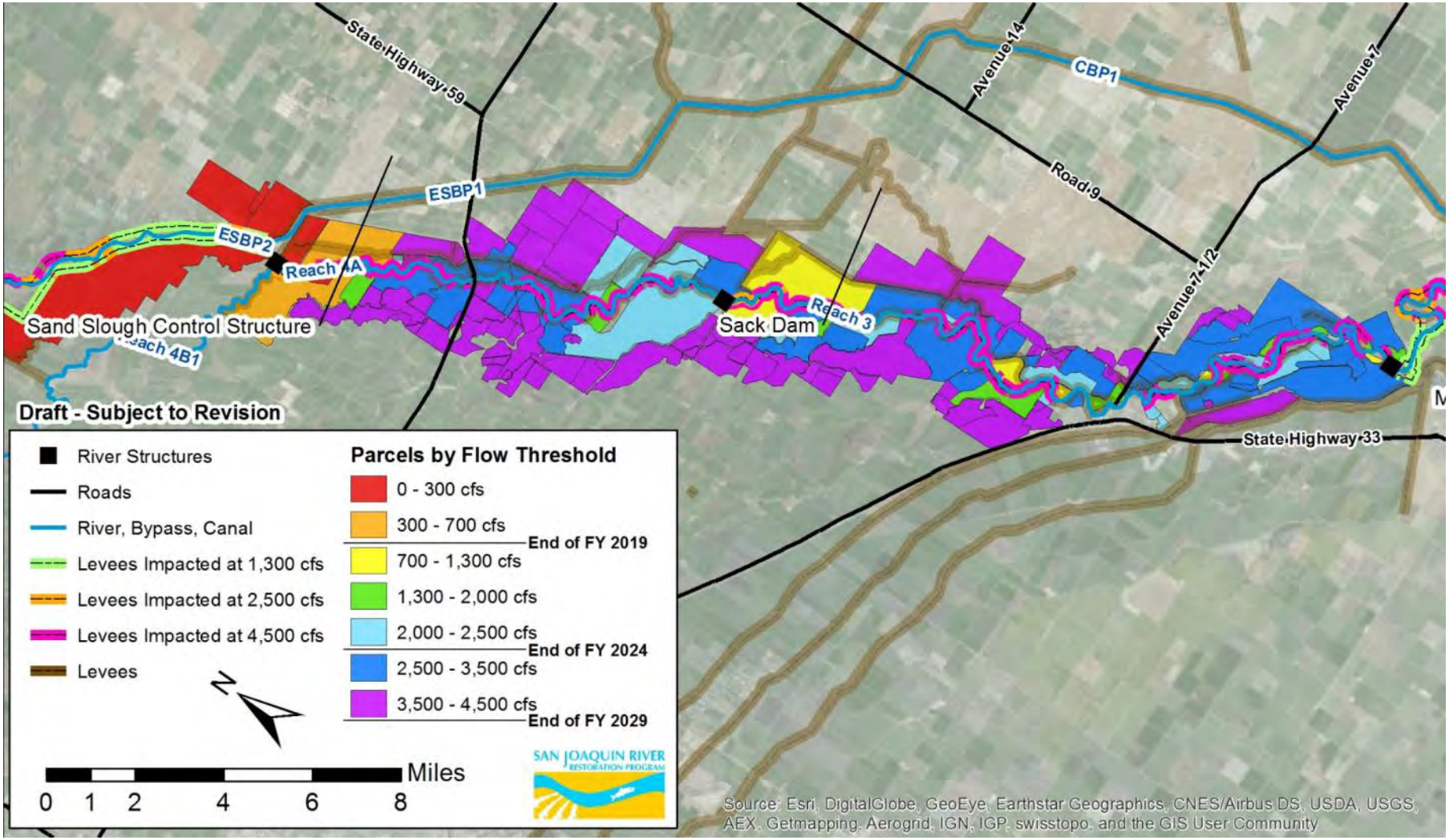
Seepage Project Process



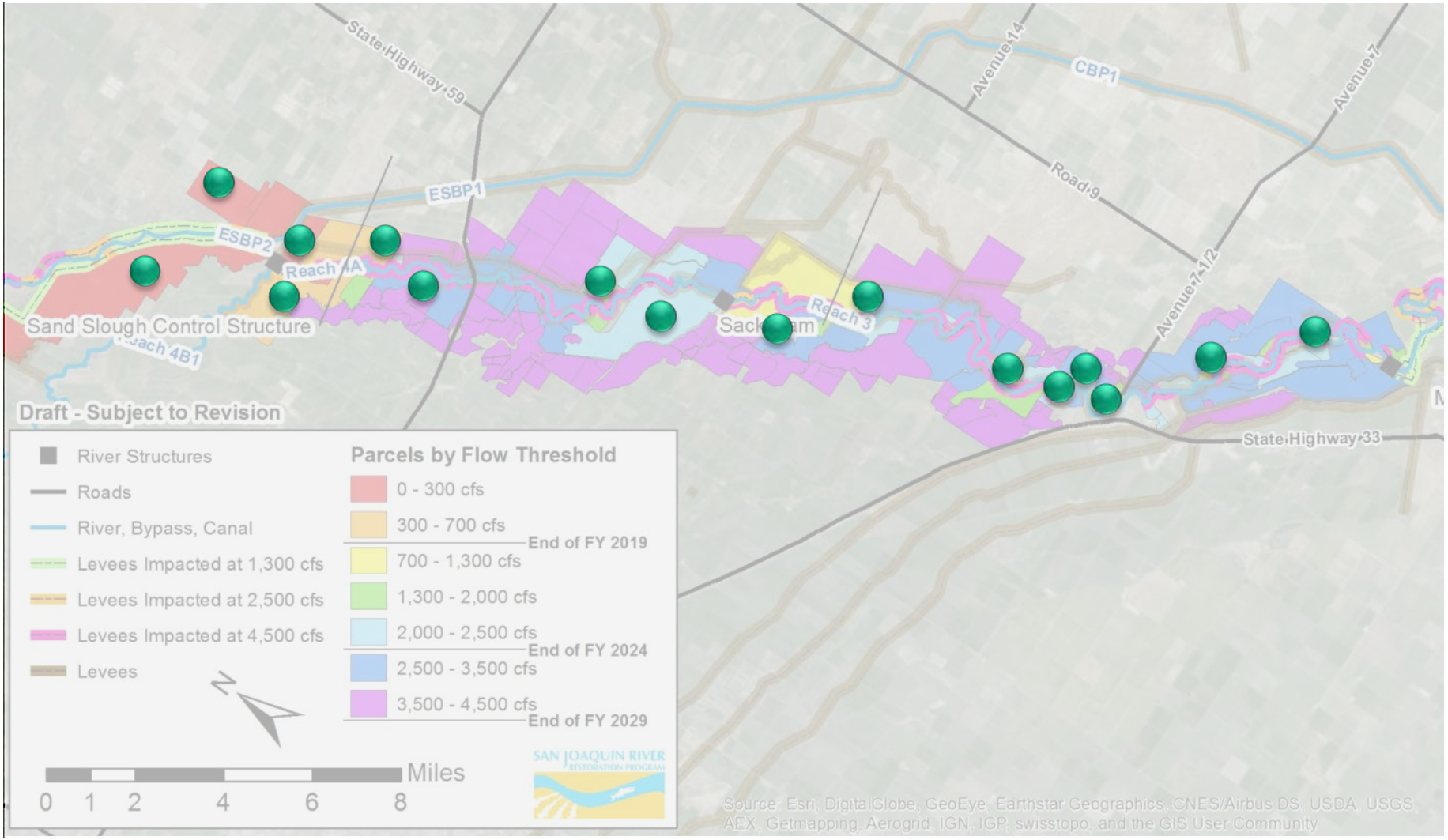
Seepage Project Process



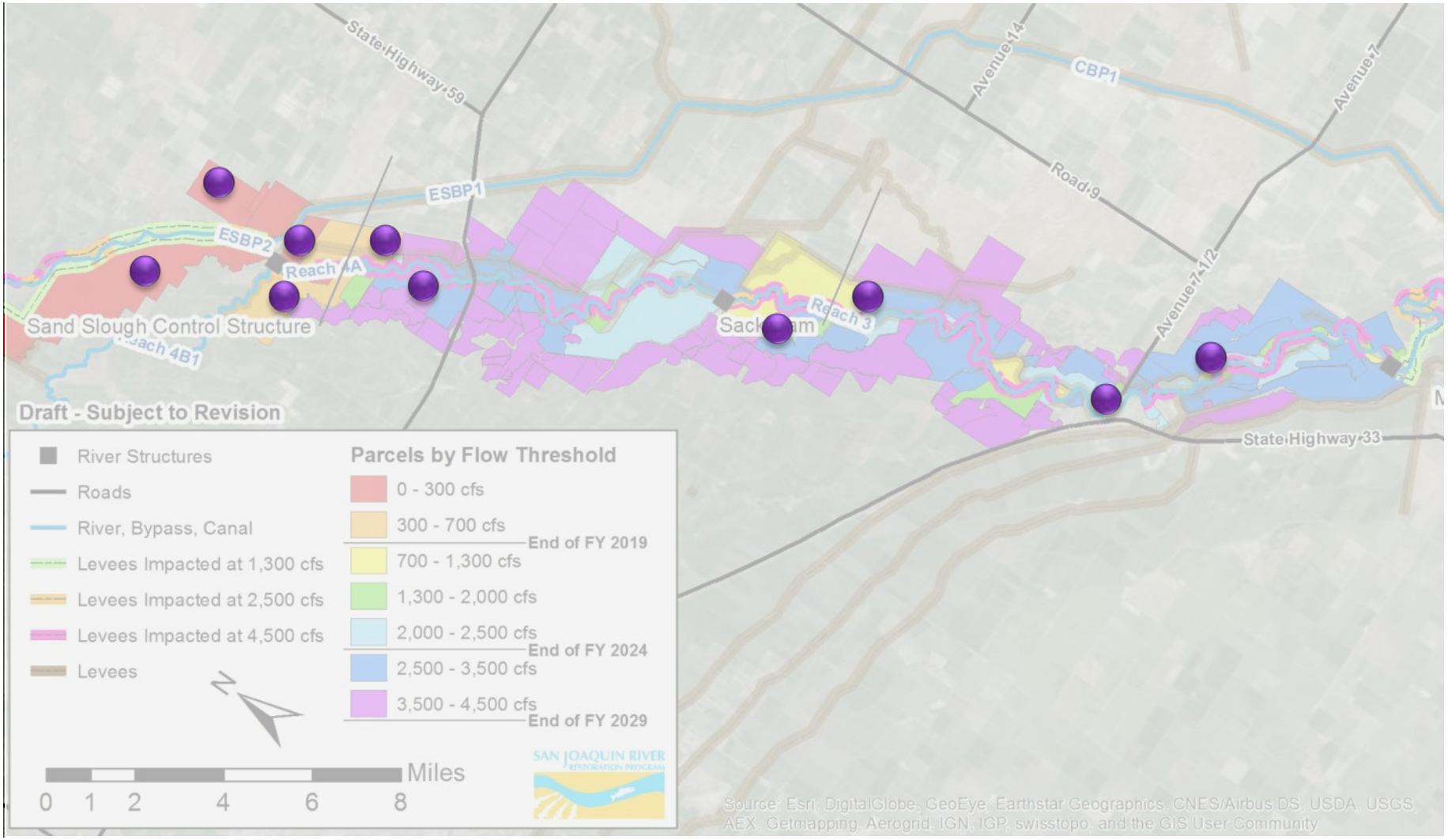
Seepage Project Prioritization



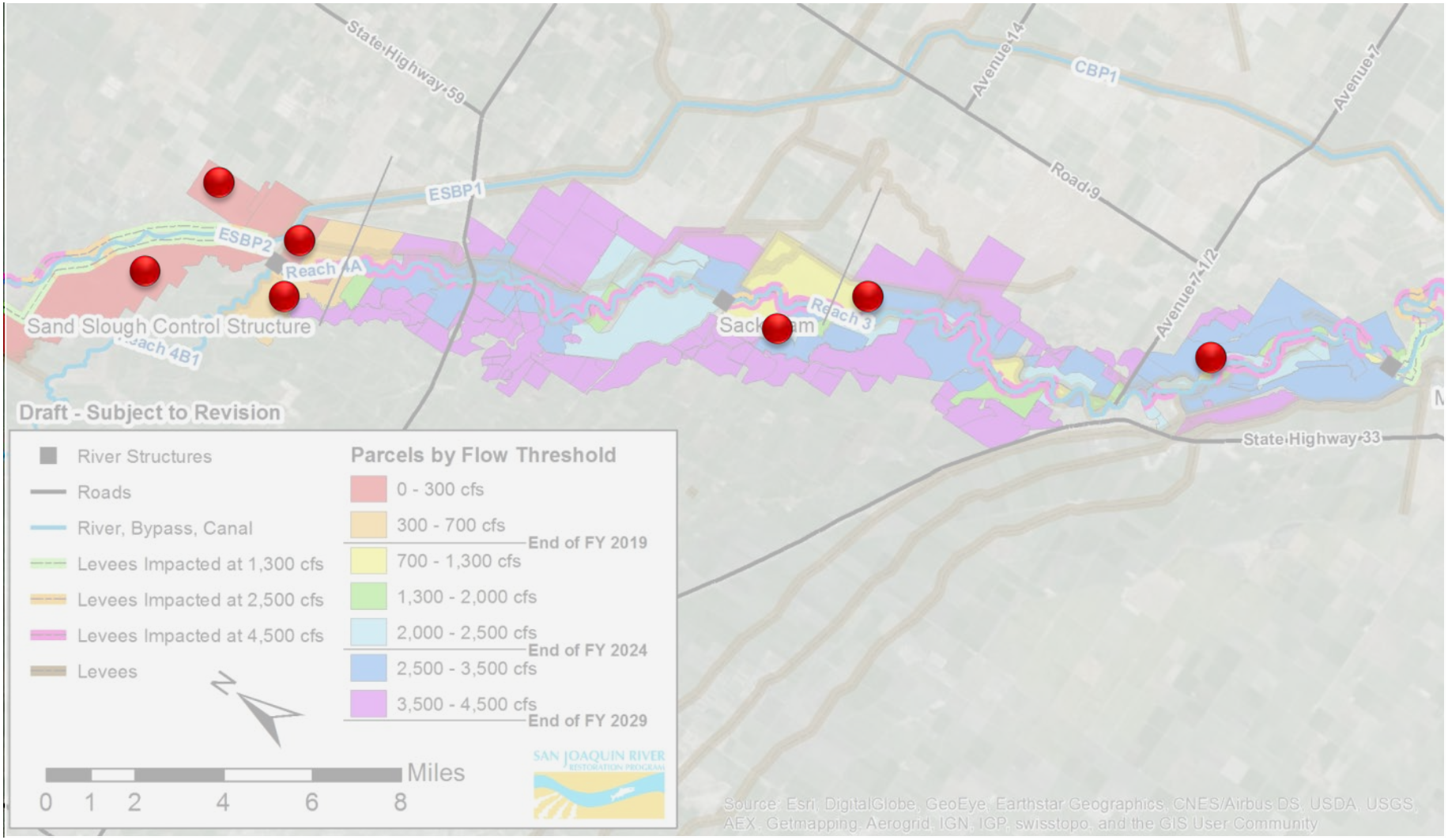
Site Visit, Meeting with Landowner



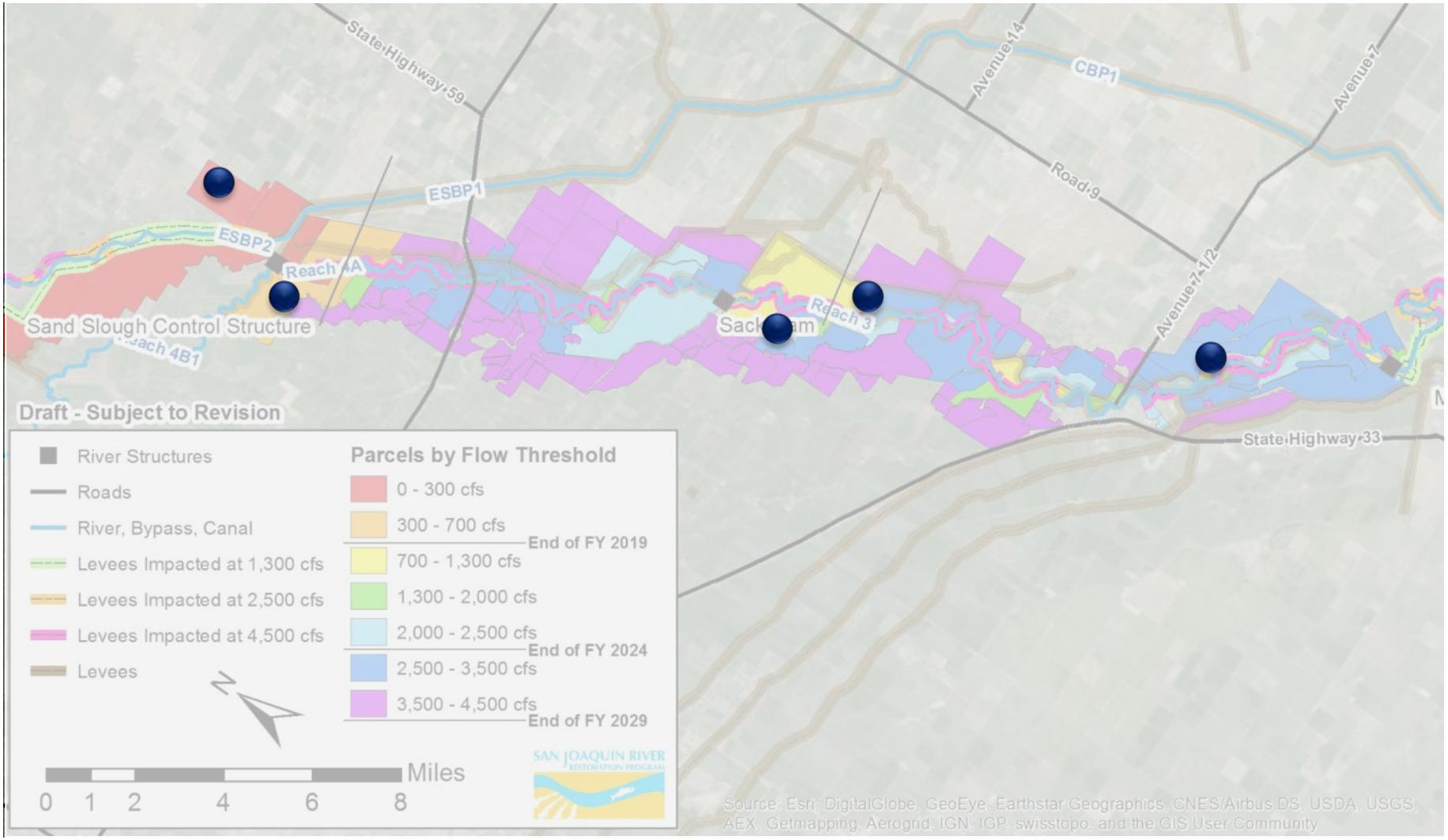
Site Evaluation for Seepage Effects



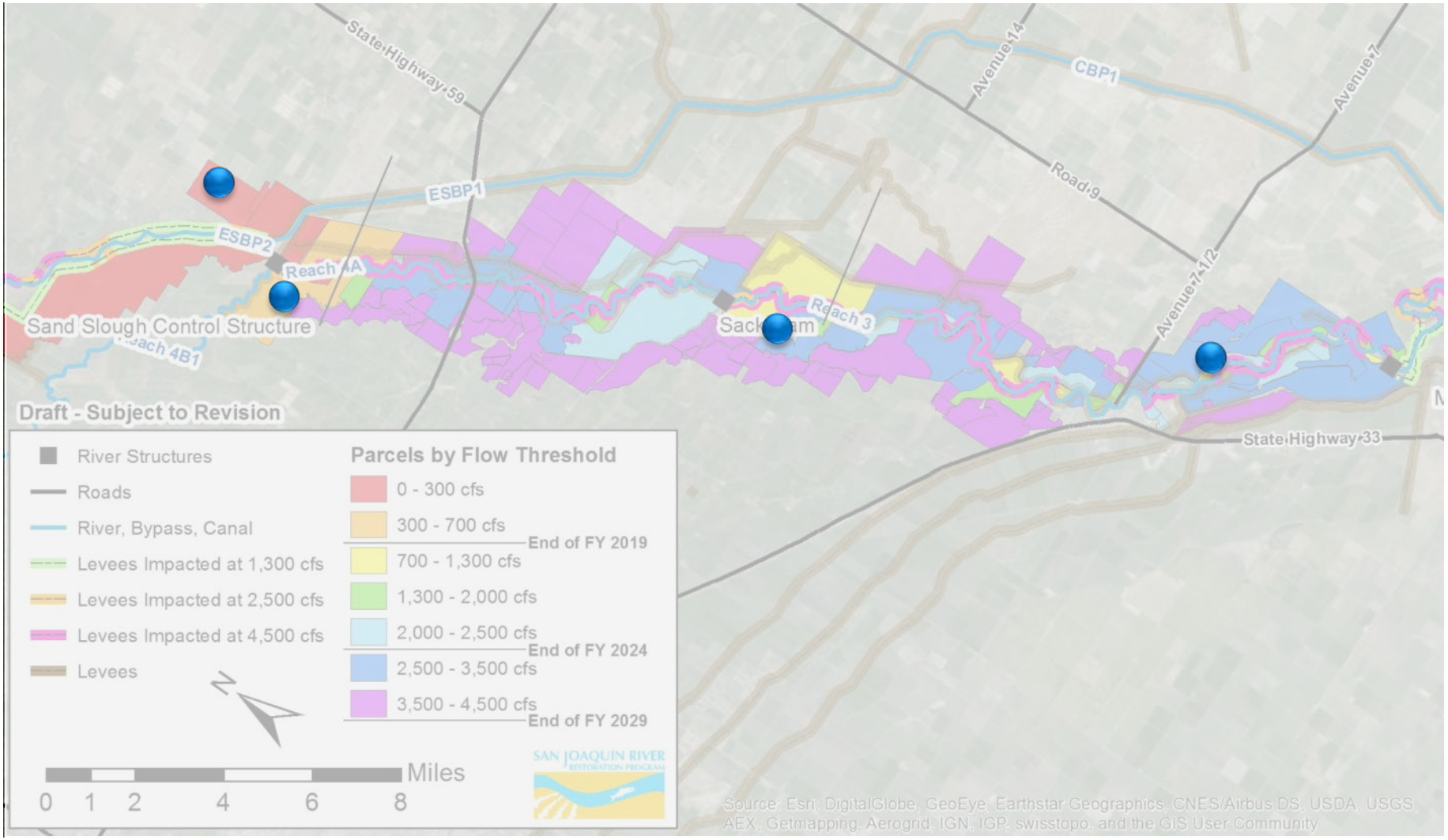
Preliminary Design, Seepage Project



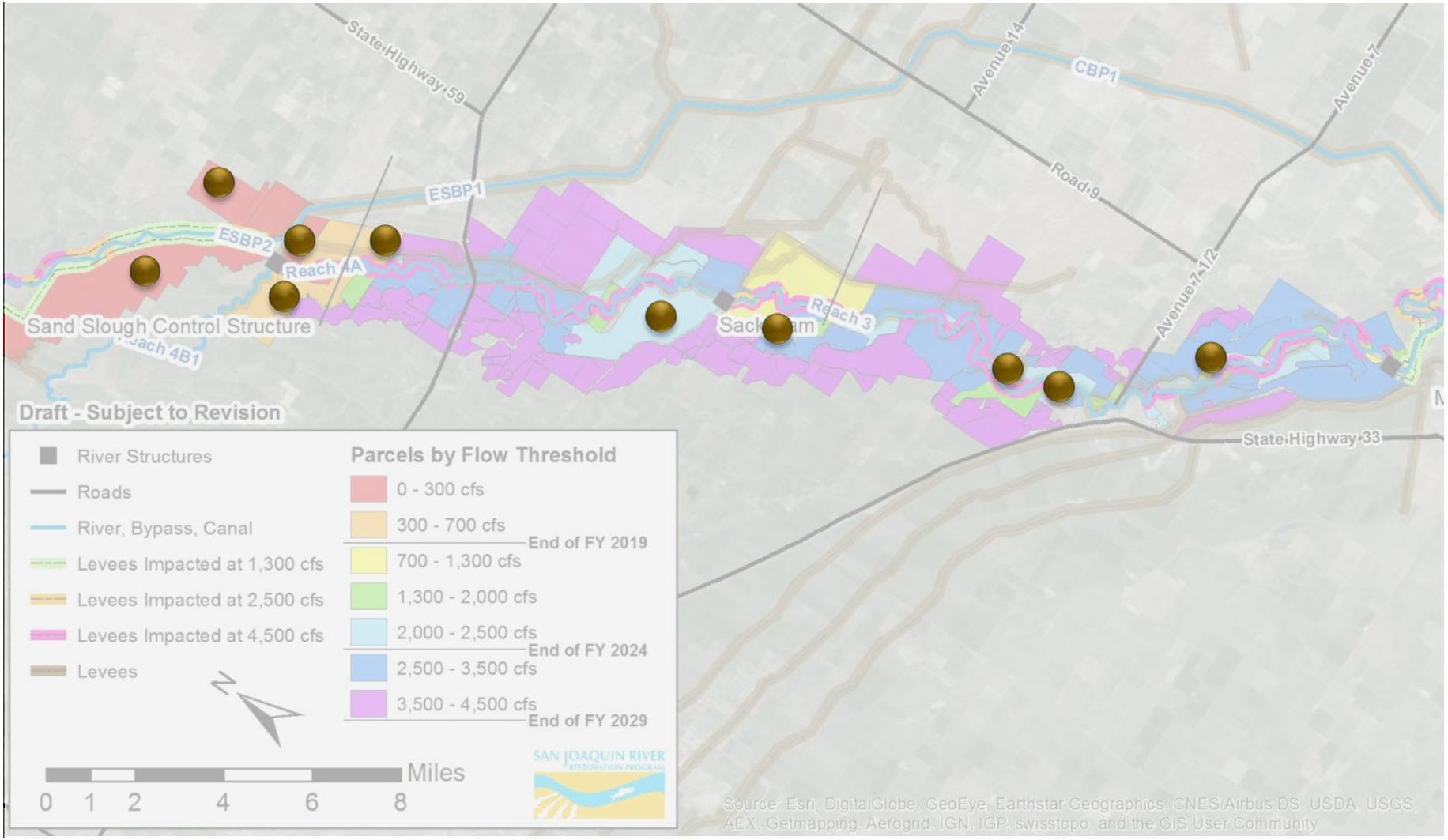
Hydraulic Conductivity Testing



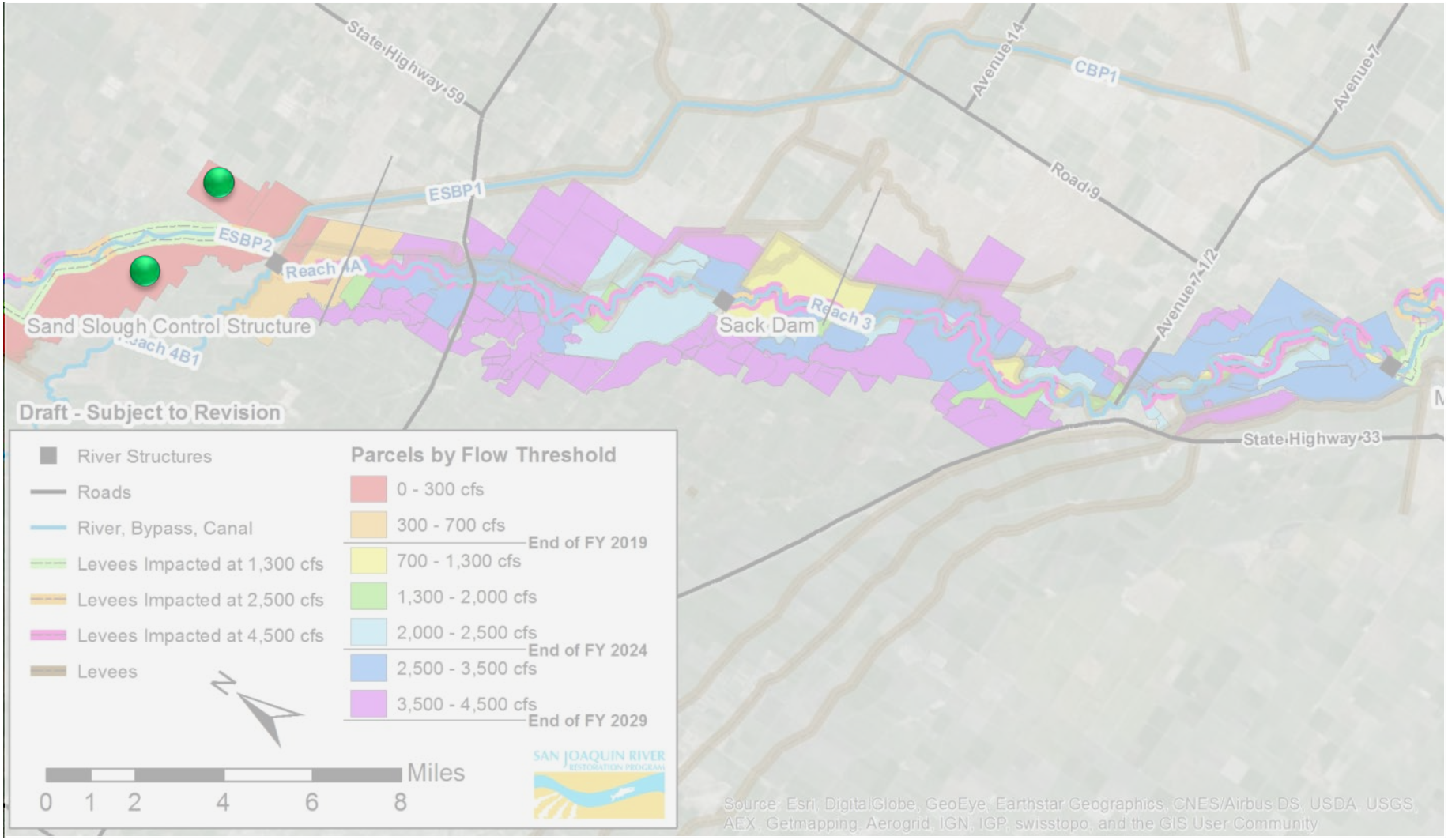
60% Design, Interceptor Line



Appraisal (Complete or Underway)



Completed Projects



Timelines

- 300 cfs in 2015-2016
- 700 cfs in 2016-2017
- 1,300 cfs by 2019
- 2,500 cfs by 2024
- 4,500 cfs by 2029

Flow	# Projects
300 cfs	3
700 cfs	2
1,300 cfs	6
2,000 cfs	11
4,500 cfs	70
Total	**92**

Katrina Harrison

SEEPAGE EASEMENTS

Purpose and Objective

- Variety of options available for groundwater seepage mitigation
- Realty actions include:
  - Seepage license agreements (rentals)
  - Seepage easements (permanent)
  - Acquisition (fee title purchase)
- Compensate for higher groundwater levels under the property

Discharge

- Reclamation-built interceptor line
  - Reclamation retains dominion and control
  - Water is SJRRP water protected under Order
  - Discharge goes to the river or for sale for the SJRRP
- Seepage easement
  - Landowner can build own interceptor line
  - Abandoned groundwater
  - Landowner or district can keep water

Easements with Interceptors

- How can Reclamation pursue a landowner specific approach?
- How can I be protected if my neighbor wants a seepage easement and I want an interceptor line?

- Whiteboard Examples

Gerald Hatler, SJRRP Program Manager

John C. Baker, Central Enforcement District Chief

FISHING REGULATION DISCUSSION

CDFW Angling Regulations

***Area or Body of Water*:** (A) From Friant Dam downstream to the Highway 140 bridge. (B) From the Highway 140 bridge downstream to the Interstate 5 bridge at Mossdale.

***Open Season and Special Regulations*:** All year.

***Daily Bag and Possession Limit*:** 2 hatchery trout or hatchery steelhead**; 4 hatchery trout or hatchery steelhead** in possession. Closed to the take of salmon.

**Hatchery trout or steelhead in anadromous waters are those showing a healed adipose fin clip (adipose fin is absent). Unless otherwise provided, all other trout and steelhead must be immediately released. Wild trout or steelhead are those not showing a healed adipose fin clip (adipose fin is present).

Section 1.04. ANADROMOUS WATERS.: Anadromous waters are inland waters that are accessible to fish migrating from the ocean.

CDFW Angling Regulations

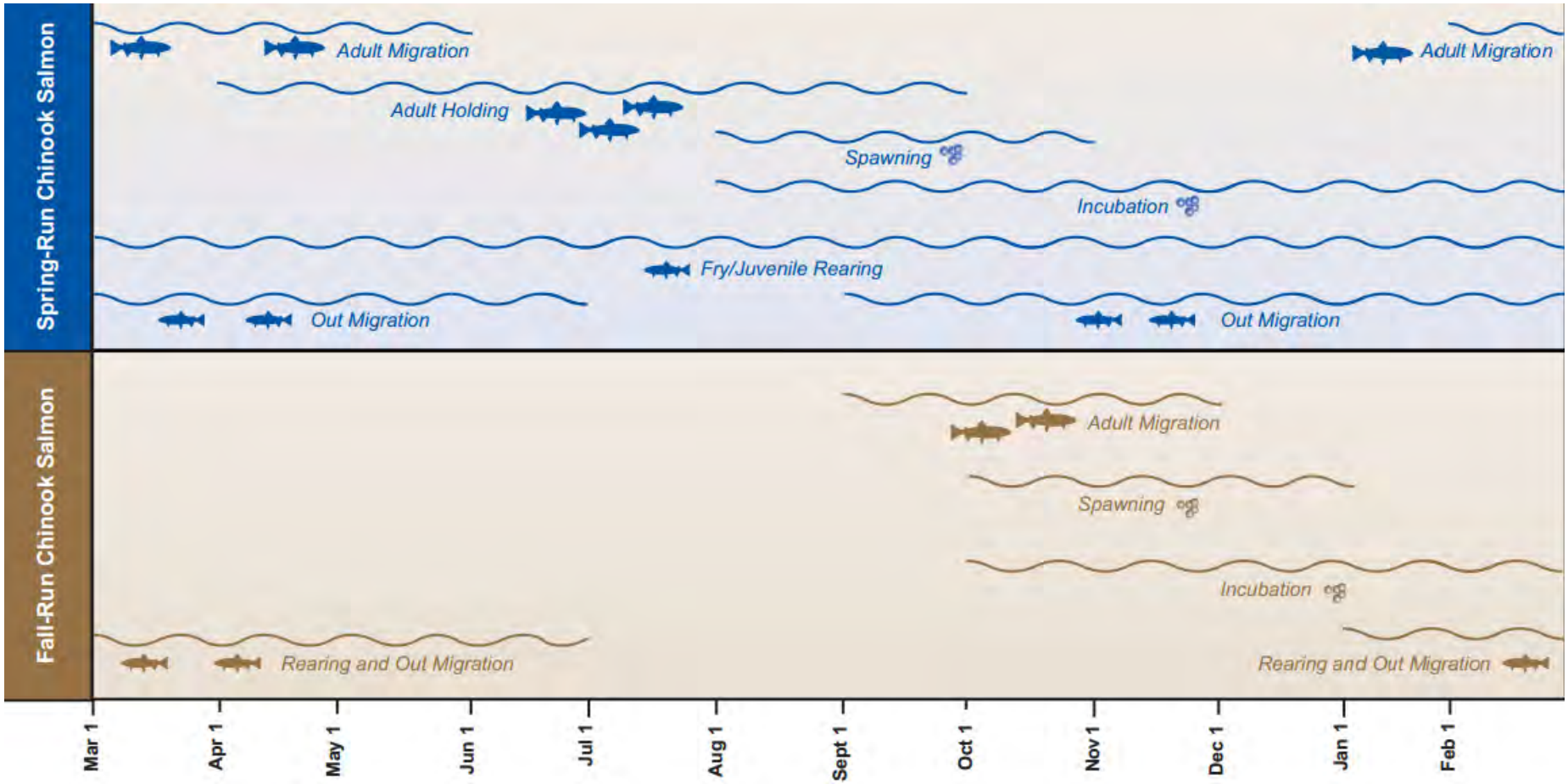
Future Angling Regulations

National Marine Fisheries Service: Nonessential Experimental Population Designation and 4(d) Take Provisions for Reintroduction of Central Valley Spring-Run Chinook Salmon to the San Joaquin River Below Friant Dam

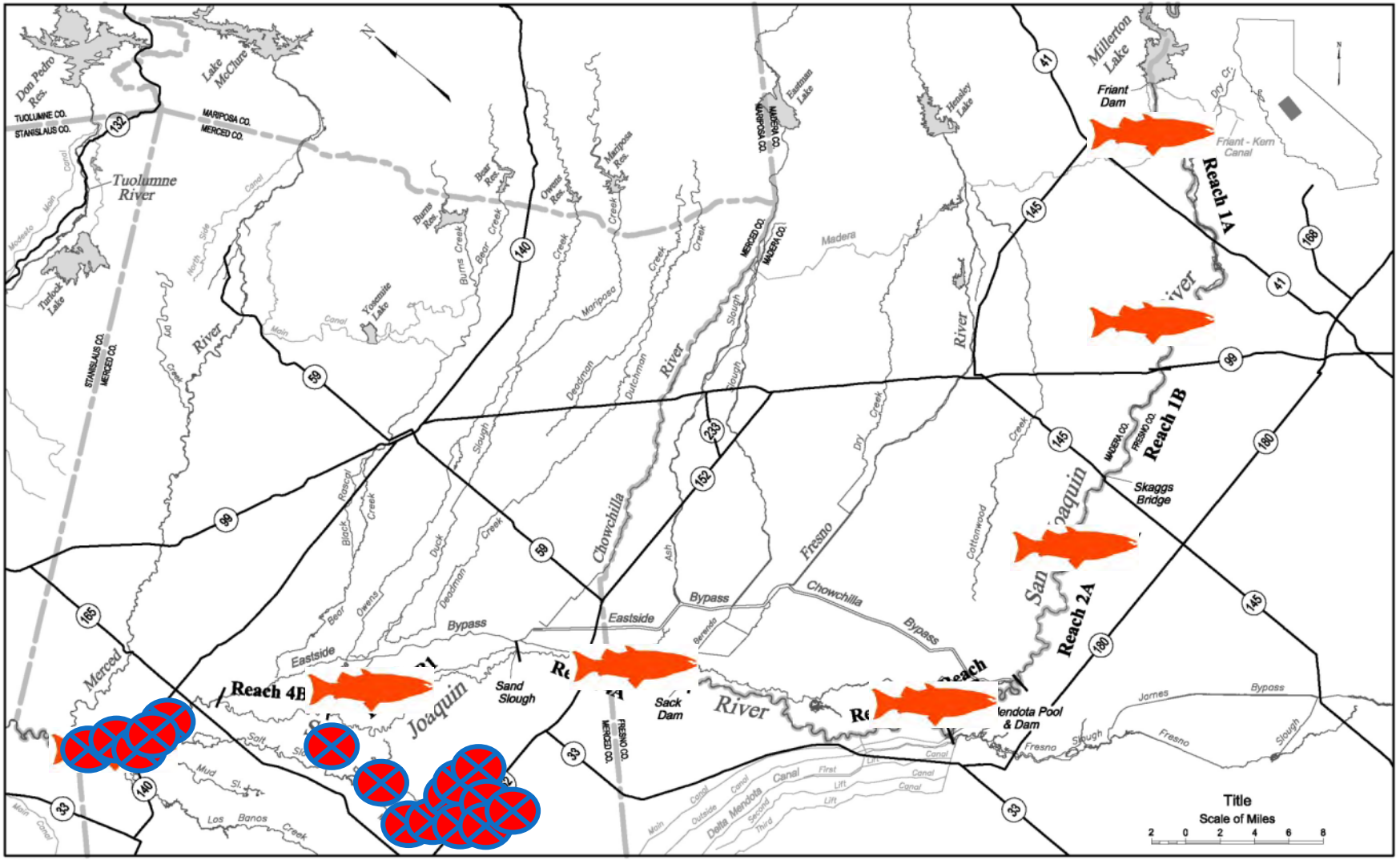
78 Fed. Reg. 79632-69633 (December 31, 2013); 50 C.F.R. § 223.301(b) (2013)

"…we prohibit the intentional take of CV spring-run Chinook salmon in the experimental population area by angling. We intend to work with CDFW to review fishing regulations in the geographic area in order to minimize the impact of this prohibition on current angling on other species. In the future, if the experimental population becomes established, we may consider allowing limited harvest of CV spring-run Chinook salmon in the experimental population area through a Fishery Management and Evaluation Plan developed by CDFW and approved by NMFS."

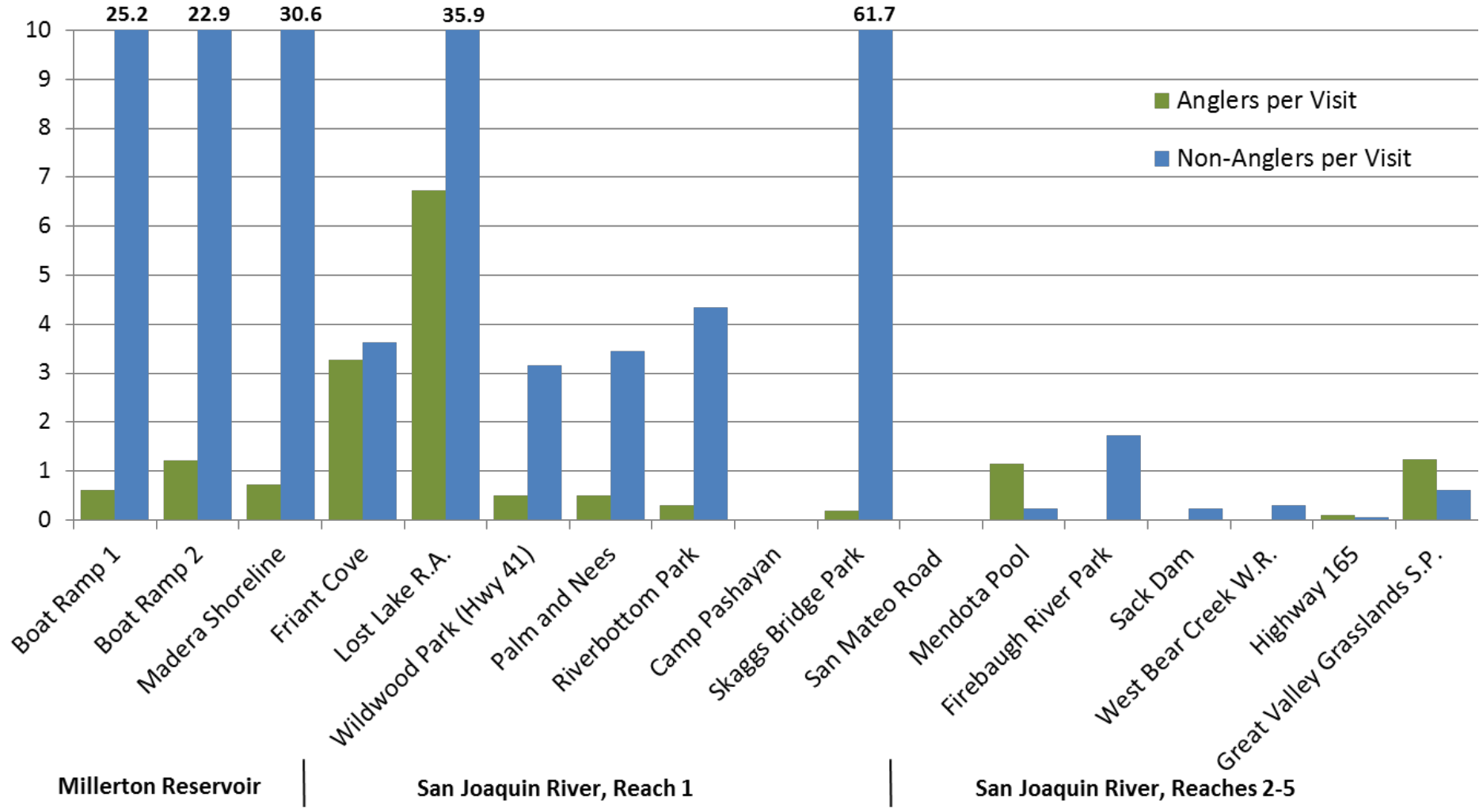
Salmon Life History



Salmon Life History



San Joaquin River Angling



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WRAP-UP, ACTION ITEMS

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