SAN JOAQUIN RIVER RESTORATION PROGRAM

Seepage and Conveyance Technical Feedback Group Meeting

March 31, 2016

(recap of February 12, 2016 Meeting)

Preliminary draft – subject to change

Agenda

- Introductions
- Purpose
- Operational Decision Making
- Almond Study – Phase 1
  - Response to Comments
- Almond Study – Phase 2
  - Potential Field Program
- Wrap-Up, Action Items

Katrina Harrison

PURPOSE

Meeting Purpose

- Recap of February 12, 2016 SCTFG Meeting
- 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

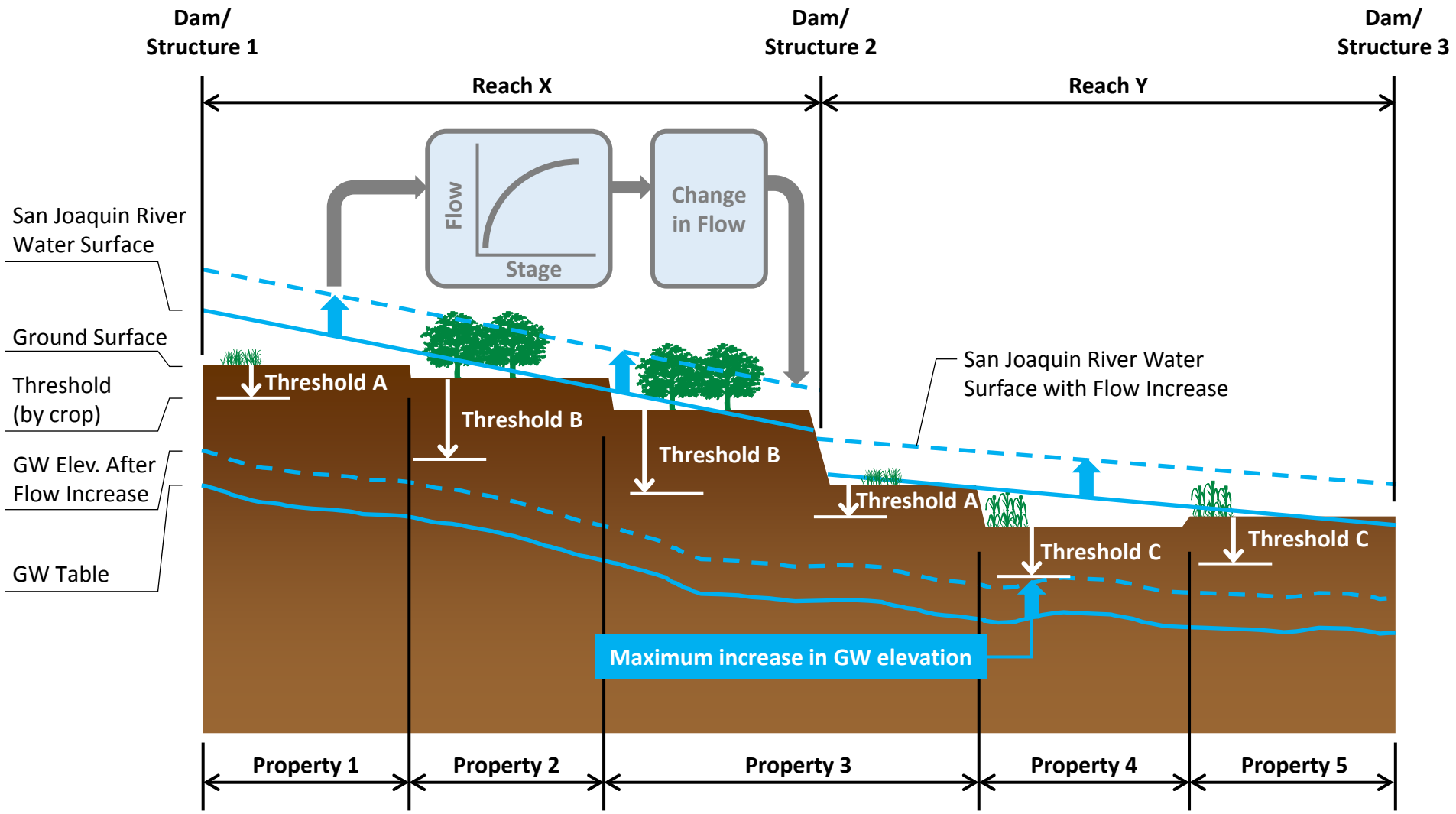
Katrina Harrison

OPERATIONAL DECISION MAKING

OPERATIONS VS. THRESHOLDS

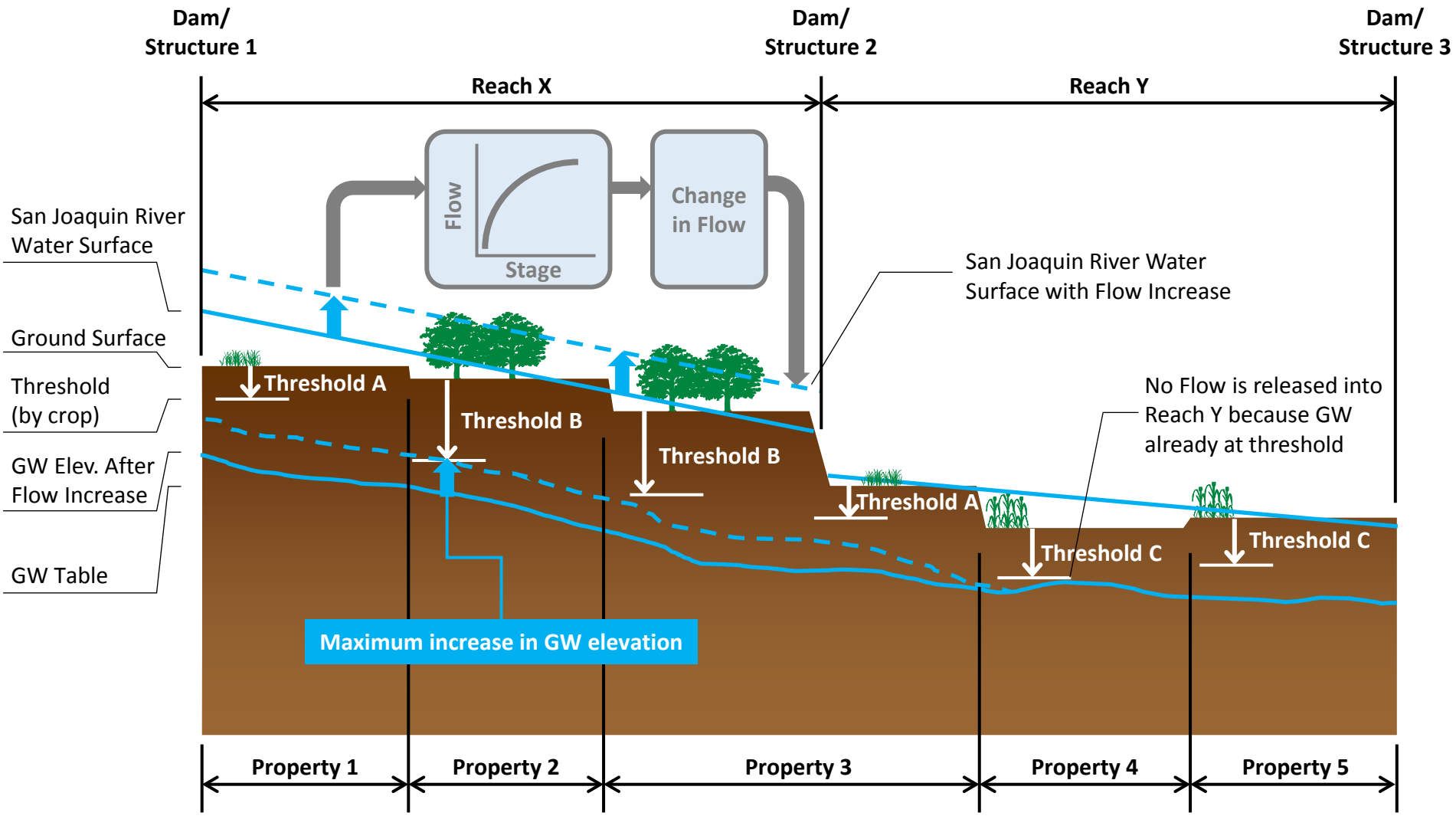
SAN JOAQUIN RIVER RESTORATION PROGRAM

Operate to Thresholds, Example 1



Preliminary draft – subject to change

Operate to Thresholds, Example 2



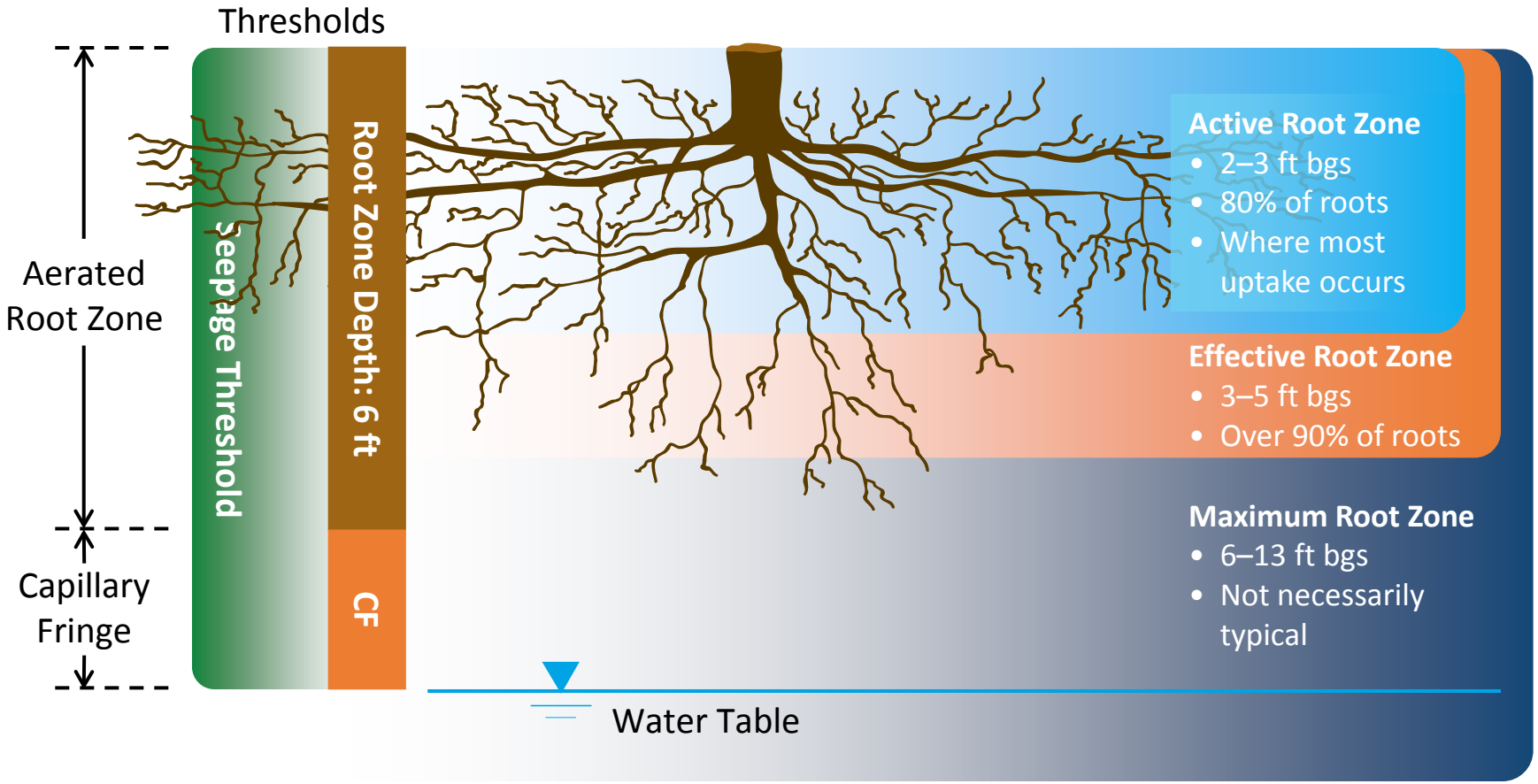
Preliminary draft – subject to change

Mica Heilmann, Stephanie Tillman

PHASE I ALMOND STUDY

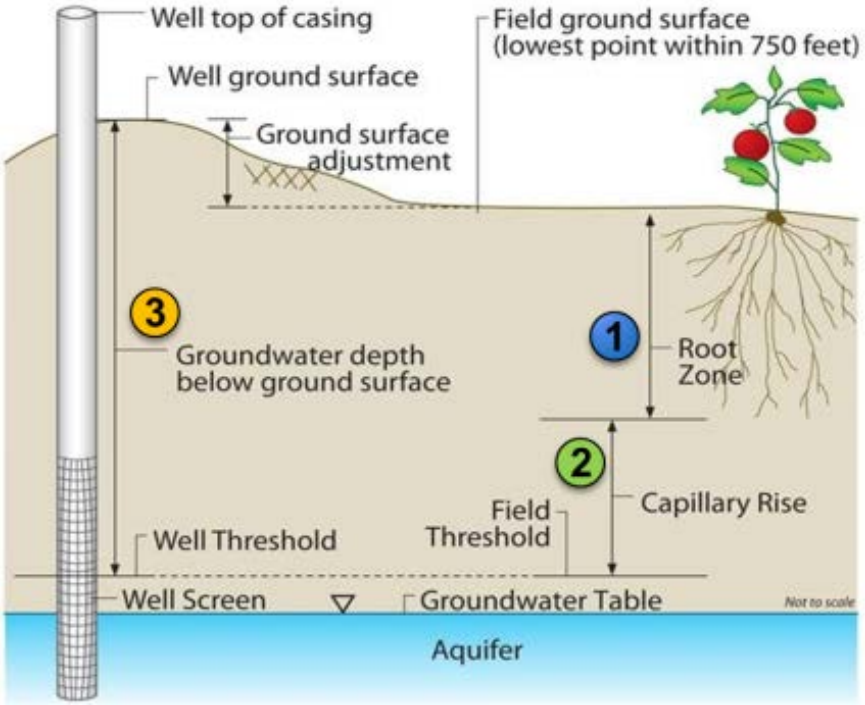
RESPONSE TO COMMENTS

Root Zone Threshold Terms



Preliminary draft – subject to change

Threshold Calculation: Agricultural Practices Method



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

Preliminary draft – subject to change

Conclusions from Comments

- General agreement on 6 foot root zone
- Must be combined with a capillary fringe of up to 4 feet depending on site-specific factors
- Capillary fringe was not considered as part of Phase 1 Study
  - Current 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
  - Likely, no change in threshold in silt / clay soil types

Mica Heilmann

PHASE 2 ALMOND STUDY

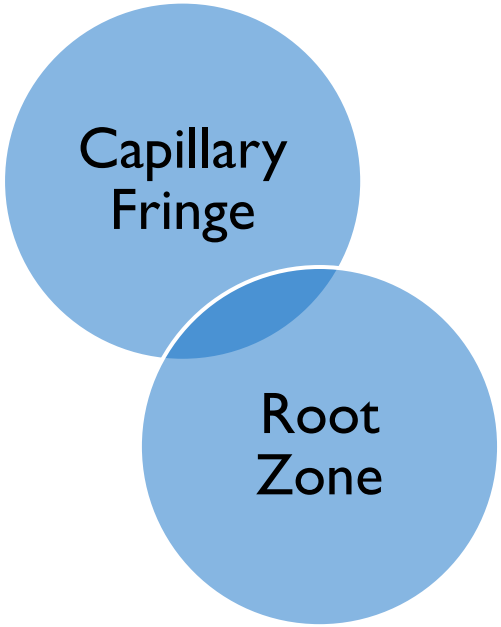
POTENTIAL FIELD PROGRAM

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

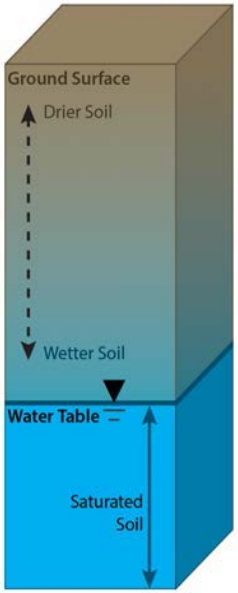
Potential Phase 2 Study

- 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

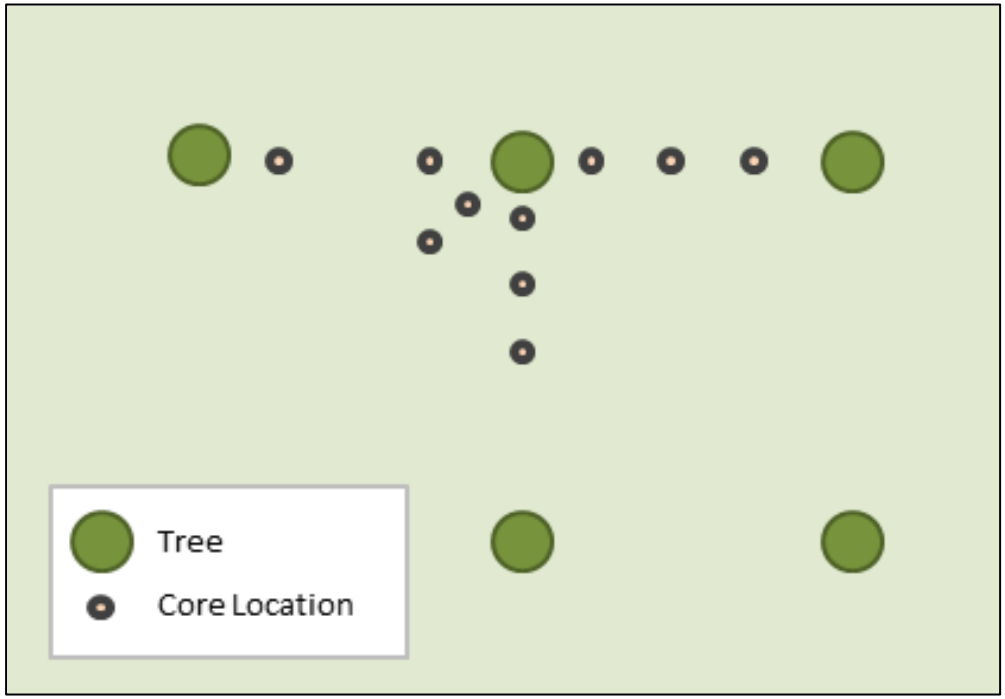
Conceptual approach (cont.):

- 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?

WRAP-UP, ACTION ITEMS

Contact

- Technical Feedback Group: Katrina Harrison
  - 916-978-5465
  - KHarrison@usbr.gov
- Seepage Concerns: Seepage Hotline
  - 916-978-4398
  - RestorationFlows@restoresjr.net

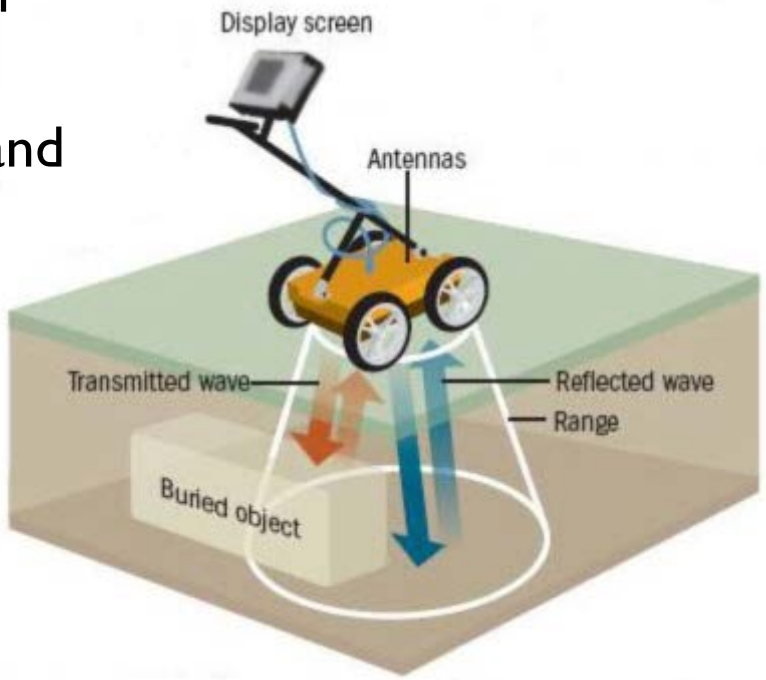
Do Not Print

BACK-UP SLIDES

FIELD STUDY METHODS

Methods of Studying Root Depth

- Non-invasive
  - Ground Penetrating Radar
    - Transmits and senses waves from different media
    - Restricted to specific soil types and dry soils
  - Differential Electric Conductance
    - Measures differences in conductance caused by moisture
    - Technology needs more development



Methods of Studying Root Depth

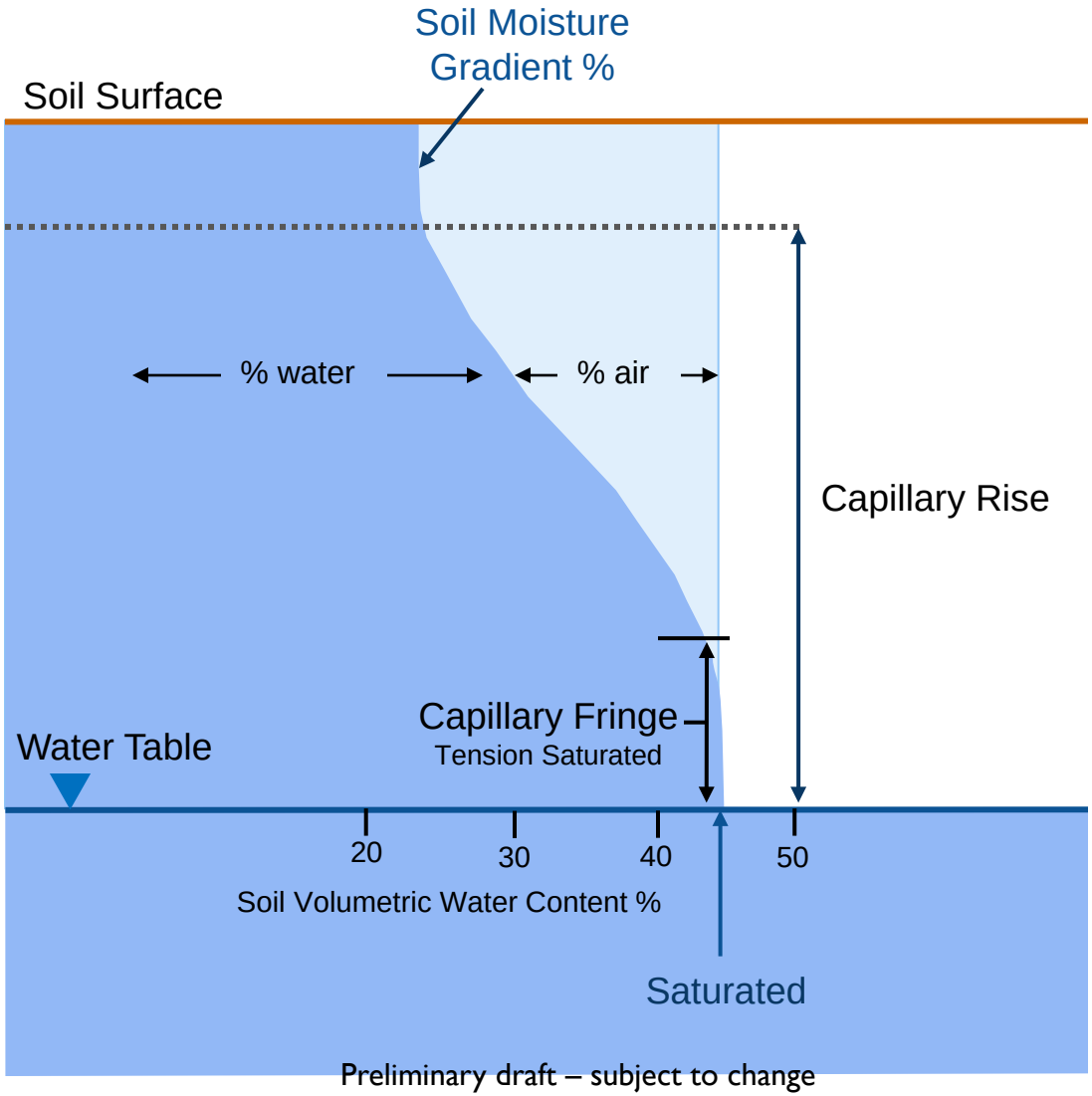
- High Invasive
  - Whole Root Excavation and/or Pits and Trenches
    - Time, effort and cost intensive
    - Safety concerns
  - Root Excavation by Supersonic Airstream
    - "Blasts" soil away from roots
    - Time, effort and cost intensive
    - Requires specialized equipment and training

Methods of Studying Root Depth (continued)

- 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

CAPILLARY FRINGE

Capillary Fringe



Preliminary draft – subject to change

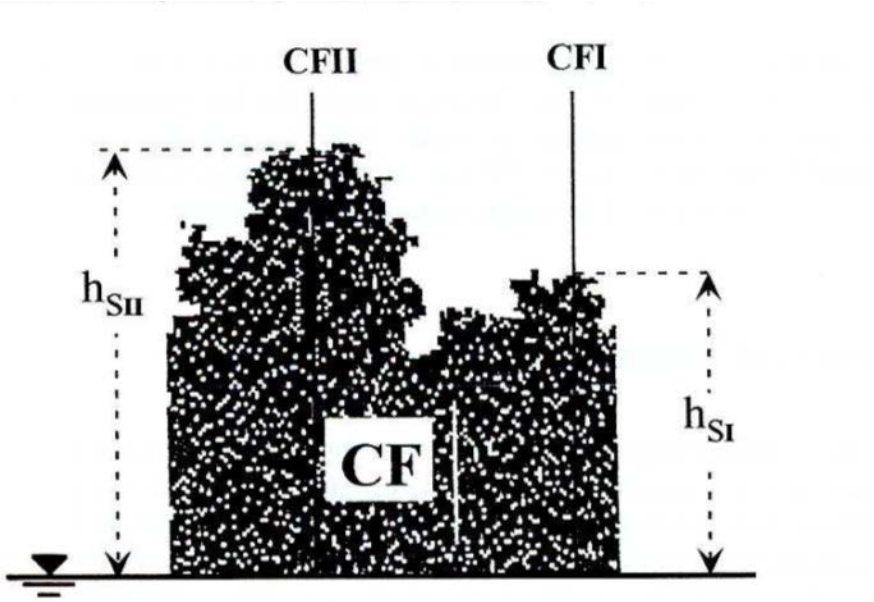
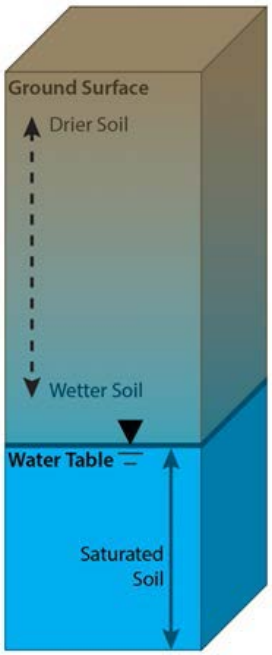
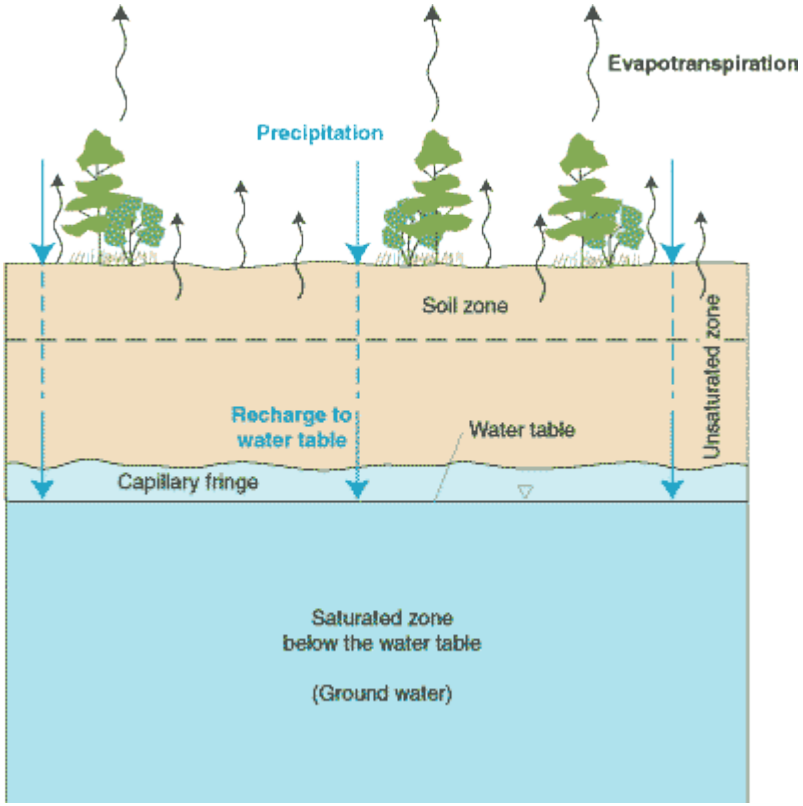


Figure A-2.
Vertical Section of 3D Capillary Fringe Simulation.
CF=Capillary Fringe (I and II); H=Height; S=Saturation.


Ground Surface
Drier Soil
Wetter Soil
Water Table
Saturated
Soil


Evapotranspiration
Precipitation
Soil zone
Unsaturated zone
Recharge to
water table
Water table
Capillary fringe
Saturated zone
below the water table
(Ground water)

SAN JOAQUIN RIVER RESTORATION PROGRAM

Terminology

Active Root Zone

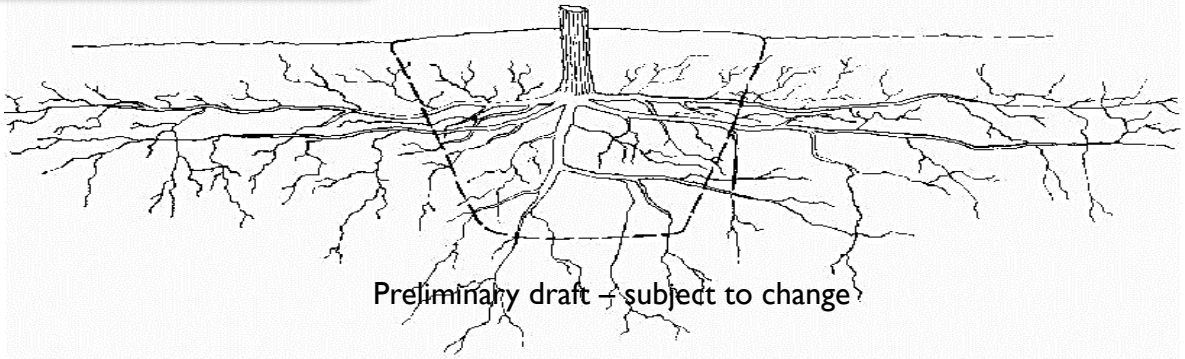
- The portion of the effective root zone where most of the nutrient and water uptake occur

Effective Root Depth

- Typically thought of as the zone where most of the roots are and where most of the root function (anchorage, water and nutrient uptake) takes place

Maximum Root Depth

- The total depth that a tree's roots can (but don't necessarily) reach



Joe Brummer

CAPILLARY FRINGE OBSERVATIONS

Capillary Fringe Observations

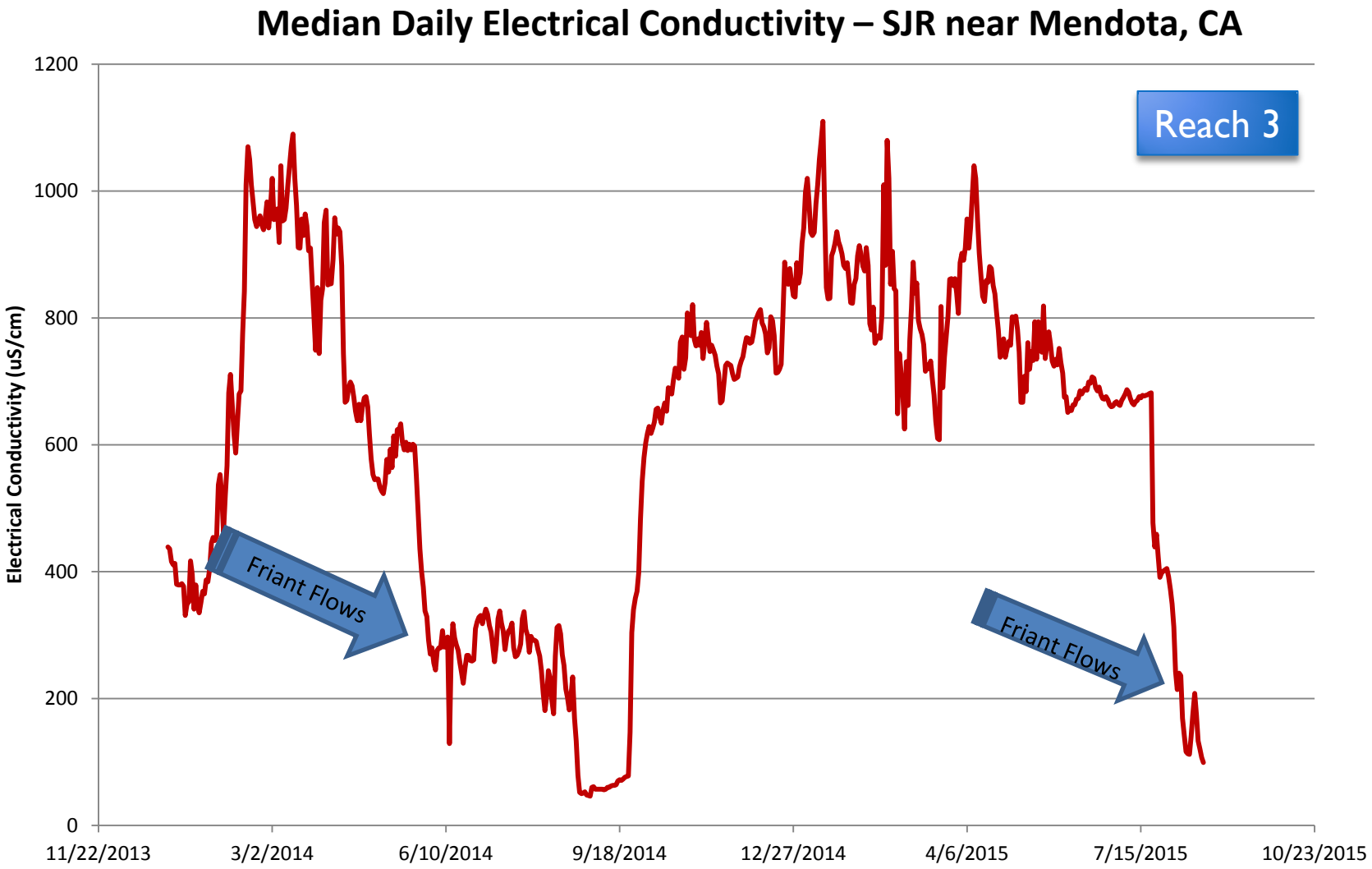
Category	Soil Texture	Number of Observations	Average Rise, Inches	95% Confidence Range, inches
1	Sand, loamy sand	15	6.9	4.1 – 9.1
2	Sandy loam, loamy fine sand	4	13.75	9.5 – 18.1
3	Fine sandy loam, loam, silt loam, very fine sandy loam	21	18.3	14.3 – 22.3
4	Clay loam, silty clay loam, clay	6	10.3	5.1 – 15.5
2 and 3	Loamy fine sand, silt loam	25	17.6	14.1 – 20.9

Capillary Fringe Observations

2009 to 2015					
Category	**Number of Observations**	**Average Thickness (Inches)**	**95% Confidence Range (Inches)**	**Anoxic Zone Thickness (Inches)**	**Anoxic Zone Adjustment (Inches)**
Sands, loamy sands	39	8.6	7.2 - 10.0	4.3	6
All other soils	160	17.0	15.5 - 18.5	8.5	12
All soils	199	15.4	14.1 - 16.7		

SAN JOAQUIN RIVER RESTORATION PROGRAM

Water Quality Improvement



Preliminary draft – subject to change