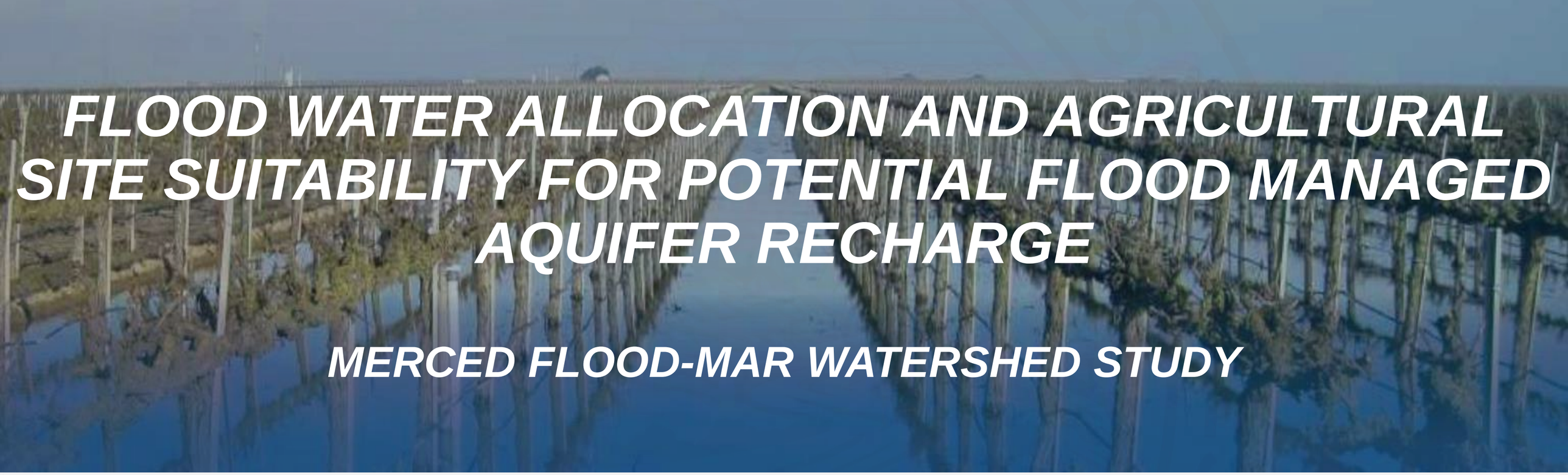


FLOOD WATER ALLOCATION AND AGRICULTURAL SITE SUITABILITY FOR POTENTIAL FLOOD MANAGED AQUIFER RECHARGE

MERCED FLOOD-MAR WATERSHED STUDY

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

ESA

MBK ENGINEERS

Sustainable Conservation

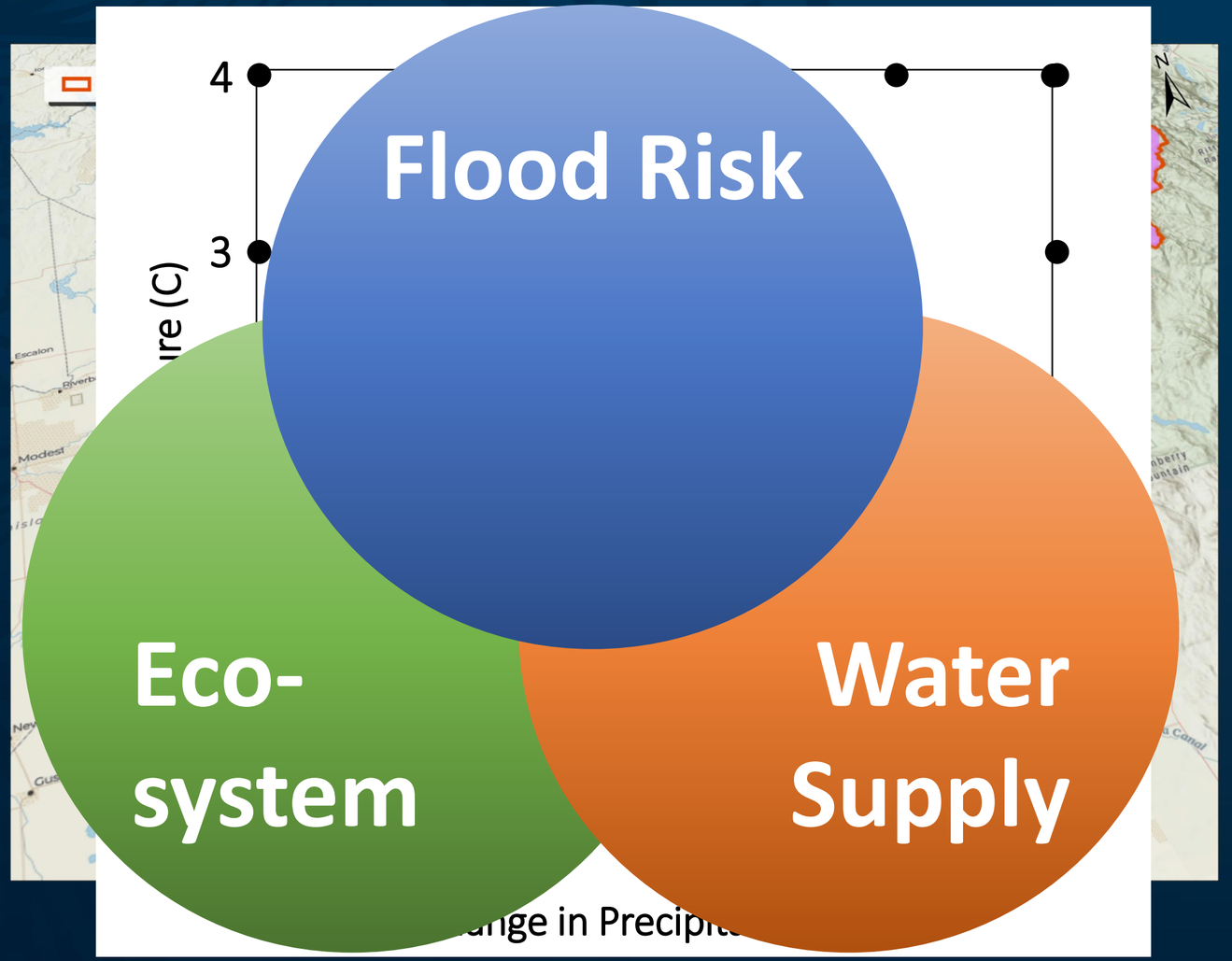
WOODARD &CURRAN

theEARTH GENOME
REVEALING THE POSSIBLE

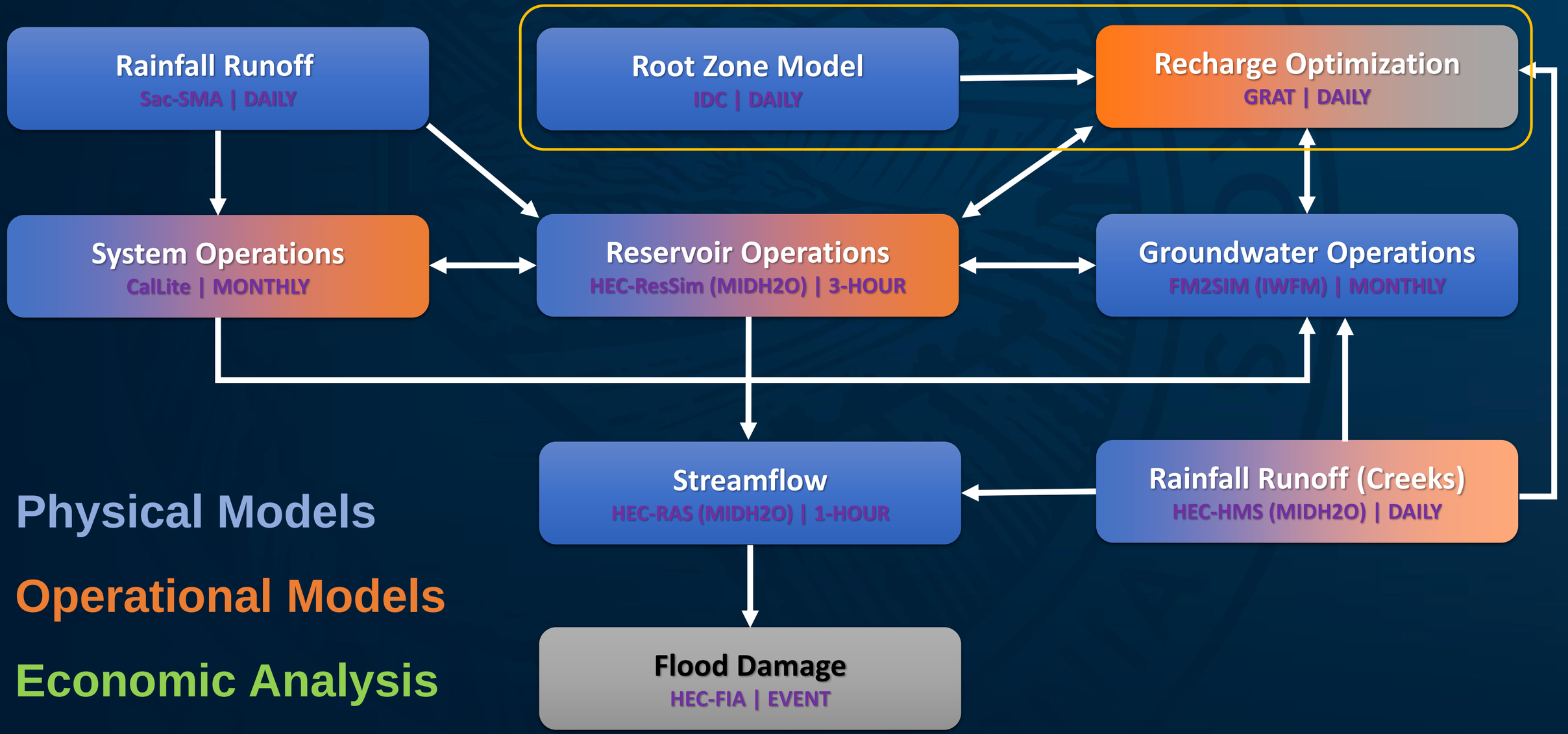
MID MERCED IRRIGATION DISTRICT
WATER & POWER

WHAT IS MERCED WATERSHED STUDY?

- watershed-scale reconnaissance study
- application of decision-scaling
- assess multi-sector effects
  - climate change
  - Flood-MAR
- using an integrated headwater-to-groundwater toolset



Integrated “headwater-to-groundwater” modeling



Water Allocation and Agricultural Site Suitability

Root Zone Model

IWFM Demand Calculator (IDC) | DAILY

- Simulates the root zone saturation levels
- Determines the floodwater application, frequency, & dry-down intervals to maintain acceptable soil O_2 conditions

- Inputs
  - Crop types
  - Soil properties
- Outputs
  - Applied floodwater per unit area (inches)

Recharge Optimization

Groundwater Recharge Assessment Tool (GRAT) | DAILY

- Evaluates where, when, and how much water can be applied
- Uses best available data and hydrologic, agronomic and geologic science

- Inputs
  - Flood-MAR Diversion
  - Conveyance
  - Soil Properties
  - Recharge Suitability
  - Crop Compatibility Calendar
- Outputs
  - Recharge Locations
  - Flood-MAR Schedule

Root Zone Model | IDC Conceptual Model

- Conceptual model to simulate crop and soil type combinations
- Enhance GW recharge assumptions in GRAT
- Inputs: Daily timestep
  - Crop type
  - Soil type properties
- Outputs: Daily timestep
  - Applied floodwater per unit area (inches)

Crop Type - Land IQ 2014	Alfalfa	Almonds	Pistachios	Vineyards	Walnuts	Idle (Fallow Land)
Root Depth (ft)	6.0	6.0	6.0	6.0	6.0	6.0
	13	14	15	16	17	18
	7	8	9	10	11	12
	1	2	3	4	5	6

Crop/Land Use Type (Land IQ 2014)

Soil Type (SAGBI Index)

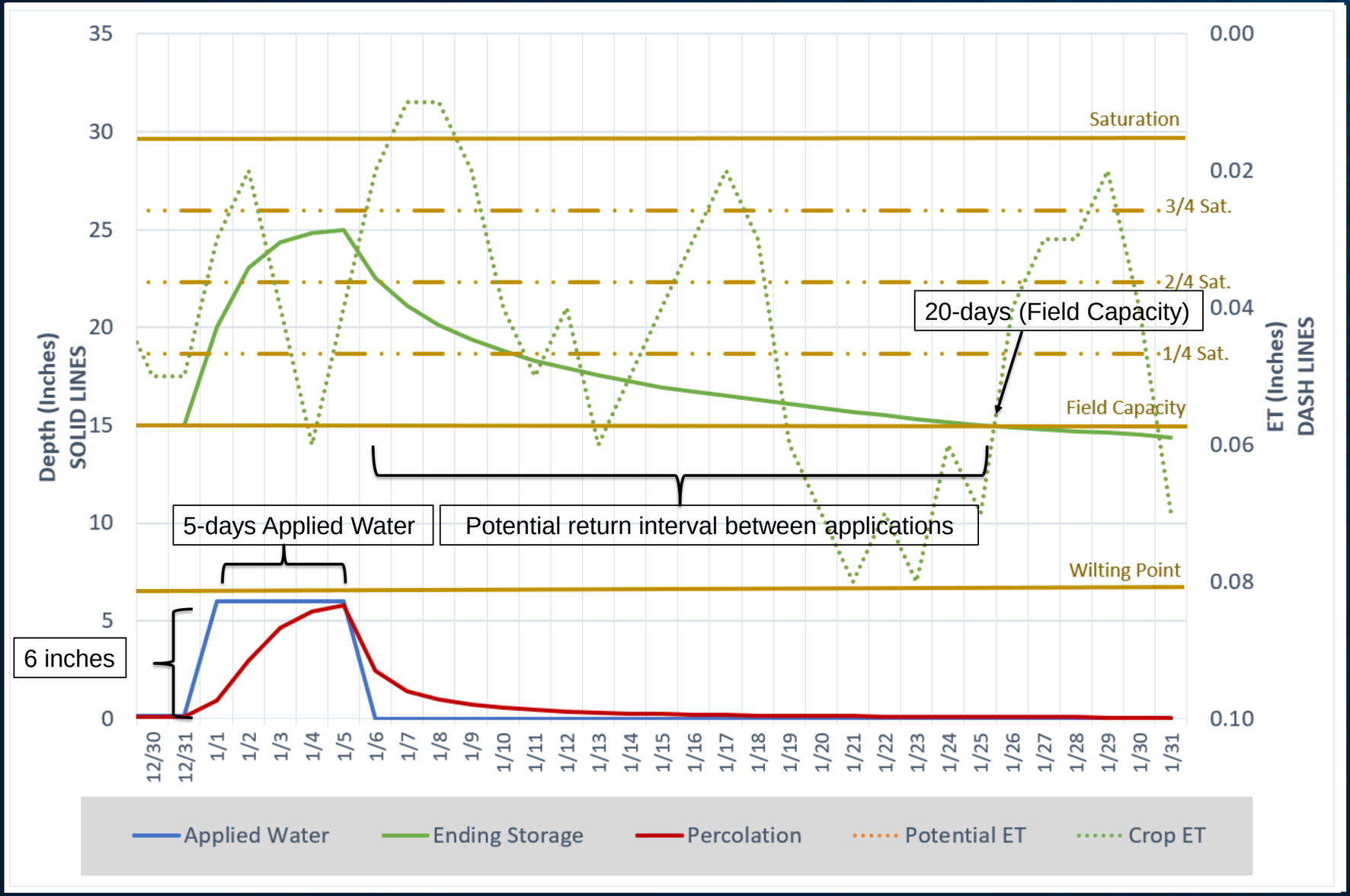
12

1-Acre Grid

Soil Types Properties - Rawls et. al. 1982

SAGBI Suitability Index	Soil Texture Type	Median Ksat (ft/day)	Wilting Point (%Vol)	Field Capacity (%Vol)	Saturation Water Content (%Vol)	Effective Porosity (%Vol)	Lamba-Pore Size Distribution (dimensionless)
Excellent	Sand	7.9	6.4	13.7	37.6	41.7	0.69
Good	Loamy Sand	3.0	7.3	15.6	38.7	40.1	0.55
Moderately Good	Sandy Loam	1.1	8.9	20.8	41.3	41.2	0.38

Root Zone Model | IDC Conceptual Model



- Crop Type: Almonds
- ET: Potential ET
- Root Depth: 6 feet
- Applied Water
  - -Amount: 6 inches/day
  - -Duration: 5 days (Jan 01 – 05)
- SAGBI Index: Moderately Good
- Soil Texture: Sandy Loam
- Soil Depth: 6 feet
- Ksat: 2 feet/day
- Wilting Point: 8.9 (% Vol.)
- Field Capacity: 20.8% (% Vol.)
- Total Porosity: 41.2% (% Vol.)

- **No Precipitation**

Water Available For Recharge (WAFR)

- Primary ingredient in Flood-MAR
- Multiple factors affect the availability of water
  - Source (multiple sources)
  - Season (Nov – Mar)
  - Location at existing diversions
  - Existing water rights
  - Environmental needs
  - Strategies (excess flows & reservoir re-operation)

How can WAFR be allocated across potential recharge sites?

- How much recharge can be achieved and where

- Key Message #1: On-farm Flood-MAR planning must consider:
  - daily availability of water
  - diversion and conveyance capacity
  - hydro-geologic site suitability
  - crop compatibility

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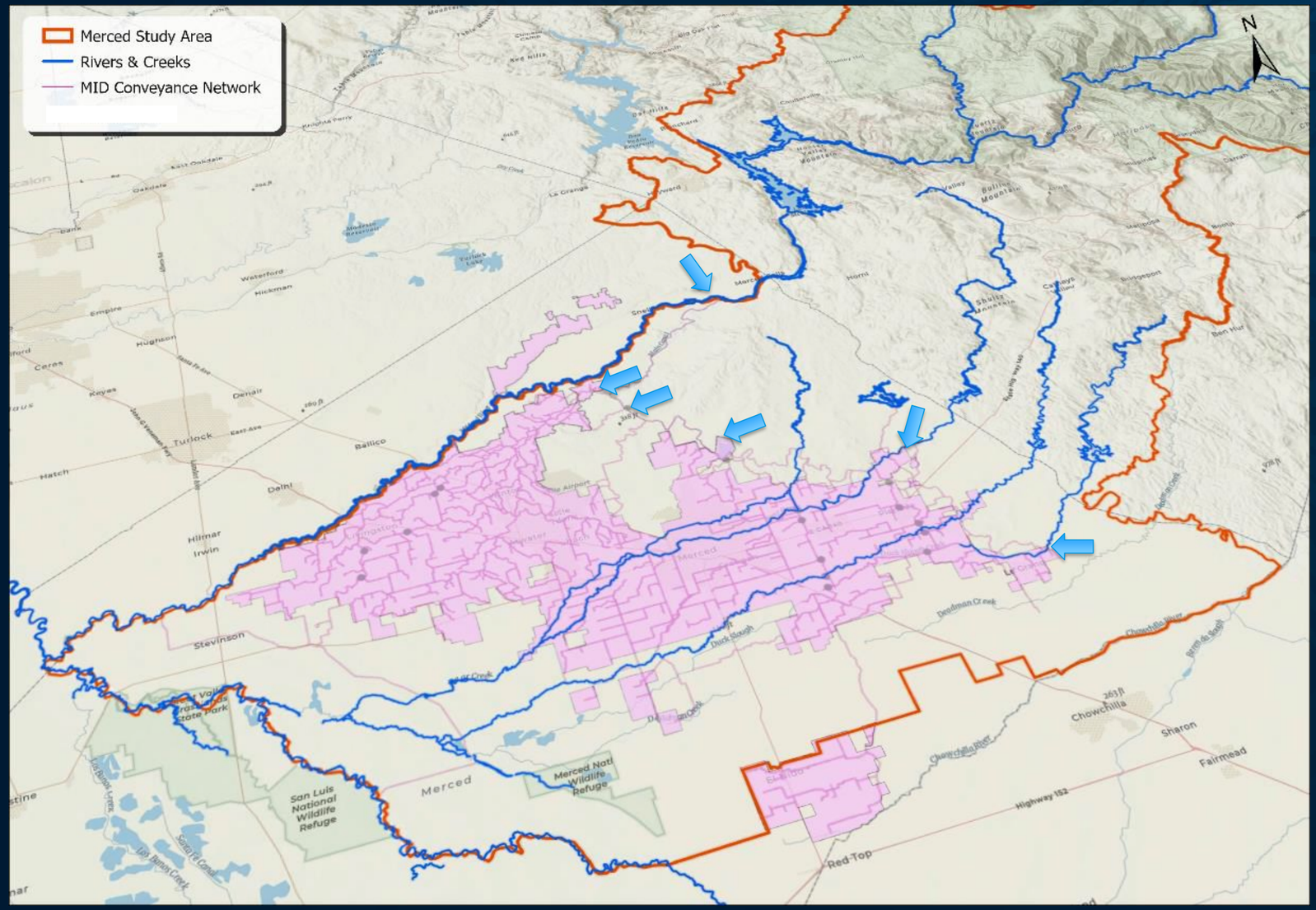
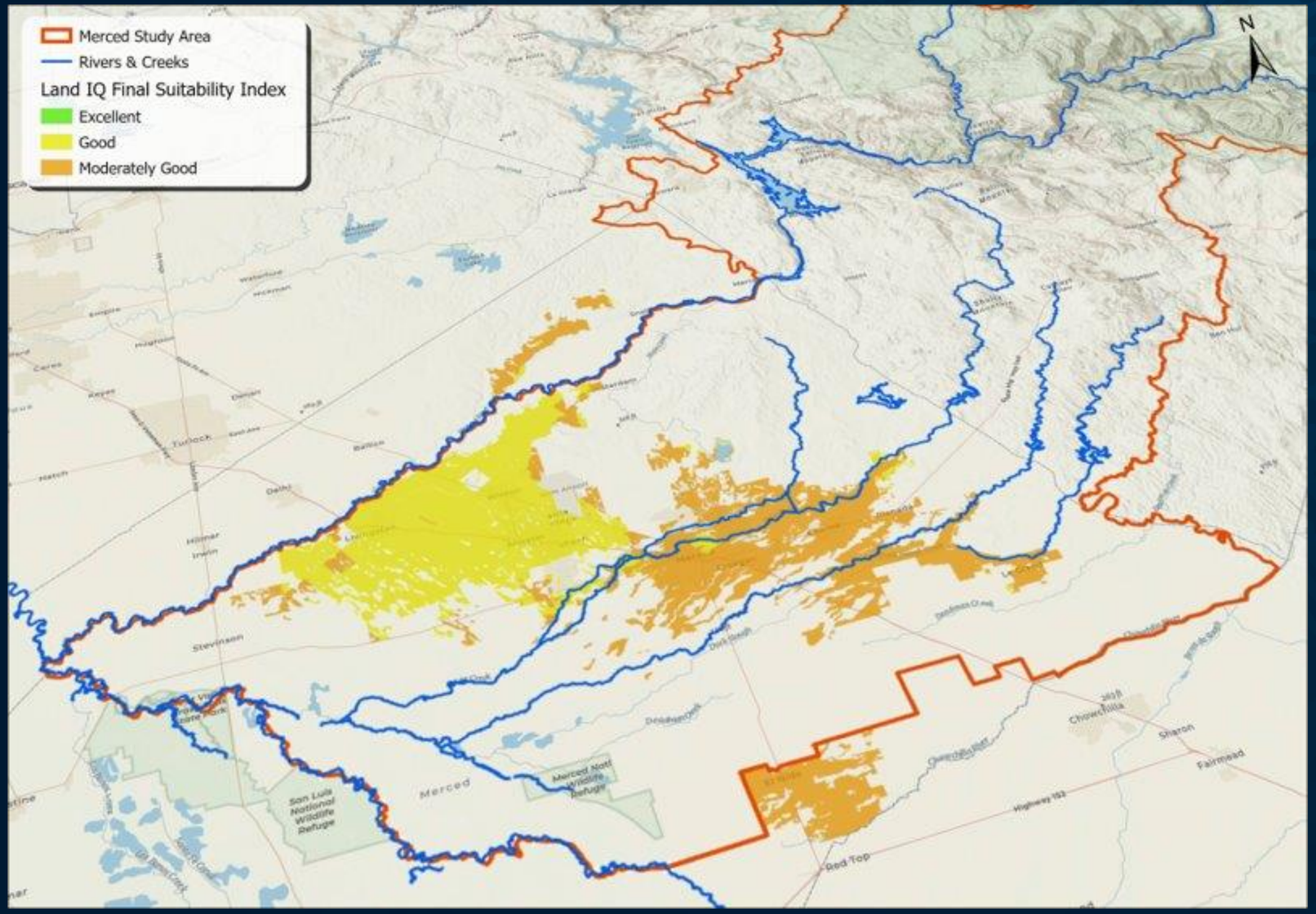
District diversions and canals determine how much water can be applied and where



Hydro-geologic site Suitability



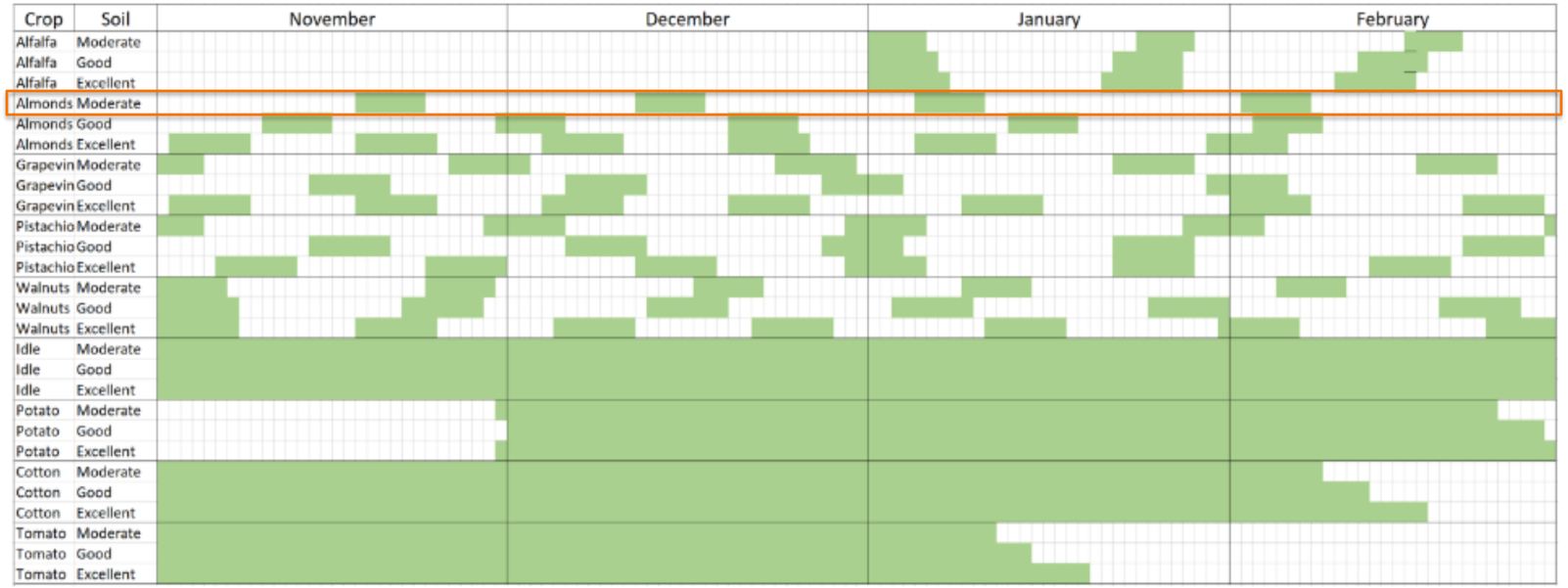
Fields with suitable:

- Soils
- Depth to groundwater
- Subsurface permeability

LAND IQ

Crop Compatibility Calendar

- Limit water application to maximum of 75% soil saturation, then provide time to dry down to field capacity
- Quantity and duration of recharge varies by crop and soil type



Crop Calendar documents acceptable recharge days (in green)

- Integrates crop biological considerations (bloom, winds)
- Integrates crop management activities (pruning, spraying, harvesting)

Key message #2: Recharge schedule can be safely designed around the existing land uses and agricultural practices

IDC – GRAT Mechanics

Root Zone Model

Crop Compatibility Calendar

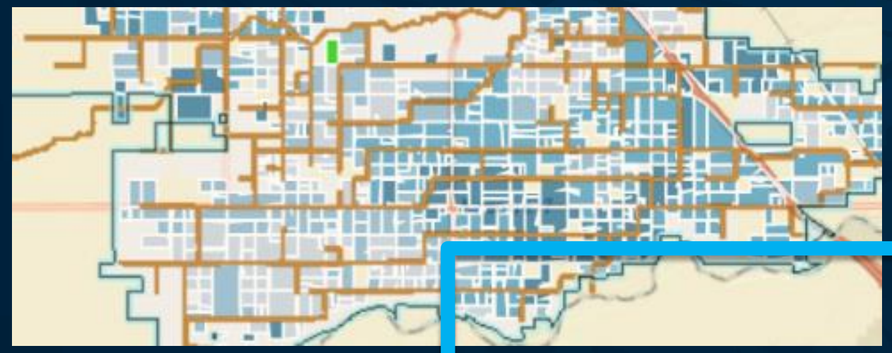
Site Suitability Index

Climate Runoff & Flooding scenarios

Daily WAFR schedule

Fields ranked

Daily canal capacity



Water applied to ranked fields

Monthly recharge by field

Unused water

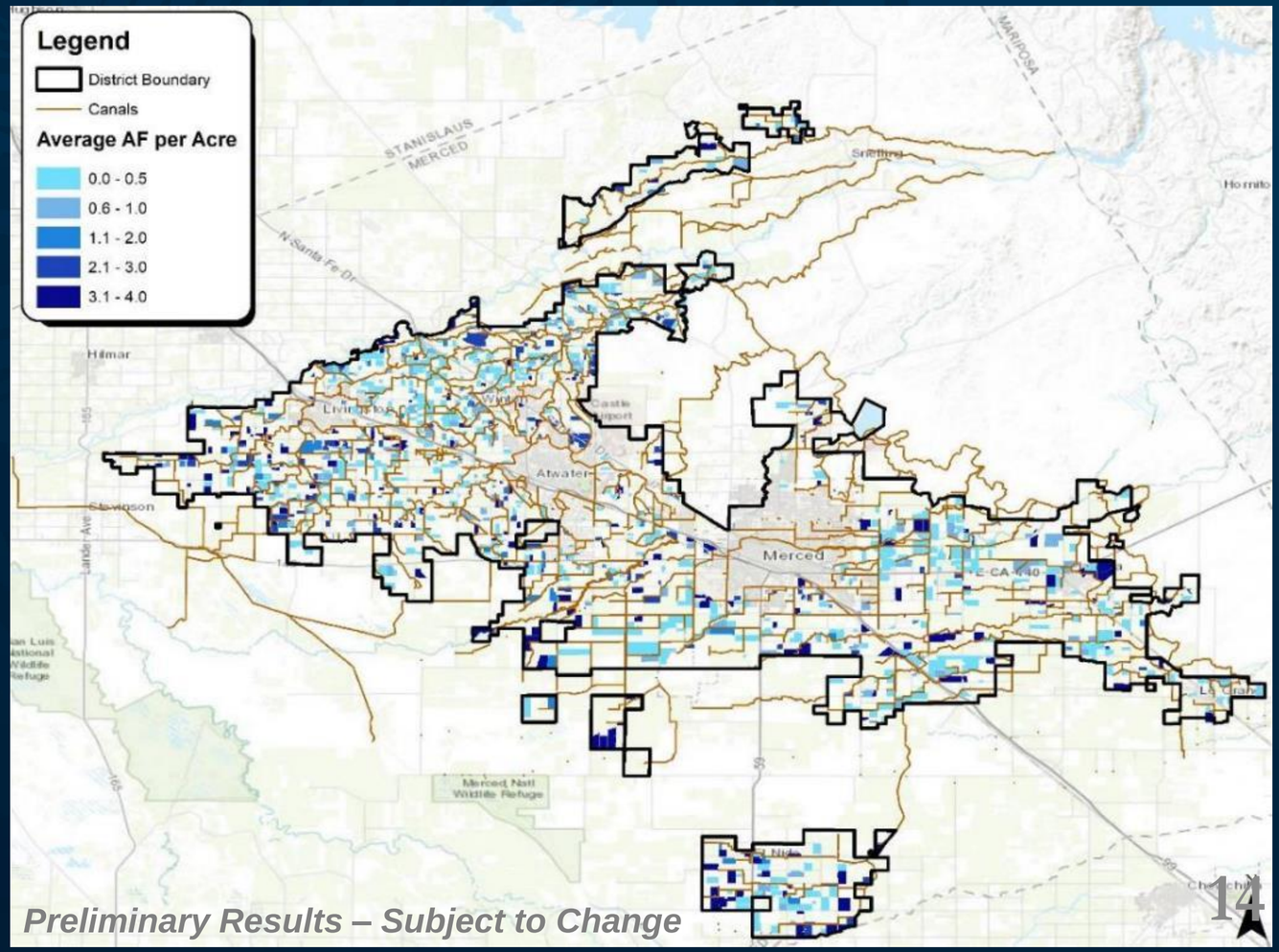
Water remaining in river

Groundwater

Key message #3: Where you recharge matters!

Objective: Select fields for maximizing recharge of available water

Metric: Recharge intensity/acre

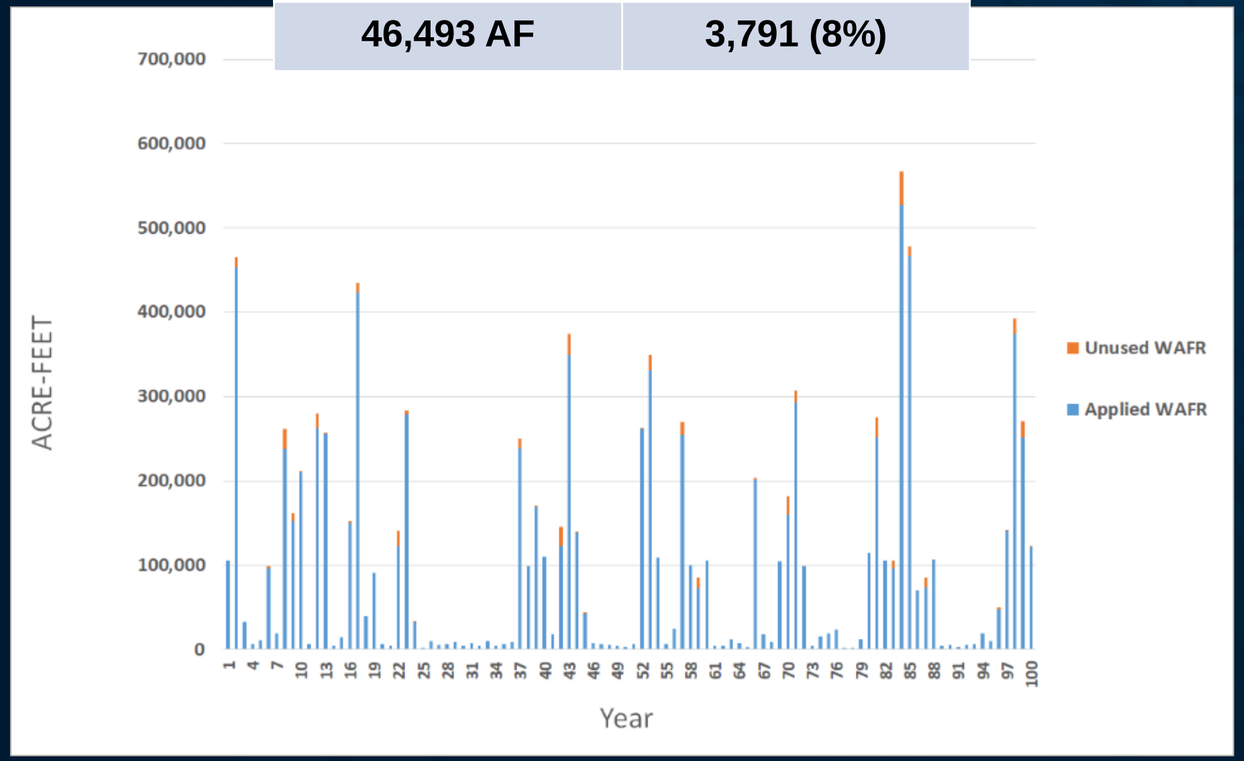


Preliminary Results – Subject to Change

How much water was captured?

Current Climate

AVG annual WAFR	AF Unused WAFR (% of total WAFR)
46,493 AF	3,791 (8%)



Preliminary Results – Subject to Change

Can additional unused WAFR be captured for recharge and to reduce flood risk?

- Expand stream and river floodplain capacity
- Expand canal capacity
- Increase field turnout capacity

Credit: dvids

Credit: CVWAC

Credit: ITRC

Targeted recharge sometimes involves tradeoffs but can achieve multiple benefits…

…and requires greater collaboration.

Questions?

Francisco Flores-López, Ph.D. | California Department of Water Resources

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