Real Time Forecast Modeling for the San Joaquin Basin

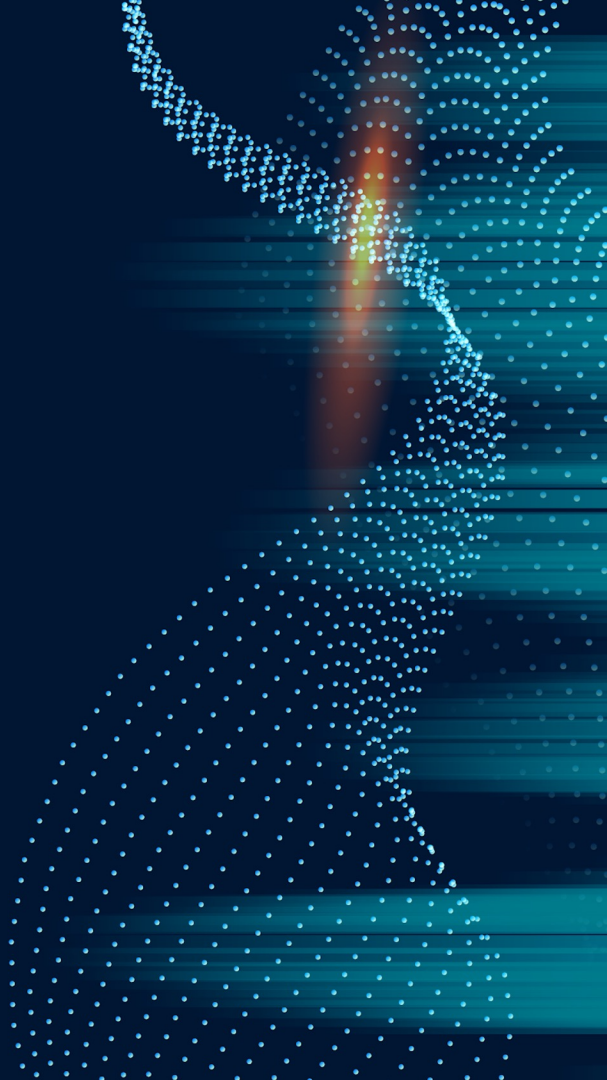
2022 ANNUAL MEETING

April 6, 2022

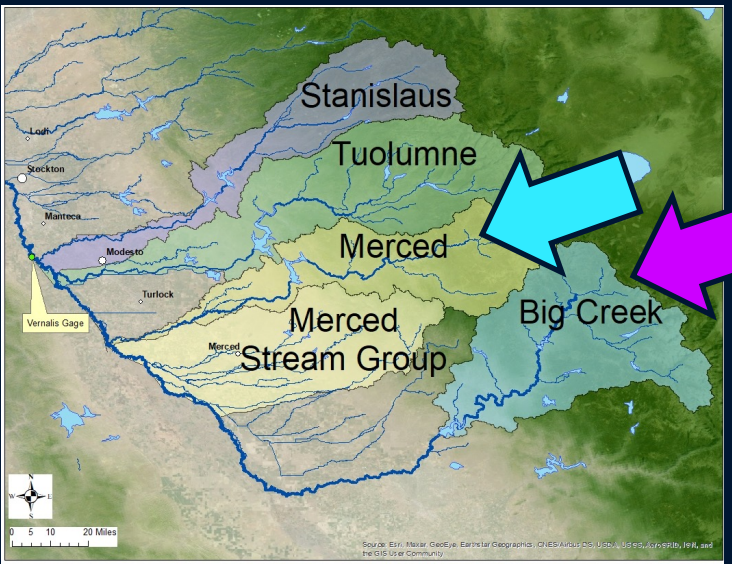
Marco A. Bell, MBA, MSc, PE
WEST Consultants, Inc.

Acknowledgements

- Stephen Ho, MID
- Tom Evans, RMA
- Caleb DeChant, RMA
- Catherine Fong, YNP
- Bibek Joshi, CA DWR
- David Rizzardo, CA DWR
- Joe Forbis, USACE
- Alan Haynes, CNRFC
- Pete Fickenscher, CNRFC



TWO IMPLEMENTATIONS HEC-RTS MODELS



BCH2O

Big Creek Hydrologic and Hydraulic Optimization

MIDH20

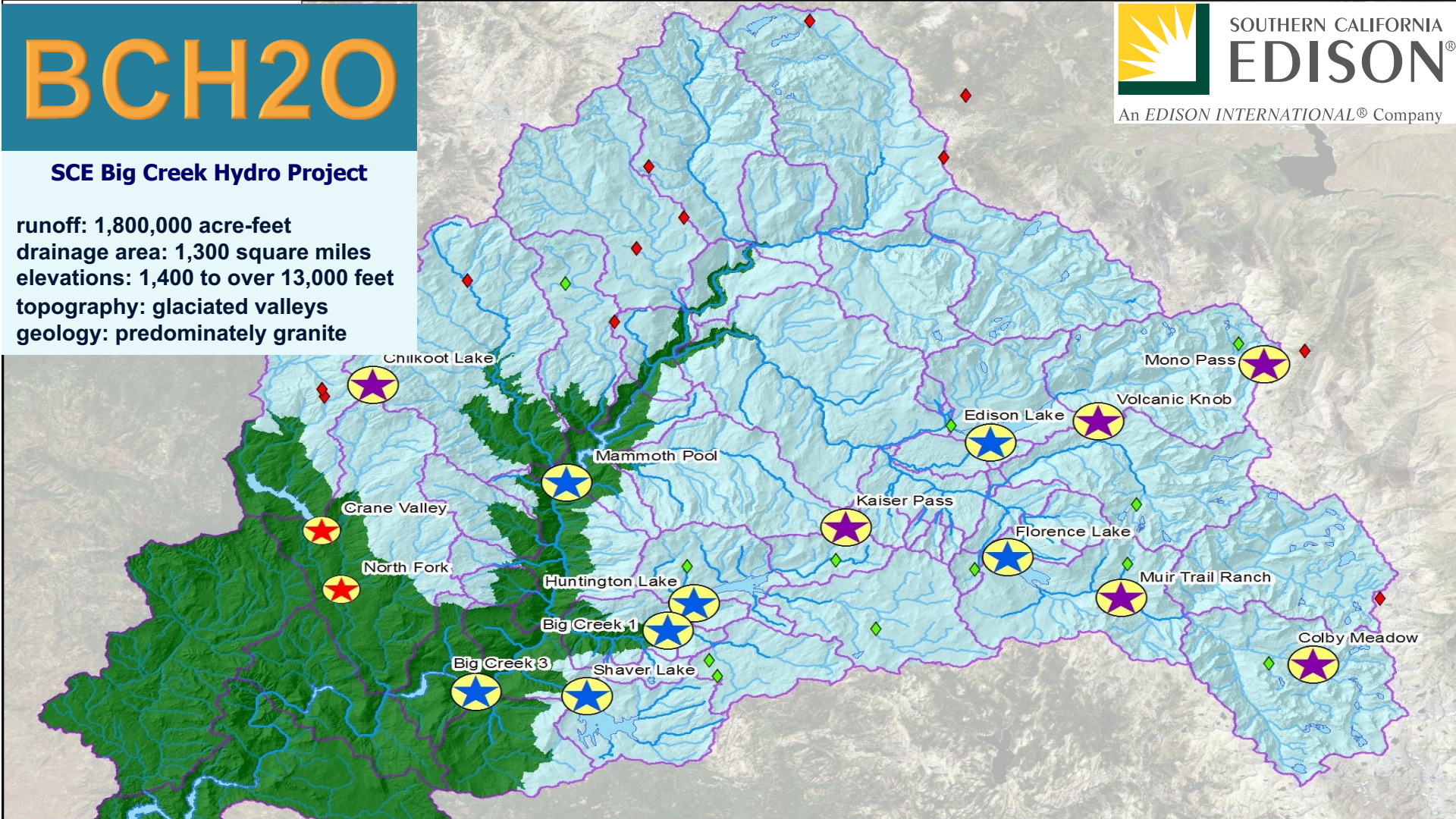
Merced Irrigation District Hydrologic and Hydraulic Optimization

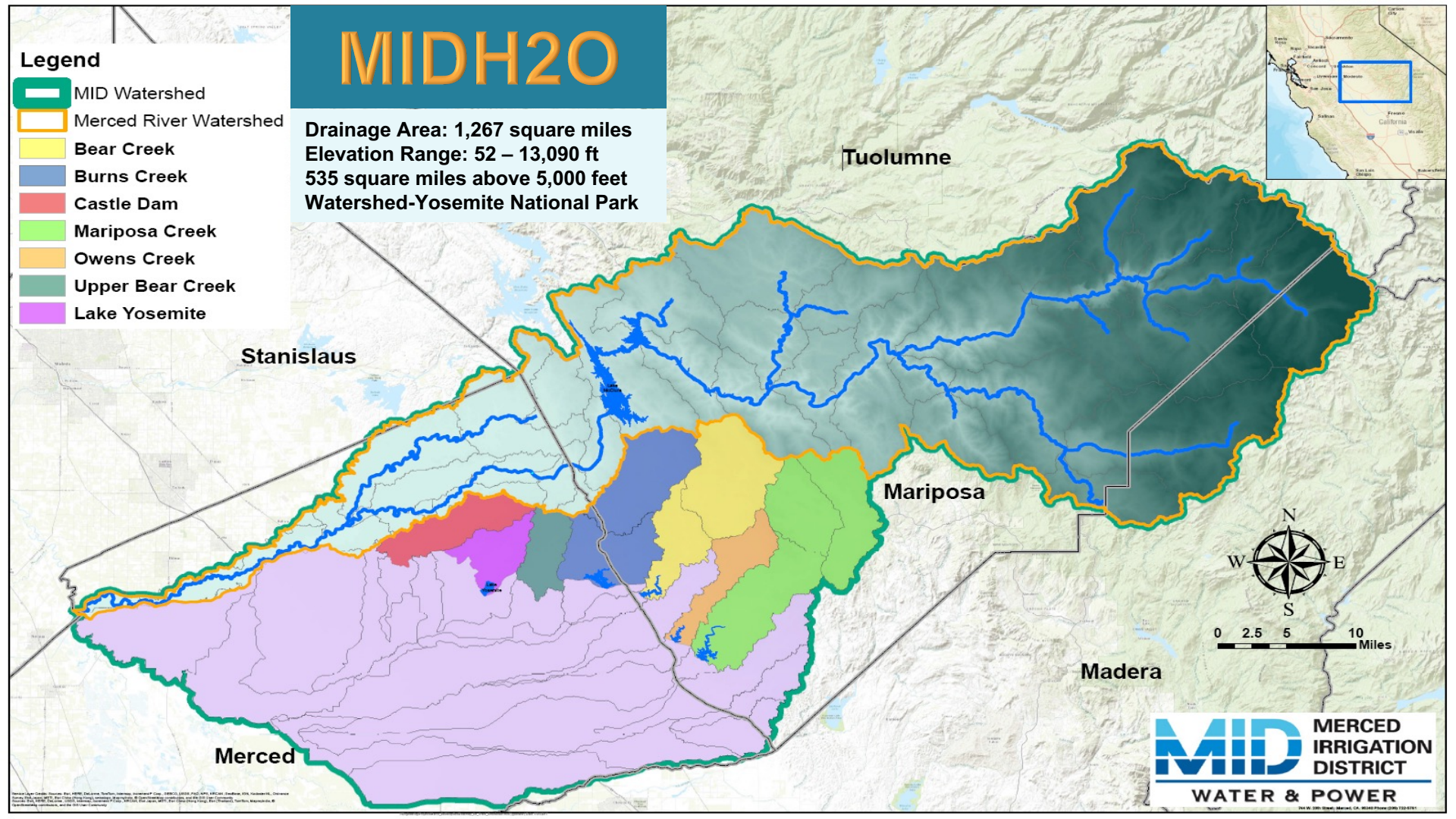
BCH2O

SCE Big Creek Hydro Project

runoff: 1,800,000 acre-feet
drainage area: 1,300 square miles
elevations: 1,400 to over 13,000 feet
topography: glaciated valleys
geology: predominately granite

SOUTHERN CALIFORNIA EDISON®
An *EDISON INTERNATIONAL*® Company

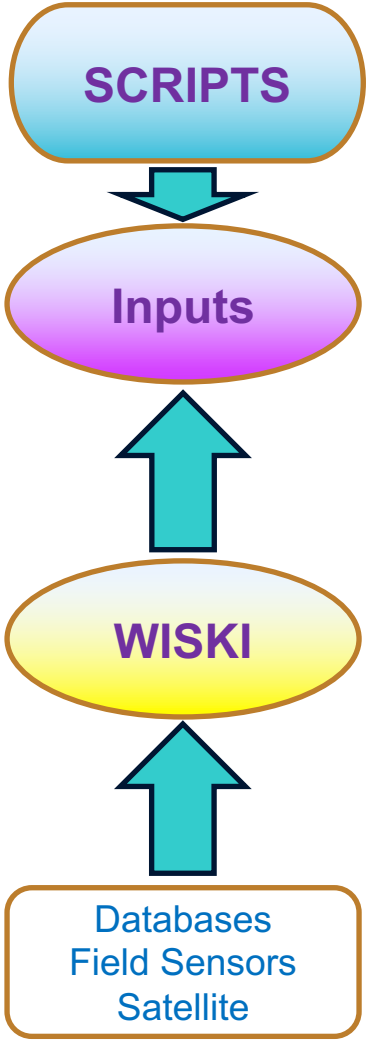



MIDH2O
Drainage Area: 1,267 square miles
Elevation Range: 52 – 13,090 ft
535 square miles above 5,000 feet
Watershed-Yosemite National Park
Legend
MID Watershed
Merced River Watershed
Bear Creek
Burns Creek
Castle Dam
Mariposa Creek
Owens Creek
Upper Bear Creek
Lake Yosemite
Tuolumne
Stanislaus
Mariposa
Madera
Merced
N
W
E
S
0 2.5 5 10
Miles
MERCED IRRIGATION DISTRICT
WATER & POWER

KISTERS WISKI
Time Series Database

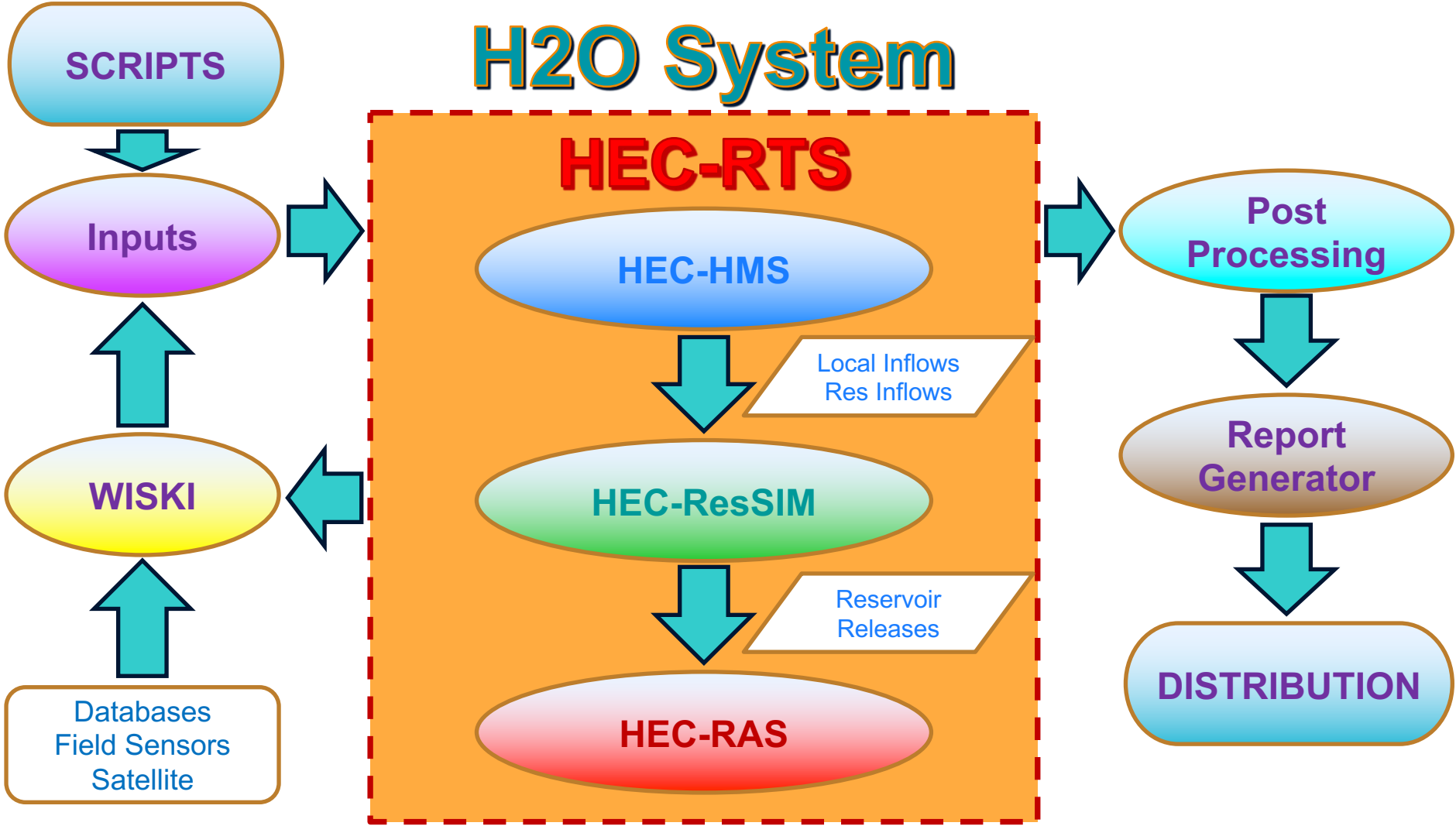
- API for RTS Communications
- Versatile Reporting
- Flow Path Monitoring / Asset Tracking
- Alert Notification System
- Integrates with SCADA/CDEC/USGS/NWS

H2O System

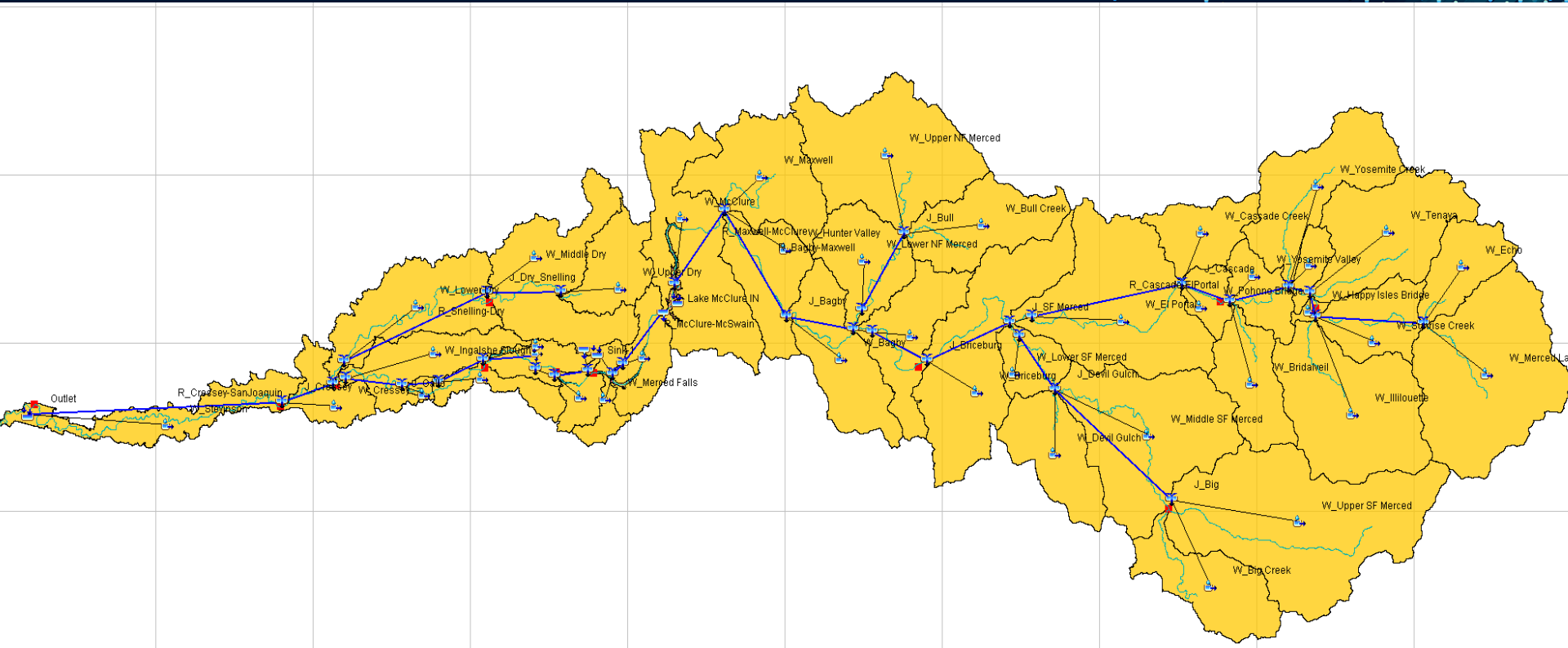


INPUTS

Base Historical Conditions
State Conditions
Gridded Observed Precipitation
Gridded Observed Temperature
Gridded Precipitation Forecast
Gridded Temperature Forecast
Gridded Freezing Forecast
Soil Moisture
Snow Water Equivalent
Observed Flows
Irrigation Demand
Supplemental Releases

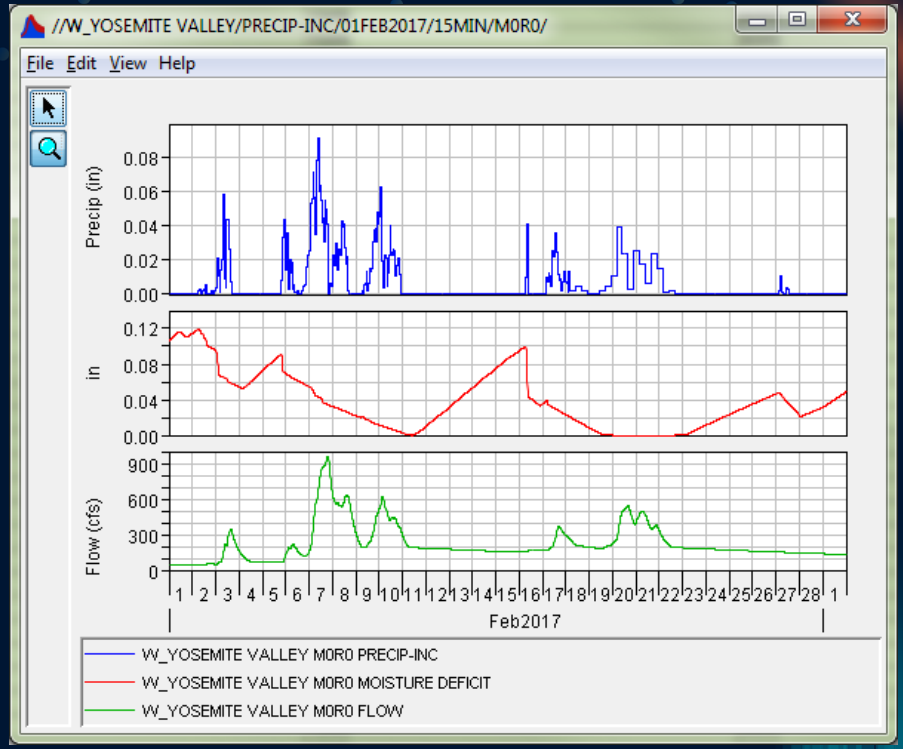

H2O System
SCRIPTS
Inputs
WISKI
Databases
Field Sensors
Satellite
HEC-RTS
HEC-HMS
Local Inflows
Res Inflows
HEC-ResSIM
Reservoir
Releases
HEC-RAS
Post
Processing
Report
Generator
DISTRIBUTION

MIDH2O HMS

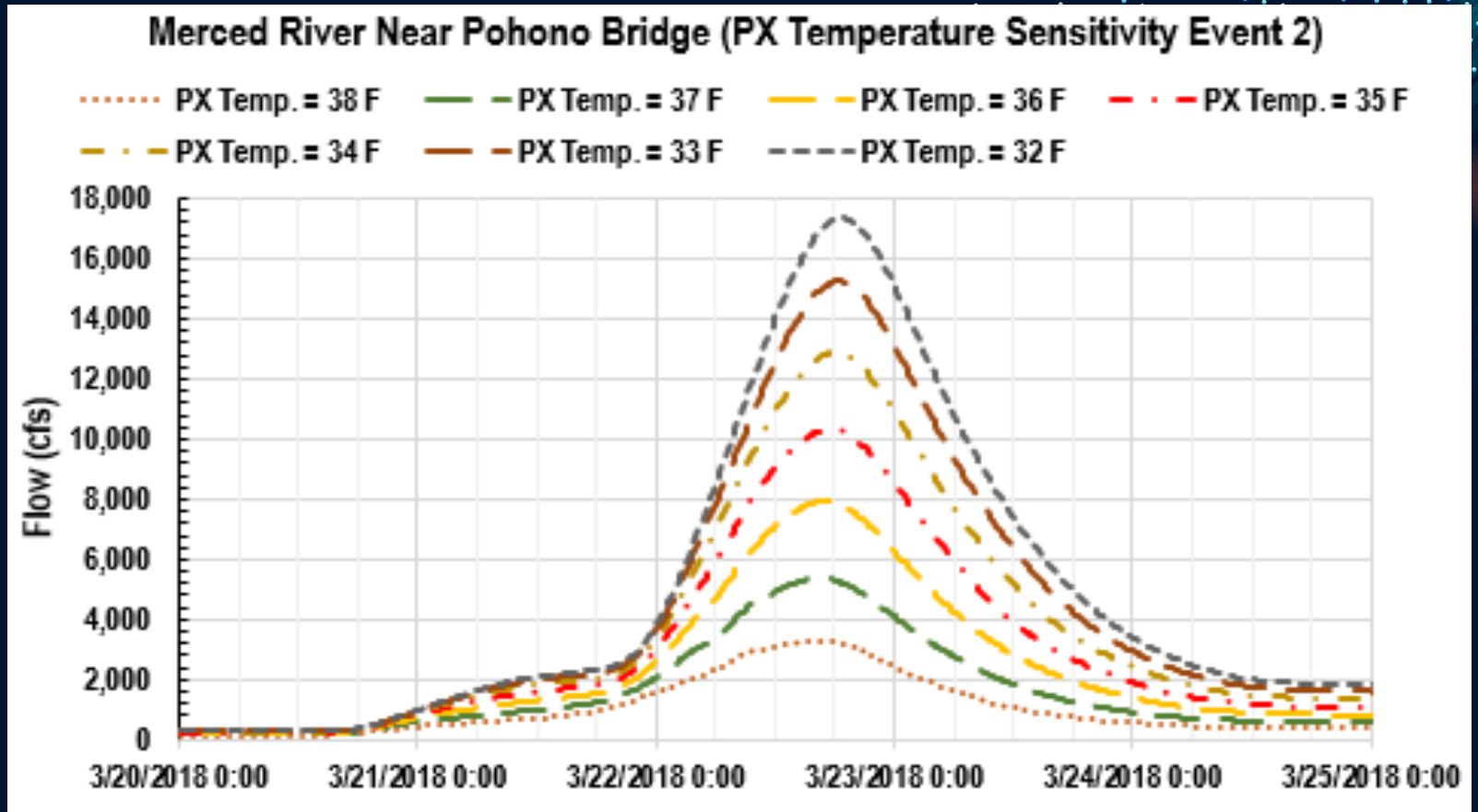

W_Upper NF Merced
W_Maxwell
W_McClure
J_Bull
W_Bull Creek
W_Hunter Valley
R_Maxwell-McClure
R_Bagby-Maxwell
W_Lower NF Merced
W_Middle Dry
J_Dry_Snelling
W_Upper Dry
W_Lower Dry
R_Snelling-Dry
Lake McClure IN
R_McClure-McSwain
J_Bagby
W_Bagby
W_Ingalsbe Slough
Sink1
W_Merced Falls
Outlet
R_Cressey-SanJoaquin
W_Cressey
W_Stevinson
W_Briceburg
J_Briceburg
J_SF Merced
W_Lower SF Merced
J_Devil Gulch
W_Devil Gulch
W_Middle SF Merced
J_Big
W_Upper SF Merced
W_Big Creek
W_Cascade Creek
J_Cascade
R_Cascade-ElPortal
W_El Portal
W_Pohono Bridge
W_Yosemite Creek
W_Yosemite Valley
W_Tenaya
W_Echo
W_Happy Isles Bridge
W_Sunrise Creek
W_Bridalveil
W_Illilouette
W_Merced La

HEC-HMS Components

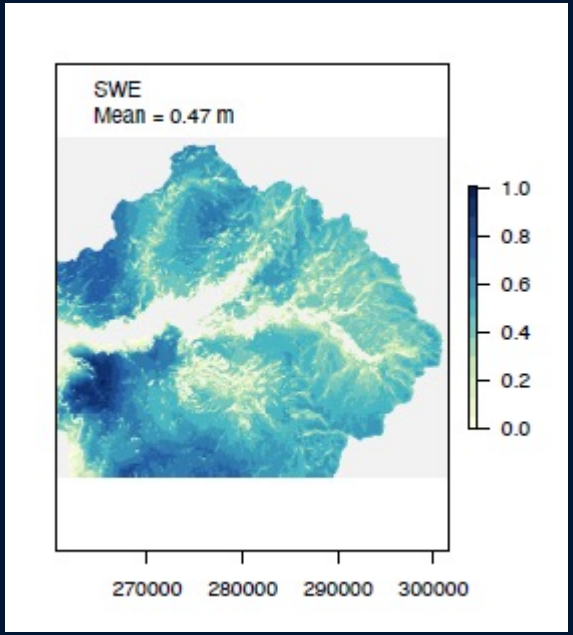
- Loss -> Deficit and Constant
  - Canopy -> Simple Canopy
  - Evapotranspiration -> Monthly Average
  - Moisture deficit can recover
- Transform -> ModClark
- Routing -> Modified Puls and Muskingum-Cunge
- Baseflow -> Recession

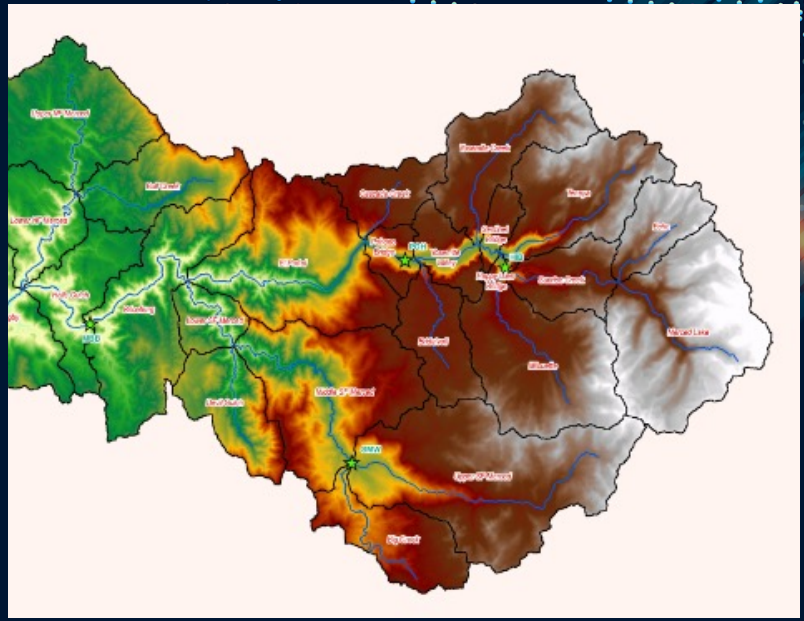


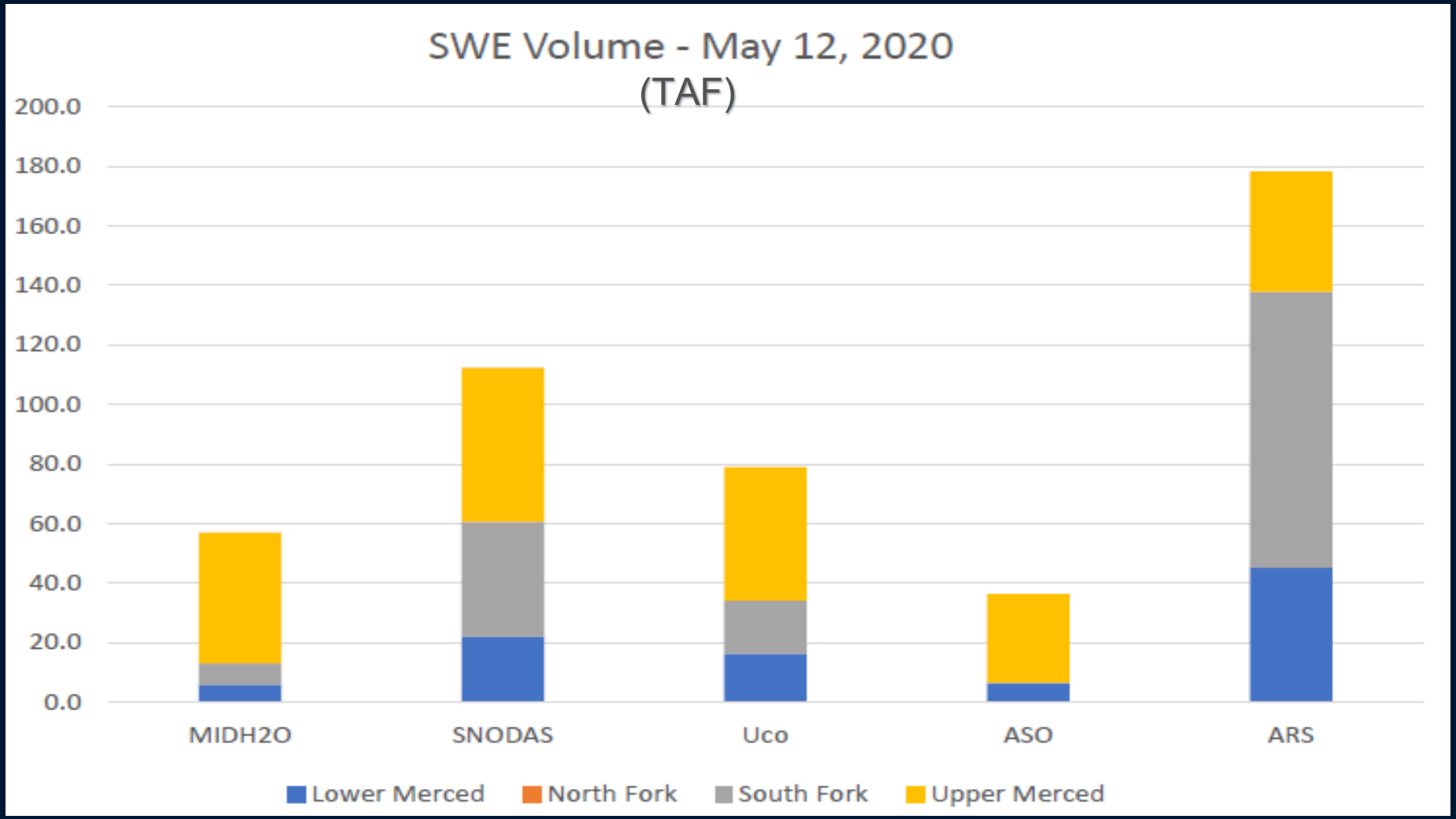
Precipitation is Key



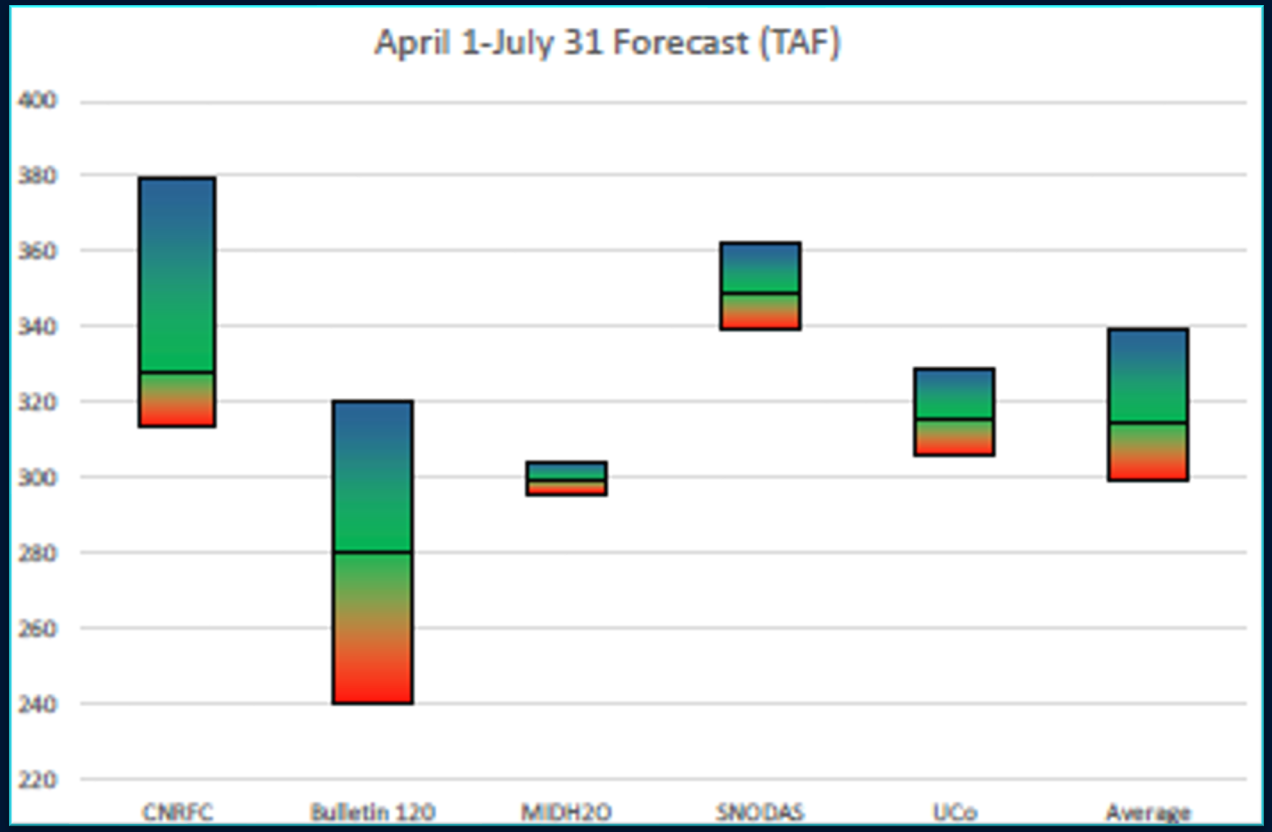
Precipitation is Key
ASO Inc. Data is key to SWE





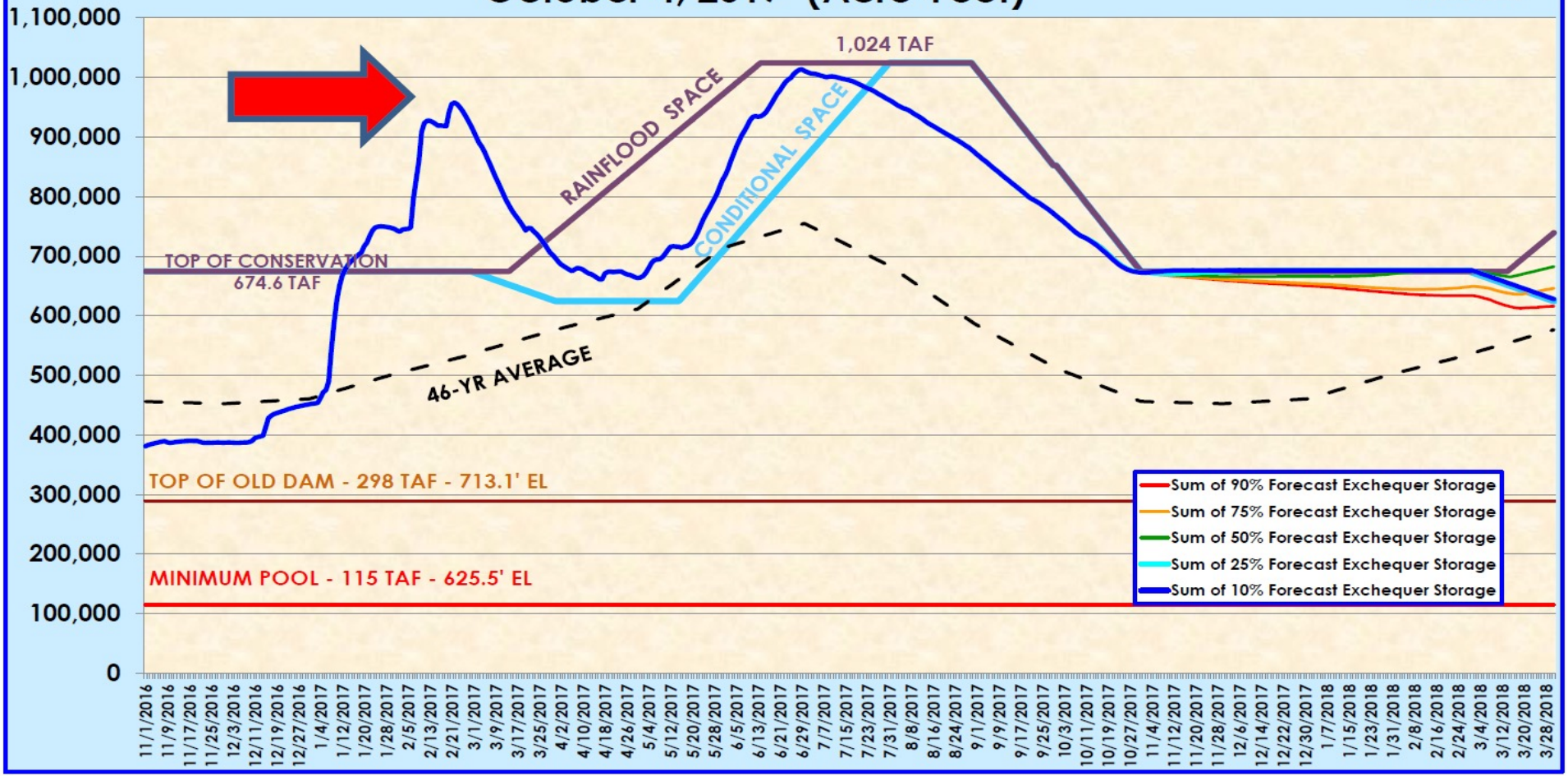

SWE Volume - May 12, 2020
(TAF)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
MIDH2O
SNODAS
Uco
ASO
ARS
Lower Merced
North Fork
South Fork
Upper Merced

April – July Runoff Forecast – May 2020



NEW EXCHEQUER - STORAGE FORECAST
October 4, 2017 (Acre-Feet)

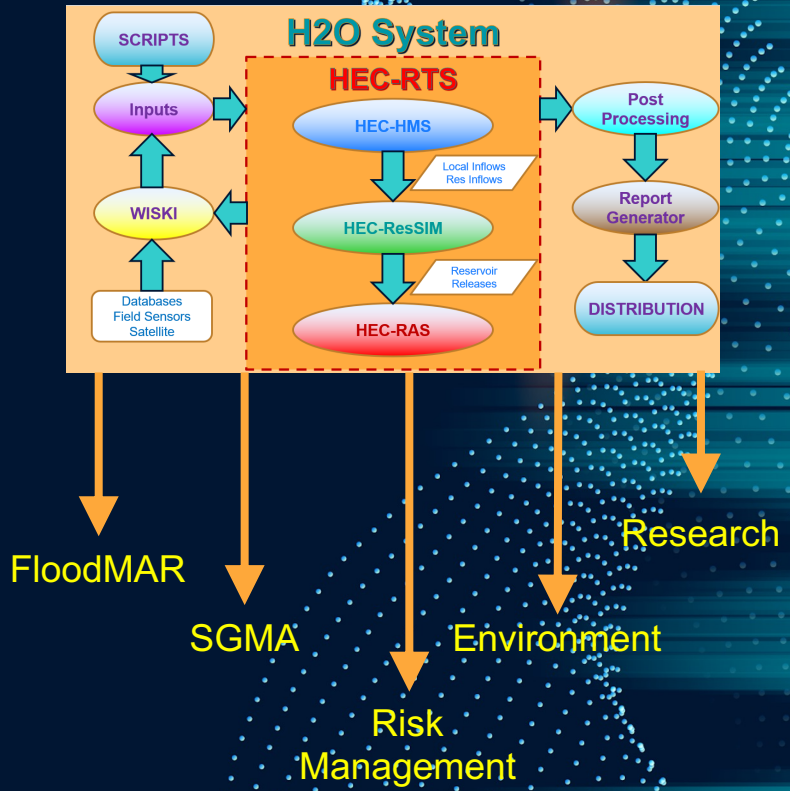
MERCED IRRIGATION DISTRICT
WATER & POWER



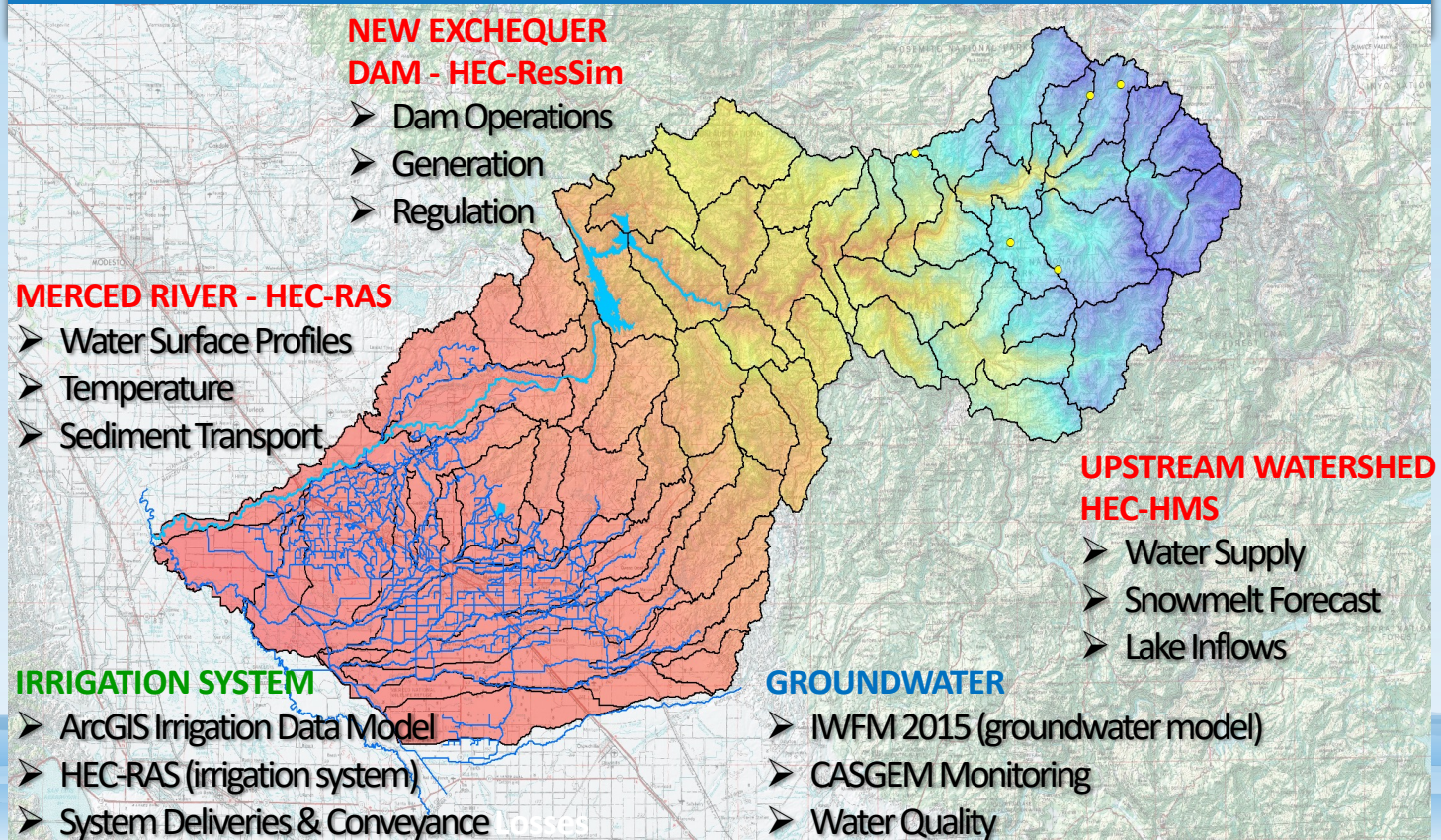
H2O Automation & Optimization

- Reduces opportunity of human error
- Produces a consistent approach
- Reduces costs and increases revenues
- Considers system resources
- Includes priorities of meeting demands

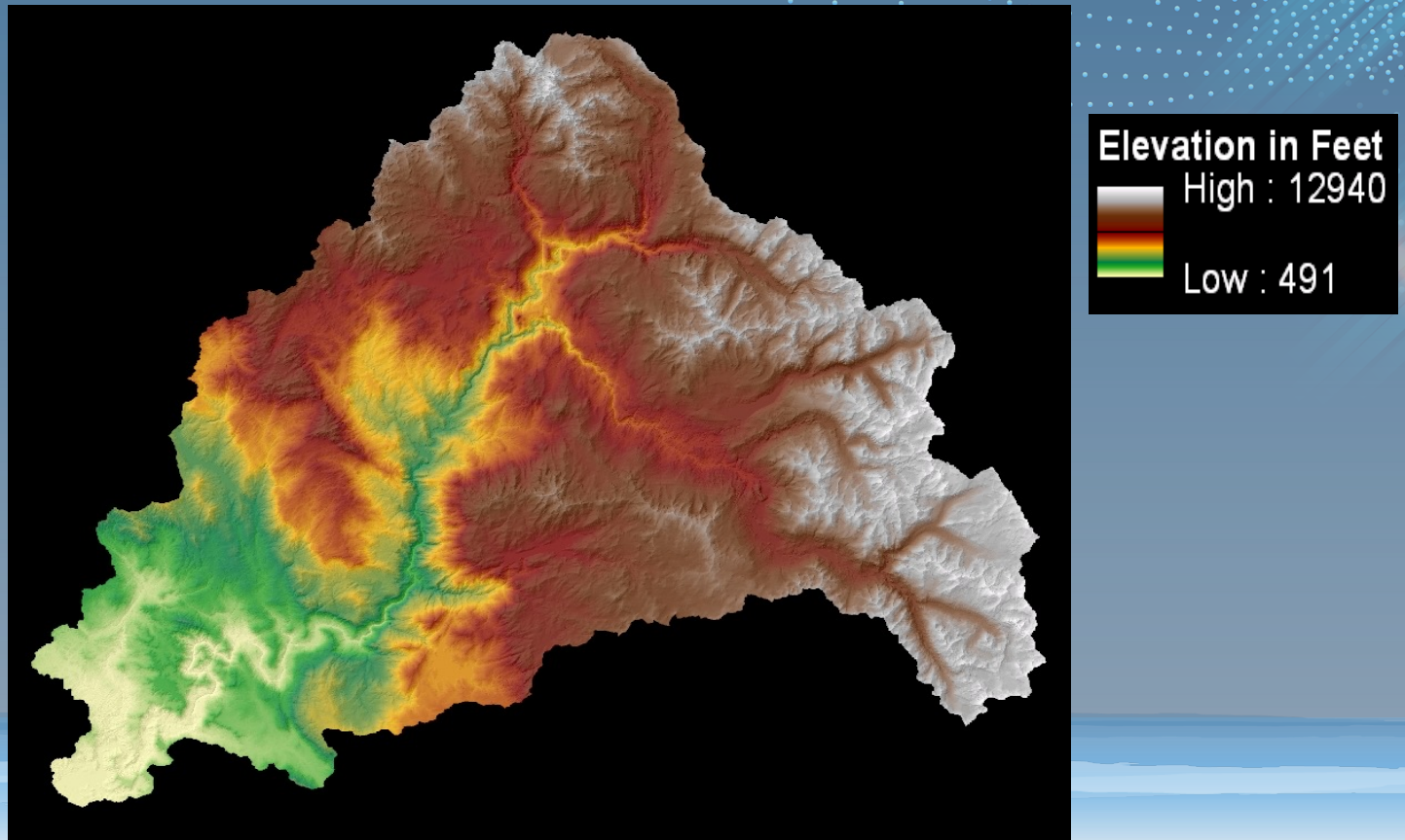
Automation increases utility.
Optimization increases reliability.



Optimization of All Water Resources Enterprise Data Management System

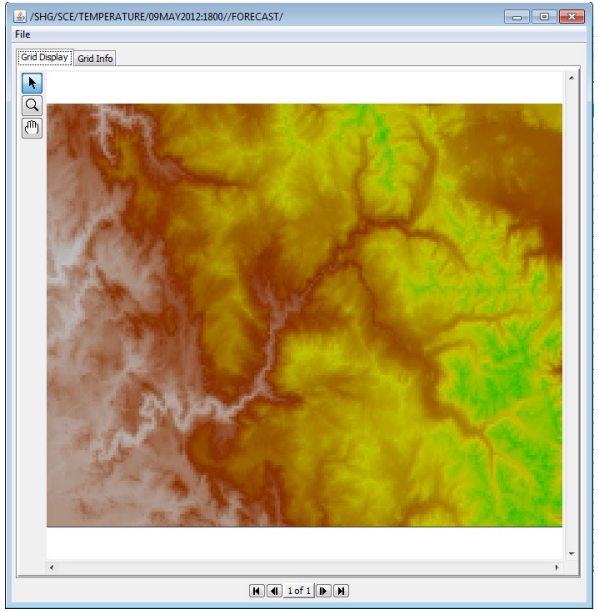


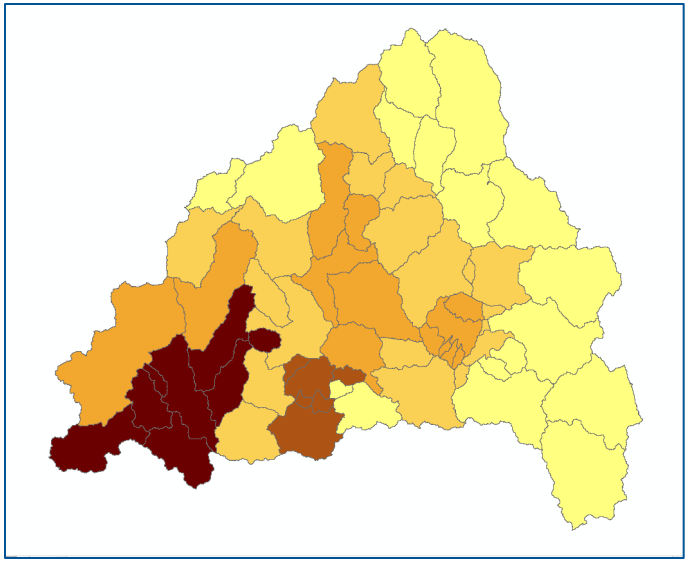
Big Creek IFSAR 5 Meter Digital Terrain Model



Grids

Observed Grids VS Grids from a Point Values





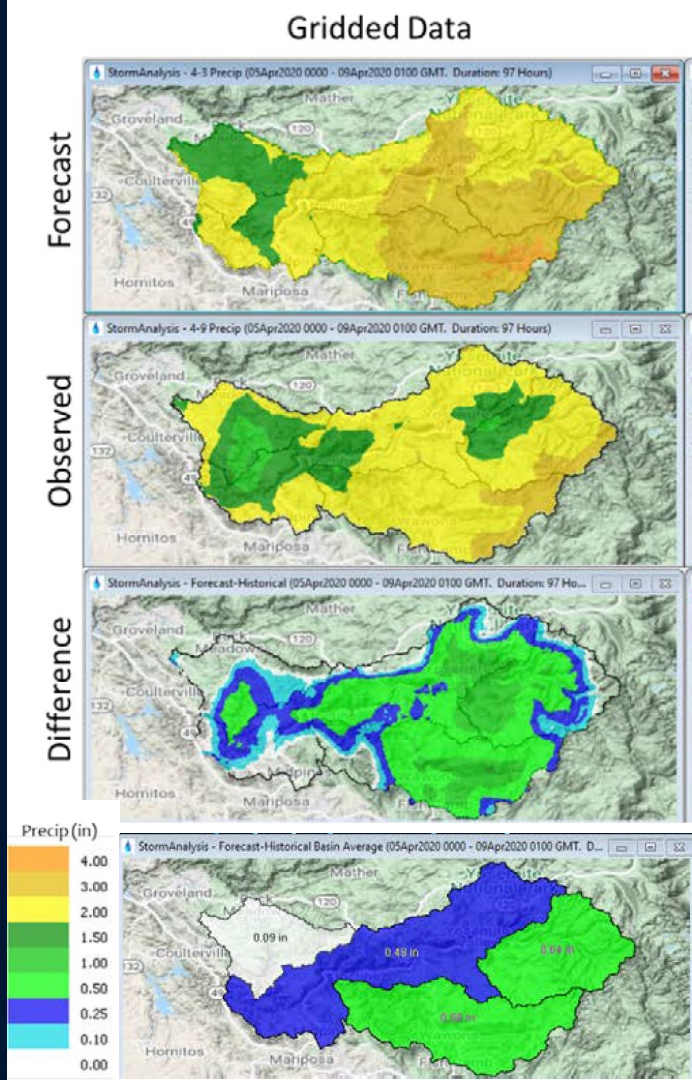
Dewberry

ASO Inc. Data Benefits

Managers want to focus on the data they need to make decisions.

- Localization of needed studies
- Right answers = stakeholder buy-in
- Continuity of standardize reporting
- Flexible and adaptable
- Automated scripts

Give clients what they need.



April 5th-8th 2020 Storm

6,290,000 AF

Vernalis - Average Annual Unimpaired Volume

18,940,000 AF

Vernalis - 1983 Max Unimpaired Volume

Appendix C
Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives
February 2012
State Water Resources Control Board
California Environmental Protection Agency

UC Merced Research

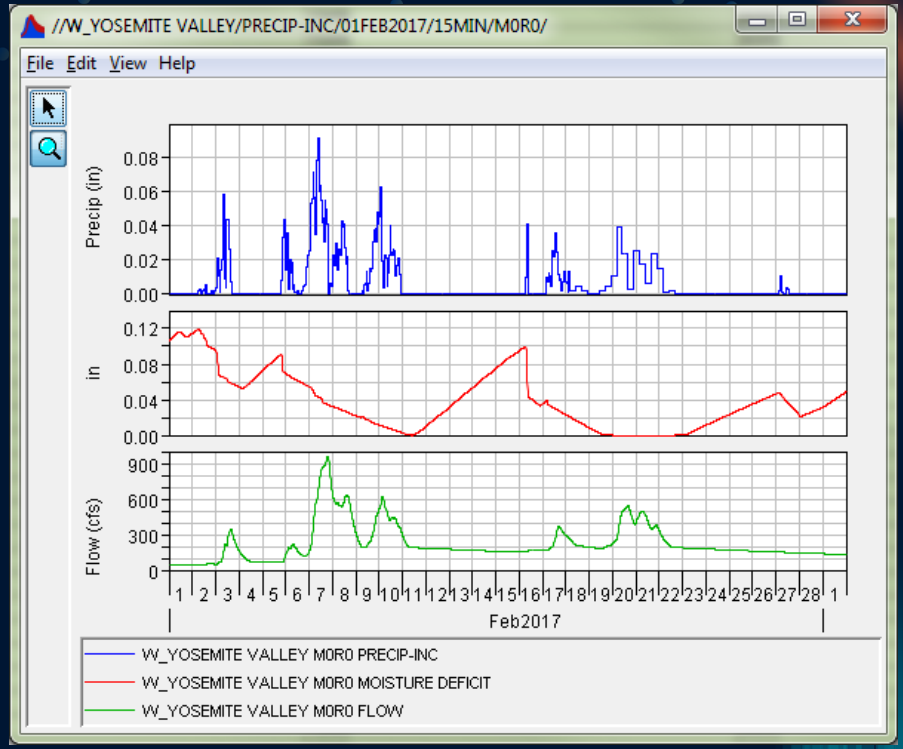
Snow Hydrologic Characteristics

Soil Moisture Deficit

Simulation of Losses

HEC-HMS Components

- Loss -> Deficit and Constant
  - Canopy -> Simple Canopy
  - Evapotranspiration -> Monthly Average
  - Moisture deficit can recover
- Transform -> ModClark
- Routing -> Modified Puls and Muskingum-Cunge
- Baseflow -> Recession



Primary Sustainable Development Goals - UN

Ensure availability and
sustainable management of water
and sanitation for all

San Joaquin HEC-HMS → Enhanced Water Supply Reliability → Agriculture, Jobs and Recreation

Other Applicable Sustainable Development Goals

Technical Enhancements

HEC-RTS

1. Water Control Manual
2. Real Time w Forecast
3. Degree-Day/Lumped Px
4. Standard QPF
5. Basin Surface Water
6. Flood Control
7. Some QA/QC

FIRO

1. Enhanced Operations
2. Planning w Real Time
3. Degree-Day/Lumped Px
4. Weather Forecast w AR
5. Basin Reservoir Ops
6. Flood Control & Water Supply
7. Standard QA/QC

H2O

1. Automated & Optimized
2. Real Time & Planning
3. ASO w Gridded Px
4. Surface Model w Climate
5. System Based Modeling
6. Flood, Drought, Multipurpose
7. Extensive Real Time QA/QC

Lessons Learned Summary

H2O is a complete RTS based system with multiple enhancements to make a robust and useful modeling tool for decision making.

- Phased Approach
- Gridded not Lumped
- Precipitation is Key
- QA/QC Everywhere
- Automation & Optimization
- Custom Reporting
- Annual Symposium

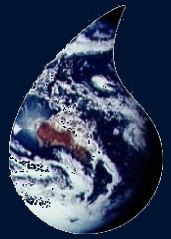
H2O SUMMARY FACTS

- Successfully used in two major basins
- Forecast informed model
- Real time, automated and optimized
- Snowpack simulation with ASO Inc. data
- Synergy with water resources programs

WEST Consultants, Inc.

THANK YOU!

mbell@WESTconsultants.com
916.907.4669



CREDITS: This presentation template was created by Slidesgo, including icons by Flaticon, and infographics & images by Freepik.

QUESTIONS?

WEST Consultants, Inc.

THE END