

Indian Wells Valley Groundwater Model

March 7, 2019
PAC Meeting

2/21/2019



Outline

- Hydrogeologic Conceptual Model
- Historical Calibration Water Budget
- 2020-2070 Baseline (No Action) Model Run
- TDS Baseline (No Action) Model Run
- Predictive Management Scenarios
- Next Steps



Conceptual Model and Water Budget Components

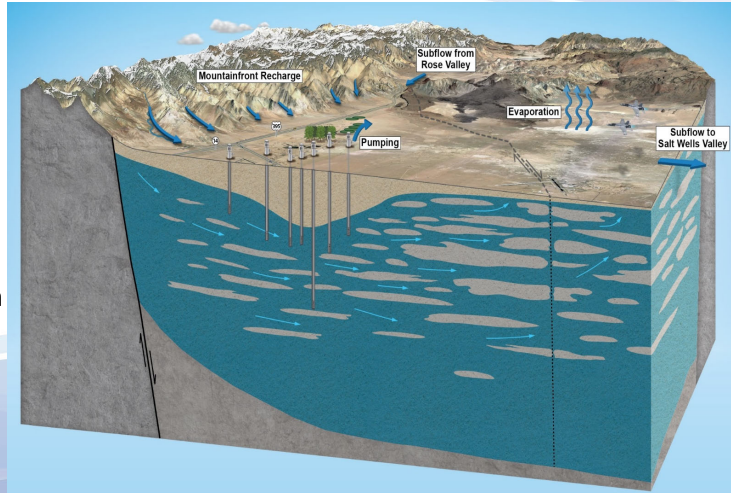
Inflow

Subsurface Flow from Rose Valley
 Mountain Front Recharge
 [Imported Water]
 [Recycled Water]

Outflow

Subsurface Flow to Salt Wells Valley
 Playa Evaporation / Evapotranspiration
 Groundwater Pumping
 [Brackish Water Desalination]

Change of Water in Storage



2/21/2019



Historical Model Calibration (1922-201)

	<u>Calibration</u>	
	1922-2016 (95 years)	2011-2015 (5 years)
<u>Inflow</u>	AF/Y	AF/Y
Recharge	7,650	7,650
Recycled Water	--	--
Imported Water	--	--
TOTAL:	7,650	7,650
<u>Outflow</u>		
Pumping	15,240	27,740
Evapotranspiration	6,580	4,850
Flow to Salt Wells	60	50
TOTAL:	21,880	32,640
Change in Storage	-14,230	-24,990

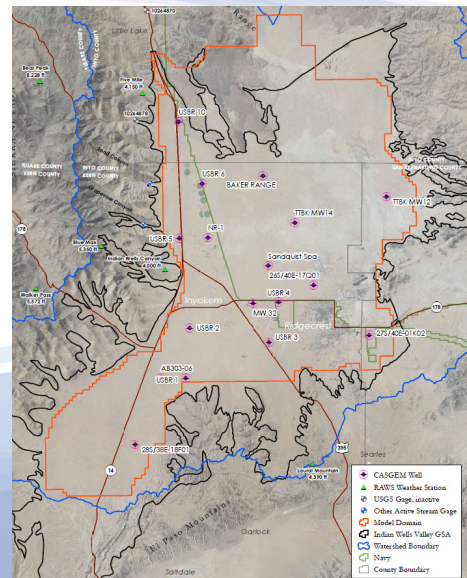


Baseline (No Action) Model Run

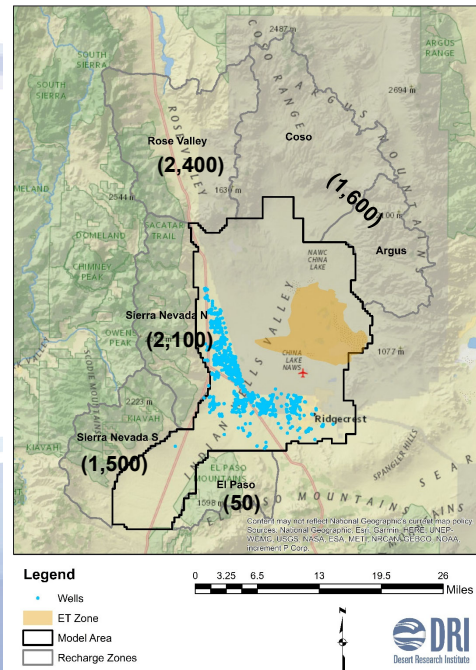
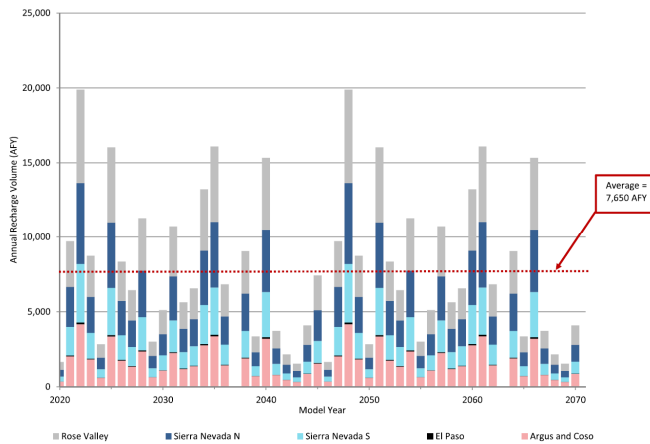


Baseline (No Action) Assumptions

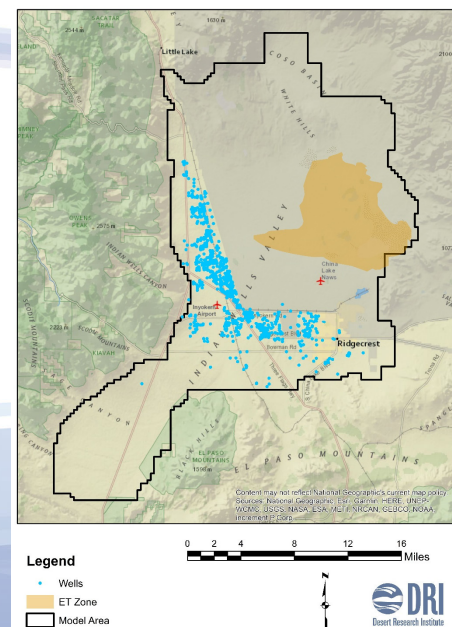
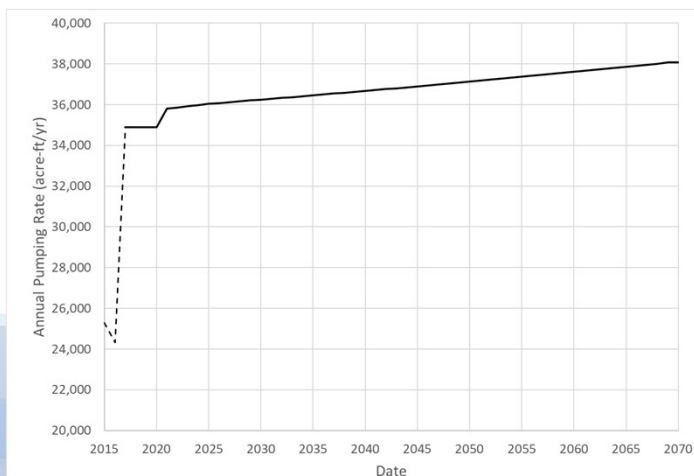
- **Recharge**
Balanced Hydrology 2020 through 2070
Mountain Front Recharge
Subsurface Flow from Rose Valley
- **Pumping Assumptions**
Current Management Practices
Projected out through 2070
- **Baseline Model Output**
Water Budget Terms:
by IWW Basin & Management Sub-Areas
Groundwater Indicator Wells (CASGEM)



Simulated Recharge (Average = 7,650 AFY)



Simulated Pumping (51-year Average = 36,880 AFY)



Water Budget (average AF/Y)

	<u>Calibration</u>		<u>Baseline</u>
	1922-2016 (95 years)	2011-2015 (5 years)	2020-2070 (51 years)
<u>Inflow</u>	AF/Y	AF/Y	AF/Y
Natural Recharge	7,650	7,650	7,650
Recycled Water	--	--	--
Imported Water	--	--	--
TOTAL:	7,650	7,650	7,650
<u>Outflow</u>			
Pumping	15,240	27,740	36,880
Evapotranspiration (ET)	6,580	4,850	1,610
Flow to Salt Wells	60	50	40
TOTAL:	21,880	32,640	38,530
Change of Groundwater in Storage	-14,230	-24,990	-30,880



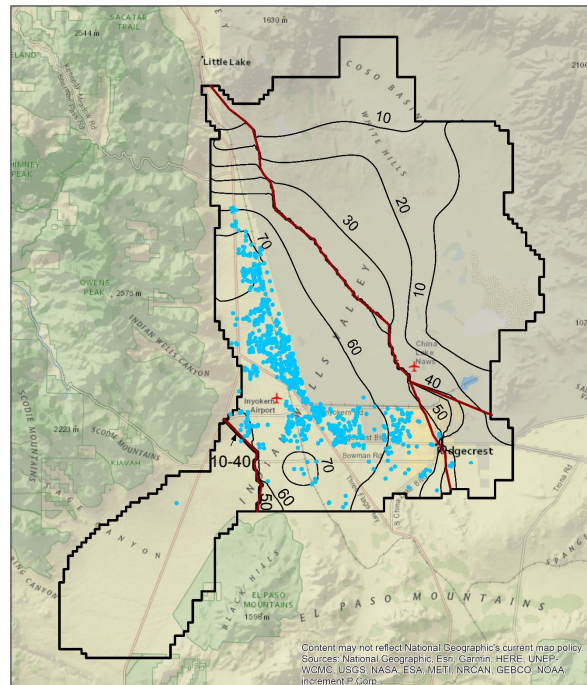
Drawdown Results

- Drawdown from 2020 to 2070

Legend

- Wells
- Geologic Faults
- Drawdown (2020-2070) ft
- Model Area

0 1.5 3 6 9 12 Miles



Content may not reflect National Geographic's current map policy.
Sources: National Geographic, Esri, Garmin, HERE, UNEP,
WMO, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA,
iStockphoto, P. Corp.

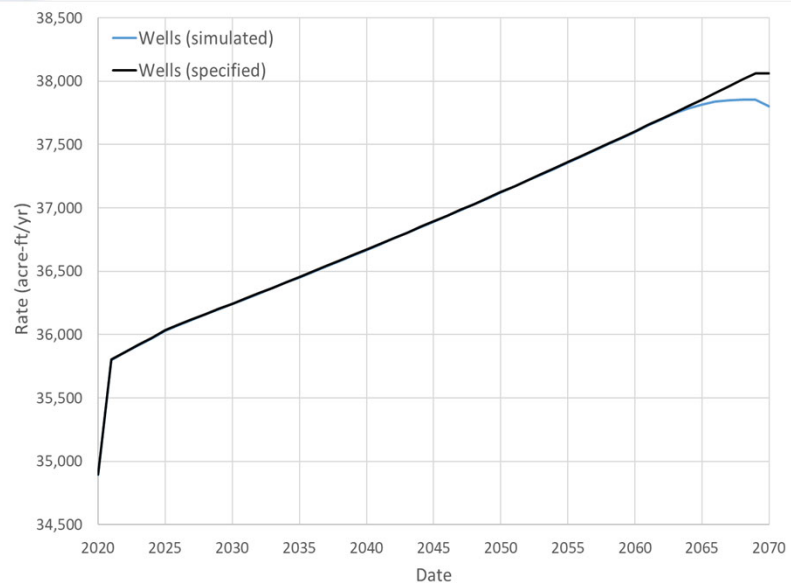
Simulated and Specified Pumping Results

Baseline pumping simulated input by the model (50-yr average 36,880 AFY)

Ability to pump groundwater from storage (lowering of water table) using existing wells.

Screen intervals simulated using full model layer thickness

Does not account for potable vs saline groundwater



Graph from DRI Jan 3, 2019 TAC Presentation IWV Baseline Model Run

STETSON
ENGINEERING, INC.

TDS Baseline (No Action) Model Run

12 STETSON
ENGINEERING, INC.

TDS Conceptual Model (mg/L)

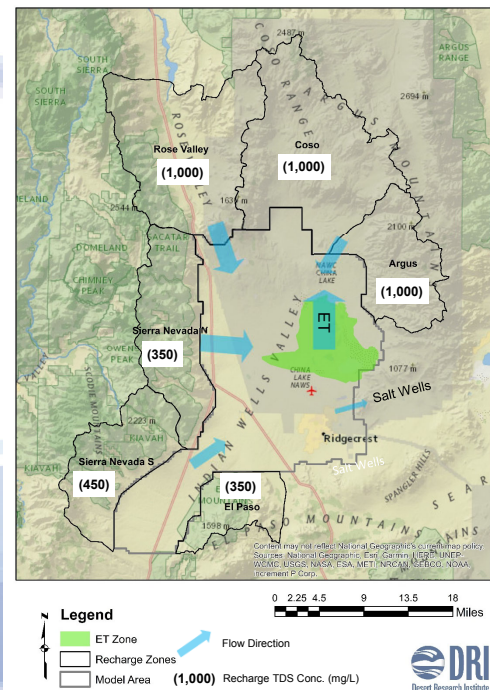
• Sources:

- Solutes in recharge
- Dissolution of minerals in basin
- Mixing with saltier groundwater
 - Remnant evaporative brines
 - Geothermal fluids

• Concentration by evaporation

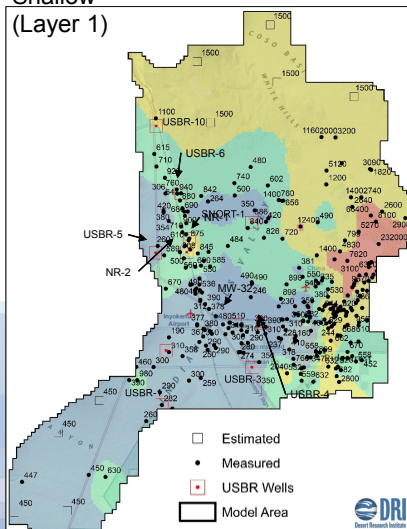
• Sinks:

- Solutes in discharge to Searles Valley
- Precipitation of minerals

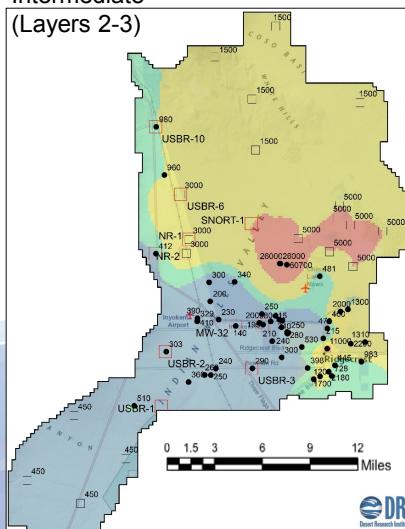


TDS Baseline Initial Conditions

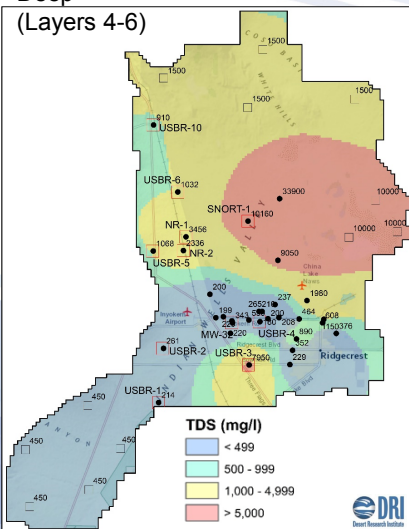
Shallow
(Layer 1)



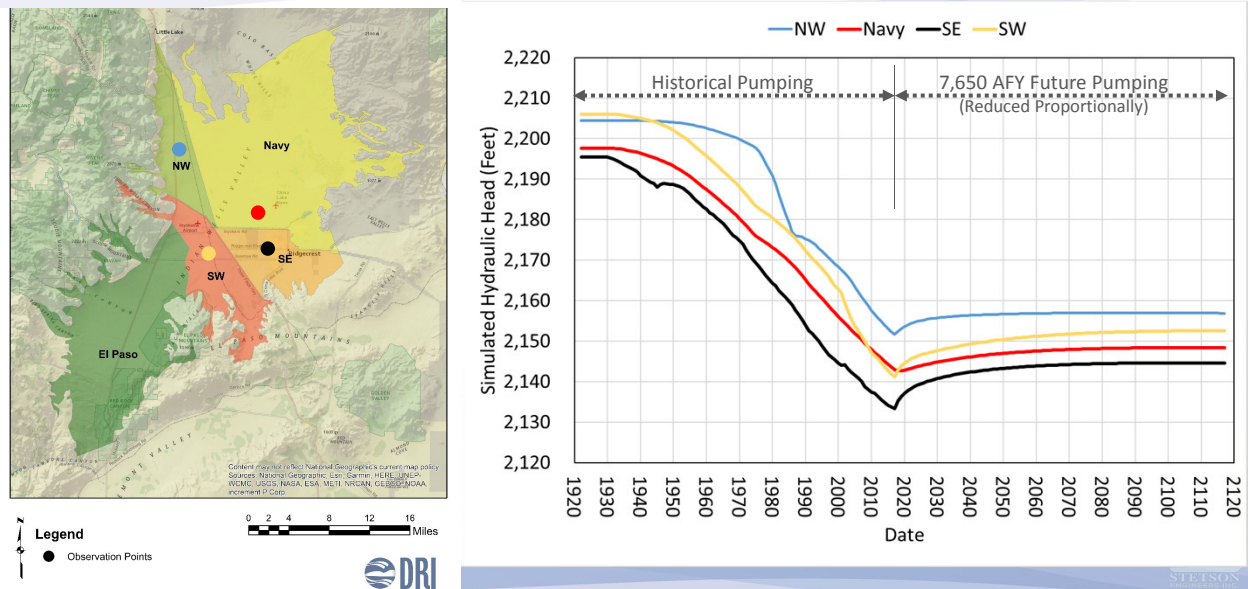
Intermediate
(Layers 2-3)



Deep
(Layers 4-6)



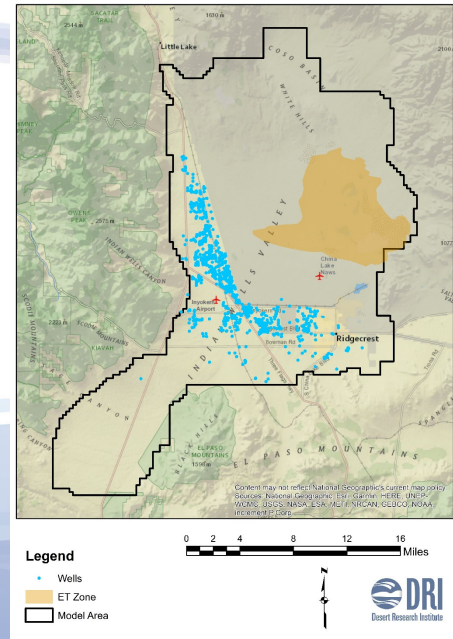
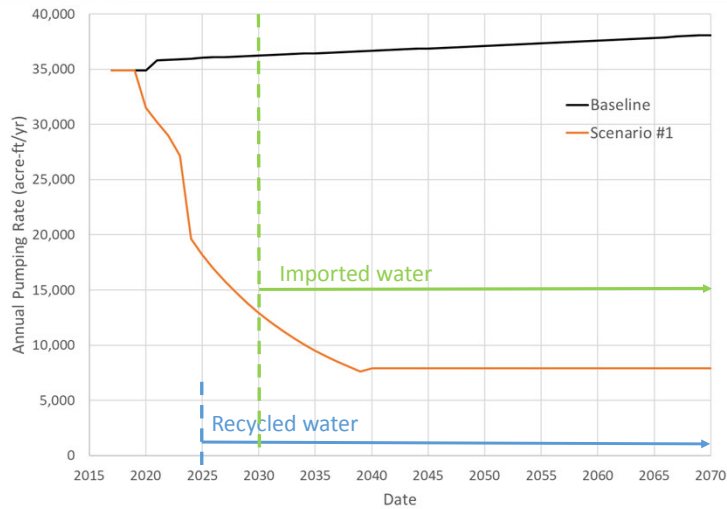
Predictive Simulation with Pumping Reduced to Basin Recharge



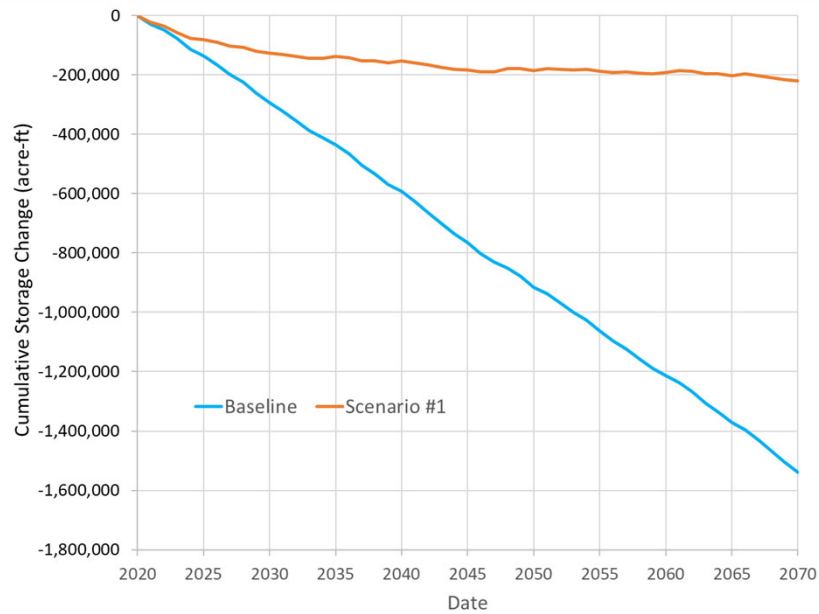
Management Scenario #1 Model Run

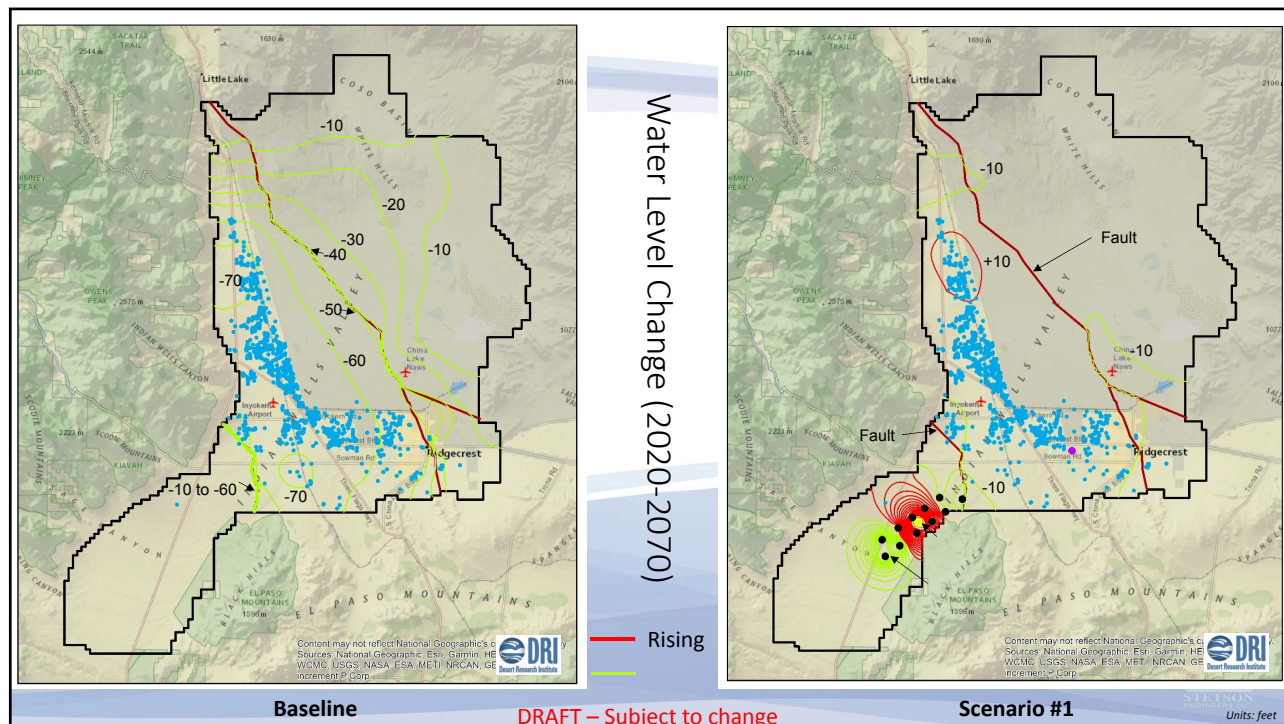
- SGMA Management Period Requirements:
 - Sustainable in 20 years (year 2040)
 - Sustainable through 50-year planning horizon (year 2070)
- Simulation analysis: 2020 – 2070
- Seasonal (monthly) time steps
- Variable hydrologic conditions for recharge
- Scenario #1 conditions
 - Reduced pumping: Ramp Down, Cliff, Leasing
 - Imported water use (storage and recovery project)
 - Recycled water use (injection)

Simulated Pumping



Change in Groundwater Storage

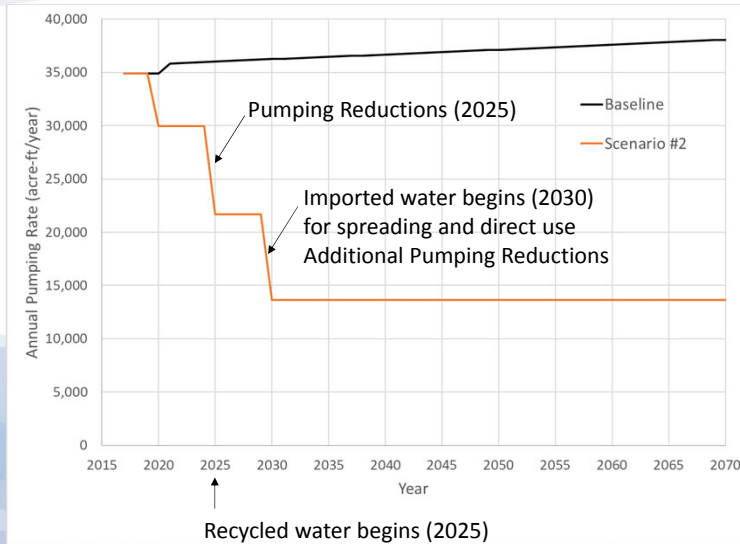




Management Scenario #2 Model Run

- SGMA Management Period Requirements:
 - Sustainable in 20 years (year 2040)
 - Sustainable through 50-year planning horizon (year 2070)
- Simulation analysis: 2020 – 2070
- Seasonal (monthly) time steps
- Variable hydrologic conditions for recharge
- Scenario #2 conditions
 - Reduced pumping: Step Down in 2025 and 2030
 - Imported water use (recharge project)
 - Recycled water use (injection)
 - Imported direct use

Simulated Pumping



2020 Pumping = 29,940 AF

2025 Pumping = 21,680 AF

No Reduction	Navy
No Reduction	Domestic
No Reduction	SVM
10% Reduction	IWVWD
10% Reduction	Mutuals, CSD
40% Reduction	Agriculture
No Pumping	City (Recycled Water)

2030 Pumping = 13,650 AF

No Reduction	Navy
No Reduction	Domestic
No Addtnl Reduction	Mutuals, CSD
No Addtnl Reduction	Kern County
No Addtnl Reduction	Agriculture
No Pumping	City (Recycled Water)
No Pumping	IWVWD (Direct Use)
No Pumping	SVM (Direct Use)

2030 through 2070 Pumping = 13,650 AFY



Groundwater Basin Budget

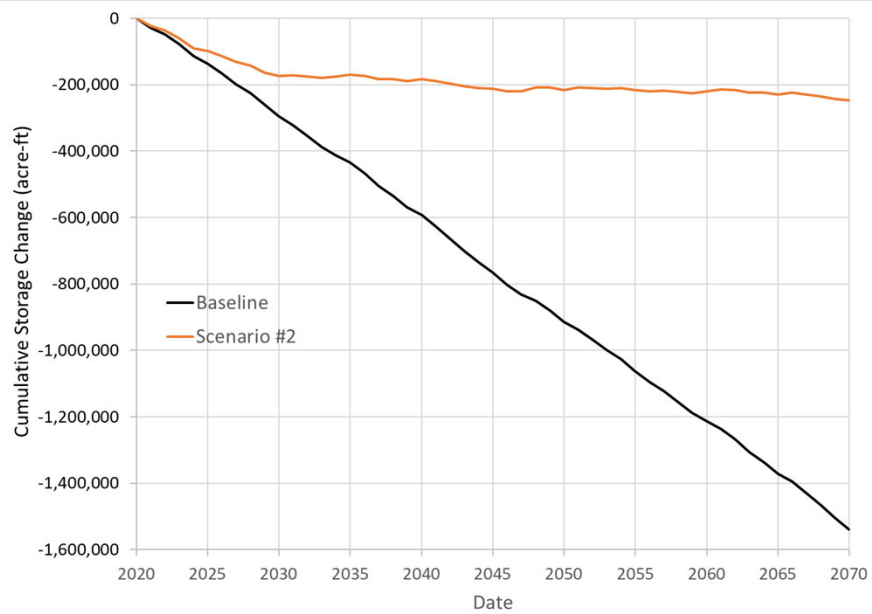
	BASELINE (2020 - 2070)	SCENARIO #2		
		(2020 - 2025)	(2035 - 2040)	(2065 - 2070)
<u>INFLOW</u>				
Natural Recharge	7,650	7,650*	7,650*	7,650*
Imported Water Recharge	-	-	5,640	5,640
Recycled Water Recharge	-	-	350	350
TOTAL	7,650	-	13,640	13,640
<u>OUTFLOW</u>				
Pumping	36,880	29,940	13,650	13,650
Evapotranspiration	1,610	2,634	1,950	1,230
Flow to Salt Wells Valley	40	65	46	16
TOTAL	38,530	32,639	15,645	14,896
<u>CHANGE IN GW STORAGE</u>	-30,880	-21,383	-1,221	-3,890

*Averaged over 2020 - 2070

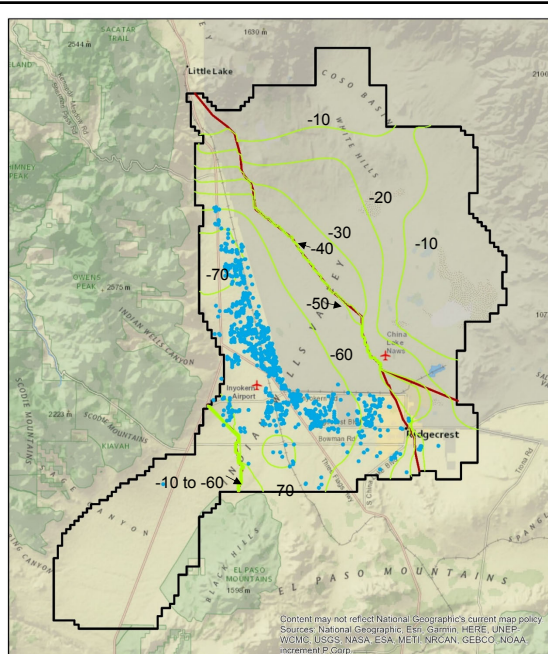
DRAFT – Subject to change



Scenario #2 Change in Basin Groundwater Storage



From DRI March 7, 2019 TAC Presentation

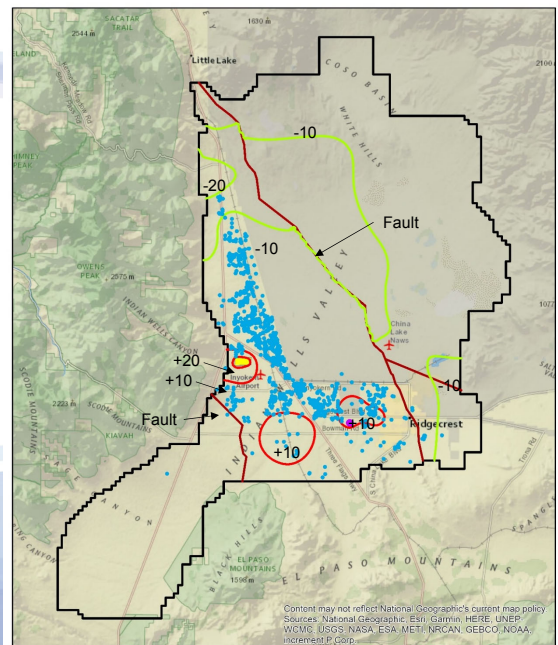


Baseline

50-Year Groundwater Level Change
(2020-2070)

Rising
Falling

From DRI March 7, 2019 TAC Presentation



Scenario #2

Units: feet

Next Modeling Steps

- Work with Board/PAC/TAC to develop Sustainable Management Alternatives
- Complete two more model scenarios (DRI and TAC)
- Model documentation and GSP Sections (DRI and WRM)

