Indian Wells Valley Brackish Groundwater Project

Status Update to
Indian Wells Valley Groundwater Authority
Technical Advisory Committee (TAC)
June 27, 2019

1

1

Outline

- What is a brackish groundwater project?
- Where has brackish water been developed?
- How can brackish water development help IWV?
- Characteristics of a suitable brackish groundwater location
- Brackish groundwater locations
  - Location #1 – NW corner of the basin
  - Location #2 – SE corner of the basin
  - Location #3 – S-Central part of the basin
- Next Steps

2

2

Brackish Water Resources Partnership

- Formed in 2015
- Purpose is to examine the development of brackish groundwater in the basin to offset freshwater pumping and prolong the life of the freshwater resource
- Agreement between Funding Partners in 2016
- Major Funding Partners
  - Indian Wells Valley Water District
  - Mojave Pistachios
  - Coso Geothermal
  - Searles Valley Minerals
- Minor Funding Partner
  - Meadowbrook Dairies

3

3

DWR Desalination Feasibility Study Grant

- Application for Prop. 1 Grant funding in September 2017
- Notice of Award made in the spring of 2018
- Budget and scope revisions and discussions with DWR
- Resolution of main items in April 2019
- DWR preparing contract documents
- Contract should be in place before the end of June 2019
- Grant Award: $700,000

4

4

What is a Brackish Groundwater Project?

- **Fresh** Water: < 1,000 mg/L of total dissolved solids (TDS)
- **Brackish** Water: 1,000 mg/L to 10,000 mg/L (USGS, 2017)
- **Saline** Water: > 10,000 mg/L TDS
- Brackish groundwater is an **alternative** supply that can **augment** existing "fresh" groundwater supplies or provide a "**bridge**" to future imported water

5

5

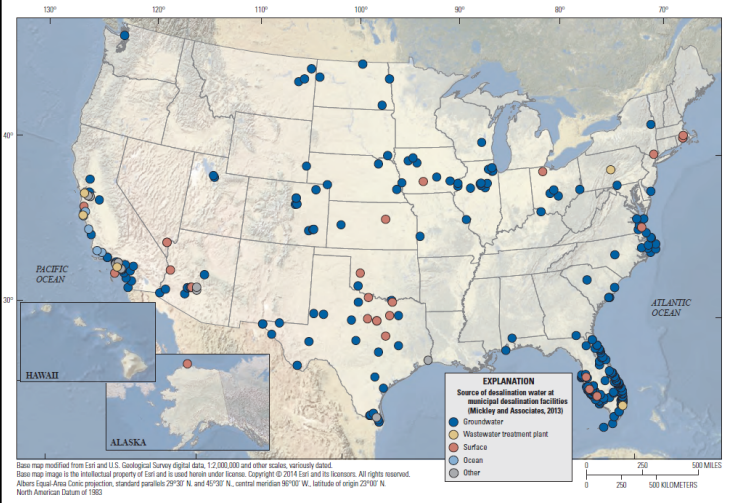
What are the Elements of a Brackish Project?

- **Extract** with wells
- **Pre-treat** to remove suspended solids, hardness, etc.
- **Treat** with Reverse Osmosis (RO)
- **Deliver** fresh treated water to customers
- **Disposal** of the RO concentrate (salts)

6

6

Where has Brackish Water Been Developed?



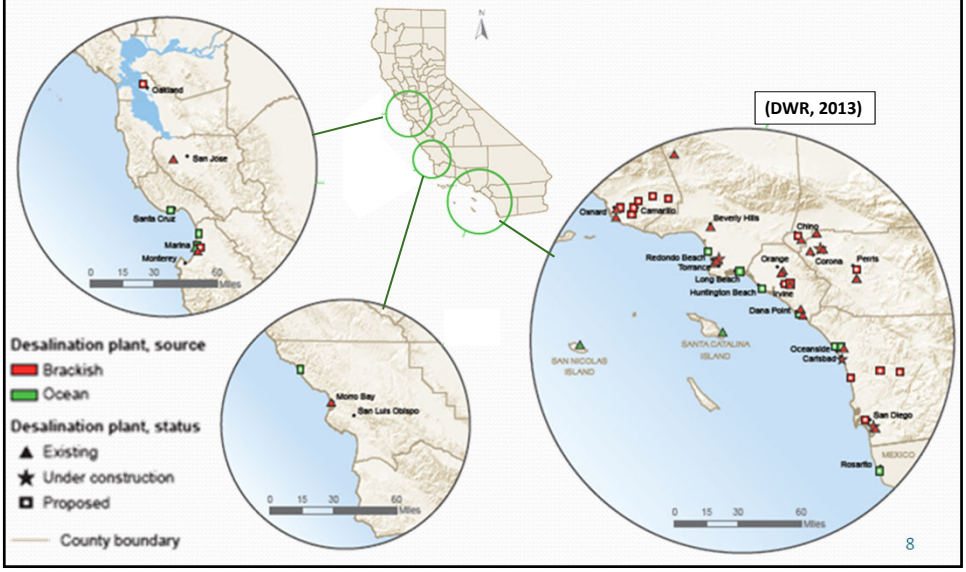
Globally:

- 120 countries
- 21,000 desalination plants worldwide - 50% use brackish water

7

7

Brackish Water Projects in California



8

8

Brackish Water Projects in Kern County

- Buena Vista Water Storage District (BVWSD) perched groundwater project
  - ~6,000 AFY of brackish perched groundwater
- Westside District Water Authority (WDWA)
  - ~50,000 AFY of brackish groundwater and ~10,000 AFY of oil-field produced waters (BOF Project)
- Semi-Tropic Water Storage District (STWSD) brackish project
  - 16,000 AFY of brackish groundwater
- Indian Wells Valley Brackish Project
  - ~10,000 AFY of brackish groundwater

9

9

How Can Brackish Water Development Help Indian Wells Valley?

- Bridge and buffer to achieve SGMA sustainability
- Diversify local water supplies
  - Offsets pumping in fresh groundwater areas mitigating water levels declines
  - Augments existing groundwater supplies
  - Bridge to future imported water
  - Buffer during periods when imported water is expensive
  - Mitigates the migration of brackish groundwater into areas of fresh groundwater
  - Local emergency supply

10

10

How Can Brackish Water Development Help Indian Wells Valley?

- Improving Reliability
  - Part of a portfolio of multiple sources of water
    - Existing fresh groundwater
    - Imported water
    - Recycled water
    - Banked water
- Brine (RO Concentrate) for local, beneficial industrial use
  - Coso Geothermal
  - Searles Valley Minerals

11

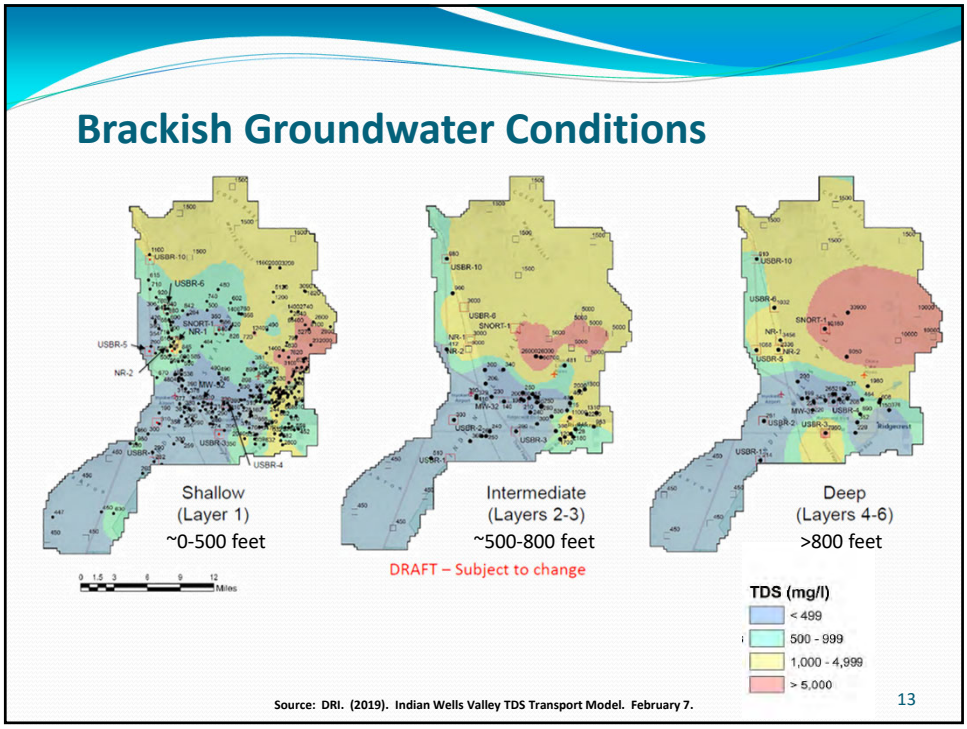
11

Characteristics of a Suitable Extraction Location

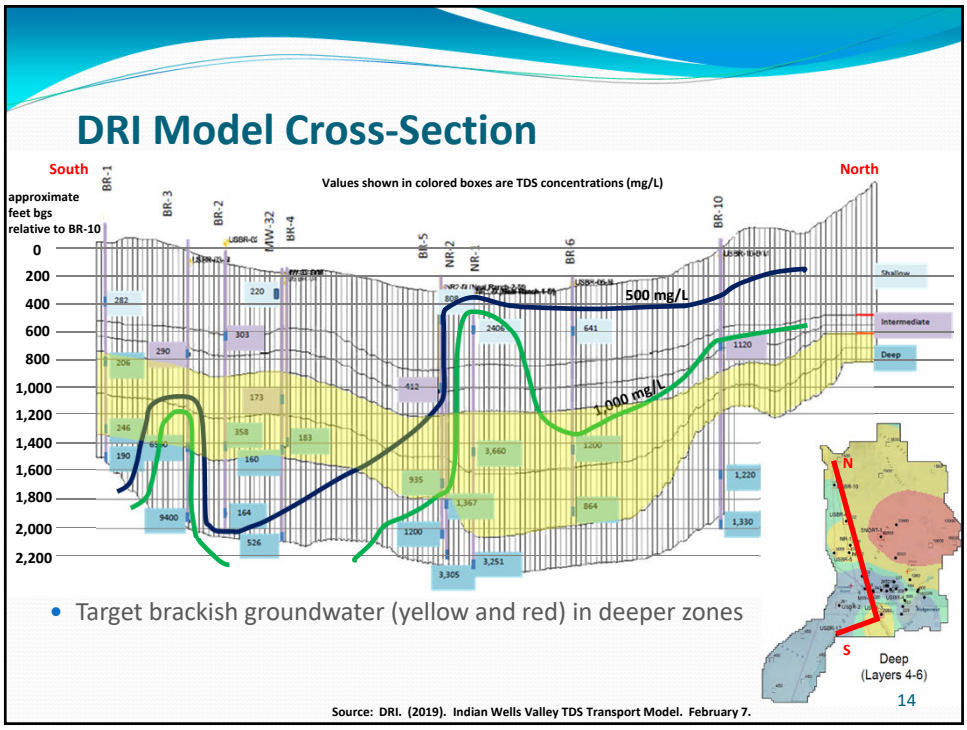
- The "*ideal*" brackish groundwater extraction well has several characteristics:
  - Completed in a **sand layer** that will yield a desirable volume of water over the long term
  - Completed where the long-term **TDS concentrations** of the brackish groundwater are > **1,000 mg/L** (up to 4,000 mg/L)
  - Located **away** from existing fresh water **production wells**
  - Located in an area where the potential for **impacts to freshwater resources are minimized** (lateral transport, vertical transport)
  - Located in an area where **impacts from subsidence are minimized**

12

12


Brackish Groundwater Conditions
Shallow
(Layer 1)
~0-500 feet
Intermediate
(Layers 2-3)
~500-800 feet
Deep
(Layers 4-6)
>800 feet
DRAFT – Subject to change
TDS (mg/l)
< 499
500 - 999
1,000 - 4,999
> 5,000
Source: DRI. (2019). Indian Wells Valley TDS Transport Model. February 7.
13

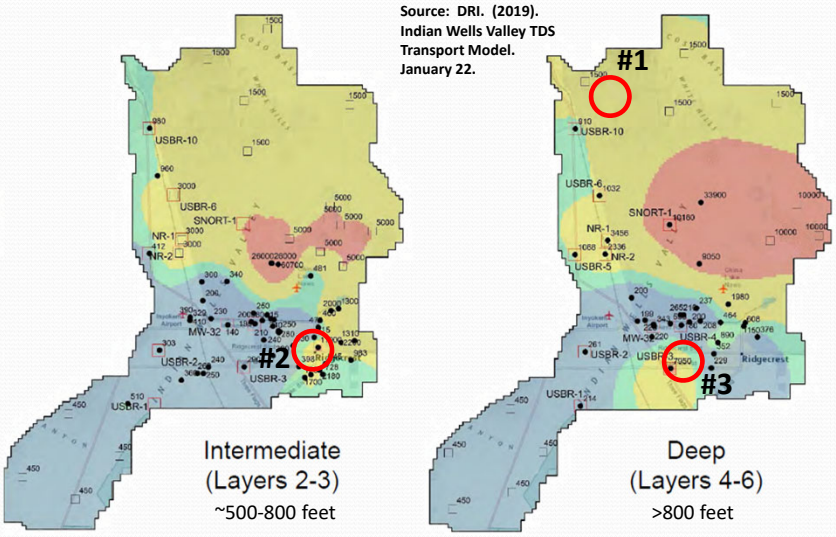
13


DRI Model Cross-Section
South
North
Values shown in colored boxes are TDS concentrations (mg/L)
approximate
feet bgs
relative to BR-10
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
BR-1
BR-3
BR-2
MW-32
BR-4
BR-5
NR-2
NR-1
BR-6
BR-10
500 mg/L
1,000 mg/L
Shallow
Intermediate
Deep
N
S
Deep
(Layers 4-6)
Target brackish groundwater (yellow and red) in deeper zones
Source: DRI. (2019). Indian Wells Valley TDS Transport Model. February 7.
14

14

Initial Extraction Locations

Source: DRI. (2019). Indian Wells Valley TDS Transport Model. January 22.



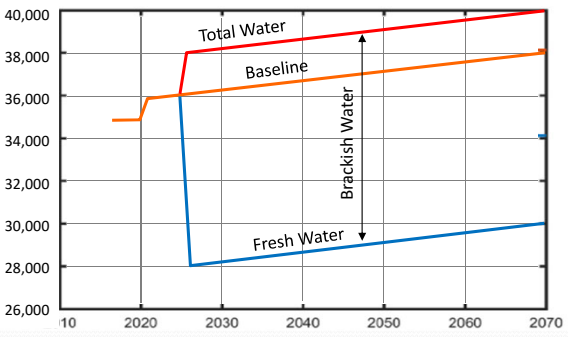
Intermediate (Layers 2-3)
~500-800 feet

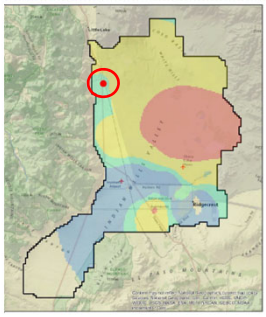
Deep (Layers 4-6)
>800 feet

15

15

Location #1: Single Well in NW





- 10,000 AFY of pumping at BWG well
- Located at Pearsonville, Inyo County
- Well screen: 750-1,500 feet bgs
- 8,000 AFY reduced fresh water pumping
- Starts in 2025 and runs through 2070
- Initially considered a "worst case" scenario, 10k AFY from a single well to see the magnitude of the effects on the basin
- Extraction modeling will evolve to consider distributed vertical well fields and horizontal wells

16

16

Reduced Freshwater Pumping (1)

- 8,000 AFY reduction in freshwater pumping (667 AF per month)
- Initial reductions of 125 AF per month for:
  - IWV Water District, Searles Valley Minerals, Meadowbrook Dairies, Mojave Pistachios, Small Agriculture
- Initial reduction of 42 AF per month for Other (City of Ridgecrest and Kern County)
- 667 AF per month of treated brackish water distributed to offset freshwater pumping reductions

17

17

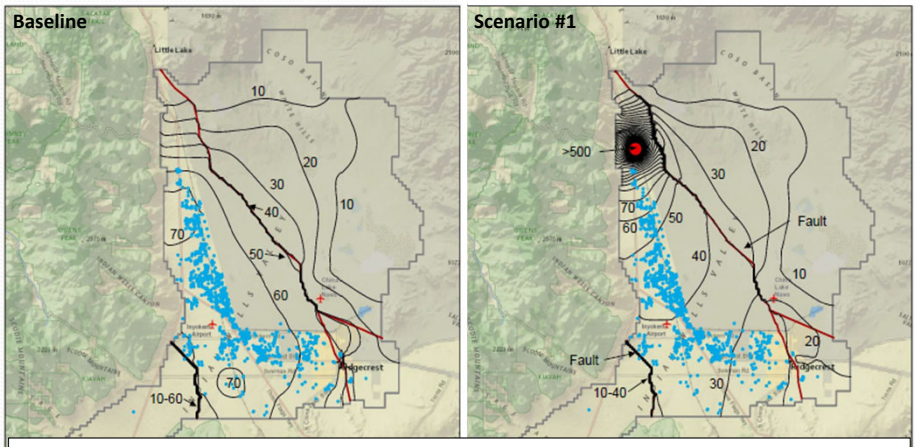
Reduced Freshwater Pumping (2)

- In the fall and winter months, Mojave Pistachios, Small Agriculture, and Others use less fresh groundwater.
  - These pumpers would have an excess treated brackish water allocation
  - The excess is equally distributed to IWV Water District, Searles Valley Minerals, and Meadowbrook Dairies.

18

18

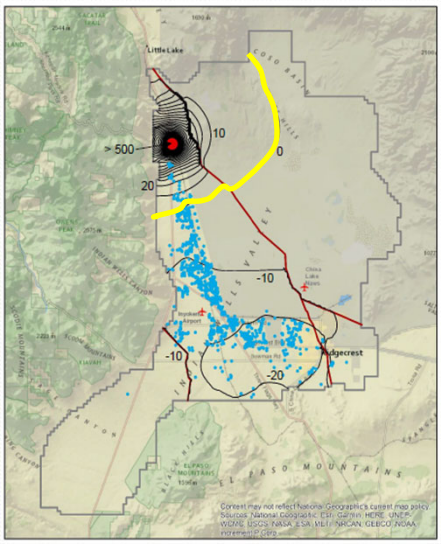
Location #1: Drawdown 2020-2070



- Drawdowns shown are in the shallow layer of the model
- Extreme drawdown in the vicinity of single extraction well (as expected)
- Relative to baseline, drawdown contours in areas where majority of wells are located offset significantly towards the NW (less drawdown in areas of freshwater pumping)

19

Location #1: Drawdown Differences

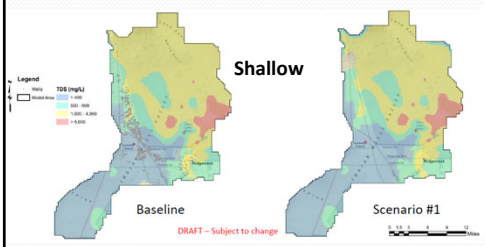


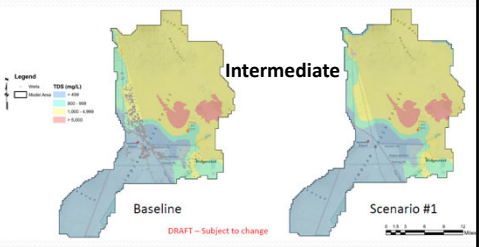
- When changes from Baseline are examined, freshwater drawdown in the majority of the basin is reduced between 0 and 20 feet, (prolonging the life of the freshwater resources)

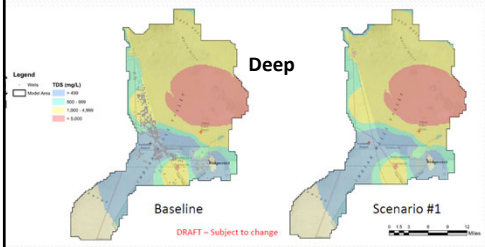
20

20

Location #1: TDS Concentrations 2020-2070







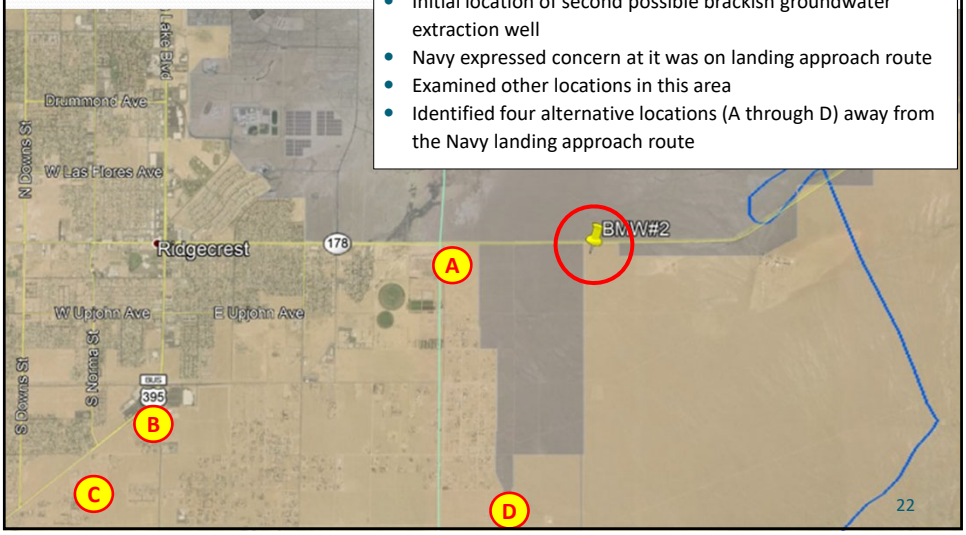
- No changes in water quality in the shallow, intermediate or deep layers relative to the Baseline

21

21

Location #2: Single Well in SE

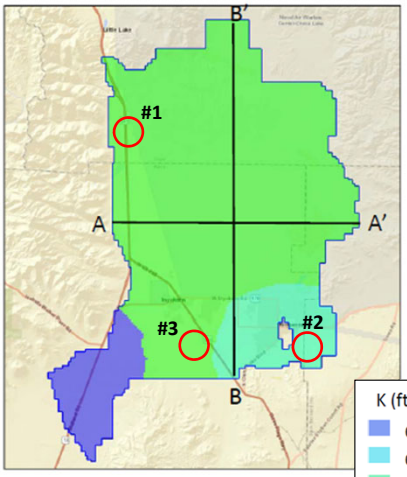
- Initial location of second possible brackish groundwater extraction well
- Navy expressed concern at it was on landing approach route
- Examined other locations in this area
- Identified four alternative locations (A through D) away from the Navy landing approach route



22

22

Location #2: Hydraulic Conductivity



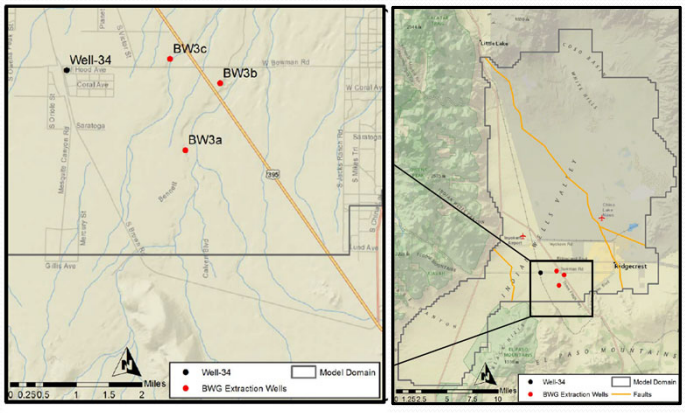
Layers 4, 5 and 6

- Examined DRI model hydraulic conductivity (K) distribution for the Basin
- K in area of Location #2 found to be an order of magnitude lower than in area of Location #1
- Decided not to model brackish groundwater extraction at this location, as yields would be low and drawdown high
- Moved on to examine Location #3

23

23

Location #3: S-Central Brackish Well Cluster

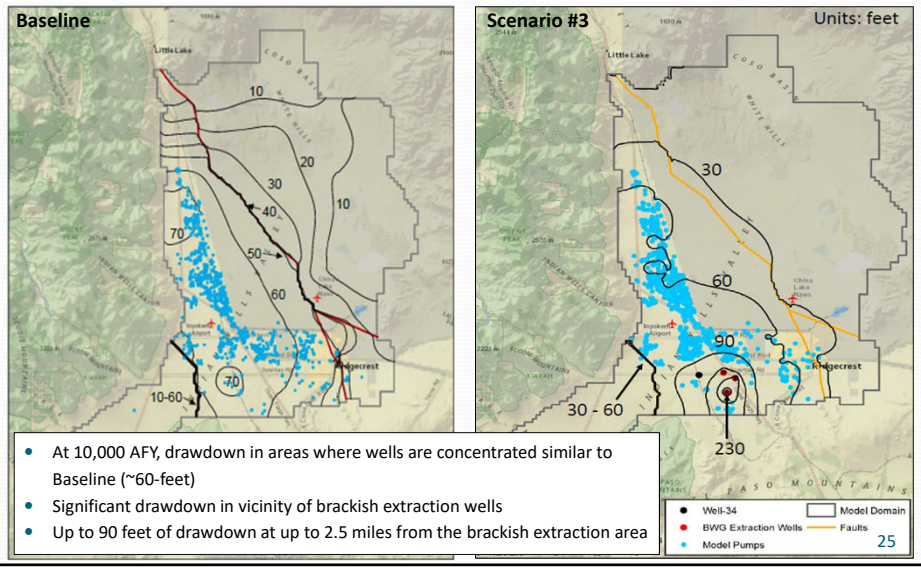


- Three vertical extraction wells (screened 750 – 1,500 feet bgs)
- Four extraction rates (2,500, 5,000, 7,500, and 10,000 AFY)
- Pumping equally divided between the three extraction wells
- IWVWD Well #34 shown for proximity reference

24

24

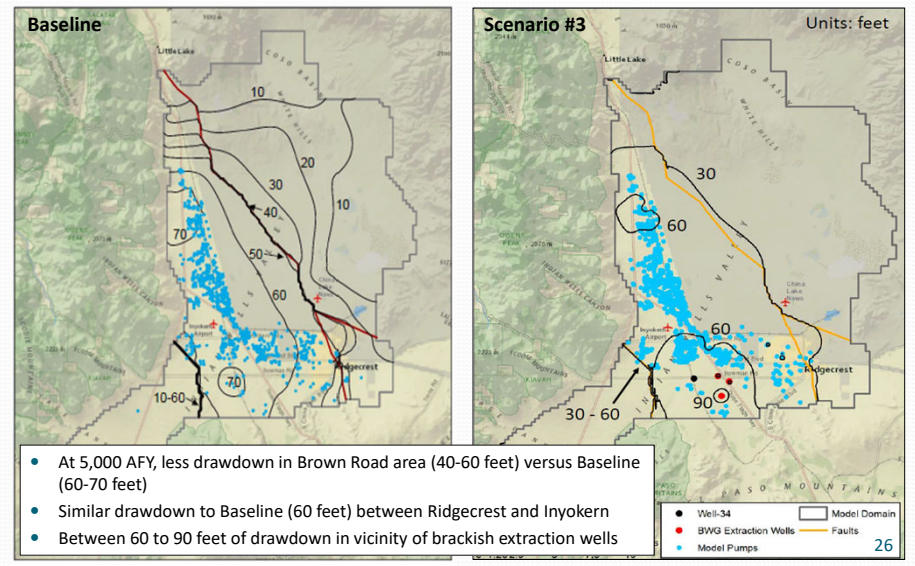
Location #3: Drawdown 2020-2070 (10,000 AFY)



- At 10,000 AFY, drawdown in areas where wells are concentrated similar to Baseline (~60-feet)
- Significant drawdown in vicinity of brackish extraction wells
- Up to 90 feet of drawdown at up to 2.5 miles from the brackish extraction area

25

Location #3: Drawdown 2020-2070 (5,000 AFY)



- At 5,000 AFY, less drawdown in Brown Road area (40-60 feet) versus Baseline (60-70 feet)
- Similar drawdown to Baseline (60 feet) between Ridgecrest and Inyokern
- Between 60 to 90 feet of drawdown in vicinity of brackish extraction wells

26

Location #3: SW Corner of Basin

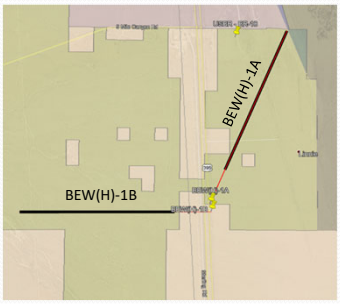
- Location is potentially viable at low brackish extraction rates (~2,500 to 5,000 AFY)
- However, proximity to IWVWD Well #34 and additional drawdown at that well make this location less desirable
- Additionally, the apparent limited extent of the brackish resource in this area, combined with the proximity to the majority of the freshwater resources reduce the desirability even more
- Brackish groundwater extraction focus will move to NW corner of the basin (Location #1)

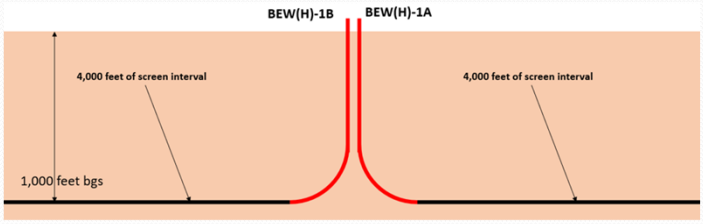
27

27

Location #1: Horizontal Wells in NW

- Four extraction rates
  - 2,500, 5,000, 7,500, 10,000 AFY
  - Both BEW(H)-1A and BEW(H)-1B pumping

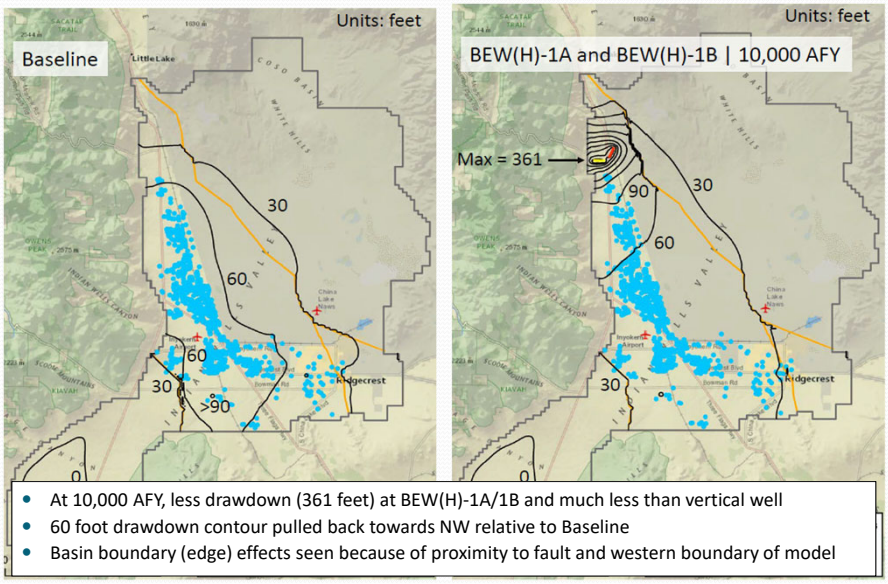




28

28

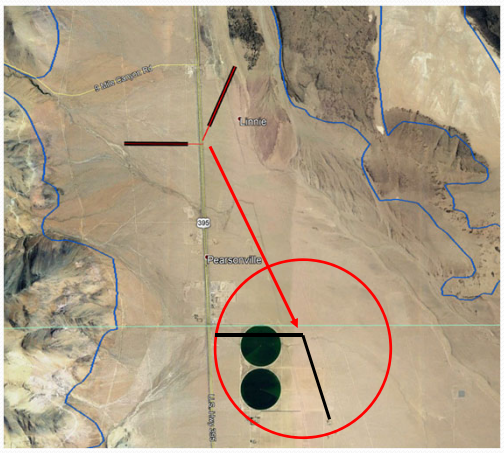
Location #3: BEW(H)-1A and 1B – Drawdown



- At 10,000 AFY, less drawdown (361 feet) at BEW(H)-1A/1B and much less than vertical well
- 60 foot drawdown contour pulled back towards NW relative to Baseline
- Basin boundary (edge) effects seen because of proximity to fault and western boundary of model

29

Recommendations For Next Steps



- Focus on NW corner of basin
- Horizontal wells and vertical well field (for FS evaluation)
- Move location south slightly to mitigate boundary effects (fault to east, and model boundary to west) and into Kern County
- Model a brackish groundwater "bridging" scenario

30

30

Questions and Comments

31

31