Indian Wells Valley Water District

Celebrating more than 60 Years of Service

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Special Board Meeting
October 21, 2024

October Special Board Meeting

1. Call to Order

2. Pledge of Allegiance

3. Roll Call

4. Posting of Agenda Declaration

5. Conflict of Interest Declaration

6. Public Questions and Comments

This portion of the meeting is reserved for persons desiring to address the Board on any matter not on the agenda and over which the Board has jurisdiction. However, no action may be taken by the Board of Directors on any item not appearing on the agenda. Non-agenda speakers are asked to limit their presentation to five minutes. Public questions and comments on items listed on the agenda will be accepted at any time the item is brought forth for consideration by the Board. When you are recognized by the chairperson, please state your name and address for the record.

October Special Board Meeting

7. Opening Comments

October Special Board Meeting

8. Presentation on Assessment of Groundwater Storage for the Indian Wells Valley Groundwater Basin

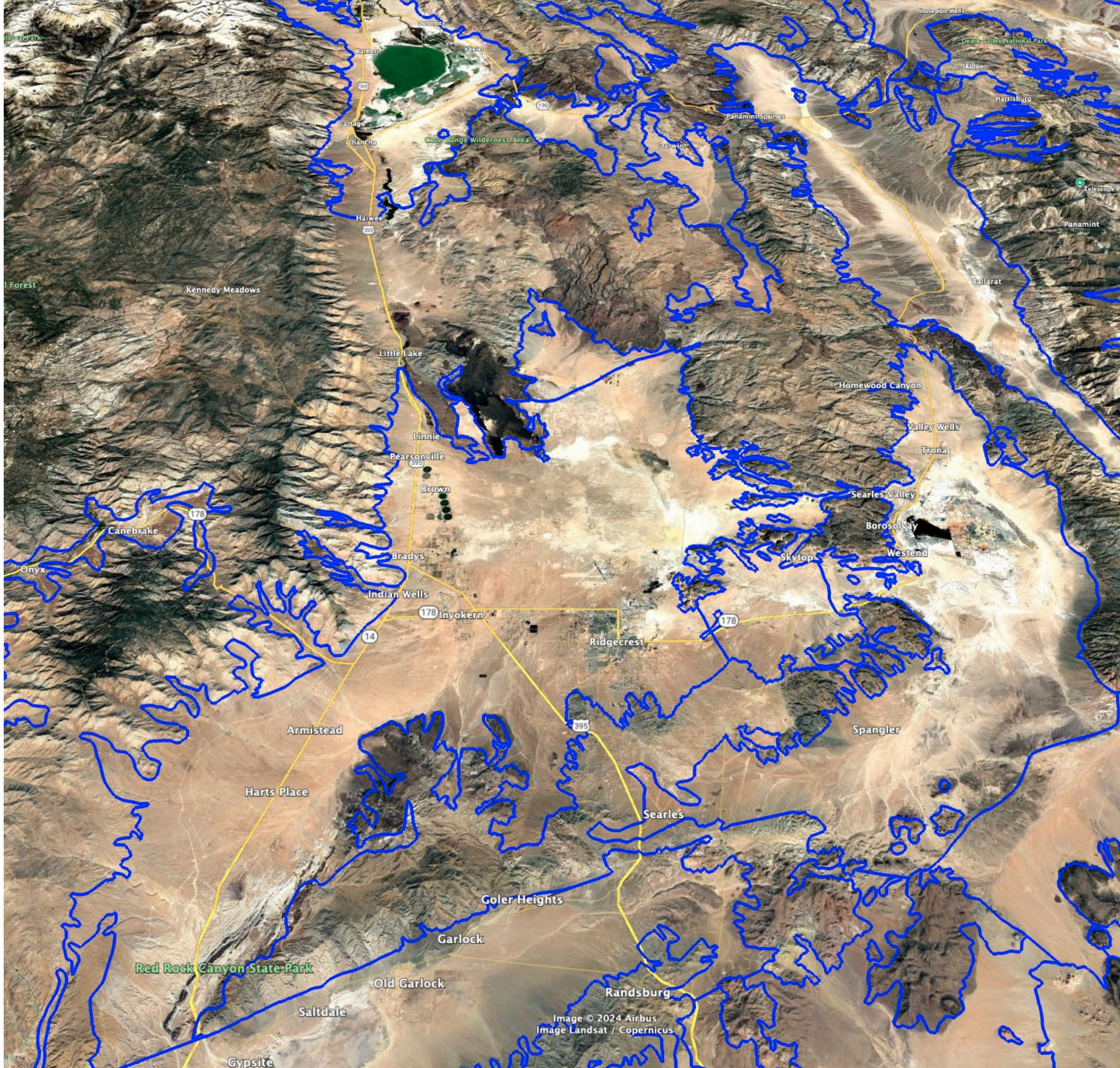
9. Presentation on Assessment of Safe Yield for the Indian Wells Valley Groundwater Basin

(Tim Parker)

Storage and Safe Yield Estimate for Indian Wells Valley Groundwater Basin

Special Board Meeting
Indian Wells Valley Water District
Historic USO Building
October 21, 2024 – 6:00PM

The Technical Working Group
Presented by
Timothy K. Parker, PG, CEG, CHG
Parker Groundwater



Acknowledgements

The Technical Working Group

- Indian Wells Valley Water District
    - Krieger & Stewart - Chuck Krieger, Travis Romeyn
    - Parker Groundwater – Tim Parker
    - Ramboll - Alka Singhal, Eva Sebok, Paul Thorn
- Meadowbrook Dairy
    - Luhdorff Scalmanini - Eddy Teasdale, Will Halligan
- Mojave Pistachios
    - Aquilogic - Anthony Brown, Wade Major
- Searles Valley Minerals
    - Geoscience Support Services, Inc. - Lauren Wicks, Johnson Yeh, Dennis Williams

Collier Geophysics for seismic processing/interpretation for basin geometry

Previous Cooperative Work done in the basin jointly by US Naval Air Weapons Station, US Bureau of Reclamation, Indian Wells Valley Water District, and Searles Valley Minerals (formerly North American Chemical Company).

Outline

- Executive Summary
- Dispelling Some Myths
- Basin Overview
- GSP Storage Estimate Approach and Results
- TWG Storage Estimate Approach and Results
- GSP Sustainable Yield Estimate Approach and Results
- TWG Safe Yield Estimate Approach and Results
- Final Summary

Executive Summary

- IWV Basin Storage Estimates
  - GSP < 1,750,000 AF remain
  - TWG > 30,000,000 AF remain

- IWV Basin Yield Estimates
  - GSP Sustainable Yield 7,650 AFY
  - TWG Safe Yield 14,300 AFY

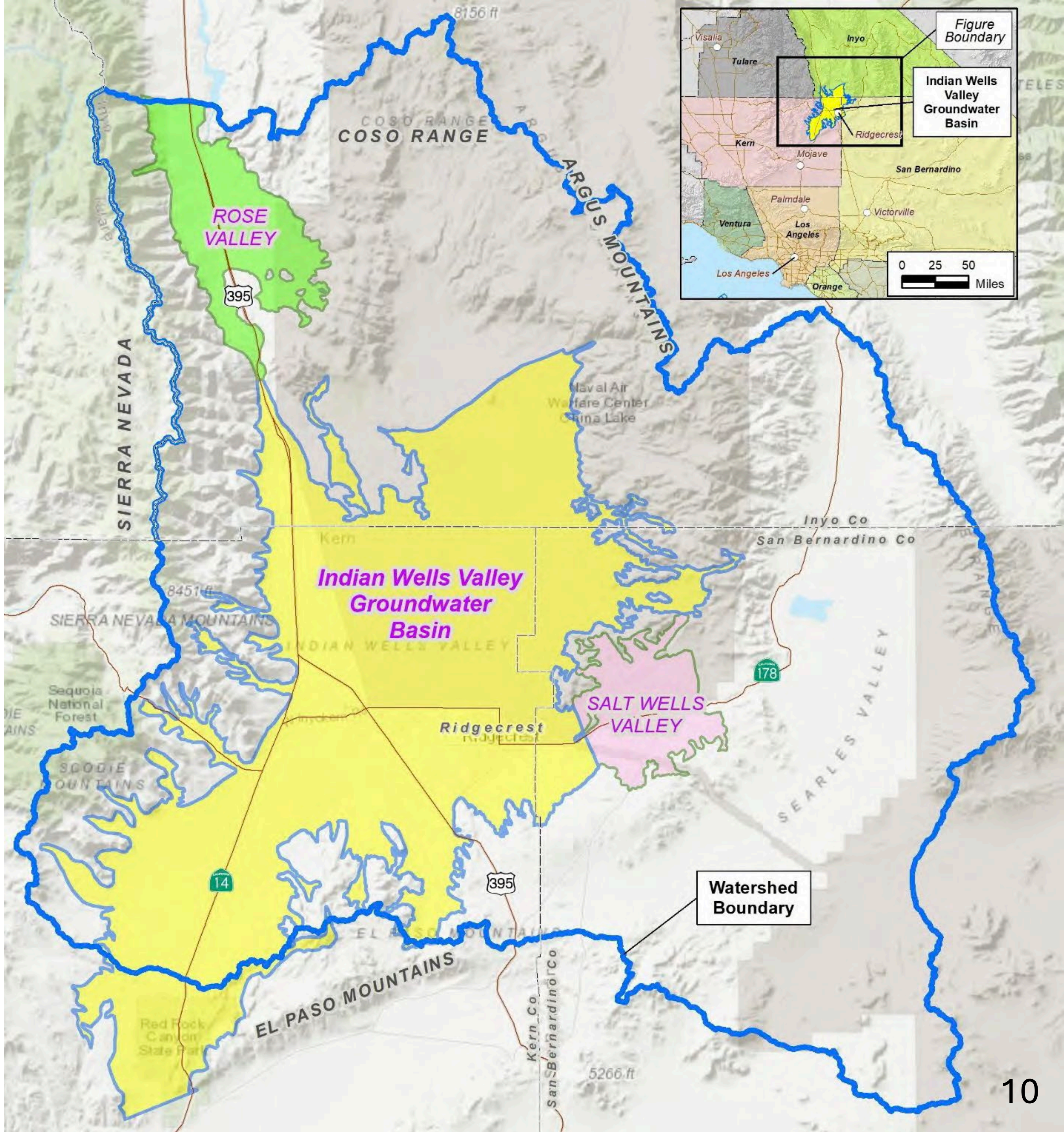
GSP – groundwater sustainability plan
TWG – Technical Working Group
AF - Acre-foot = one foot of water covering one acre of land = 325,800 gallons
AFY - acre-feet per year

Dispelling Some Myths in the Indian Wells Valley Groundwater Basin

Myth	Fact
1. Many domestic wells going dry (97 by 2018, additional 81 by 2030)	1. Very few domestic wells have failed or gone dry, with five well owners applying for assistance
2. There is less than 1.75 million acre feet of usable water left	2. Basin is deep and contains abundant usable groundwater in storage
3. The sustainable yield of the basin is 7,650 acre-feet per year	3. The science behind the sustainable yield estimate in the GSP is disputed
4. There is a newly discovered thick clay underlying NAWS	4. The thick Pleistocene lacustrine clay has been known about for decades
5. No new science has been applied in the work funded by the District	5. New science applied in the basin includes interpretation of the 2017 AEM and 2D seismic reflection lines to characterize deep basin geometry and aquifer properties, and domestic well analysis, etc.

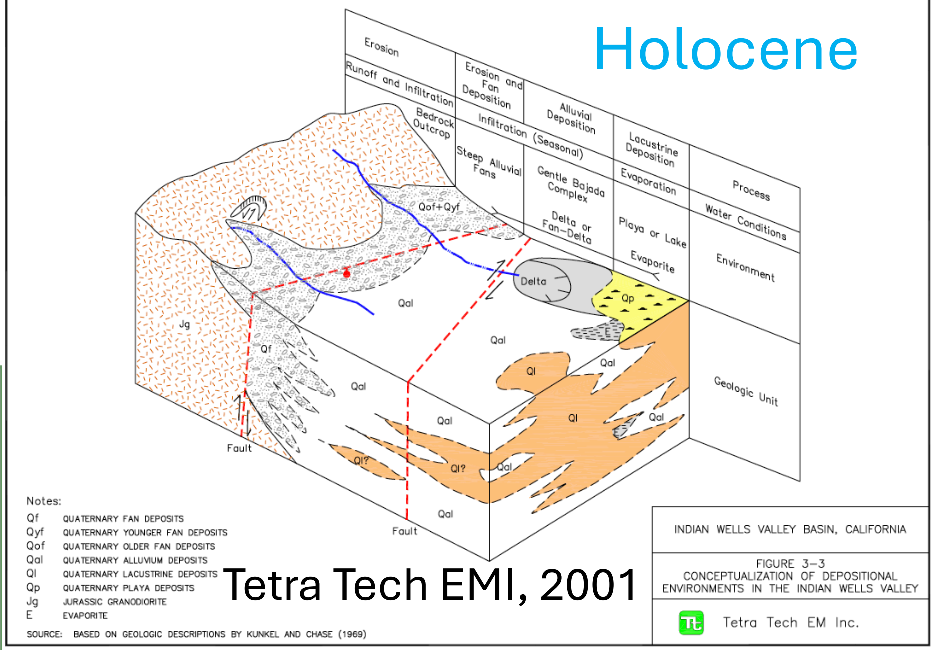
Basin Overview

- 600 mi^2 COD groundwater basin up to ~8,000 feet deep
- Half graben structure deepest on west side
- ~ 1,500 parcels on domestic wells (not on mutual or municipal supply)
- Current pumping ~19,000 acre-feet per year (AFY)
- Major pumpers include:
    - Indian Wells Valley Water District
    - Searles Valley Minerals
    - Meadowbrook Dairy
    - Mojave Pistachios
    - US Navy



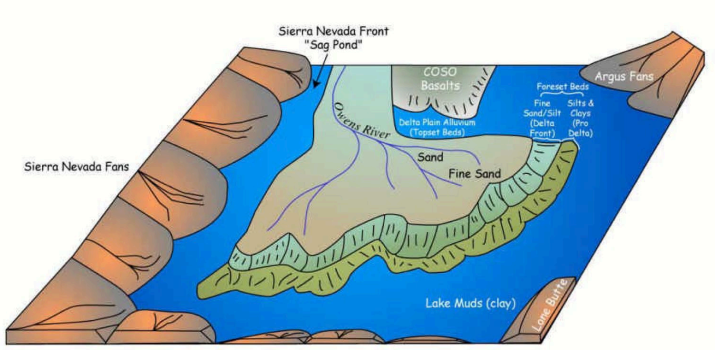
Hydrogeologic Conceptual Models

Holocene



Tetra Tech EMI, 2001

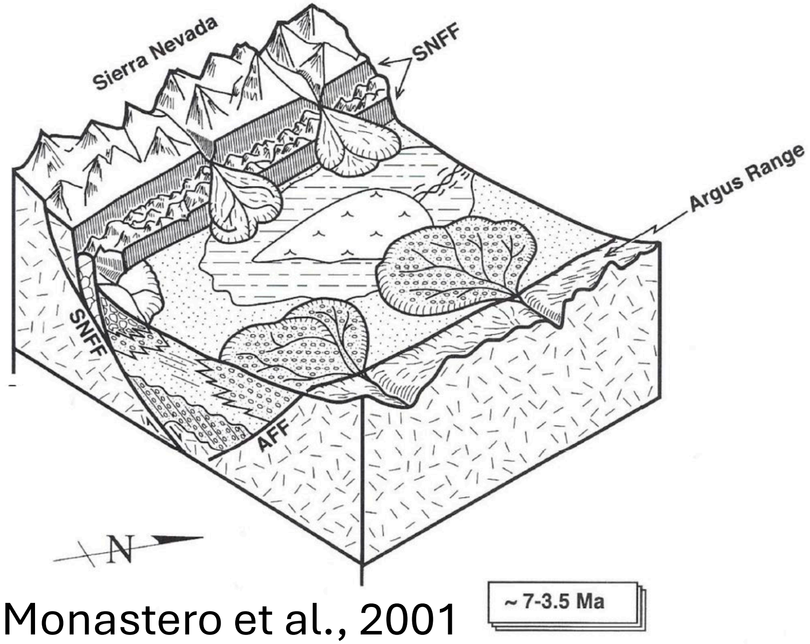
Pleistocene



US EPA, 2004

Conceptualization of Owens River Delta Sedimentary Environments

Mio-Pliocene



Monastero et al., 2001

Tetra Tech EMI, 2003

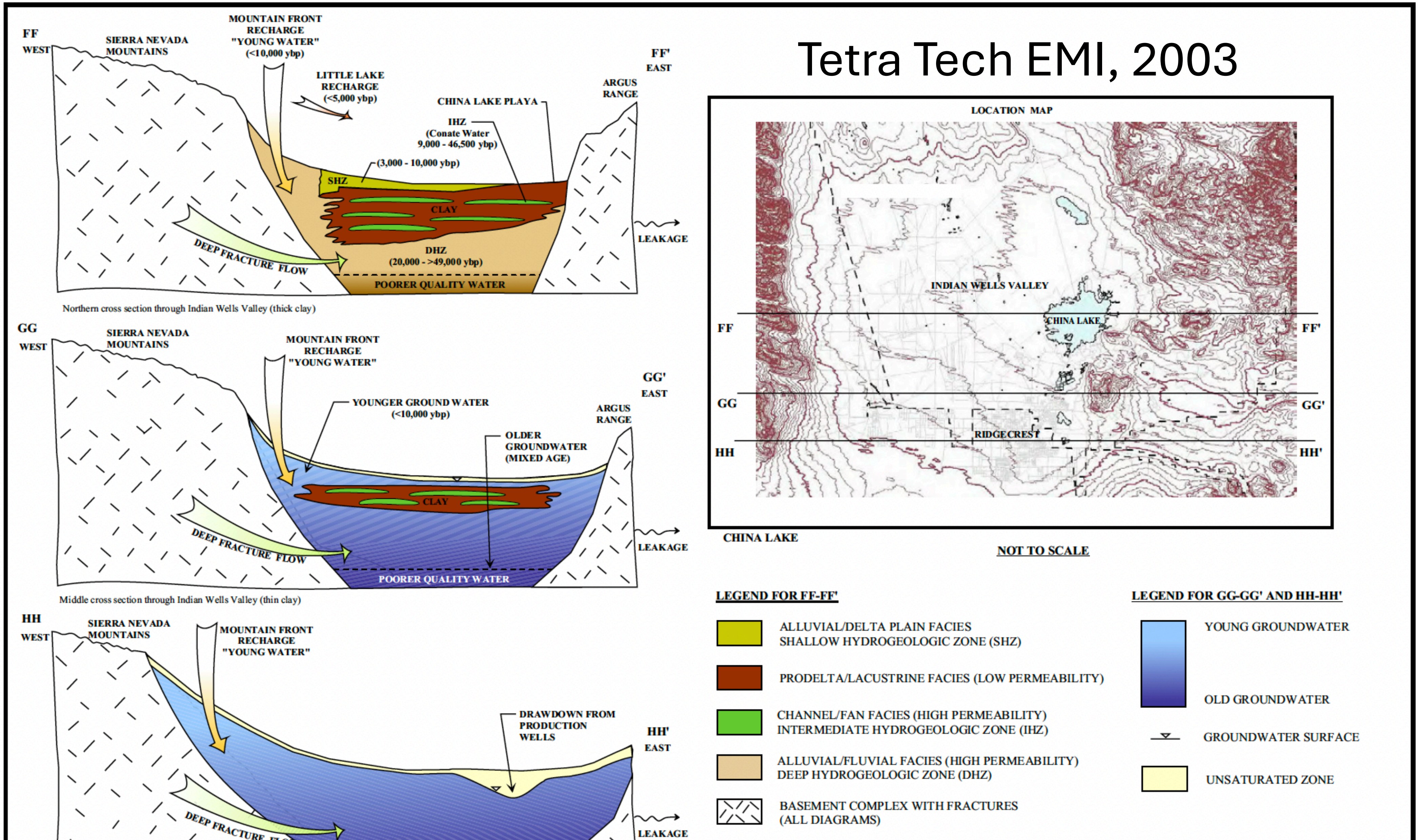
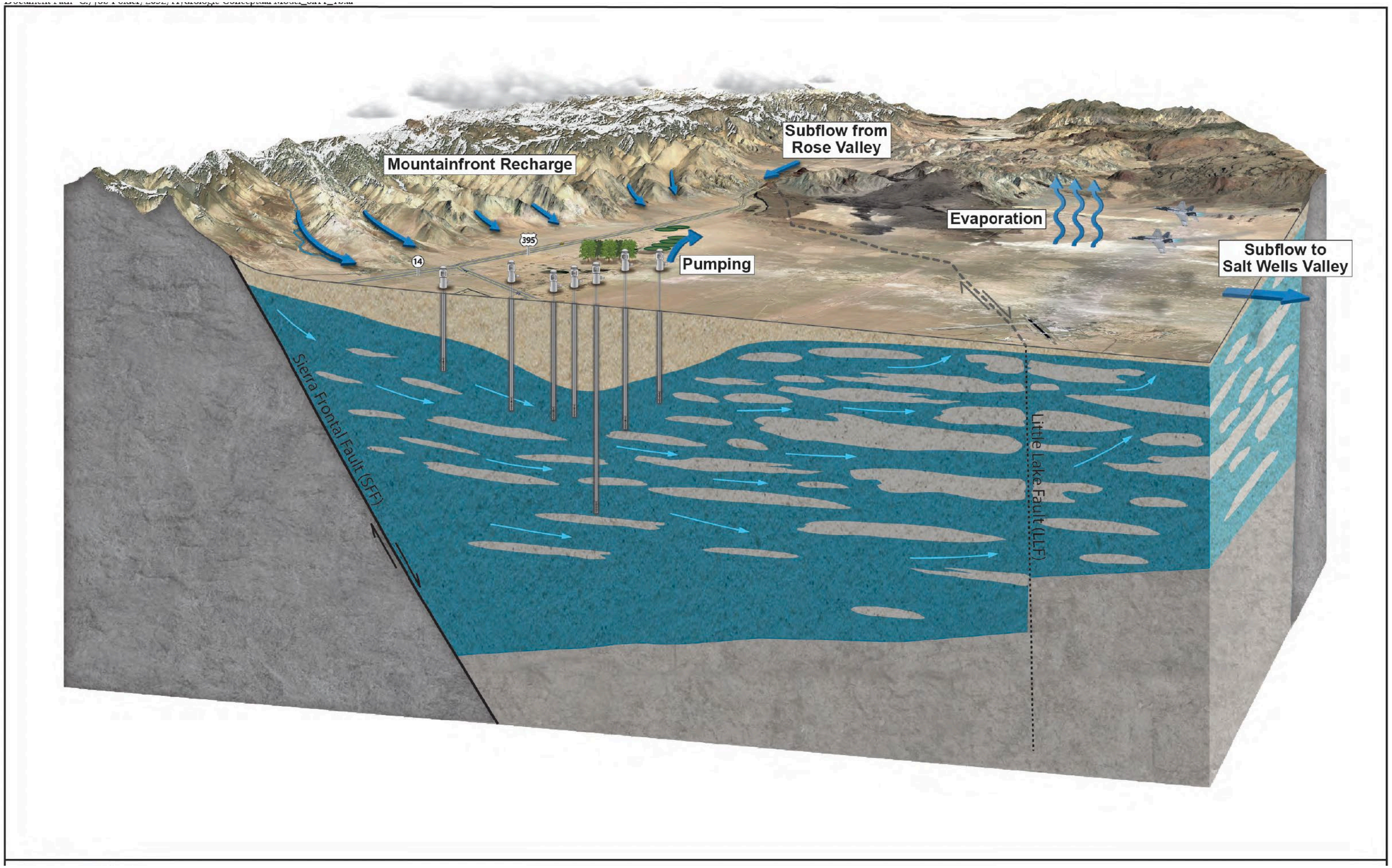


FIGURE 5-2
CONCEPTUAL SITE MODEL
NAWS CHINA LAKE, CALIFORNIA

GSP Hydrogeologic Conceptual Model Block Diagram



GSP Storage Estimate Approach and Results

Identify 92.5 square mile area (59,200 acre) of the 600 square mile (384,000 acre) basin

↓

AREA times **200 FOOT DEPTH** times **SPECIFIC YIELD**

↓

Results for estimated usable fresh water in storage:
2,370,000 acre-feet in 1993
1,750,000 acre-feet in 2017

GSP Storage Estimate Approach

Reference: US BUR 1993

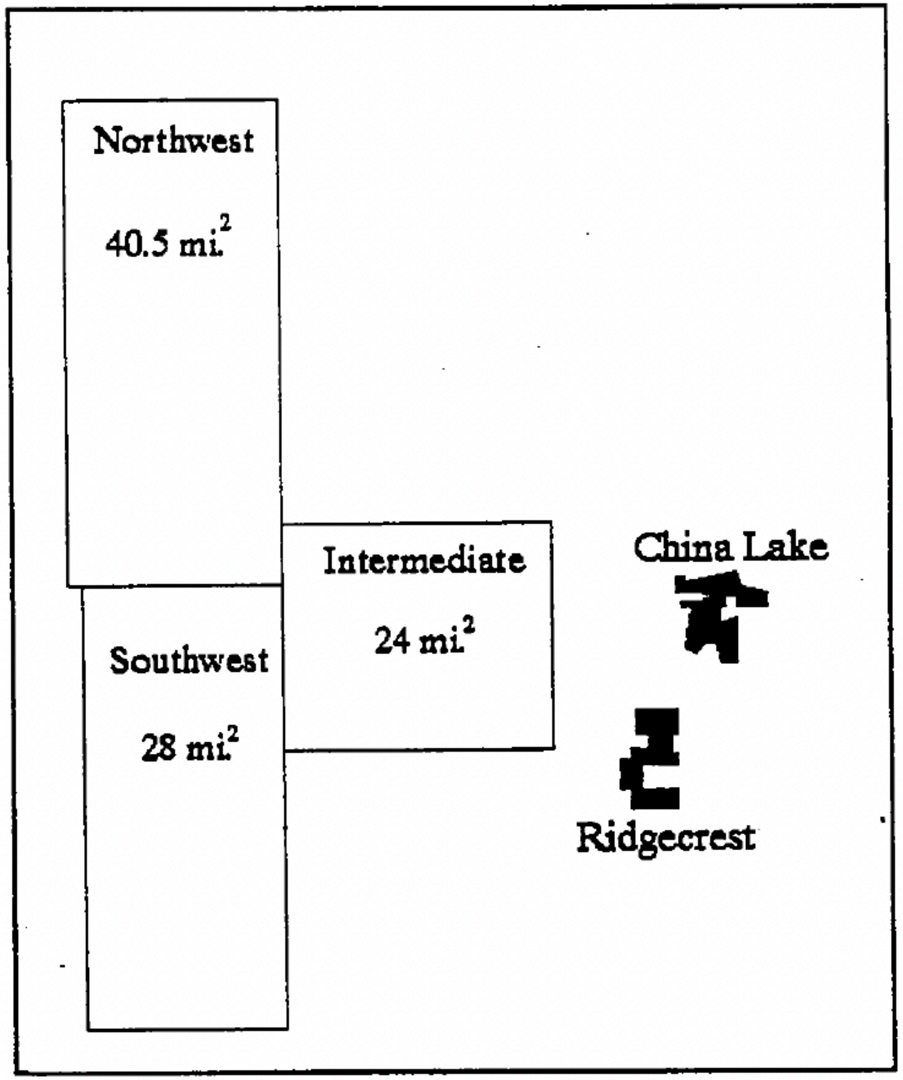
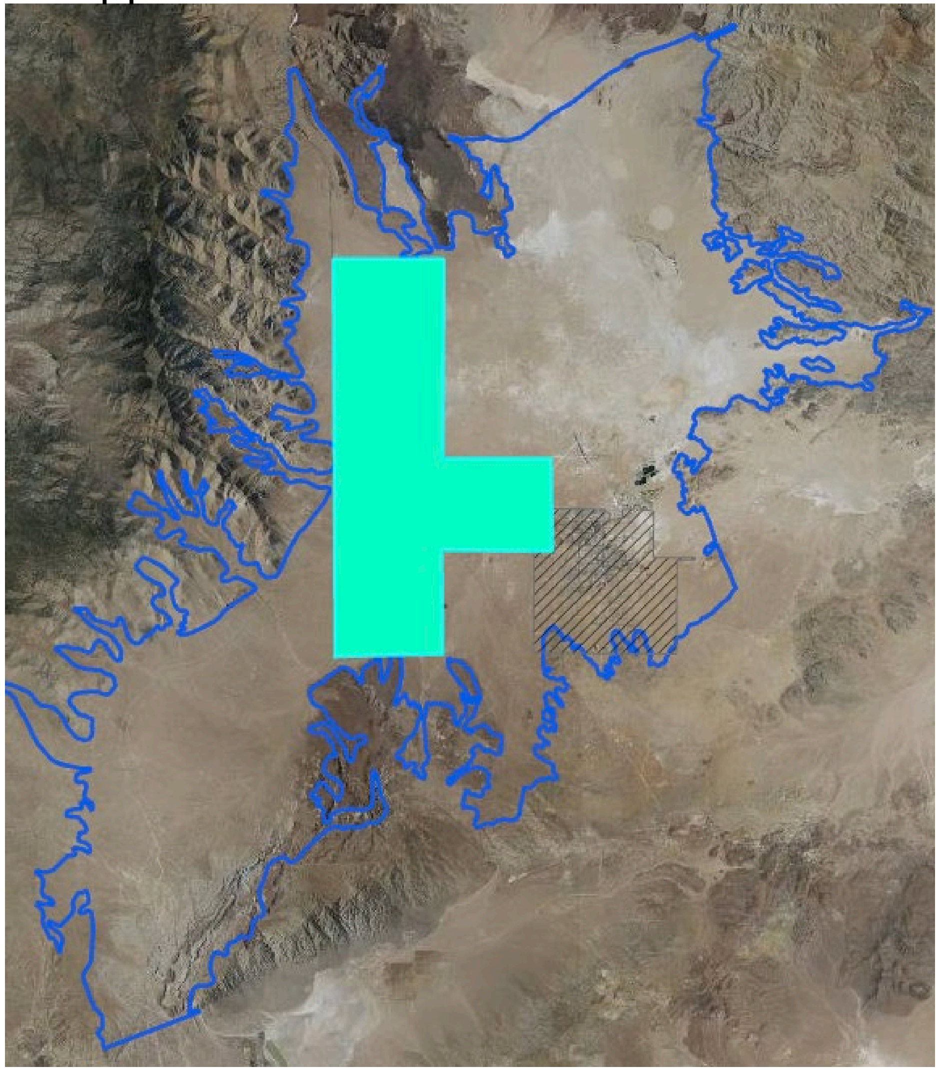


Figure 2

Approximate location of 92.5 mi^2 area



TWG Storage Estimate Approach and Results

Overlay one-mile square grid over entire 600 square mile (384,000 acre) basin

↓

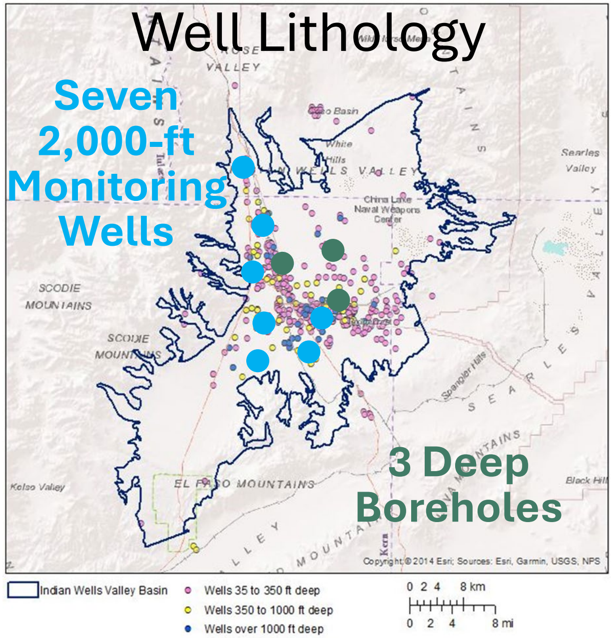
AREA times **THICKNESS** times range in **SPECIFIC YIELD** for each Hydrogeologic Zone then add together

↓

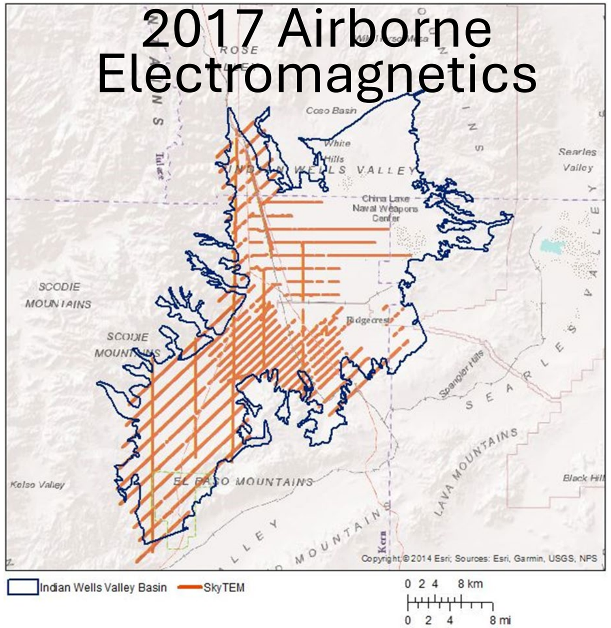
Results for estimated fresh water in storage:
30,000,000 to 36,000,000 acre-feet

IWV Best Available Datasets

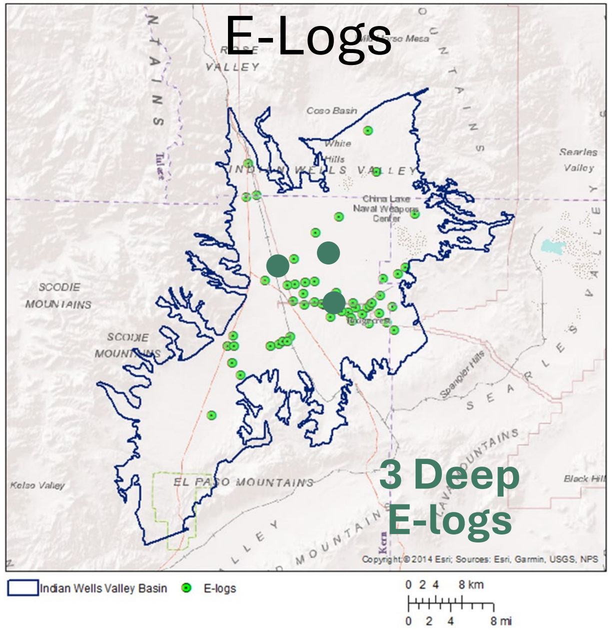
Well Lithology



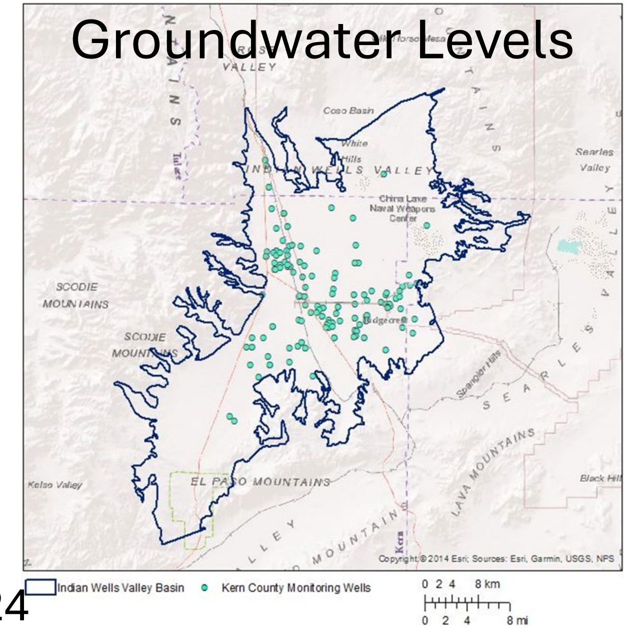
2017 Airborne Electromagnetics



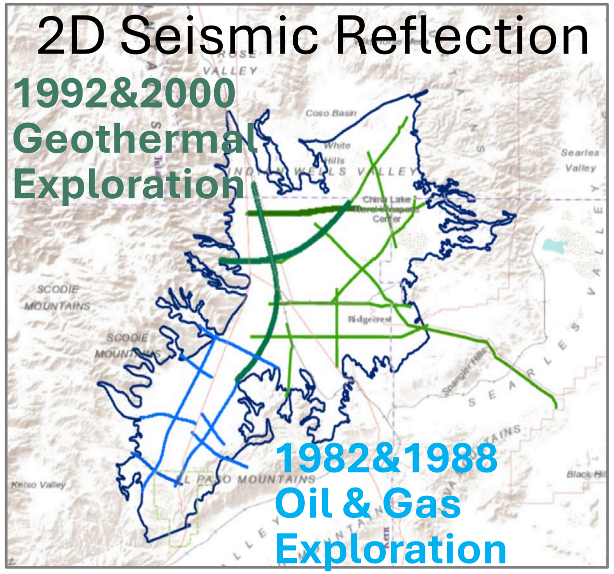
E-Logs



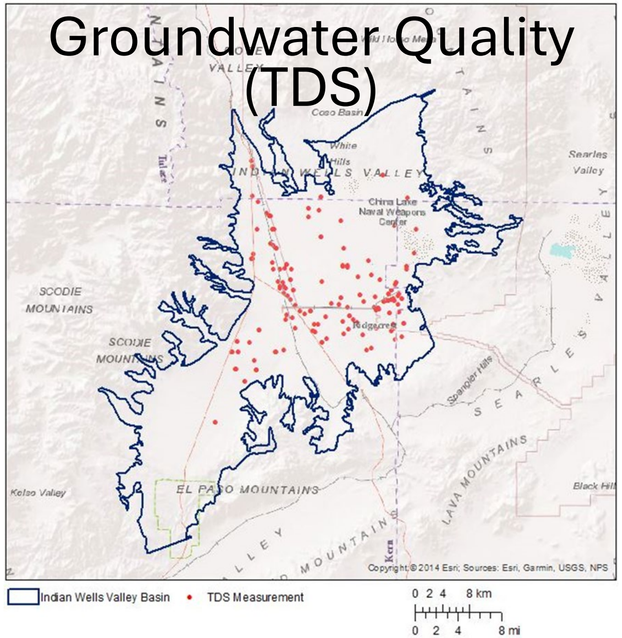
Groundwater Levels



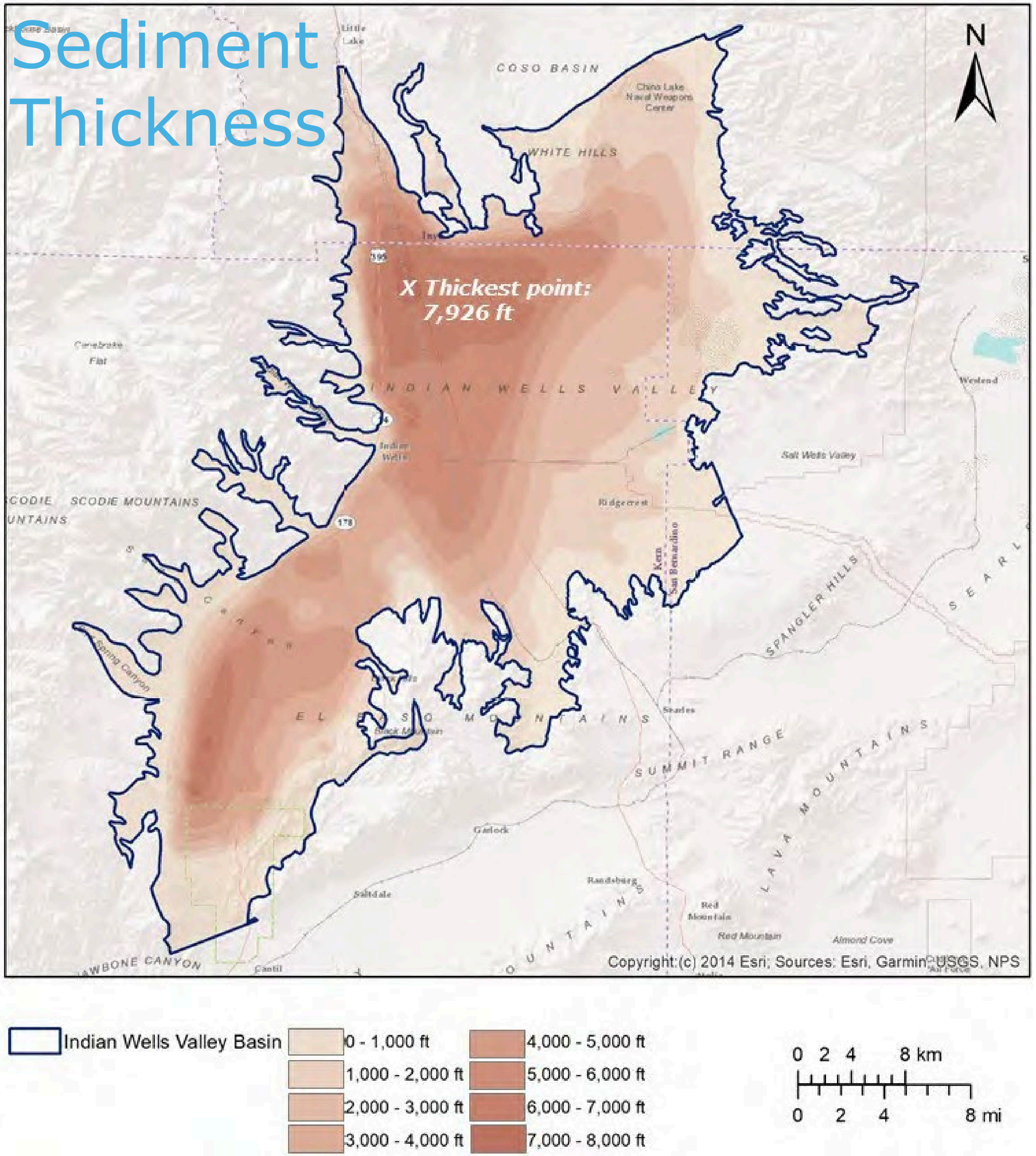
2D Seismic Reflection



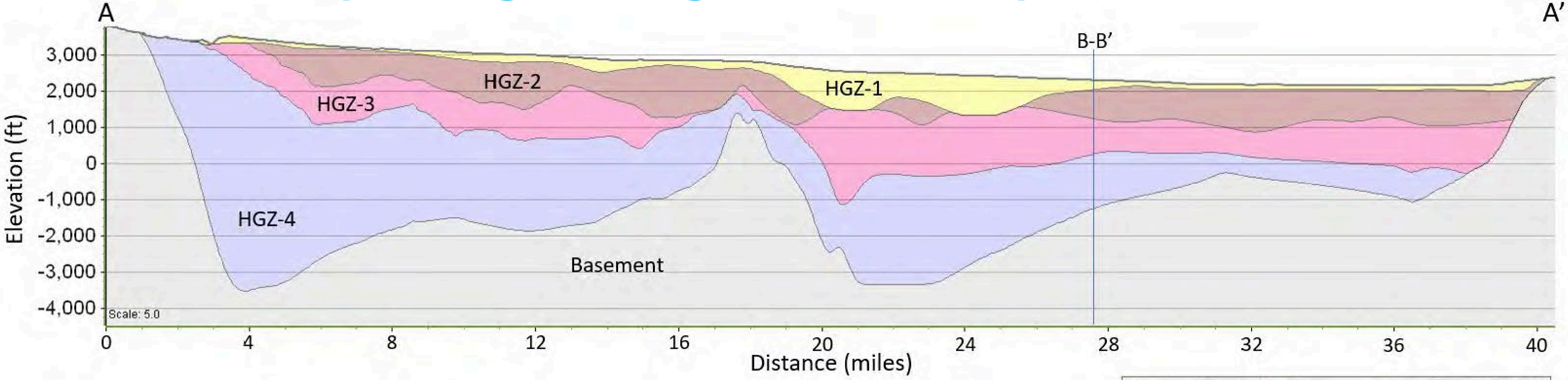
Groundwater Quality (TDS)

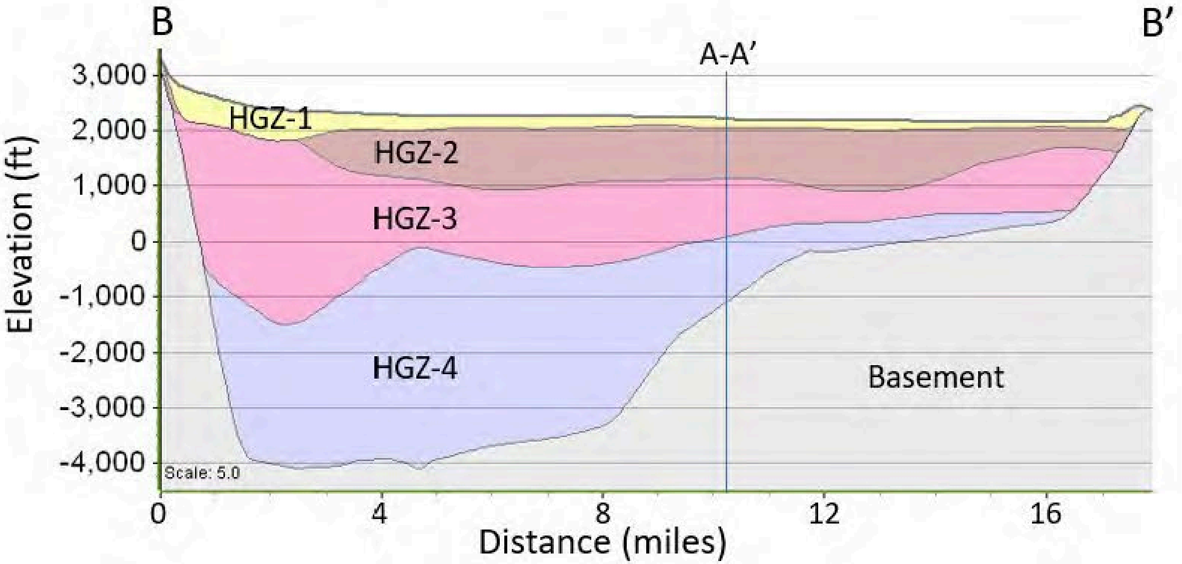


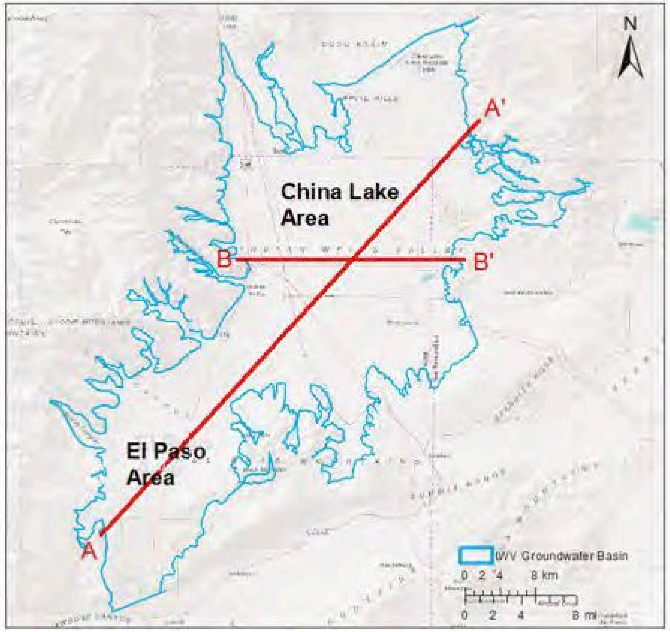
Sediment Thickness

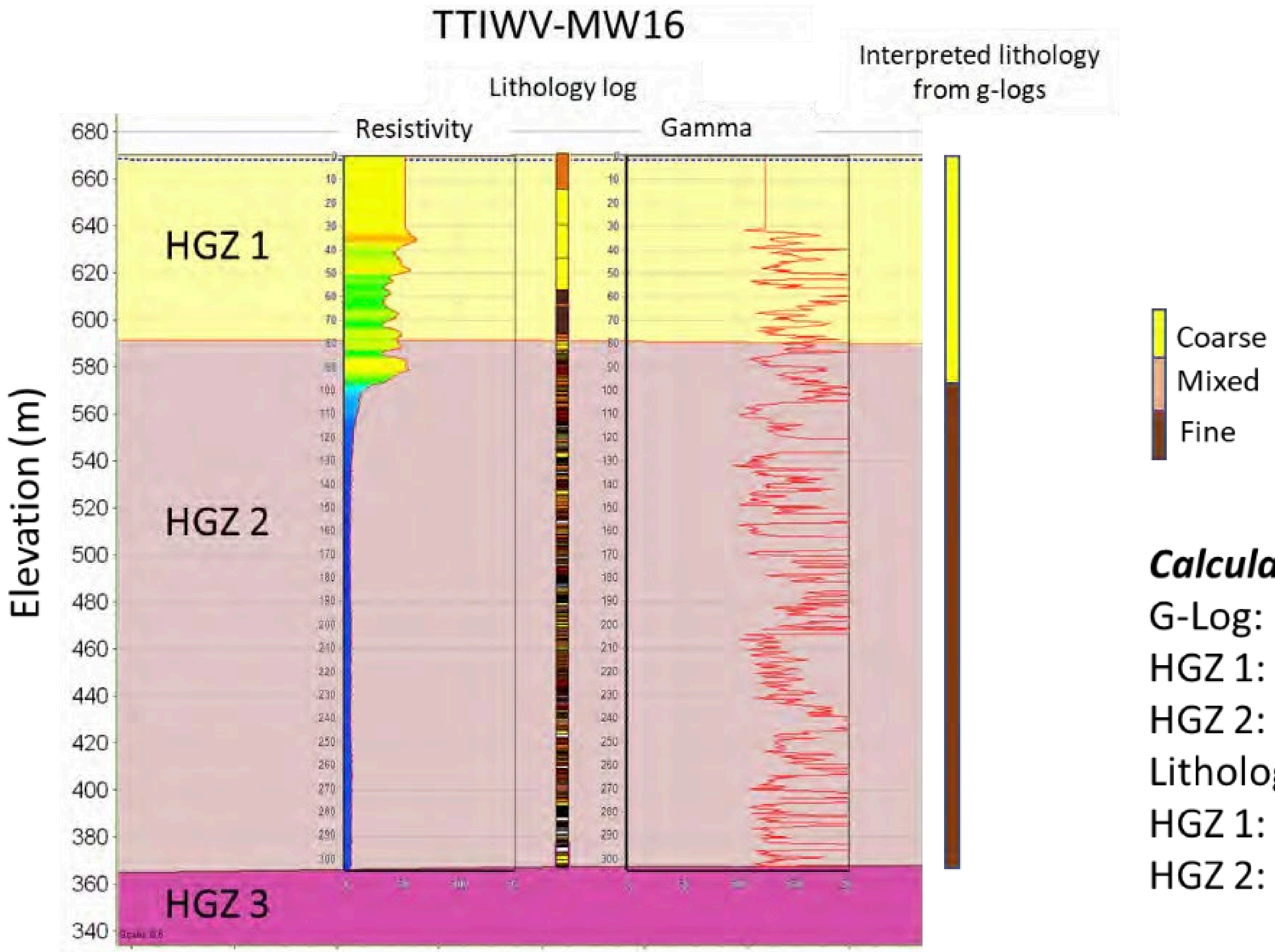


Ramboll Hydrogeologic Conceptual Framework









Calculated percent coarse

G-Log:

HGZ 1: 100% Coarse

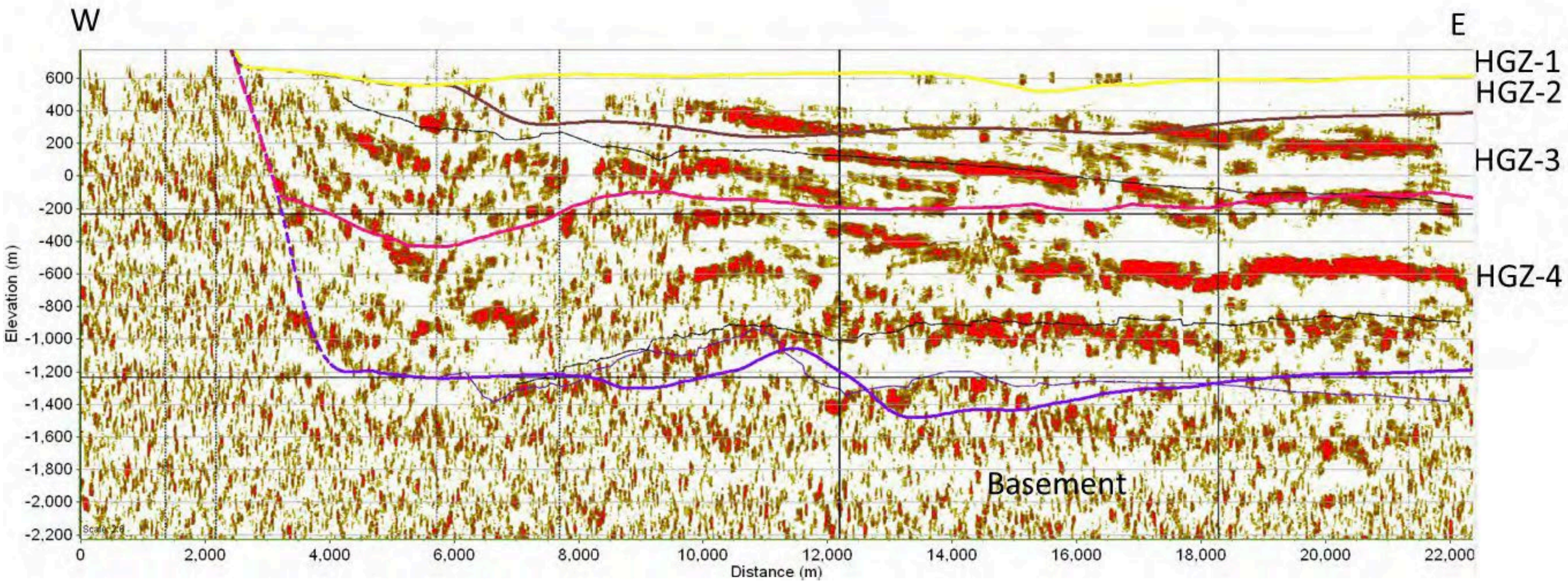
HGZ 2: 0% Coarse

Lithology Log:

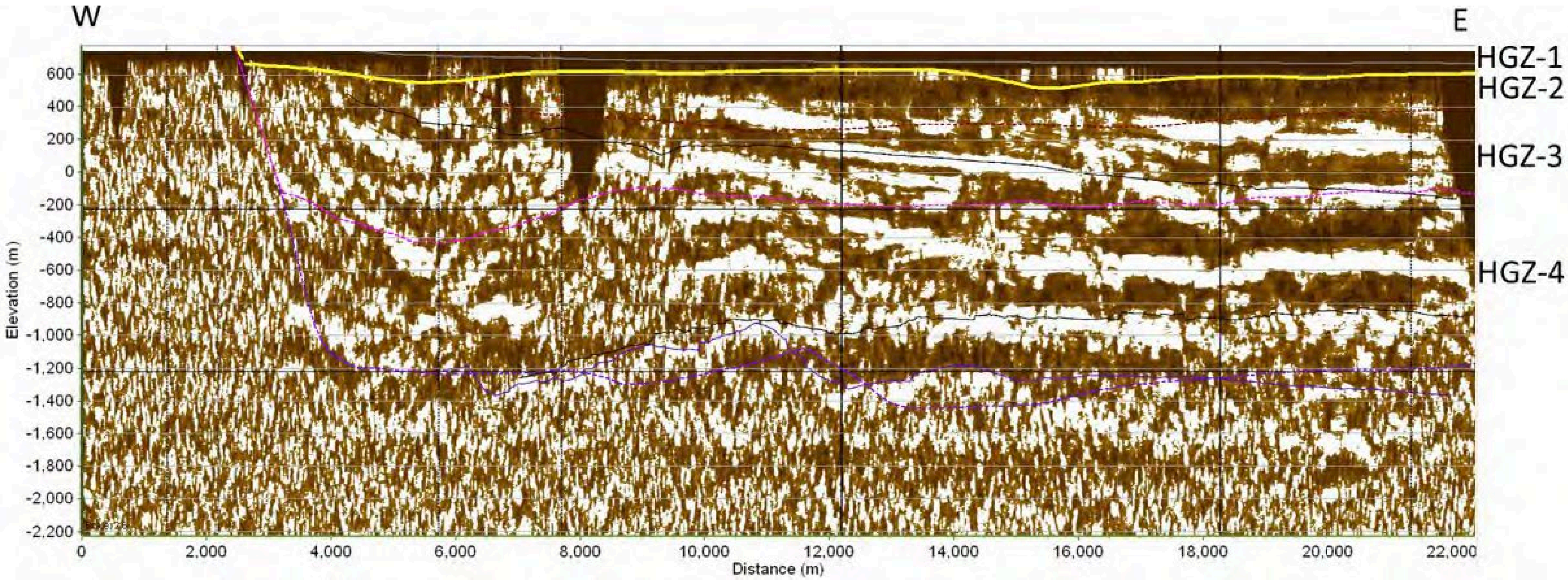
HGZ 1: 70% Coarse

HGZ 2: 16% Coarse

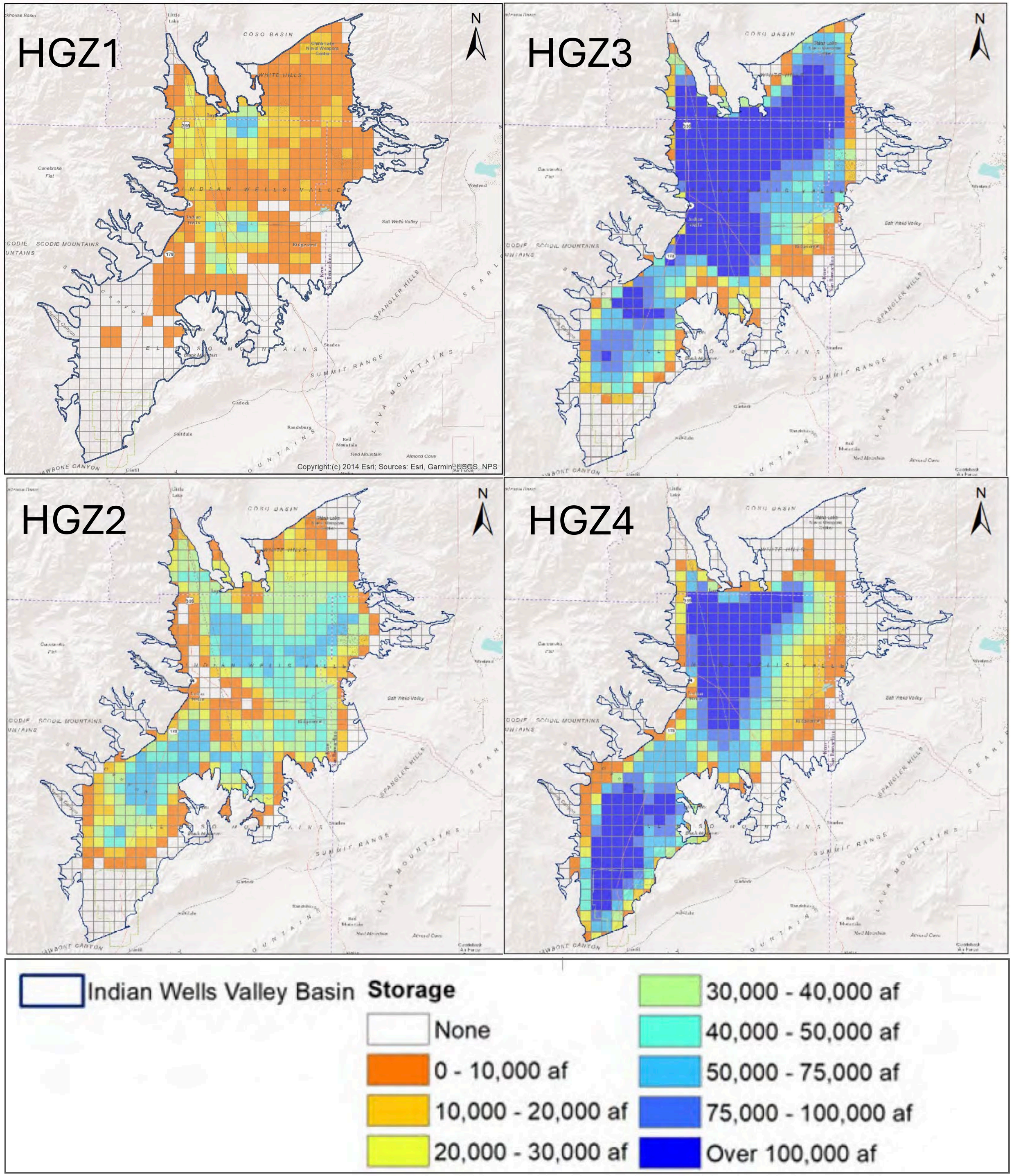
Net Sand



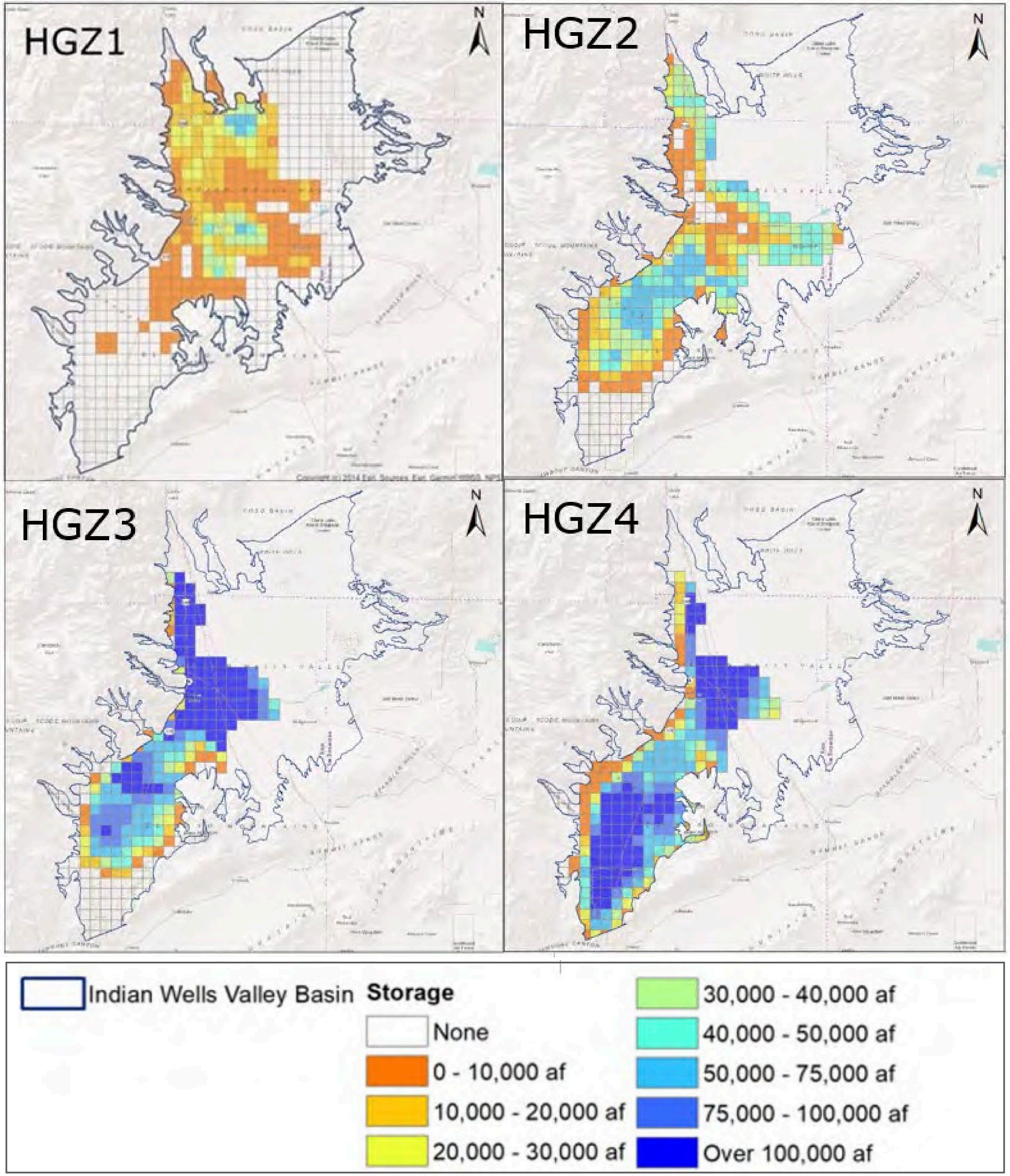
Net Clay



Total Groundwater in Storage by Hydrogeologic Zone



Total Groundwater in Storage by Hydrogeologic Zone Under 1,000 mg/L Total Dissolved Solids



TWG Fresh Groundwater Storage Estimate

HGZ	Type	Estimate 1		Estimate 3				Average of Methods	
		Fresh [AF]	Brackish [AF]	Fresh [AF]		Brackish [AF]		Fresh [AF]	Brackish [AF}
HGZ1	Range	---	---	3,500,000	5,000,000	1,100,000	1,600,000	---	---
	Average	10,970,000	5,810,000	4,250,000		1,350,000		7,610,00	3,580,000
HGZ2	Range	---	---	6,700,000	8,400,000	7,100,000	8,800,000	---	---
	Average	6,330,000	10,170,000	7,550,000		7,950,000		6,940,000	9,060,000
HGZ3	Range	---	---	19,700,000	22,900,000	19,400,000	22,800,000	---	---
	Average	24,670,000	35,480,000	21,300,000		21,100,000		22,990,000	28,290,000
Sub-Total	**Range**	**---**	**---**	**29,900,000**	**36,300,000**	**27,600,000**	**33,200,000**	**---**	**---**
	Average	**41,970,000**	**51,460,000**	**33,100,000**		**30,400,000**		**37,530,000**	**40,930,000**
HGZ4	Range	---	---	15,200,000	25,500,000	12,400,000	20,600,000	---	---
	Average	---	---	20,350,000		16,500,000		---	---
Total	Range	---	---	**45,100,000**	**61,800,000**	**40,000,000**	**53,800,000**	---	---
	Average	---	---	**53,450,000**		**46,900,000**		---	---

GSP Sustainable Yield Estimate

Bootstrap Brute-Force Recharge Model
9,300 to 29,000 AFY

↓

Distribute Recharge in 2D Groundwater Flow Model based on data from Dutcher & Moyle 1973 – result 5,250 AFY

↓

Include Rose Valley Interbasin Flow
5,250 + 2,400 = 7,650 AFY

↓

Construct and Calibrate 3D Flow Model with Recharge of 7,650 AFY Set as Constant

TWG Safe Yield Estimate

Complete literature review and synthesis of basin recharge

- 6,600 AFY to 22,000 AFY – **average 14,000 AFY**
- **8,700 AFY recharge - USGS** Basin Characterization Model (BCM)

↓

Compilation and QA/QC of best available pumping and water level datasets

↓

Application of Thiessen Polygons to calculate storage change over time (as in Annual Reports)

↓

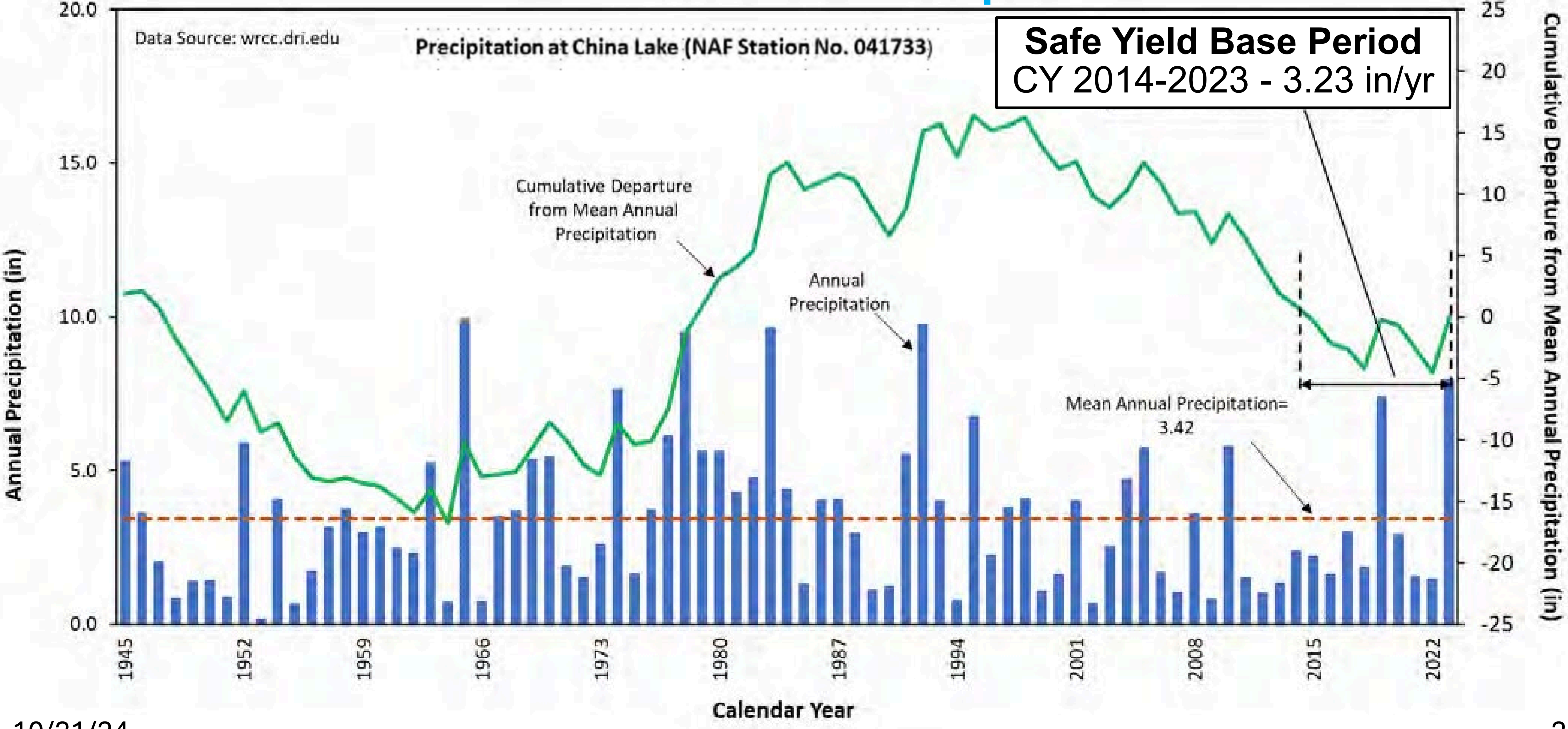
Safe Yield = Pumping +/- Change in Storage

Safe Yield Equations

1. Safe Yield = Pumping +/- Change in Storage
2. Change in Storage = A x Sy x ΔWL
   (same approach IWVGSP Annual Reports)
3. Safe Yield = Average Pumping +/- Average Σ ($A\ x\ S$y $x\ \Delta WL$)

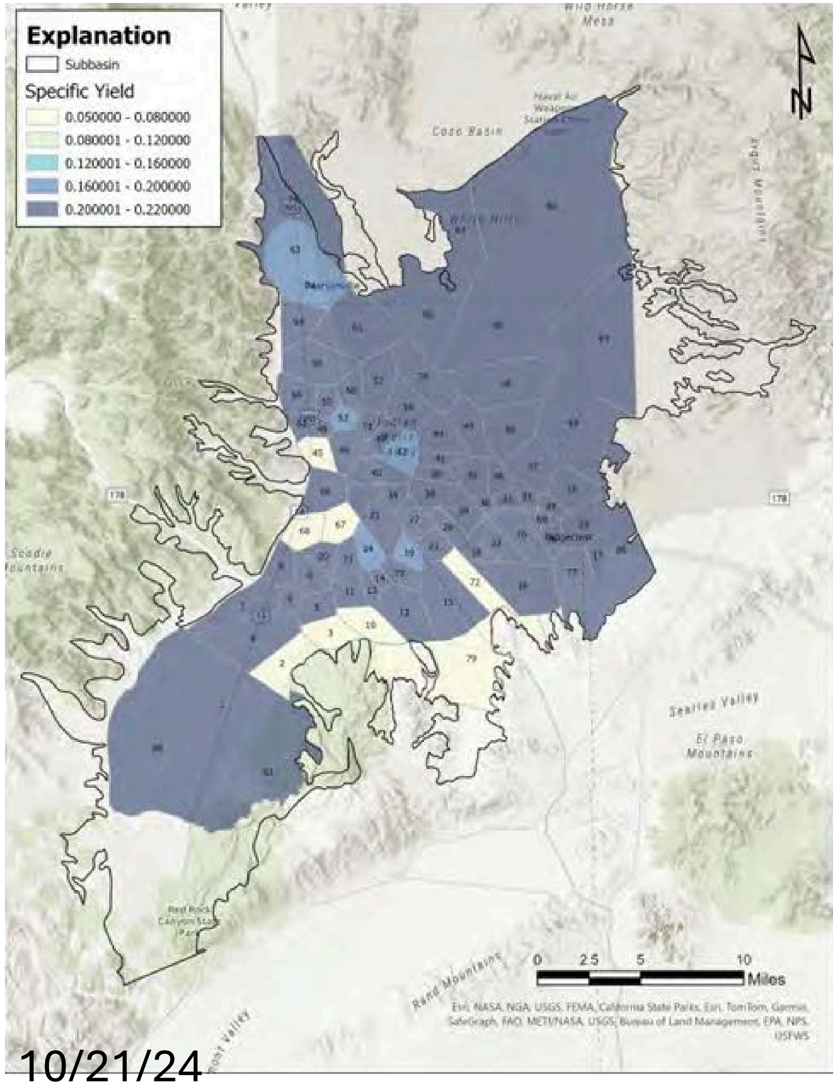
A - area
Sy – hydrogeologic zone specific yield
ΔWL – annual change in groundwater level measured in selected well

IWV Basin Average Annual Precipitation and Cumulative Departure

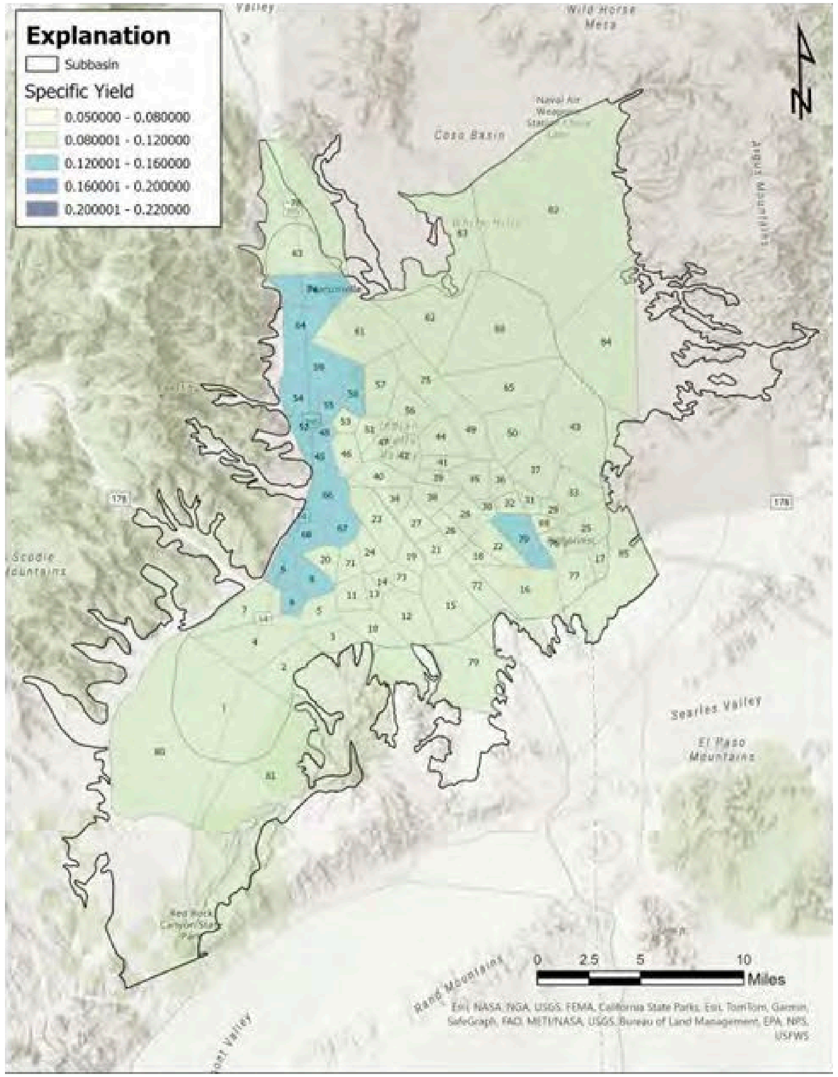


Specific Yield Distribution

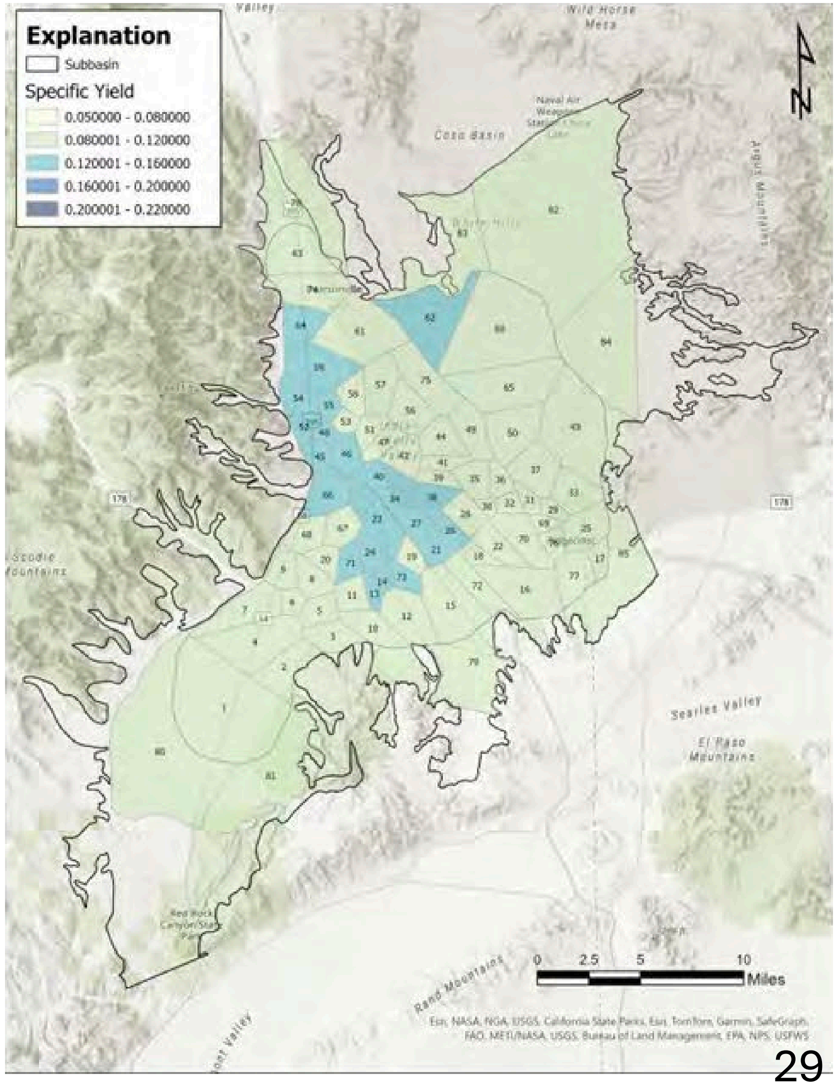
IWV GSP Model



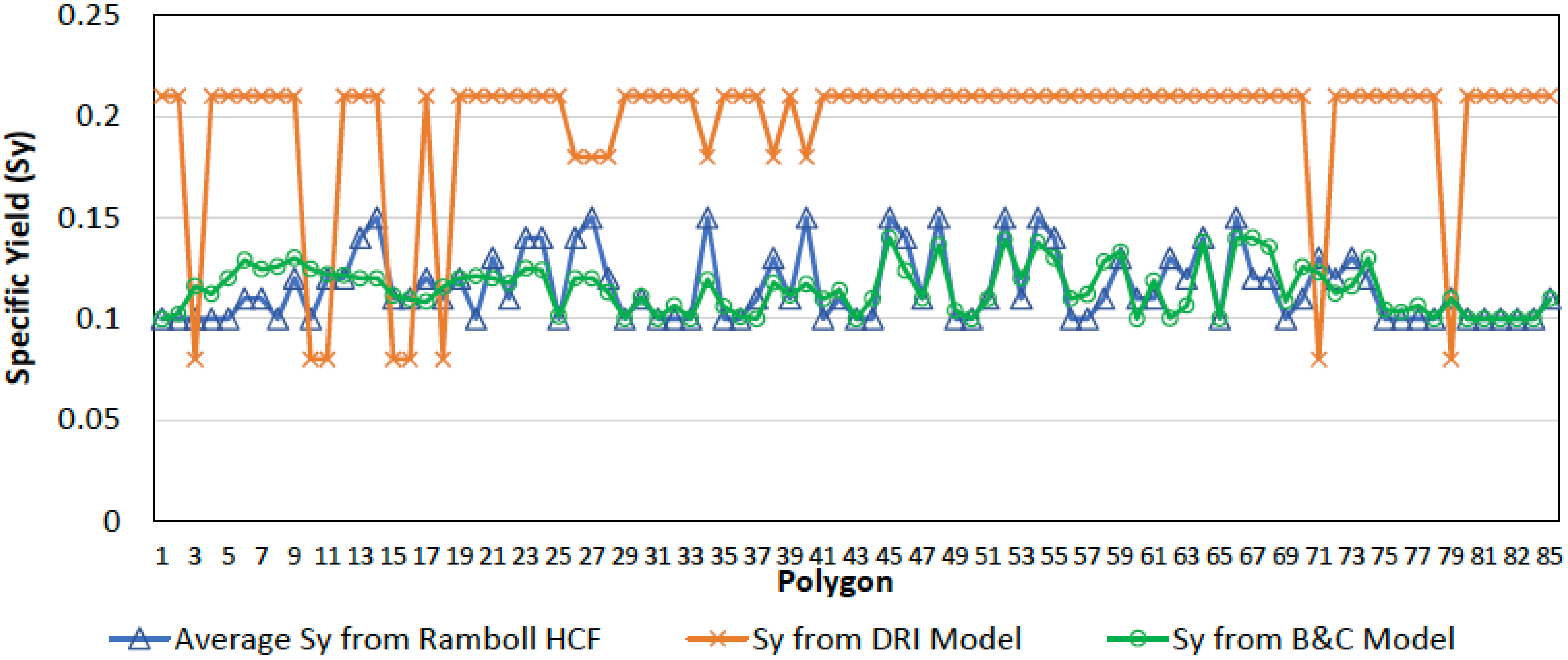
Brown & Caldwell Model



Ramboll Hydrogeologic Conceptual Framework

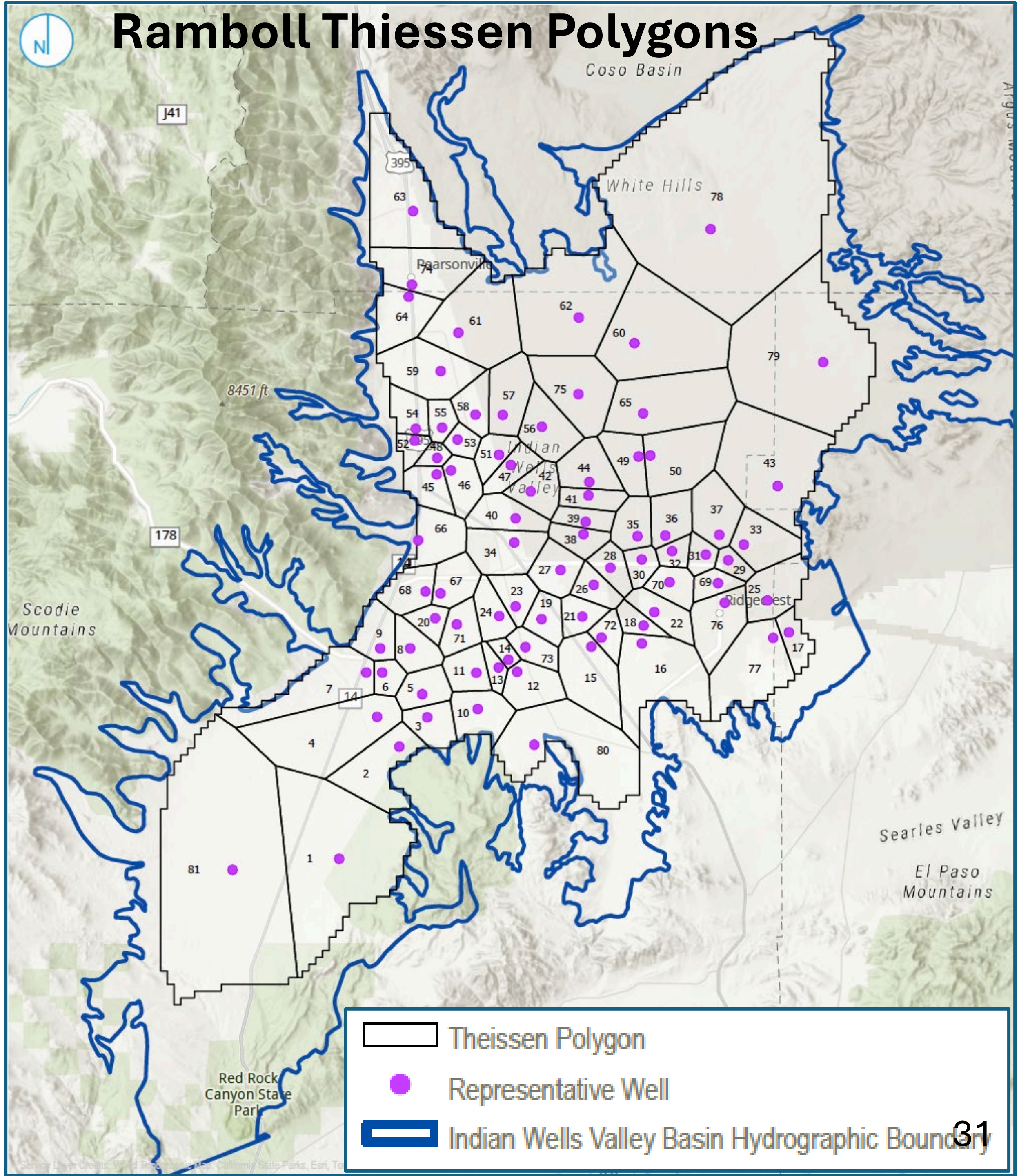


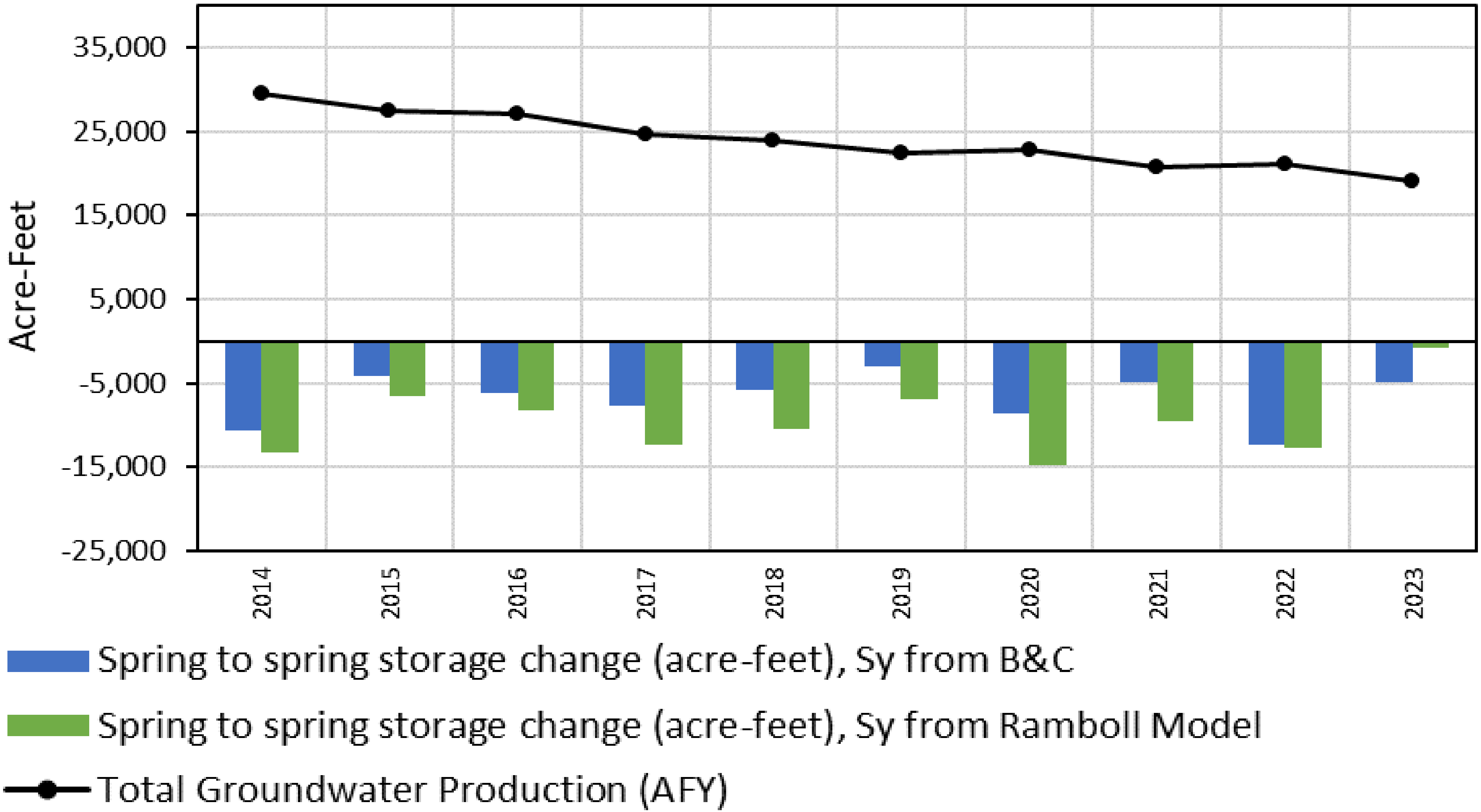
Specific Yield Distribution by Thiessen Polygon

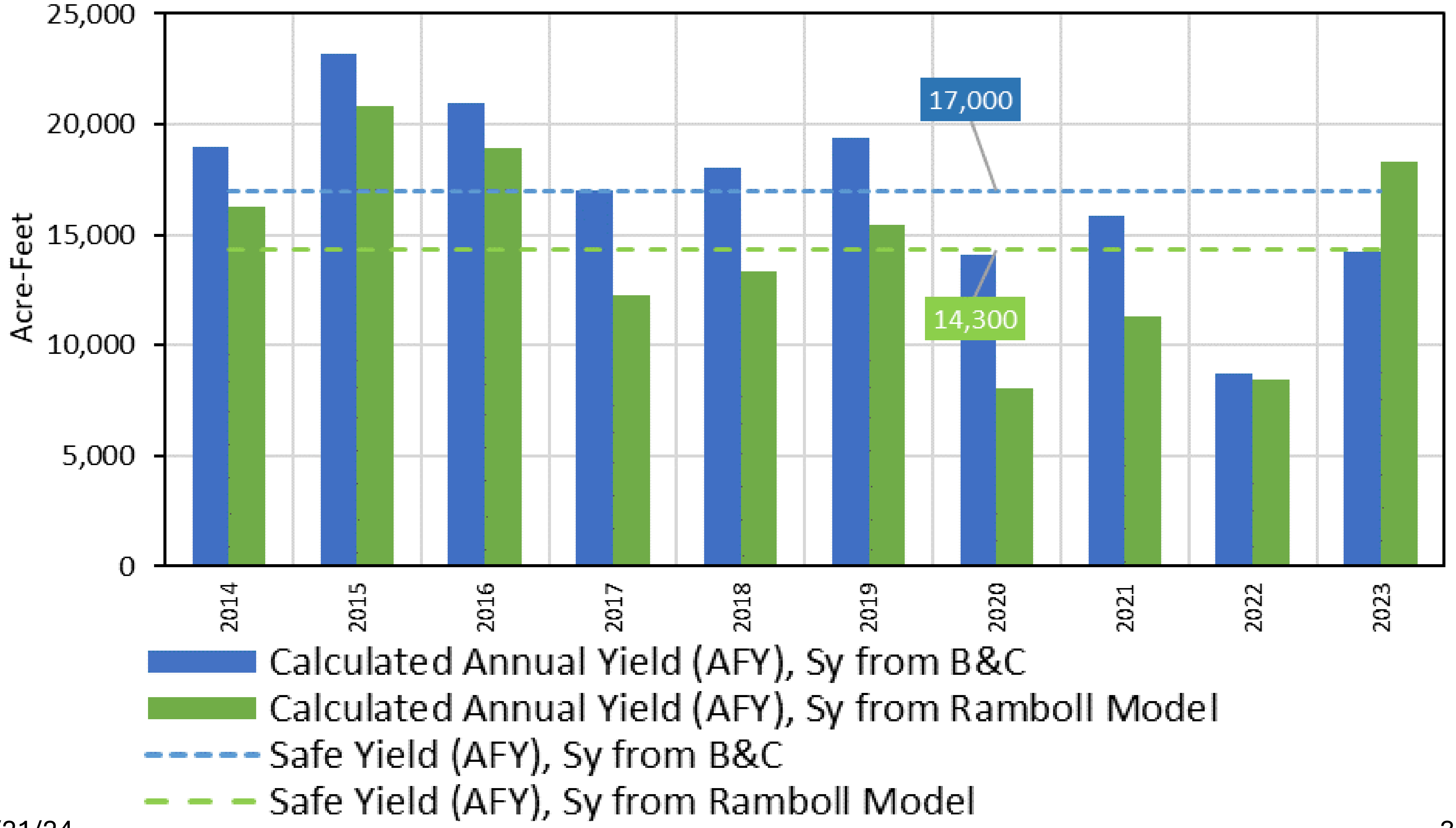


Thiessen Polygons

- One well per polygon
- Applied measured spring-to-spring annual change in groundwater level times specific yield times polygon area for volume
- $A \ x \ S\text{y} \ x \ \Delta\text{WL}$




35,000
25,000
15,000
5,000
-5,000
-15,000
-25,000
Acre-Feet
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Spring to spring storage change (acre-feet), Sy from B&C
Spring to spring storage change (acre-feet), Sy from Ramboll Model
Total Groundwater Production (AFY)


25,000
20,000
15,000
10,000
5,000
0
Acre-Feet
17,000
14,300
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Calculated Annual Yield (AFY), Sy from B&C
Calculated Annual Yield (AFY), Sy from Ramboll Model
Safe Yield (AFY), Sy from B&C
Safe Yield (AFY), Sy from Ramboll Model

Year	B&C Sy [AFY]	Ramboll Model Sy [AFY]	Average [AFY]
2014	18,900	16,200	17,550
2015	23,200	20,800	22,000
2016	20,900	18,900	19,900
2017	17,000	12,300	14,650
2018	18,000	13,300	15,650
2019	19,400	15,400	17,400
2020	14,100	8,000	11,050
2021	15,800	11,300	13,550
2022	8,700	8,400	8,550
2023	14,200	18,300	16,250
Safe Yield (2014 - 2023)	**17,000**	**14,300**	**15,700**

References

- Epstein, B.J., Pohll, G.M., Huntington, J., and R.W.H. Carroll, 2010. Development and Uncertainty Analysis of an Empirical Recharge Prediction Model for Nevada’s Desert Basins. Journal of the Nevada Water Resources Association, Vol. 5, No. 1.
- Indian Wells Valley Groundwater Authority, 2020. Indian Wells Valley Groundwater Sustainability Plan.
- Tetra Tech EM, Inc., 2003. Final Basewide Hydrogeologic Characterization Summary Report, Naval Air Weapons Station China Lake, California. Prepared for Department of the Navy.
- The Technical Working Group, 2024. Assessment of Groundwater Storage for the Indian Wells Groundwater Basin. Prepared for IWVWD, Meadowbrook Dairy, Mojave Pistachios and Searles Valley Minerals.
- The Technical Working Group, 2024. Assessment of Safe Yield for the Indian Wells Groundwater Basin. Prepared for IWVWD, Meadowbrook Dairy, Mojave Pistachios and Searles Valley Minerals.
- United States Bureau of Reclamation, 1993. Indian Wells Valley Groundwater Project. A cooperative effort among BUR, IWVWD, Searles Valley Minerals (formerly North American Chemical Company), and Naval Air Weapons Station.

Summary

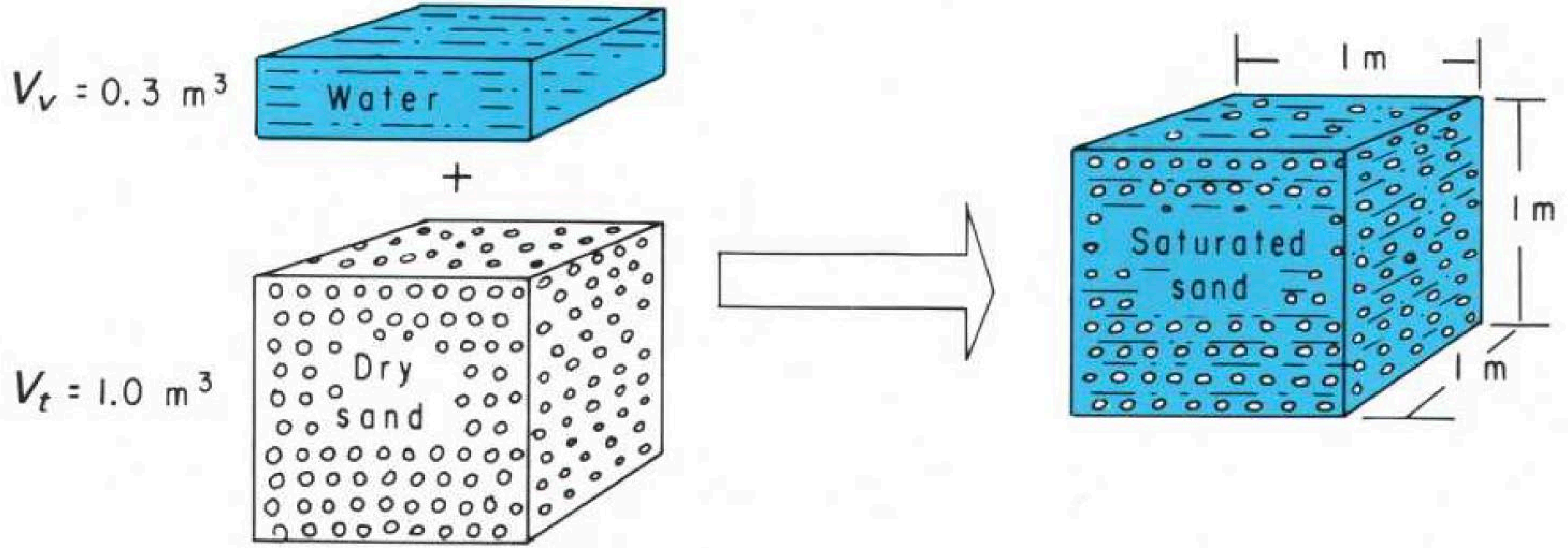
- IWV Basin Storage Estimates
  - GSP < 1,750,000 AF remain
  - TWG > 30,000,000 AF remain

- IWV Basin Yield Estimates
  - GSP Sustainable Yield 7,650 AFY
  - TWG Safe Yield 14,300 AFY

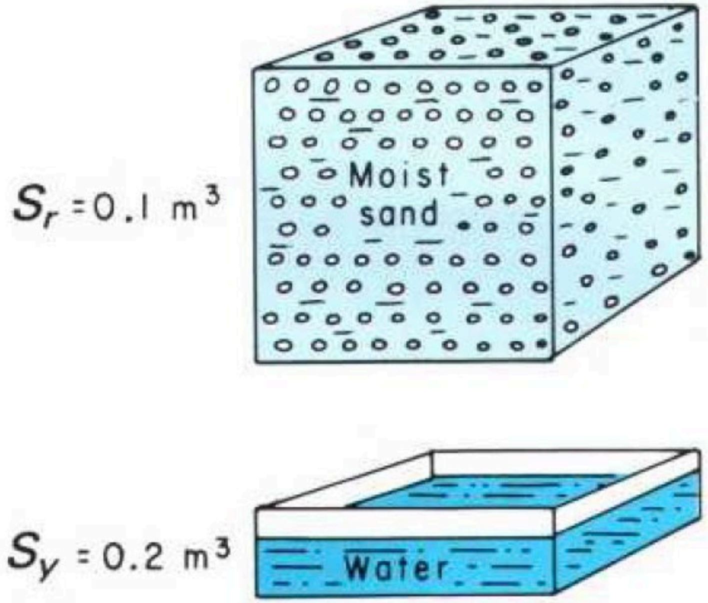
https://sgma.water.ca.gov/portal/gsp/comments/59
Click button "Submitted After Comment Period"

Questions?

Back up Slides – NOT FOR board package

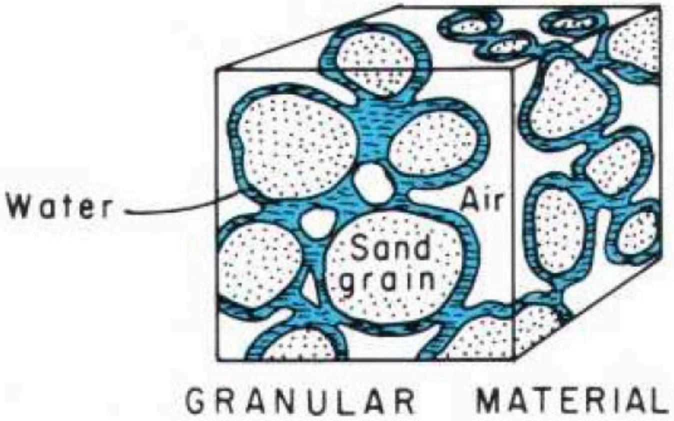


$$\text{Porosity } (n) = \frac{\text{Volume of voids } (V_v)}{\text{Total volume } (V_t)} = \frac{0.3\ m^3}{1.0\ m^3} = 0.30$$



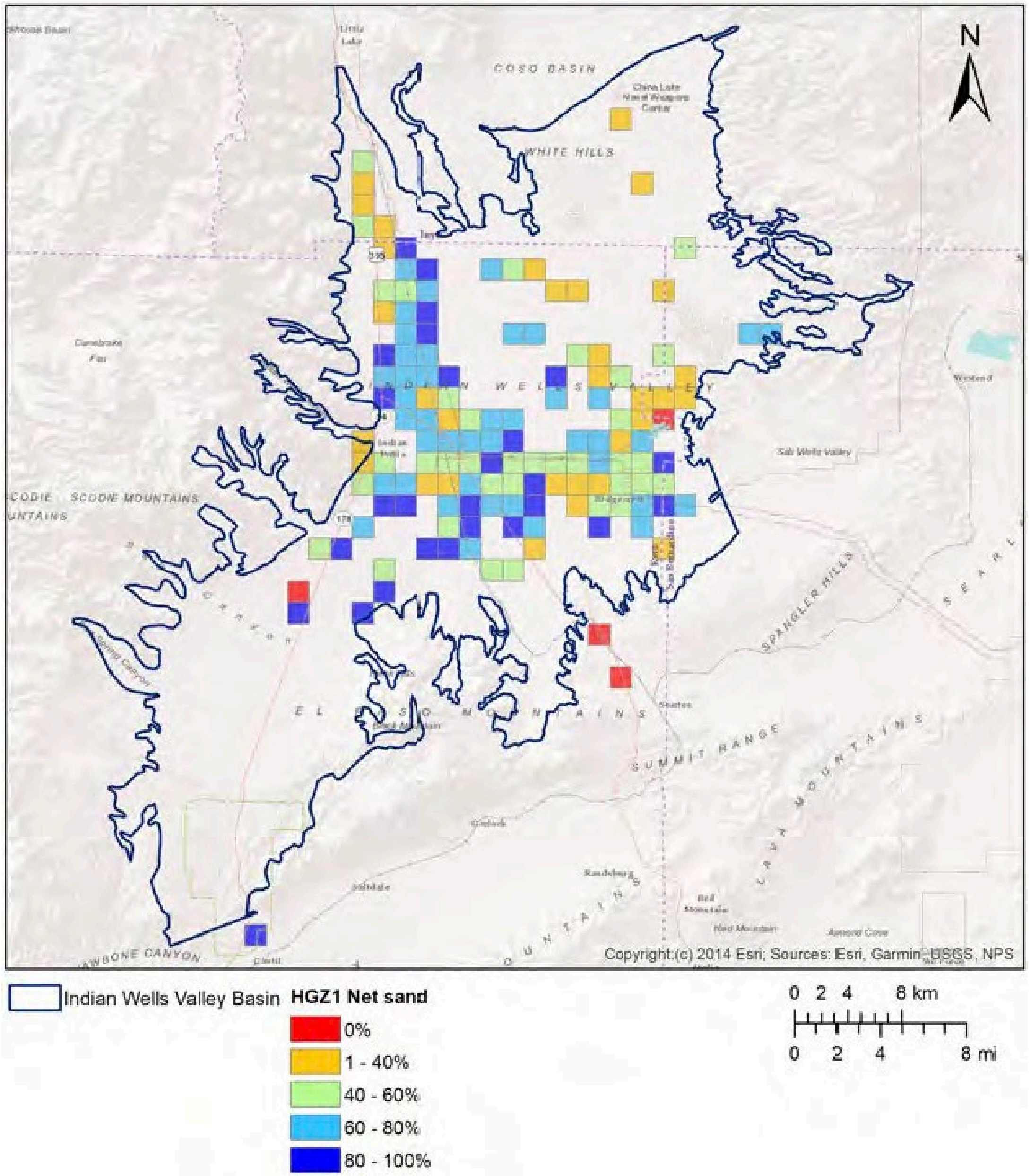
$$n = S_y + S_r = \frac{0.2\ m^3}{1\ m^3} + \frac{0.1\ m^3}{1\ m^3} = 0.30$$

(1)

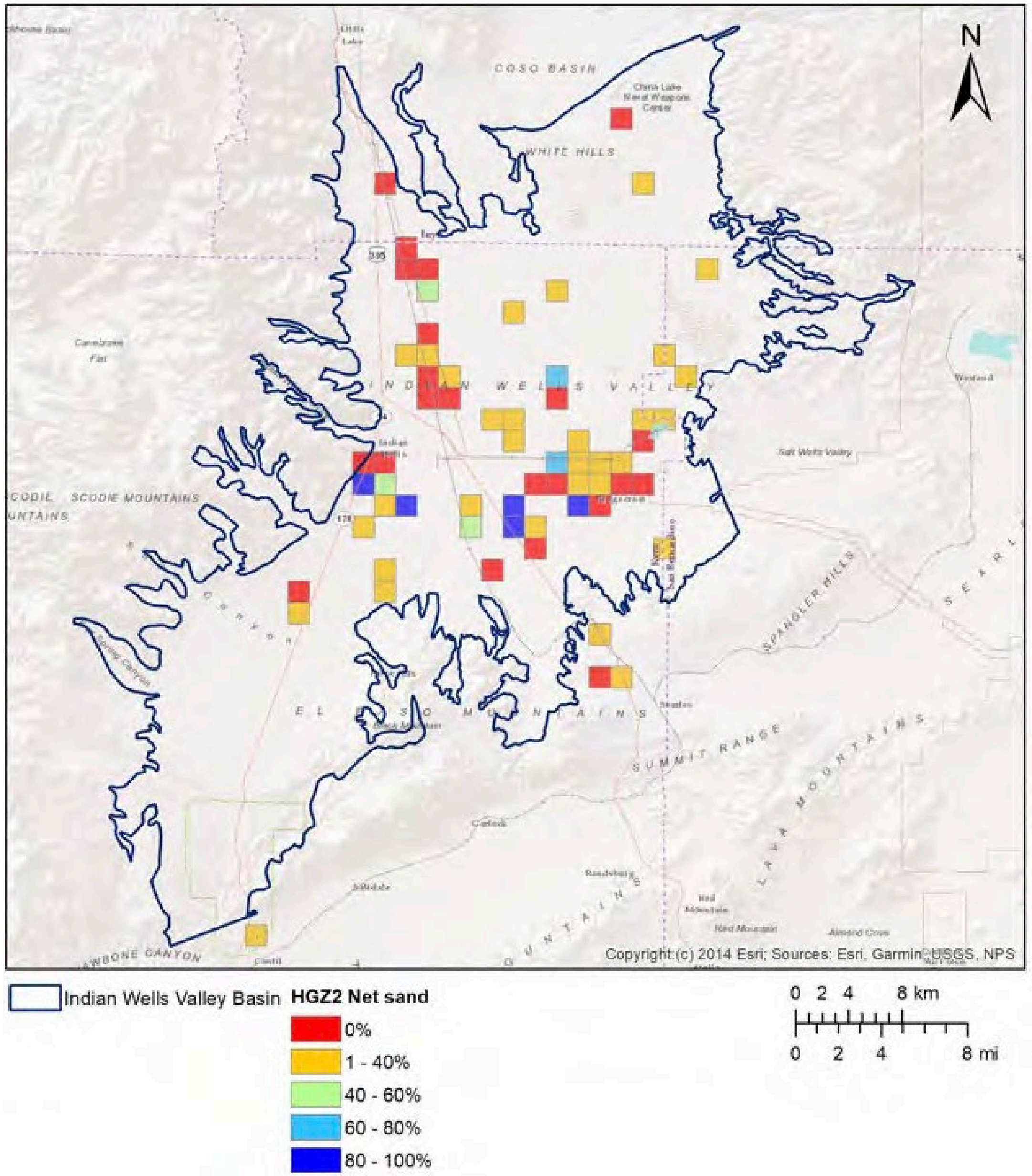


Water retained as a film on rock surfaces and in capillary-size openings after gravity drainage.

HGZ1 Net Sand



HGZ2 Net Sand



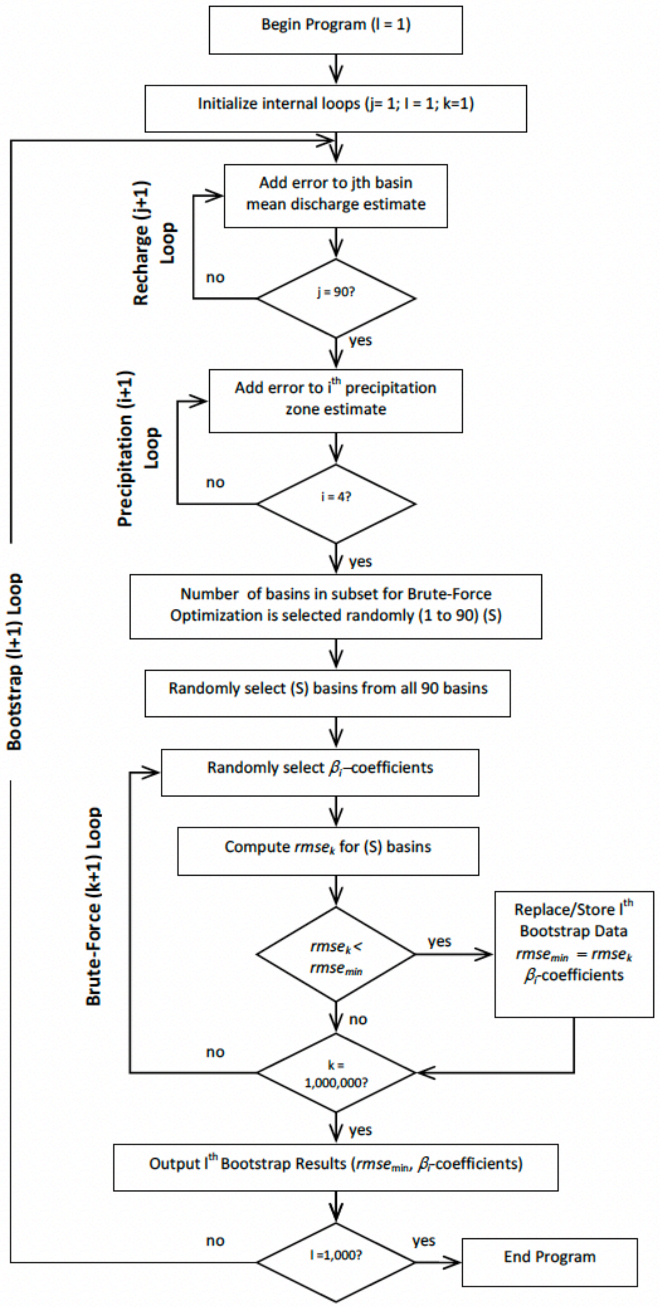


Figure 5: Schematic of the bootstrap brute-force approach.

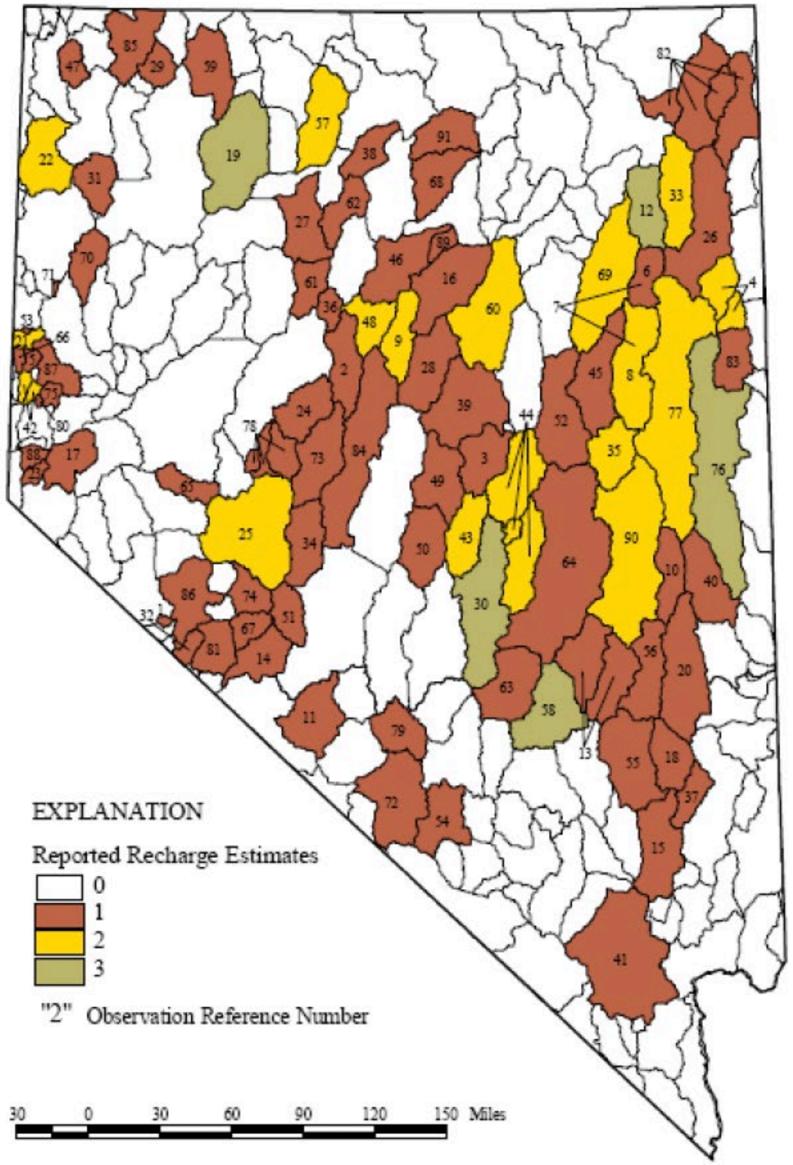


Figure 4: Ninety hydrogeographic areas used to calibrate BBPM β-coefficients. The number of independently reported recharge estimates are color coded. Basin observation numbers are correlated to hydrographic area identification numbers in Table 3.

- "Empirical recharge models currently available, including the BBRM, are relatively simplistic."
- "Using other explanatory variables to characterize mount block and mountain front recharge processes such as geology, vegetation type and rooting depth, evapotranspiration, and soil properties of permeability and depth to bedrock might improve recharge predictions from empirical models."
- USGS Indian Wells Valley Basin Characterization Model contracted in 2017 by Kern County and funded by a state grant
    - Includes geology, vegetation type and rooting depth, ET and soil permeability and depth to bedrock
    - **8,800 AFY natural recharge in IWV**, not including anthropogenic sources of recharge (water system leaks and other urban irrigation and septic return flows, LA Aqueduct leakage and dishcarges, Ag return flows, etc.)

October Special Board Meeting

10. Presentation on Cost Estimate for the IWVGA Imported Water Pipeline Project

(George Croll and David Moore of Clean Energy Capital)

Indian Wells Valley Water District

Celebrating more than 60 Years of Service

www.iwvwd.com

Review of IWV Imported Water Cost

Overview

Goal: Provide the Board and the Public with a reasonable and realistic estimate of IWVWD customer cost impact if the Imported Water Pipeline is Built

Background:

- GA estimated cost of pipeline, but not additional costs such as Water Rights Purchase, Mods to WD facilities', and other costs
- WD hired Clean Energy Capital, certified public utility financial institution to do a comprehensive Project Cost

Using CEC Costs to Estimate Customer Costs

CEC estimates fall into three broad categories

- **Project Construction**: This includes the Pipeline and associated pumping stations, water treatment, modifications to the WD system, grants that offset costs and remaining costs to be financed
- **Water Rights:** Costs to purchase sufficient water rights so that water is available for delivery via Pipeline
- **Annual Operations & Maintenance (O&M):** Assumed to be paid in a manner similar to existing Replenishment Fee structure as these costs will replace/supplement the Replenishment Fee when the Pipeline is built

Replenishment Fee As a Model for O&M

- The Groundwater Authority is already collecting funds to pay for Water Rights, the Replenishment Fee

- The only large pumper to have paid this fee is the IWV Water District - we assume this will remain the case for this and any future fees.

Most Probable Costs to IWV Residents

- Total Project Costs = Project Construction + WD System Mods + Water Rights = $285M
- Less $160M in WRDA and Design Grants = $125M
- Escalated for inflation from 2023 to 2028 = $185M
- Financed over 30 Years at 4% this is $19M in annual cost
  - That could be $950/parcel/year for 20,000 parcels in the IWV
  - Or: $125/month per WD customer (12,500 customers)
- Additional O&M Cost to IWVWD Customers ($10M/year)
  - $66/month for 12,500 customers

In Plain English

- Scenario 1. $950 per year in new taxes for each residence/parcel, PLUS $66/month for each water bill.
  - Assumes all construction costs paid via taxes, O&M paid on Water Bill
- Scenario 2. $190/month for every water district customer (12,500 customers)
  - All costs put on your Water Bill equally as a fixed rate increase
- Scenario 3. Your water bill today doubles
  - WD budget increase spread over existing customers.

Bottom Line

The Water District GM considers these costs excessive.

The General Manager recommends that the Board and the Public:

Resolve to oppose the pipeline as currently envisioned and funded

Urge the GA to re-evaluate/investigate other options which may be more cost effective

October Special Board Meeting

11. Public Discussion and Questions with District Consultants

October Special Board Meeting

12. Board Comments

October Special Board Meeting

13. Adjournment