WEST YOST
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Borrego Springs Watermaster

Technical Advisory Committee Ad-Hoc Meeting

March 29, 2024

Agenda

1. Roll Call
2. Public Comment
3. Preparatory Work for Task 4 of the 2025 redetermination of the Sustainable Yield – *Model Recalibration*
   - Version of BVHM to recalibrate
   - Model Calibration Targets and Data
   - Pilot Points & Adjustable Model Parameters
   - Historical On-Farm Efficiencies

Background

Task 1 – Compare FMP-estimated Pumping to Actual Pumping for WY 2022

- BVHM extended through WY 2022 → FMP significantly under-estimates pumping
- Water-use factors used in the FMP to estimate actual ET and groundwater pumping are inaccurate

Task 2 – Update Water-Use Factors in the FMP

- KC and OFE were set to more realistic values for current conditions and irrigation practices
- Improved the ability of the FMP to estimate Actual Pumping during WYs 2021 and 2022

Task 3 – Correct Errors Identified in the 2021 BVHM

- Recommendation: Incorporate all BVHM improvements from Tasks 1-3 and proceed with Task 4

Task 4 – Model Recalibration

Task 5 – Determine the Sustainable Yield

Version of BVHM to Recalibrate in Task 4

- Incorporated all prior work in Tasks 1-3 to extend and improve the BVHM
- Ran the "Pre-Calibrated BVHM" to simulate the pre-calibrated water budget
- Compared FMP-estimated pumping to Actual Pumping:

WY	Actual Pumping (af)	*Task 1* 2022 BVHM		*Task 2* BVHM - *Updated Water-Use Factors*		Task 3 BVHM - *Corrected Errors in 2022 BVHM*		*Task 4 Pre-Calibrated BVHM*	
		FMP-Estimated Pumping (af)	% Difference	FMP-Estimated Pumping (af)	% Difference	FMP-Estimated Pumping (af)	% Difference	FMP-Estimated Pumping (af)	% Difference
2021	12,857	8,428	-42%	11,625	-10%	8,428	-42%	11,625	-10%
2022	10,863	7,649	-35%	10,551	-3%	7,649	-35%	10,551	-3%

Comparison of Average Annual Water Budgets

Water Budget Component -- Annual Average	Annual Average Water Budget over the Simulation Period October 1944 - September 2022						
	Task 1 2022 BVHM	Task 2 BVHM - *Updated Water-Use Factors*		Task 3 BVHM - *Corrected Errors in 2022 BVHM*		*Task 4 Pre-Calibrated BVHM*	
	afy	*afy*	*% Difference*	*afy*	*% Difference*	*afy*	*% Difference*
Total Inflows	**6,633**	**7,772**	**16%**	**7,632**	**14%**	**8,777**	**28%**
Streambed Recharge	3,775	4,038	7%	3,888	3%	4,151	9%
Unsaturated Zone Recharge	1,490	2,368	46%	1,622	8%	2,505	51%
Subsurface Inflow	1,367	1,366	0%	2,121	43%	2,121	43%
Total Outflows	**13,796**	**15,968**	**15%**	**14,057**	**2%**	**16,276**	**16%**
Groundwater Pumping	10,630	13,026	20%	10,693	1%	13,149	21%
Non-FMP Wells	2,226	2,074	-7%	2,299	3%	2,205	-1%
FMP Wells	8,404	10,952	26%	8,394	0%	10,944	26%
Evapotranspiration	2,644	2,422	-9%	2,841	7%	2,606	-1%
Subsurface Outflow	521	520	0%	523	0%	522	0%
Total Change in Storage	**-7,163**	**-8,196**	**-13%**	**-6,425**	**11%**	**-7,500**	**-5%**

Pre-calibrated BVHM
versus
2022 BVHM

- Inflows increased by 2,144 AFY
- Outflows increased by 2,480 AFY
- Storage Loss increased by 336 AFY

West Yost Conclusion: Tasks 1-3 have led to significant improvements to the BVHM → Ready to Recalibrate

TAC Comments and Responses

***AAWARE Comment*:** BVHM underestimates pumping

	Total Metered Pumping			Task 4 *Pre-Calibrated BVHM* Modeled Pumping		Difference between Actual Pumping and Modeled Pumping			
Water Year	Total BPA Parties	FMP Wells	Non-FMP Wells	FMP Wells	Non-FMP Wells	FMP Wells		Non-FMP Wells	
2021	15,221	12,857	2,364	11,625	1,720	1,232	9.6%	644	72.7%
2022	13,038	10,863	2,175	10,551	1,518	312	2.9%	657	69.8%

Notes:

a. All values are provided in acre-feet.

b. Total Metered Pumping from Non-FMP Wells = Total Pumping BPA Parties – Total Metered Pumping from FMP Wells.

Response: This is a valid observation for non-FMP wells. Pumping assigned and simulated at non-FMP wells will be reviewed and addressed during model recalibration.

AAWARE Comment: The use of the FMP yields unrealistic results. The FMP methodology needs to be redefined to incorporate OpenET data into the calculation.

Table 2. Comparison of crop water demand estimates between OpenET and the traditional crop coefficient methodology.

Year	OpenET [a]	Crop coefficient [b]	% Difference
2021	251	482	91.8%
2022	265	401	51.4%
2023	216	451	109.0%

Notes:
[a] Open ET data are generated using the METRIC methodology.
[b] Initial KC value of 0.65 for citrus (Table 1 of Task 2 technical memorandum) and OFE of 0.78 for micro-irrigation (Table 3 from West Yost TM).

$$crop\ demand = \frac{ET_0 * KC * Area}{\cancel{OFE}}$$

Response:

- The comparison of "OpenET" to the "Crop coefficient" method is inaccurate; and hence, is not a justification for redefining the FMP methodology.
- AAWARE has not proposed a method for using OpenET to estimate pumping; nor, has such a method been evaluated against measured pumping in the Basin.
- However, we recognize the FMP is not perfect. OpenET can be used to validate the ability of the FMP to estimate crop demands (BWD recommendation).

BVHM Domain

***BWD Comment*:**

Address the discrepancy in the boundaries between the BVHM domain and the Subbasin.

Response:

- During Task 4, West Yost will present the water budget for:
  - Entire BVHM domain
  - Portion of BVHM containing only the Subbasin, which will be used to redetermine the Sustainable Yield
- Specific method is still being developed, but could include Python scripts or ZoneBudget

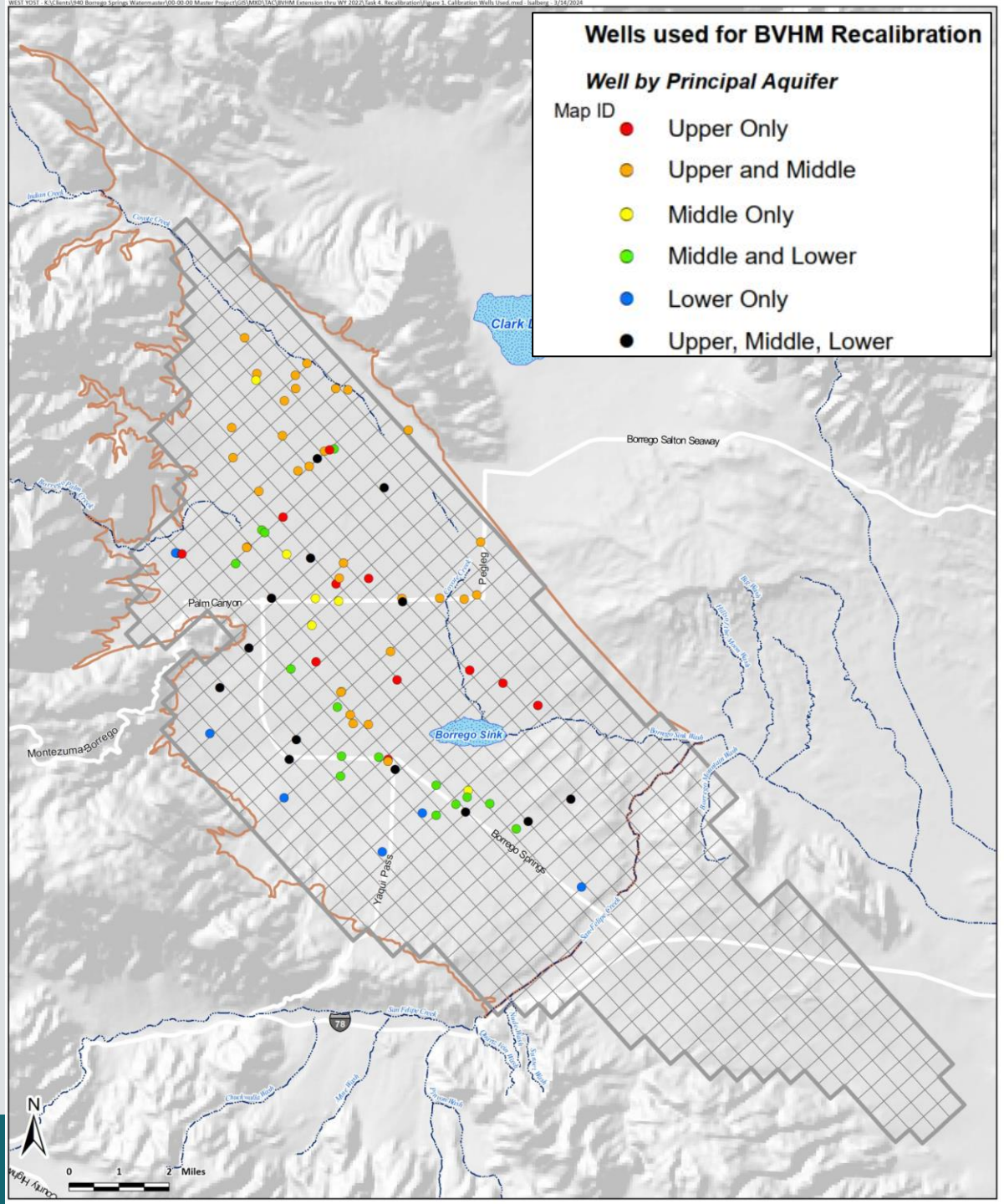
Calibration Targets & Data

- Calibration targets: Wells in the Basin
- Calibration data: Groundwater levels

***AAWARE Comment*:**
Address wells used for calibration with "unknown" depth.

Response:

- All wells will be assigned a model layer(s) for recalibration.
- Of the 21 wells shown as "unknown," model layers will be assigned using:
  - Construction information identified (15 wells)
  - USGS classification from model calibration (5 wells)
  - Assumption of a shallow screen across Layers 1 and 2 (1 well)



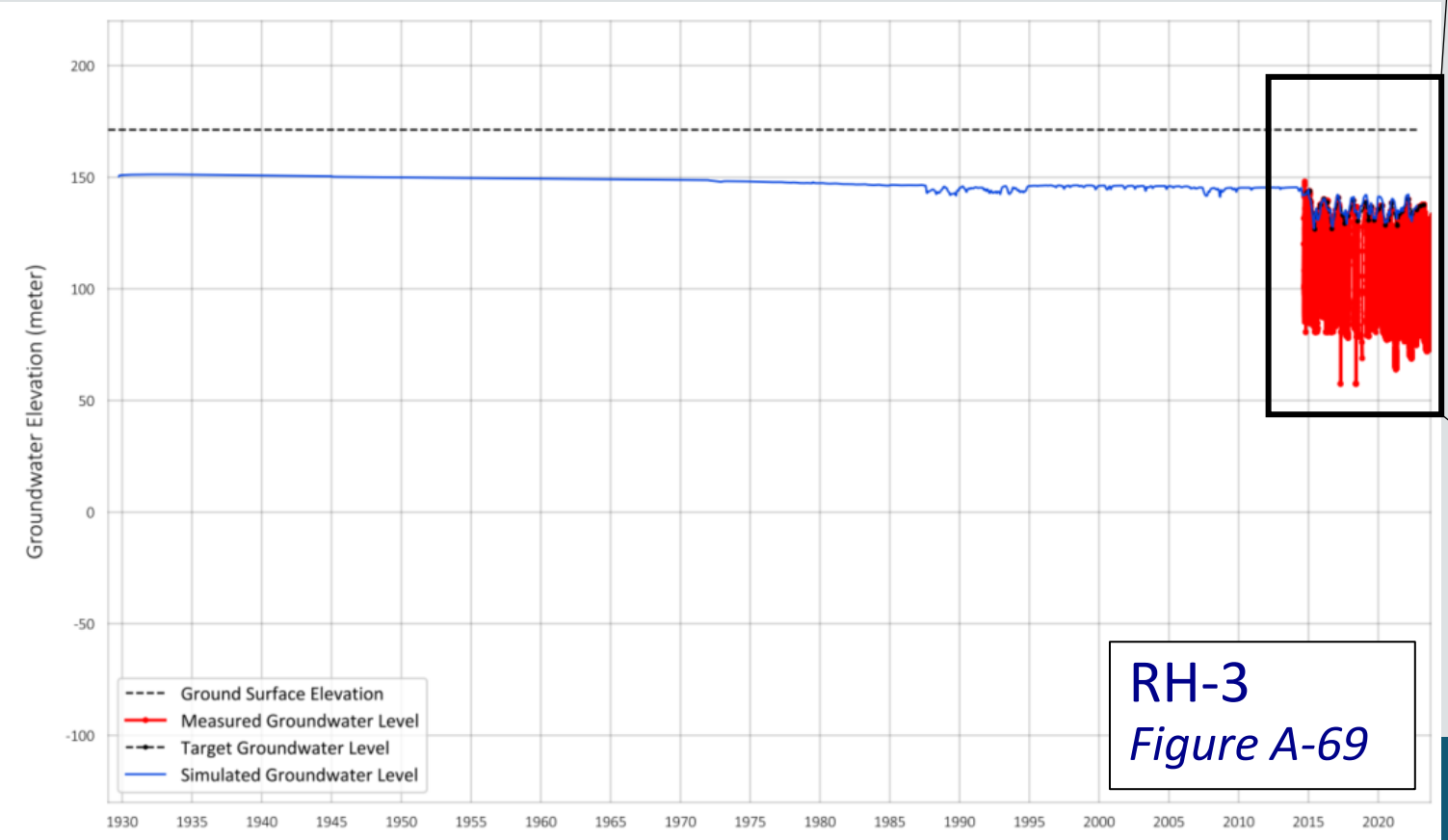
***AAWARE Comment*:**
Document methodology used to select calibration data.

Response:

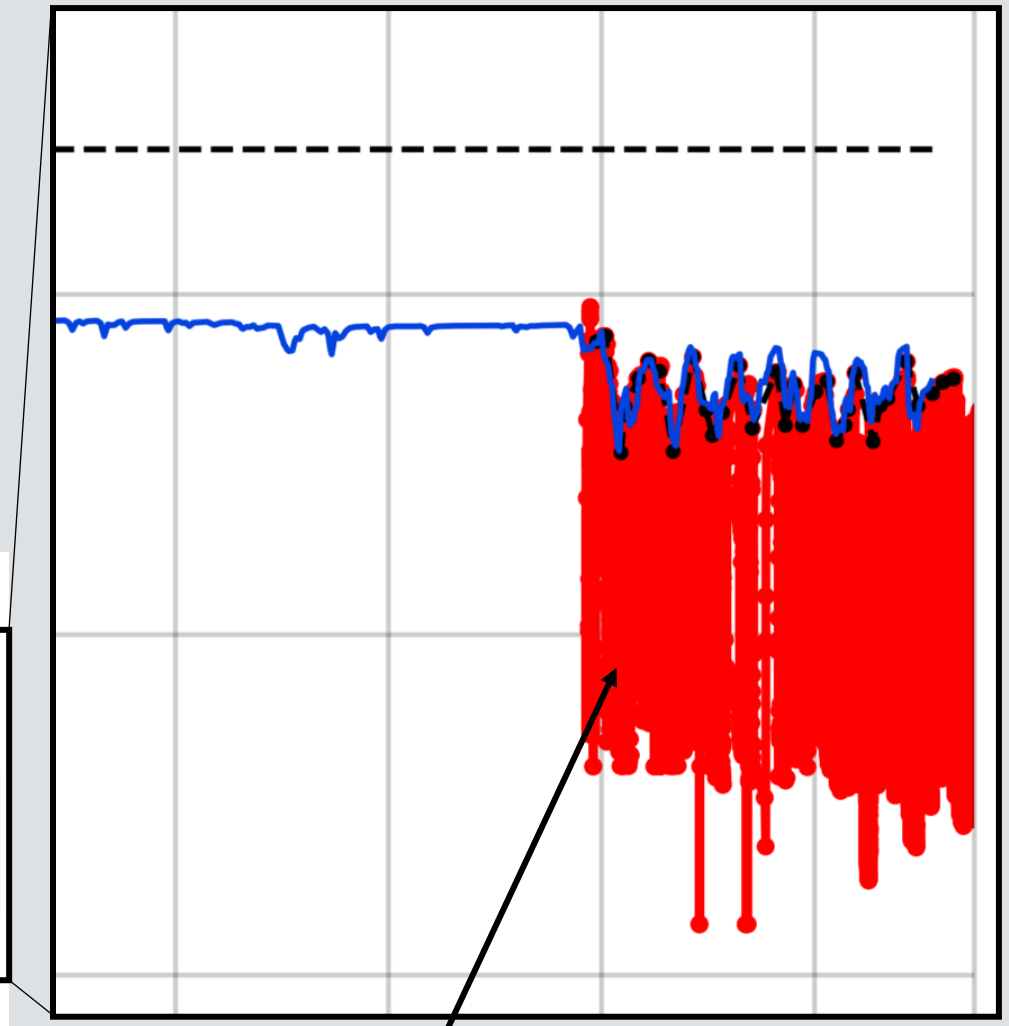
Generally followed the methodology documented in the Task 4 Methods TM, including:

- Selecting wells spatially and vertically distributed across the model domain.
- Selecting groundwater-elevation measurements at wells evenly distributed over time. To avoid bias toward wells with high-frequency water level measurements (i.e., measurement recorded by transducers), a subset of measurements from such wells at least 90-days was selected.
- Using groundwater-elevation measurements used by the USGS during calibration (including single measurements).
- Using new data collected since last calibration.

Transducer Data

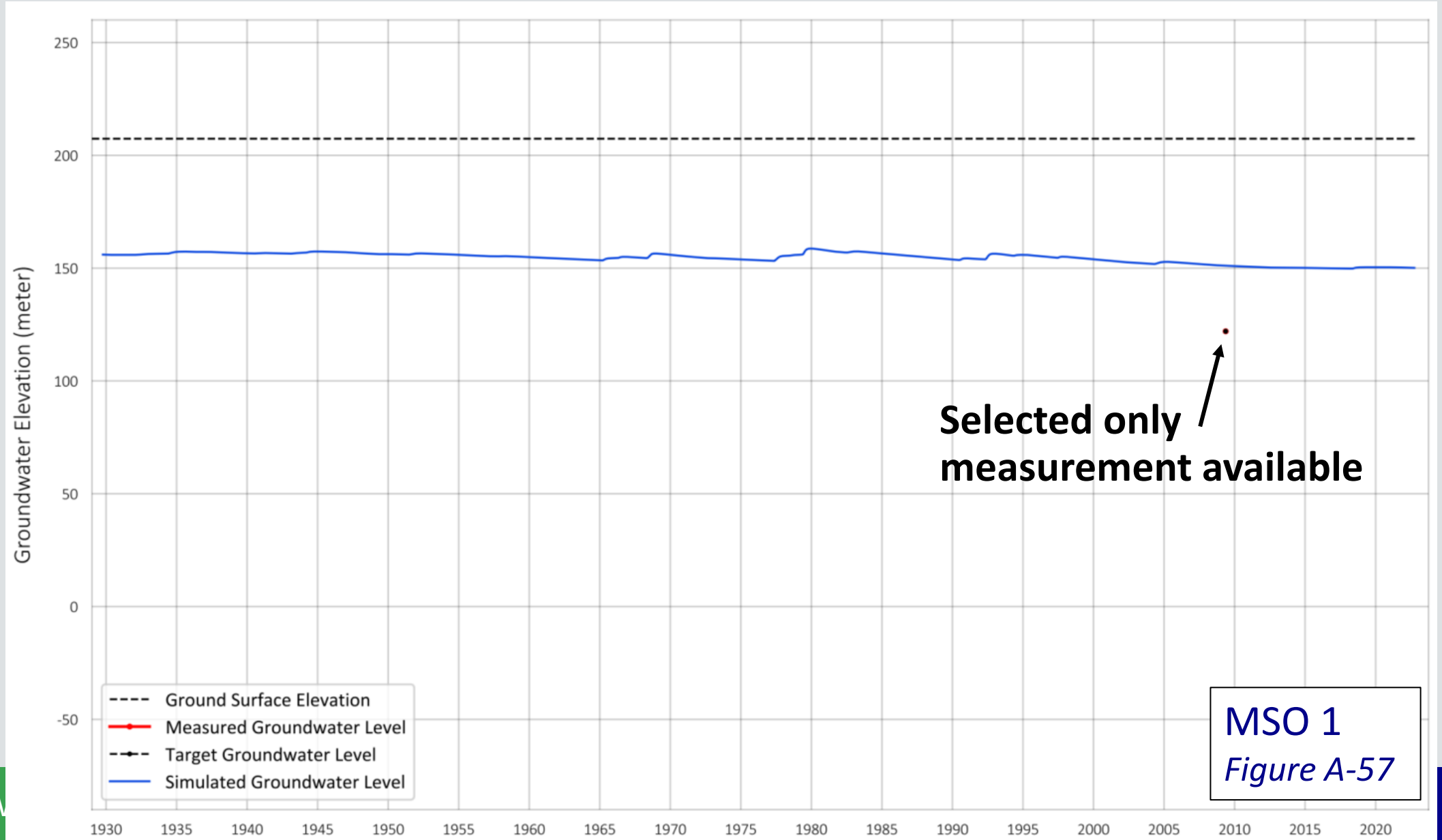


RH-3
Figure A-69



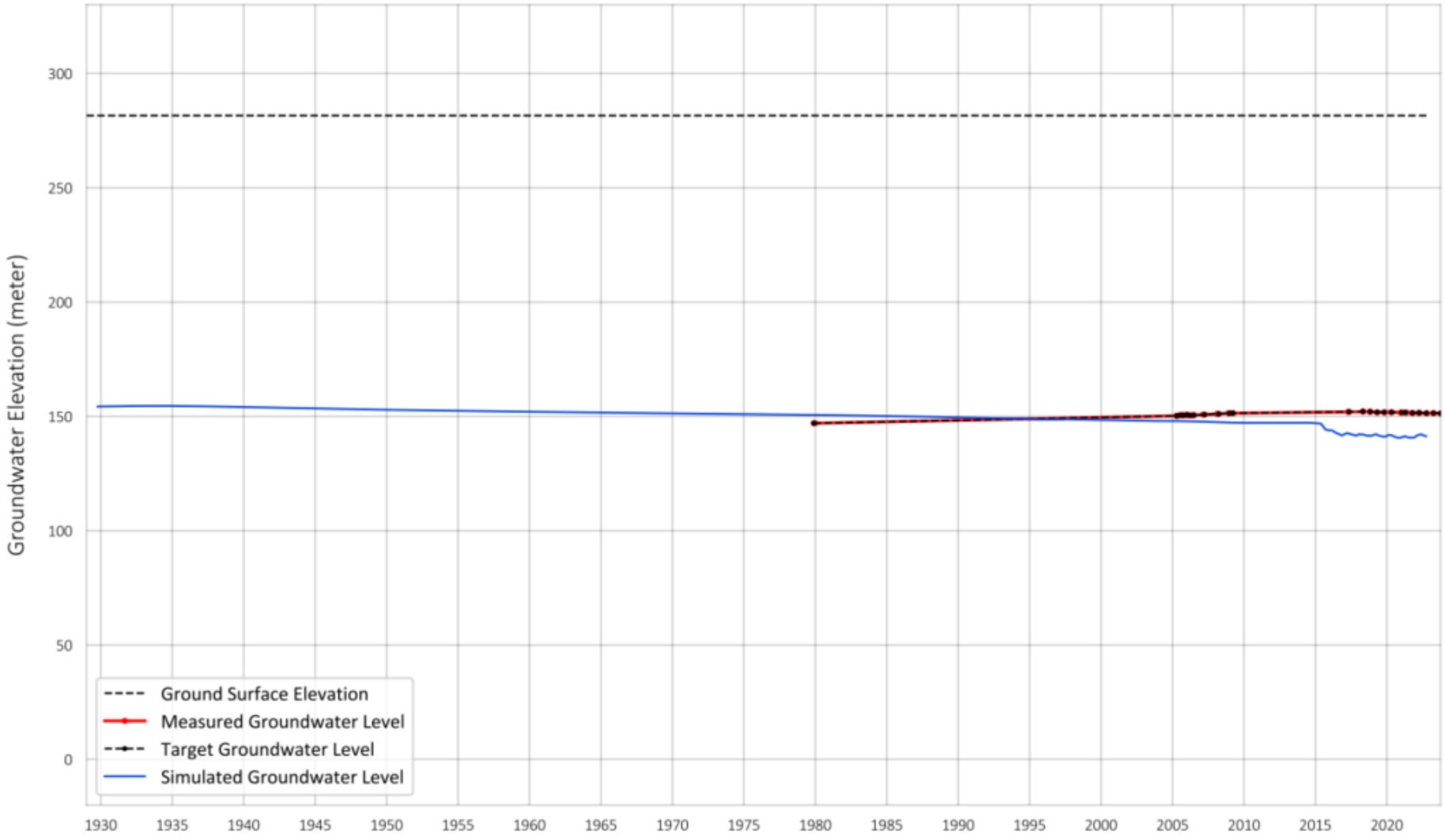
Selected measurements approximately every 90 days (including levels influenced by nearby pumping)

Single Measurement



***AAWARE Comment*:**
Please include simulated groundwater levels for Army Well (Figure A-18).

***Response*:**
Simulated groundwater levels for Army Well have been added to time-series (Figure A-18)



Prepared by:

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Well Location

Task 4 Pre-Calibrated BVHM
Groundwater Level
Well Name: Army Well

Figure A-18

Pilot Points & Adjustable Model Parameters

***AAWARE Comment*:** Document changes made to model parameters during recalibration.

Response:

- Changes will be documented in a TM (initial vs. final)
- Parameters that will be adjusted were documented in Methods and Preparatory Work memos, and include:
  - Aquifer parameters
    - Hydraulic properties (conductivity, storage properties)
    - Unsaturated zone properties (water content)
  - Scalar multipliers
    - Stream runoff (SFR)
    - Underflow (FHB)
    - OFE and KC values (FMP)

Historical On-Farm Efficiencies

- Proposed historical OFEs are based on the history of crops and irrigation practices in the Basin.
  - Literature review
  - Interviews with farmers
  - Inspection of air photos and abandoned irrigation infrastructure

Table 3. Proposed Historical OFEs for Irrigated BVHM Grid Cells in Task 4

Crop Type	Irrigation Method(s)	OFE	Range of OFE[c]
Citrus	flood and furrow (pre-1980)	0.6	0.4 - 0.7
	micro-irrigation (1980-present)	0.78[a]	0.7-0.95
Dates	flood and furrow	0.6	0.4 - 0.7
Golf Courses	broadcast sprinkler	0.86[b]	0.6 - 0.9
Nursery	micro-irrigation	0.78[a]	0.7-0.95
Palm	micro-irrigation	0.78[a]	0.7-0.95
Potatoes	flood and furrow	0.6	0.4 - 0.7
Row Crops	flood and furrow (pre-1980)	0.6	0.4 - 0.7
	micro-irrigation (1980-present)	0.78[a]	0.7-0.95
Semiagricultural	broadcast sprinkler	0.86[b]	0.6 - 0.9
Grapes	flood and furrow (1945-1966)	0.6	0.4 - 0.7

Recommended Next Steps

1. Begin model recalibration
2. Distribute results of model recalibration to TAC via email (as soon as available, expected late April)
3. Discuss Task 4 results at TAC Meeting on May 1, 2024
4. Prepare TM on Task 4

Future Meetings

- Next TAC meeting: May 1, 2024
- Draft Agenda:
  - Results of Task 4 – *Model Recalibration*
  - Review Sections 1-4 of the 5-Year GMP Assessment Report

Thank you!